UNIVERSITY OF KWAZULU-NATAL

EVALUATING SERVICE QUALITY IN THE SOUTH AFRICAN PUBLIC ROAD TRANSPORTATION INDUSTRY: A CASE STUDY OF JOHANNESBURG

by

Ayanda Menzi Vilakazi

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Supervisor: Prof. K.K. Govender

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Declaration

I, **Ayanda Menzi Vilakazi**, declare that

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ABSTRACT

The study of public road transport in Johannesburg is important because public transport provides the benefits of personal mobility and access to economic prosperity to a large number of people who rely, and are, dependent on public transport for their mobility needs. However, for decades, the public transport in South Africa has been characterized by many economic and social problems that can no longer be overlooked; exacerbated by the poor quality of service and the lack of modal integration. These problems require sustainable long term solutions, and if left unattended, could seriously impact a range of communities in the city. This study is of particular importance as it is envisaged that it will contribute towards improving the quality of public road transport service in Johannesburg, thus attracting new users and retain existing ones.

The aim of the study was to evaluate passengers' perceptions of the quality of service offered by the bus and minibus taxi industries utilising reliability, extent of service, comfort, safety, and affordability as important service quality dimensions. A sample of 902 respondents participated in the study. The respondents were drawn predominantly from Johannesburg because the study focus was on the Johannesburg Public Road Transportation System. The survey was administered personally by the researcher to individual passengers, intercepted at bus and minibus-taxi terminals in Johannesburg. As a result of the complexities involved in the process of sampling in the public transport context, an area sampling technique was used to select terminals, thereby automatically selecting the passengers to be included in the study. Various statistical tools were used for data analysis. The data was analysed utilising Statistical Package for the Social Sciences (SPSS) and Statistical Analysis System (SAS).

The study findings showed that the perceived quality of bus transport service exceeded that of minibus taxis by a significant margin. Those who used buses more often tended to have a higher opinion of the quality of bus transport. Those who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience. The service quality dimensions of reliability, extent of service, comfort, safety, and affordability, were perceived as being positively correlated and important to passengers' perceptions of service; thus increasing future utilization of the service. Gender and occupation were not significant in influencing the overall service quality provided by the bus. Gender and income were not significant in influencing the overall service quality provided by the minibus taxis. The study findings met the objectives of the study. Consequently, professionals and academics stand to benefit from the study findings. The focus should be on the aforementioned service quality dimensions in order to improve passengers' perceptions of public road transport service, and thus, address the public transport conundrum.

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List of Abbreviations

AARTO	-	Administration Adjudication of Road Traffic Traffic Offences Act
AIDA	-	Attention-Interest-Design-Action
AMES	-	Adult Migrant English Service
AMOS	-	Analysis of a Moment Structures
APTA	-	American Public Transport Association
AVL	-	Automatic Vehicle Location
β	-	Beta
BART	-	Bay Area Rapid Transit System
BBM	-	BlackBerry Messenger
BEE	-	Black Economic Empowerment
BEF	-	Business Excellence framework
BRT	-	Bus Rapid Transit
CBD	-	Central Business Districts
CIPRO	-	Companies Intellectual Property Office
CoF	-	Certificate of Fitness
CoJ	-	City of Johannesburg
CSIR	-	Centre for Scientific and Industrial Research
DAGMAR	-	Awareness-Comprehension – Conviction – Action
DBSA	-	Development Bank of Southern Africa
DETR	-	Department for the Environment, Transport and the Regions
DFID	-	Department for International Development (UK)
EJTIR	-	European Journal of Transport and Infrastructure Research
EPCOT	-	Experimental Prototype Community of Tomorrow
ETA	-	eThekwini Transport Authority
FIA	-	The Fédération Internationale de l'Automobile
FHWA	-	Federal Highway Administration
FIFA	-	Fédération Internationale de Football Association
GAUTRANS	-	Gauteng Department of Transport and Public Works
GCM	-	Gross Combination Mass
GCIS	-	Government Communication and

		Information System
GDP	-	Gross Domestic Product
GIS	-	Gauteng Information Services
GIZ	-	Deutsche Gasellschaft fur Internationale Zusammenarbeit
GJRTC	-	Greater Johannesburg Regional Taxi Council
GNP	-	Gross National Product
GPS	-	Global Positioning System
GSDF	-	Gauteng Spatial Development Framework
GVM	-	Gross Vehicle Mass
HOV	-	High Occupancy Vehicles
IBM	-	International Business Machines Corporation
ICC	-	Integrated Circuit Card
ICDS	-	Inner-City Distribution System
ICT	-	Information Communication Technology
IDASA	-	Institute for Democracy in South Africa
IDM	-	Transportation Demand Management
IDRE	-	Institute for Digital Research and Education
IFI	-	Incremental Fit Index
IRT	-	Integrated Rapid Transit
ITC	-	Independent Transport Commission
ITP	-	Integrated Transport Plan
ITS	-	Intelligent Transportation Systems
JDA	-	Johannesburg Development Agency
JMPD	-	Johannesburg Metropolitan Police Division
KfW	-	German Development Bank
KSF	-	Key Success Factor
LRT	-	Light Rail Transit
MA	-	Massachusetts
MB	-	Metro Bus
MC	-	Marginal Cost
MinMec	-	Ministers and Members of Executive Councils Meeting
MMS	-	Multimedia Messaging Service
MORI	-	Market and Opinion Research International
MR	-	Marginal Revenue
MRE	-	Municipal Regulatory Entities

MTC	-	Metropolitan Trading Company
NCF	-	National Consumer Forum
NDoT	-	National Department of Transport
NHTS	-	National Household Travel Survey
NLTA	-	National Land Transport Act, Act No 5 of 2009
NLTTA	-	National Land Transport Transitional Act 22 of 2000
NMBM	-	Nelson Mandela Bay Municipality
NPTR	-	National Public Transport Regulator
NSW	-	New South Wales
NTA	-	National Transport Authority
NTT	-	National Task Team
OLAS	-	Operating License Administration System
OLB	-	Operating Licence Board
P	-	Price
PAYE	-	Pay As You Earn
PPHPD	-	Passengers Per Hour Per Direction
PPP	-	Public-Private Partnerships
PrDP	_	Professional Driving Permit
PRE	-	Public Transport Regulatory Entity
PRT	-	Personalized Rapid Transit
PSQ	-	Perceptions of Service Quality Index
PTRT	-	Public Transport Rapid Transit
PTIF	-	Public Transport Infrastructure and Systems Fund
PTSAP	-	Public Transport Strategy and Action Plan
PUTCO	-	Public Utility Transport Corporation
Q	-	Quantity
RTSMP	-	Road Traffic Safety Management Plan
RISFSA	-	Road Infrastructure Strategic Framework for South Africa
RECAP	-	Recapitalisation Program
RECSA	-	Reliability; Extent of service; Comfort; Safety; and Affordability
RFI	-	Relative Fit Index
RMSEA	-	Root Mean Square Error of Approximation
RSA	-	Republic of South Africa

RTMC	-	Road Traffic Management Corporation
SA	-	South Africa
SABOA	-	South African Bus Operators Association
SABS	-	South African Bureau of Standards
SANRAL	-	South African National Roads Agency Limited
SANTACO	-	South African National Taxi Council
SAPS	-	South African Police Services
SARCC	-	South African Rail Commuter Corporation
SARS	-	South African Revenue Services
SAS	-	Statistical Analysis System
SATAWU	-	South African Transport and Allied Workers Union
SDF	-	Spatial Development Framework
SEM	-	Structural Equation Modelling
SMS	-	Short Message Service
SERVQUAL	-	Service Quality Measurement
SPSS	-	Statistical Package for the Social Sciences
SPTN	-	Strategic Public Transport Network
SSATAWU	-	South African Transport and Allied Workers Union
TA	-	Transport Authority
TDM	-	Travel Demand Management
TRL	-	Transport Research Laboratory
TRRL	-	Transport and Road Research Laboratory
UIF	-	Unemployment Insurance Fund
UITP	-	International Association of Public Transport
UK	-	United Kingdom
USA	-	United States of America
VETAB	-	Vocational Education and Training Accreditation Board
VIF	-	Variance Inflation Factors
VMS	-	Variable Messaging Screen

CHAPTER ONE

Introduction and Background

1.1 Introduction and Background to the Study

This introductory chapter discusses the concepts and models that are important to this study, which seeks to evaluate service quality in the South African Public Road Transportation Industry in Johannesburg. In particular, this chapter discusses the problem statement, objectives of the study, research questions, rationale, focus, and the limitations of the study. Chapter two will discuss the literature review, with the emphasis on the structure and nature of passenger transportation systems and networks in Johannesburg. It will also include an overview of successful passenger transportation systems on the African continent and best practice examples across the world. The literature review will be discussed in chapter three focussing on the service quality dimensions and passengers' perceptions of service. The data collection and research design approach that is likely to sufficiently address the research questions will be discussed in chapter four. Chapter five will discuss the research findings. The study concludes with a discussion of the study findings in chapter six and the incorporation of final conclusions and recommendations in chapter seven.

The study of public transport is important as it either directly or indirectly affects all citizens and all businesses. Public transport is essential to the wellbeing of any nation, while the benefits of a well-planned and efficiently managed transportation system spread far beyond the transport sector, and into the social economy as it is essential for industry, people's mobility and good communications (Barrett, 1987; Armstrong-Wright, 1993; Russell, 2012; & Matthews, 2013).

Public transport functions as a communal transporter on a large scale and is usually configured in such a way so as to provide scheduled services on fixed routes on a non-reservation basis. The majority of commuters travel locally between their homes and places of employment, shops or schools (International Association of Public Transport, 2011). Public transport offers the following advantages as compared to individual modes of transport (International Association of Public Transport, 2011):

- It is more affordable and cost effective for the society.

- It requires less urban space.
- It is less energy-intensive.
- It pollutes to a lesser degree.
- It is the safer mode of travel.
- It improves accessibility to jobs.
- It indiscriminately offers mobility to all.

The management of transport in South Africa is a shared responsibility between national, provincial and local government. In particular, the national Department of Transport (NDoT) is responsible for overall policy formulation and monitoring, as well as managing the national funds for transport (International Association of Public Transport, 2011).

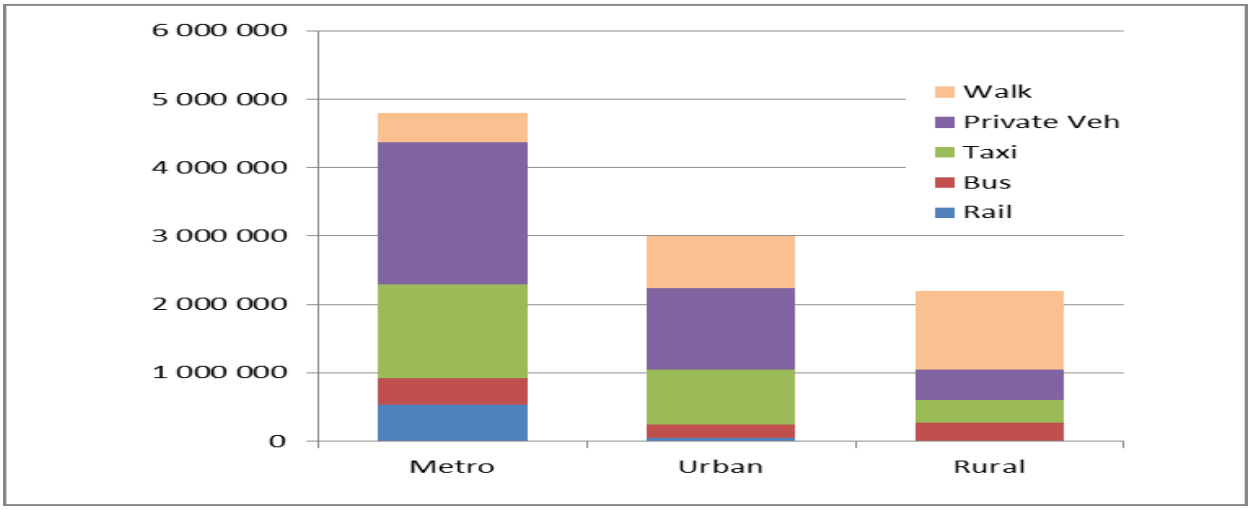
In addition to managing and implementing transport infrastructure, including provincial roads, the provincial departments of transport are also responsible for ensuring that national policy is in line with provincial circumstances, coordinating transport activities within the province and carrying out a number of administrative functions, including dealing with transport subsidies and public transport operator licensing. Many of the provincial administrative functions are set to be devolved to local government, especially in the large metropolitan areas. Local government may be regarded, among other service delivery portfolios, as transport policy implementation agents, with policy being implemented through the transport infrastructure and transport systems projects and programmes. The implementation of transport policy by local government is achieved through Integrated Transport Plans (ITPs) which, among others, prioritises the implementation of projects and programmes in municipalities (International Association of Public Transport, 2011).

All spheres of government, but especially local municipalities, play a critical role in ensuring that efficient public transport services exist, especially in the urban and metropolitan areas. Public transport is often crucial in people's lives – considered to be one of the basic services offered by government – and, thus, much is demanded of the transport systems that provide public transport (Gubbins, 1988; South African Bus Operators Association, 2010; 2011; & Arrive Alive, 2010).

Government is also tasked with the responsibility of ensuring public transport continues to contribute to the economy of the country. In South Africa, public transport claims a significant portion of, and is a substantial contributor to, the country's Gross Domestic Product (GDP). However, this industry is, unfortunately, always overlooked as regards the calculation of the transport sector's contribution to both the GDP and other social and developmental objectives of the country, including, job creation (Ndebele 2011b). The South African taxi industry is estimated to contribute more than R30 billion to the GDP of the country. The taxi industry consists of minibuses, which dominate 90% of the market, and metered taxis which are active in the remaining 10% of the market (Ndebele, 2011b).

The minibus taxi industry transports approximately 70% of the country's public transport commuters and there are an estimated 200 000 minibus taxis on the road (Thomas, Ryneveld & Pascarel, 2010; & Ndebele, 2011b). This, in turn, means that the minibus taxi industry has an estimated 70% market share while public buses have a market share of just over 20%, and the railways a market share of just over 14% (South Africa, 2012). Figure 1-1 depicts South Africa's transport modal split.

Figure 1-1: Modal split in South Africa



Source: Mokonyama (2012: 5)

More specifically, with reference to the City of Johannesburg Metropolitan Municipality, the metropole has 800 000 daily commuters – 39,6% use minibus taxis, 27,1% use private cars, 24,1% use buses, and 9,2% use rail. In 2011/12 it was estimated that there were 3,8 million people living in Johannesburg, the majority of whom were aged between 19 and 39 years of age (Johannesburg Development Agency, 2012). However, since then, the population in Johannesburg has increased to 4.4 million people, with 40% of the population under the age

of 25 (Johannesburg Development Agency, 2013). Young people are the predominant users of public transport, as will be shown later in this study, and this has implications across the economy, particularly because the majority of South Africa's population falls broadly into the category of youth. From the above it is clear that a large number of people in South Africa and Johannesburg, in particular, depend on public transport for their daily commuting. In view of the fact that public transport is an important 'commodity' to so many people, it is not possible to overlook some of the main challenges associated with it, following that it is essential that these challenges be addressed (Mokonyama, 2012). Mashiri, Moeketsi & Baloyi (2010) assert that public transport is in a state of a crisis, and the following are some of the main challenges facing public transport in South Africa (Chakwizira, Bikam, Dayomi & Adeboyejo 2011; National Planning Commission, 2011 & Mokonyama, 2012):

- Apartheid city design policies created fragmented spaces with residential areas housing the majority of the poor, who are also the majority users of public transport, located far away from the major industrial and commercial centres. Thus, poor urban communities are forced to wake up extremely early in the morning, for example, at 03:00 and return home late from work at approximately 21:00 or later on a daily basis. This leaves very little time to spend with family and engage in social activities – which drive community development and ultimately a well-rounded and productive population.

- While the middle and higher income earners are able to afford alternative means of transport, this is not the case with the poor, urban, public transport commuters.

- Inadequate and inefficient public transport systems.

- The virtual absence of public transport support other than for the metropolitan cities and for commuter trips into the metropolitan cities.

- The need to reverse chronic underinvestment in public transport requires substantial capital injections to build the required infrastructure (physical and ICT) and integrate the various systems.

- Continuous urban growth and urban complexity imply heavy public transport systems and infrastructure requirements.

- The poor urban public transport users face great transport difficulties in their quest to access and utilise the socio-economic facilities and opportunities within their greater urban living environments.

It is essential that the abovementioned challenges are addressed in innovative and timeous ways as they continue to have a significant and detrimental impact of the economy of South Africa and strategic metropolitan economies as well as being extremely costly to ignore. In addition, the IBM 2010 *Commuter Pain Survey*, which analysed traffic patterns in 20 major cities internationally, rated Johannesburg as one of the most congested cities (National Planning Commission, 2011). Steps are in place to mitigate Johannesburg – and other South African cities' – congestion and plan for the future (National Planning Commission, 2011). However, although there is evidence that public transport initiatives, such as the implementation of the Bus Rapid Transit system, are being rolled out in an attempt to improve public transport in the country, the process will, in all likelihood, take place over an extended period of approximately 10 to 15 years before reaching its final stage (Walters, 2008a).

In its planning, South Africa opted for a mass transit system known as the Bus Rapid Transit (BRT), and the preparation began as early as 2002 (Tshikalanke, 2010 & City of Johannesburg, 2012).

The planning in Gauteng was fast tracked as a result of the transport needs arising from the 2010 Soccer World Cup. South Africa has introduced the first phase of the BRT systems in Johannesburg and Cape Town, and is planning to introduce the system in Mangaung and Nelson Mandela Bay (Thomas, *et al*. 2010 & Nelson Mandela Bay Municipality, 2013). The system in the City of Cape Town is referred to as Integrated Rapid Transit (IRT) to emphasise its role in a broader system of public transport that involves more than just buses (Thomas, *et al*. 2010). South Africa decided to introduce the BRT system rather than other systems, such as light rail, because of the substantial infrastructure costs associated with these other systems and also their lack of flexibility. All South African BRT systems will expand in phases over the next decade. A particularly important dynamic in South Africa is the way in which the system will effectively integrates and includes the minibus taxi industry since, by law, public transport interventions have to involve existing operators (Thomas, *et al*. 2010).

With the introduction of BRT in South Africa, existing public transport organisations, particularly buses and minibus taxis, will have to adapt to changes or else they will inevitably fail. In general, faced with changes in the environment, transport organisations are being forced to move from a traditionally operations-driven orientation to a more market-driven orientation (Gubbins, 1988). However, this also means that it is incumbent on public transport operators to improve their service quality, attract new passengers, retain existing ones, and garner as much support as possible for their service (McKnight, Pagano & Paaswell, 1986; Zeithaml & Bitner, 2000 & Mashiri, *et al*. 2010).

In order to maximise the effectiveness of public transport, it is essential that marketing principles be applied. However, marketing in this context should be viewed as a comprehensive process through which passenger transport organisations develop and provide transport services, inform the public about transport routes and systems, and also communicate the benefits to the public at large (Mashiri, *et al*. 2010).

Researchers into public transport have equated the importance of public transport to that of a utility (Barrett, 1987 & Armstrong-Wright, 1993). In any society, people are entitled to mobility in the same way in which they are entitled to sewage and fresh water systems. This, in turn, means that passenger transport is a public utility; and the benefits derived from this public utility will be realised only if the system is planned and regulated so that all members of society benefit from it, both the poor and the rich (Barrett, 1987; Armstrong-Wright, 1993 & Bhakthan, 2011).

However, there are those who oppose the notion of transport as a public utility, maintaining that transport is a political issue and should be approached from a political perspective (Gubbins, 1988). According to Gubbins (1988), these detractors are of the opinion that market forces are important in determining the nature and role of public transport. Accordingly, these market forces should determine the price of public transport and the service offered because public transport is a derived demand, meaning that people use public transport services in order to meet their needs. Thus, the service should only be made available based on the law of demand and supply, and commuters' needs should be taken into account within the supply chain.

In France, for example, the discussion includes whether or not land public transport should be provided free as a public utility and in so doing raises the question of whether implementation of a free public transport system weakens the influence of market forces? Some believe that free public transport could reinforce the market by giving a new

legitimacy and a positive image to urban-services firms (Giovannangeli & Sagot-Duvauroux, 2012 & Huré & Waine, 2013).

Whether or not public transport is a public utility, community members represent a variety of diverse groups, all seeking to derive different benefits from the transportation systems and with different degrees of access to these systems (McKnight, *et al*. 1986). However, the difficulty is, in part, that commuters, even within the same class, do not have homogeneous demands, coupled with the fact that the transport system is not infinitely flexible.

In view of the fact that community members seek different benefits from and access to public transport is a challenge, public transport in some areas is provided at a reduced fare and is subsidised by government, based on the argument that these parts of the transport system meet a social need and should either be provided free or at a reduced cost (South African Bus Operators Association, 2006 & 2010). However, in other areas, the transport system is provided on a commercial basis and the fares are determined by market forces (demand and supply) (Button & Hensher, 2001 & Hensher & Brewer, 2001).

The users of public transport also have various perceptions of transport and its systems, for example, the different classes, young and old, men and women, and able-bodied or people with special needs. It is, therefore, important to understand the commuters' perceptions of public transport so that public transport organisations are able to provide a service that meets their needs (McKnight, *et al*. 1986). This, in turn, means that public passenger transport organisations must conduct perception studies on an on-going basis in order to enable them to meet the needs of passengers and it is those organisations that conduct perception studies and use the results effectively that are likely to deliver a quality service that meets the needs of passengers (McKnight, *et al*. 1986).

Despite the fact that service quality is an all-pervasive problem affecting both urban and rural populations, it is in the urban context that this problem receives the most attention (Dalvi, 1987). This is partly as a result of the scale of the problem and also because it is in the urban context that controversial issues – concerning appropriate services that meets commuters needs, choice of inter-modal mix, transport technologies and pricing policies and strategies for transport – are hotly debated. However, it is in the context of choosing an appropriate inter-modal mix for urban transport that the poorer countries are currently faced with the greatest dilemma. Developing countries need to decide whether to follow western models and devote a major portion of their development resources to the construction of mass transit systems or whether should they opt for low cost, capital saving options. Both

choices are dependent on the political will and also the way in which governments and people, in general, perceive passenger transport (Dalvi, 1987).

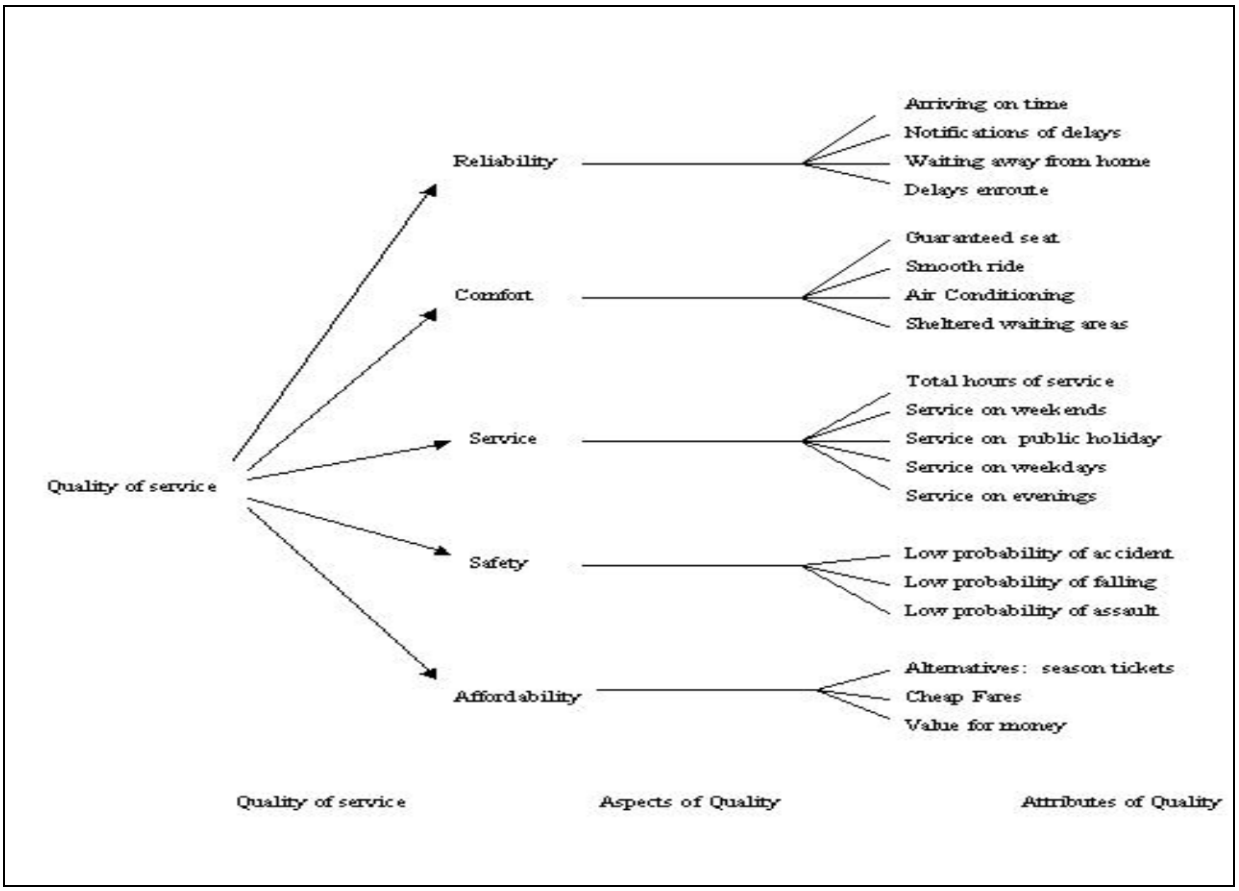
McKnight *et al*. (1986) maintain that one of the challenges confronting transport organisations is that service quality, in particular, is a complex area of study and measuring service quality, particularly in public transport, is made difficult by the subjective nature of service. In contrast to the quality of goods, which may be measured objectively by such indicators as durability and number of defects, service quality is an abstract and elusive construct because of the following three features which are unique to services (Parasuraman, Zeithaml & Berry, 1986 & 1988):

- Intangibility;
- Heterogeneity; and
- The inseparability of production and consumption.

Accordingly, in the absence of objective measures, a useful and appropriate approach to assessing the quality of an organisation's services would be to measure the customers' perceptions of quality (Thompson, De Souza & Bradley, 1985; Dodds & Monroe, 1985 & McKnight, *et al.* 1986). However, while instruments have been developed to assist organisations to measure service quality in order to meet the needs of commuters, there has, in the main, been no agreement on the measurement of the concept. The majority of the work to date has attempted to use the SERVQUAL methodology in an effort to measure service quality (Parasuraman, *et al*. 1985; 1988; Brooks, Lings & Botschen, 1999; Chaston, 1994; Edvardsson, Larsson & Setterlind, 1997; Lings & Brooks, 1998; Reynoso & Moore, 1995 & Sahney, Banwet & Karunes, 2004).

This study will use an appropriate methodology developed by McKnight, *et al*. (1986) to measure service quality in the specific context of public road transport, namely, buses and minbus taxis. In particular, the study will explore commuters' perceptions of bus and minibus taxi service in terms of the service quality dimensions of McKnight, *et al*. (1986) (see Figure 1-2), namely, reliability, comfort, extent of service, safety and affordability (RECSA). The study will also ascertain the extent to which the abovementioned service quality dimensions influence the demand for public transport, and determine the importance of each service quality dimension regarding commuter choice in respect of a public transport mode.

Figure 1-2: Clusters of service quality dimensions



Source: McKnight *et al*. (1986: 427).

1.2 Problem Statement

In view of the importance and the role of public transport in the economic and social development of the country, it is essential that the issue of public transport not be overlooked. It is an integral part of most people's lives and more is demanded of the transport systems that provided by it (Gubbins, 1988; South African Bus Association, 2010; 2011 & Arrive Alive, 2010). There is no doubt that, in the context of a developing economy, an efficient and effective public transport system is the key to a cost-effective and sustainable transportation system (Mashiri, *et al*. 2010).

It is essential that the challenges facing public road transport in Johannesburg be addressed. The current public transport system is not able to adequately address the present-day and future transportation and mobility needs of commuters, in the same way as the needs of commuters in Curitiba in Brazil, Seoul in South Korea, Rouen in France, Pittsburg in the

United States and Brisbane in Australia have been addressed (City of Johannesburg, 2006 & Mashiri, *et al*. 2010).

In Johannesburg, public transport modes operate independently, with no system integration benefits (Mokonyama, 2012). Public transport will be fully unlocked only if the excellent elements of public transport (for example, land-use planning, transport planning, urban design, communication and marketing) are combined into one public transport experience; pockets of excellence are not enough. If even one of these elements is underdeveloped, the public transport system will be unable to meet the demands of commuters. For example, the existence of a bus service alone will not give a potential user enough reason to use it (Van Dijk & Hitge, 2012).

Public transport is likely to provide a better service, and thus a better opportunity for users, in cities that are well designed, for example, and have a diversity of land uses at appropriate densities. However, in South Africa, the urban environment around public transport interchanges is mostly poor, which creates an experience that is unsatisfying to current users and prohibitive to potential new users. Changing the urban fabric in support of a public transport lifestyle is a long-term process and requires conviction and strong leadership to drive transformation (Van Dijk, *et al*. 2012).

However, this would require more than merely a technical solution and only a full package of interventions would provide the optimal environment in which a public transport-orientated lifestyle would be the norm rather than the exception (Van Dijk, *et al*. 2012).

Communication and marketing are essential in creating a positive public-transport lifestyle. Marketing and information campaigns can increase awareness, change community perceptions and highlight advantages of a specific service. In fact, the lack of profile is one of the reasons public transport users aspire to own a private car and most public transport users are held captive by the fact they do not have access to a car. Of those individuals who do have access to cars, the vast majority use their cars instead of public transport.

Most public transport trips are reliant on the non-subsidised minibus taxi services which account for approximately 70% of all public transport trips (Mokonyama, 2012). However this mode of public transport has not been effectively integrated into the BRT, resulting in dissatisfaction on the part of the minibus taxi industry. Travel times are too high across all public transport modes, thus indicating low speeds and overly long distances (Mokonyama, 2012).

In addition to the requisite public transport integration, an improved quality of public transport should also achieve a modal shift. Modal shifts should be viewed from two perspectives, (a) a shift from private to public or non-motorised transport on the part of daily commuters, (b) optimising the use of public transport. It is also essential that public transport organisations attract new travellers, retain existing ones as well as garnering support from public transport stakeholders and general commuters at large. As a result, (a) effective marketing of public transport services is required, combined with (b) the proper integration of public transport services, as well as (c) the restructuring of the public transport industry to provide an efficient quality service for commuters (Mashiri, *et al.* 2010).

As regards service quality, in particular, the developments in the transportation industry have been less than satisfactory. The focus has not been on providing quality service and, as a result, commuter satisfaction has been curtailed in at least two ways (Barnes, 1989):

- The attention of the transport operators has been distracted from the primary objective of providing efficient service and refocused on operational efficiency in order to maximise profitability.

- Insufficient attention has been paid to addressing passenger needs with it being perceived as a "nice to have" instead of a central issue on which future business hinges.

Commuters are clearly unhappy with public transport service quality. For example, the National Household Travel Survey (2003) revealed that 71% of train users, 55% of taxi users and 54% of bus users were dissatisfied with the level of crowding (Gauteng Province, 2009). In addition, 74% of bus users, 64% of taxi users and 53% of train users were unhappy with the facilities at stops, ranks and stations. There has been severe overcrowding on all modes of public transport, primarily as a result of there not being sufficient vehicles and coaches available, coupled with a lack of variety. In addition, there are excessive delays for public transport with an average waiting time of between 40 and 65 minutes (Gauteng Province, 2009).

This study will explore commuters' perceptions of service, ascertain the extent to which the service quality dimensions influence passenger transport mode choice, as well as determine the importance of service quality dimensions in choosing a mode of passenger transport.

1.3 Objectives of the Study

This study aims to achieve the following objectives:

- To explore commuters' perceptions of bus and minibus taxi service in terms of the service quality dimensions of McKnight, *et al*. (1986), namely, reliability, comfort, extent of service, safety; and affordability (RECSA);

- To ascertain the extent to which service quality dimensions can influence future demand for public transport;

- To determine the importance of each service quality dimension as regards choosing a public transport mode; and

- To recommend strategies to improve public transport service quality based on the research findings.

1.4 Research Questions

The study will address the following research questions:

- What are passengers' perceptions of service quality in the bus and minibus taxi industry?

- To what extent would passengers' perceptions of service quality influence the future demand for buses and minibus taxis?

- What is the importance of each service quality dimension in choosing a passenger transport mode?

1.5 Rationale for the Study

It is evident from the discussion above that passenger transport makes a vital contribution to the economic and social development of the country and, as a provider of commuter services, it has, and continues to provide mobility to millions of people who are dependent on passenger transport, including learners who require transport to and from school, workers

who require transport to and from their jobs, as well as individuals who are seeking employment or else access to hospitals and other services (Arrive Alive, 2011a).

The transport system has been particularly dysfunctional as a result of apartheid geo-spatial planning and policies, which resulted in 2,8 million (or 13%) of the urban population being categorised as stranded, which means that the transport system is failing more egregiously for this group than for any other. They lack affordable basic access to motorized transport and therefore have little ability to integrate with the rest of society or participate in the broader economy. The principal customer need is for low cost passenger transport. It has been predicted that this number will grow by 28% in 2020 if nothing is done to address the needs of this group (Crous & Price, 1993 & Godard & Fatonzoun, 2002).

In view of the fact that research has shown that 80% of the South African (SA) population is totally dependent on public transport (bus, commuter rail, and minibus taxis) for its mobility needs, it is clear that it is essential that the importance of public transport not be overlooked (South African Bus Operators Association, 2006 & 2010). Access to sustainable, affordable and quality public transport is critical for the urban poor as it offers a way out of economic, social and physical isolation (Sohail, 2005a).

Public transport is commonly used by the poorer members of the community, who depend on it for their daily commuting, while the private motor car is reserved for the privileged few who use their cars for their daily commuting needs (Mashiri, *et al*. 2010). Thus, this means that the poor have to use buses and minibus taxis, despite the inefficiencies within these modes (Thomas, *et al*. 2010). These (mostly poor) public bus commuters are often faced with inadequate services, poorly arranged schedules, the absence of facilities, including bus stops and shelters, and the infrequency of services, particularly at off peak times, thus the convenience of these services is severely compromised (Mashiri, *et al*. 2010). In addition, public transport is often unreliable and lacking comfort because of inefficient scheduling. Boarding conditions often prevent commuters from alighting at the desired times with over-crowding imposing severe discomfort.

The minibus taxi commuters are also faced with high rates of accidents, unroadworthy vehicles, the absence of facilities at taxi ranks, poor service as a result of destructive competition through overtrading, long off-peak waiting periods, little or no investment, and unsavoury business management principles in the industry.

These inefficiencies have further exacerbated the already tarnished image of public transport. The situation has also been made worse by the high cost of public transport. Commuters in South Africa spend more than twenty percent of their total income on an inefficient public transport system, and the acceptable norm is a maximum of ten percent (Mashiri, *et al.* 2010). However, despite the poor state of public transport, both policy makers and commuters at large continue to expect that public transport will play a more decisive role in shaping the socio-economic landscape of South Africa. This is as a result of public transport being vital not only for the sustainability and growth of business and job creation, but also for discouraging inimical, sprawling land use (Mashiri, *et al.* 2010). Thus public transport has become a key challenge for policy makers and, in particular, local governments, partly because significantly more public funding resources are required to improve public transport and partly because municipalities around the world are still searching for more sustainable public transport solutions.

This study recognises that there are no viable answers and solutions found yet with which to address the public transport problems in South Africa and that even the current BRT systems are faced with challenges of crowding, unaffordability, security concerns as a result of minibus taxi owners' unhappiness with the system, and the lack of integration with other feeder services (Chakwizira, Mathetha, Mokonyana, Mashiri, & Marrian, 2009). This study will attempt to recommend solutions to the challenges currently at play in the South African public transport industry.

Improving and encouraging the use of public transport should be one of the cornerstones of the policies of the national Department of Transport (Mashiri, *et al*. 2010). It is of concern that there is little emphasis on public transport efficiency and that it is a miscellaneous item on the South African's Government's agenda (Thomas, *et al*. 2010). Despite the attempts of the transport authorities to fix the state of public transport, public transport solutions are falling short of expectations (Thomas, *et al*. 2010).

Service quality in the public transport sector has remained an elusive and a much neglected area of study. Data regarding the quality and performance indicators of public transportation services are vaguely determined and, in fact, are practically non-existent (Simona, 2010). Much of the debate has centred on the system itself: spatial designs, systems configurations, city network developments, government policies, and engineering services. According to Nielsen and Lange (2008), the design and planning of network structure for passenger transport success is the most important factor, and should feature strongly in standard texts on public transport and in transport policy. Nielsen, *et al*. (2008) argue that ensuring that the

network is right, in terms of stability, efficiency and design irrespective of the mode of public transport, is usually more important and mode selection for new parts of the network should feature after an overall network strategy has been formulated.

Service quality has remained a challenge for the majority of public transport organisations, partly as a result of the inherent challenge of measuring service quality and, partly because commuters do not perceive quality as a one-dimensional concept – customers' assessments of quality often include perceptions of the multiple dimensions that apply to all services (see Table 1-1).

Table 1-1: Multiple dimensions for service industries

• Performance • Features • Reliability • Conformance	• Durability • Serviceability • Aesthetics • Perceived quality (equivalent to prestige)

Source: Zeithaml and Bitner (2000: 82)

This study is of particular importance in view of the fact that it is envisaged that it will contribute towards improving the quality of public road transport service in Johannesburg, South Africa, thus attracting new users and retain existing ones. The study is a deviation from the usual practice of using SERVQUAL (Parasuraman, *et al*. 1988). Instead, it uses the research results of McKnight *et al.* (1986) as pertaining to their service quality dimensions of reliability; extent of service; comfort; safety; and affordability (RECSA) – see Figure 1-2 above, which are deemed to be more relevant for public transportation studies. Therefore, failure to utilise RATER as a measure of service quality does not invalidate the research because an alternative, more appropriate measure of service quality for public transport was utilised (McKnight, *et al.* 1986).

1.6 Focus of the Study

The study focuses on determining the quality of service in public transport in Johannesburg, South Africa. Thus, it is not a national study as each of the provinces is at different levels of public transport systems development. Johannesburg was chosen because it is at an appropriate stage in the implementation of the new public bus transport system known as BRT in the city, for analysis (City of Johannesburg, 2003a; 2006; Cox, 2009; Tugwana, 2010; Ndebele, 2011a & Hudleston, 2011). However, the rail system, including the Gautrain

and other rail networks, fall outside the scope of this study although it is acknowledged that rail is critical for the proper integration of the public transport network with other modes of transport, especially road transport.

As regards the focus of the study design, this study used mainly quantitative research. Quantitative research is associated with a structured research process in terms of which data is collected and analysed. The main feature of the quantitative method is its capacity to generate quantifiable data on a large scale. The empirical research was conducted in order to answer the research questions, within the given constraints (Ghauri, Gronhaug & Kristianslund, 1995). Data collection was administered personally by the researcher to 902 individual bus and mini-bus passengers, intercepted at bus and minibus taxi terminals, who were asked to answer both closed and open-ended questions using the research instrument or questionnaire.

The sample selected was done so based on the various reasons, namely, costs, greater accuracy, speed of data collection, and availability of population elements. As a result of the complexities involved in the process of sampling in the public transport context, the choice of a probability sample is always a challenge (Cooper & Schindler, 2001). Therefore, for the purposes of this study, area sampling techniques (often referred to as the geographical sampling technique) were used to select terminals in Johannesburg, thereby automatically selecting the passengers to be included in the study. Thus, the passengers in a particular area formed part of the study (Cooper, *et al*. 2001).

As regards the data analysis, the following factors influenced the selection of the appropriate technique for the purposes of the data analysis, for example, (a) type of data, (b) research design, and (c) assumptions underlying the test statistic and related considerations (Aaker, *et al*. 2007). As a result, various statistical tools were used for data analysis including, amongst others, multiple regression, factor analysis, and structural equation modelling. The data was analysed utilising SPSS and SAS.

The study findings showed that the perceived quality of bus transport exceeded that of minibus taxis by a significant margin. The study findings met the objectives of the study and resolved the research problem. Consequently, academics and professionals will benefit from the study findings. Therefore, public transport operators need to focus on improving the aforementioned service quality dimensions in order to influence commuter's perception of public road transport, attract new users and retain existing ones.

1.7 Limitations of the Study

This research study may be regarded as the beginning of the much needed research into service quality in the public transport sector. However, as a result of time, financial and other constraints, the study was confined to one, albeit the largest city, in one, albeit the largest province, namely, Gauteng Province in South Africa. The study also investigated one model only, namely, BRT, which has been introduced in Johannesburg, South Africa only.

1.8 Conclusion

It is evident that passenger transport plays a significant role in the social and economic development of a country, while it is also essential for the wellbeing of any nation. In view of the fact that more than 80% of the commuting public in South Africa depend on public transport, access to sustainable and affordable public transport is critical, especially for the urban poor, as public transport offers a way out of economic, social and physical isolation. The management of public transport in South Africa is a shared responsibility between national, provincial, and local government and it is essential that all these spheres of government work together to improve public transport.

The study of public transport is important because, as indicated above, a large number of commuters depend on public transport for their daily commuting needs. The study is also important because it is envisaged that it will make a significant contribution towards improving public road transport in South Africa in general and in Johannesburg in particular.

Buses and minibus taxis are the dominant mode of public transport in South Africa and, thus, they transport a large number of commuters daily. It is, therefore critical that public transport provides a service that is reliable, comfortable, widely available, safe, and affordable.

This study uses the established service quality dimensions of McKnight *et al*. (1986) to explore commuters' perceptions of the bus and minibus taxi services. The study also ascertains the extent to which service quality dimensions would influence future demand for public transport. The importance of each service quality dimension as regards choosing a public transport mode will also become evident in the following chapters.

As a result, the next two chapters discuss the literature review, with the emphasis on the passenger transportation system and service quality dimensions influencing passengers' perceptions of service. Chapter two will discuss key concepts and definitions relevant to

public transportation, public transport modes, the importance of public transport, the structure under which public transport operates, the general establishment of the public transportation network in Johannesburg, as well as identifying other countries in the African continent and the rest of the world that have successfully implemented, what is arguably, effective and efficient public transportation systems, such as the Bus Rapid Transit System, to improve public transport in order to attract new users and retain current users. Chapter three will discuss the service quality dimensions, demand, importance of service quality dimensions, as well as the marketing of the public transport service to increase utilisation of the service. Both these chapters, collectively known as the literature review, will be important for the discussion chapter of this study, presented in chapter six.

CHAPTER TWO

Public Transport in South Africa: Focus on Johannesburg

2.1 Introduction

This chapter, which discusses the theoretical background to public transport, with a particular emphasis on South Africa, begins with a definition of public transport. The chapter then discusses the challenges encountered in defining public transport. Thereafter, the importance of public transport in providing mobility to the majority of commuters is discussed, with the emphasis on the modes of public transport (public buses and minibus taxis) which are the focus of this study. The chapter also includes statistics which contextualises the role and the magnitude of public transport in South Africa and, particularly, in Johannesburg.

In view of the fact that certain researchers (Tomazinis, 1975; Farris, *et al.*1976 & Cole, 1987) are of the view that, without government intervention, public transport would not improve and, thus, the free market system will not address the state of public transport to the benefit of the commuters, therefore, the chapter concludes with a discussion on government intervention into public transportation by discussing public transportation networks or systems, particularly the introduction of the BRT in Johannesburg, which aims to improve public transport service in Johannesburg in order to increase the utilisation of the service (City of Johannesburg, 2003a).

2.2 Definition

Public transport, public transportation, public transit, and mass transit are all terms which are used in transport studies, and they all refer to transport systems in which the commuters do not travel in their own vehicles (International Association of Public Transport, 2011). While public transport is generally assumed to include rail and bus services, wider definitions include scheduled ferries as well as taxicab services – in other words, any system that transports members of the general public. However, for the purposes of this study, public transport is understood and discussed within the context of the South African bus and minibus taxi transport and, therefore, transport organisations mean buses and minibus taxi organisations.

Commuters, passengers, public transport users, are all terms used in public transport, which refer to the people who require transportation services to move from one point to the other (Commuter, 2013). Therefore, commuters, passengers, public transport users are all terms that will be used interchangeable in this study to simple refer to the public transport users.

As regards public transportation systems, there is no simple definition of what constitutes a public transportation system, and any definition usually focuses on the approaches to public transport systems. However, Button *et al.* (2001) provide extensive discussion on the definition of public transport and public transportation operations in general, as discussed below, and their debate is relevant to this study and will be utilised in this discussion, henceforth.

In addition to definitional challenges, public transportation systems are both complex and subject to continual change themselves, making concrete notions of such impossible to pin down without locating in sticky context (Button, *et al*. 2001).

However, the above words are synonymous, with transport being the proper English word and transportation being it's variant. The suffixation of transport refers to a system or process of public transport (*Oxford English Dictionary,* 1989). This, in turn, implies that transportation deals with the whole system of determining why, where, when, and how people are conveyed, whereas transport is the means or act of conveyance (Button, *et al*. 2001). From one perspective, there are various modes of transportation, each of which may be seen as a system. However, from another perspective, it is possible to separate different infrastructure systems with each being regarded as a system. Although, in some cases, infrastructure systems may be used by several different modes of transport (Button, *et al*. 2001).

As regards the term "mass movement of people", which is often referred to as mass transportation, the term is used to describe the mass movement of people in an efficient manner (Button, *et al*. 2001:33). However, mass transportation is an unfortunate term because it implies that ridership (defined as the average quantity of passengers carried per certain time in a mode of public transport system) comprises a mass market of people with undifferentiated needs and characteristics. On the other hand, the term "passenger transport commuters" tends to evoke images of either helpless commuters or else the unfortunate poor and (perhaps) elderly. In reality, the market for passenger transport comprises people of different ages, sexes, occupations, incomes, languages, races, and backgrounds. They travel

for different purposes, with varying degrees of frequency, between different origins and destinations, and at different times of the day or week (Button, *et al*. 2001: 33).

As regards Transport Authorities (TA's), as a regulatory authority, South African government plays a role in public transport through the agency of local transport authorities. A TA is a municipal council/committee or similar legal entity, the sole purpose of which is to carry out municipal transport functions (Nothnagel, Campbell & Stanway, 1999). In terms of the National Land Transport Transition Bill of 1999 and the National Land Transport Transition Act of 2000 (NLTTA), which allows for the establishment of transport authorities, TAs were to be established for those transport areas that comprise individual municipalities, a combination of municipalities or parts of the aforementioned (Nothnagel, *et al*. 1999).

2.3 Importance of Public Transport

Before discussing the structure of public transport in South Africa, it is important to discuss the importance of public transport, since public transport claims a significant portion of, and is a substantial contributor to, the country's Gross Domestic Product (GDP). Public transport permeates the entirety of civilised life in the same way as do the arteries and veins of the human body (Richard, 1983; American Public Transportation Association, 2007; Mashiri, *et al*. 2010 & Ndebele, 2011b).

2.3.1 Economic

Public transport is a catalyst for economic growth, and direct and indirect job creation in South Africa. The provision of affordable, safe and reliable transportation of people is critical to the development of the country (SAGI, 2013).

Public transport enhances business and boots trade, and investing in public transportation, either by government or the private sector, is good for business and the economy of the country. In this regard, public transport often boosts real estate values. Real estate – residential, commercial or business – that is served by public transportation is valued more highly by the public and commercial investors than similar properties which are not as well served by transport.

In addition, public transport provides access to services for isolated residents and enhances local and rural economic growth in many ways, increasing the local customer base for a

range of services – shopping malls, medical and educational facilities, and other important services.

Furthermore, public transport enhances personal economic opportunities and saves individuals' money in the sense that passenger transportation use lowers household expenses and frees up more income for other needs. Public transport creates and sustains employment and this is good for both workers and companies, as it connects workers to jobs in both the suburban and rural areas; it reduces congestion and travel time and protects mobility, as well as providing a vital link to economic activities for citizens with disabilities.

Public transport is an important alternative to rising fuel prices. The fact that passenger transportation helps people stay mobile has become particularly relevant in recent years with the fuel prices spiking to record highs and the placement of residential and commercial development near transit hubs is a growing trend, taking into account fuel price hikes (American Public Transportation Association, 2007).

2.3.2 Social

Public transportation fosters liveable communities and encourages neighbourhood interaction. Furthermore, public transport encourages, amongst others, social activities and helps create strong neighbourhood centres that are economically stable, safe and productive. When commuters either use public transport or walk, contact with neighbours tends to increase, ultimately helping to bring communities together. By reducing reliance on cars, transit friendly communities also promote physical activity and walking.

2.4. Structure of Public Transport

The following section discusses the structure of public transport, taking into account that the structure of public transport in the country influences service quality in terms of reliability, extent of service, comfort, safety, and affordability, related to the objectives of the study (Farris, *et al*. 1976; Alam, 2002; Queensland Government, 2012 & McKnight, *et al*. 1986).

Farris *et al*.'s (1976) research is utilised more frequently in this section because they conducted a thorough and informative investigation of systems of public transport. This study remains as valid and true today as it was in the mid-1970s, when it was conducted. The literature is limited on the relevant and sufficient public transportation systems. However,

other researchers' work have also been utilised (McKnight, *et al*. 1986; Suen & Mitchell, 1985; Kilivington & Cross, 1986; Forshaw & Freeman, 1989; Hilling, 1996; Alam, 2002; Storer & Teljeur, 2003; Mayer & Onyango, 2005; Walters, 2006; Ryneveld, 2008; Gauteng Province, 2009; Ndebele, 2011a; Institute for Democracy in Africa, 2011; Queensland Government, 2012 & Wikipedia, 2012; NTA, 2012; Prileszky, 2012; Ndebele, 2012).

2.4.1 Systems of Public Transport

Public transport systems affect the quality of service in terms of reliability, extent of service, comfort, safety, and affordability. Poor systems will adversely affect the delivery of quality service to commuters. Accordingly, an understanding of the systems of public transport plays an important contributing role in the bid to improve service, specifically the reliability, extent, comfort, safety, and affordability of service (Farris, *et al*. 1976 & Alam, 2002).
Public transport is composed of the following four interrelated component systems. These will be discussed in greater detail below:

- Physical
- Economic Pricing
- Regulatory.

2.4.1.1 Physical and Economic Systems

While it is fairly common practice to use the term system when referring to physical public transport, the term, in fact, has three meanings or uses:

- The use of system to refer to a small part of the overall physical system of public transport.
- A somewhat broader use of system is found when industry groups publish statistics or other data about the highway system, the rail system, the airline system, and so on. Thus, in this context, a system refers to a collection of organisations or components of similar, and sometimes competing, types of physical public transport operations.

- A comprehensive use of the term system occurs when all the modes (with their individual organisations or components) providing the total physical function of moving people are considered. Thus, in this context, the physical system of public transport becomes broad, inter-modal, non-geographic, and all-inclusive with multiple-operators and multiple units (Farris, *et al*. 1976; Alam, 2002; Queensland Government, 2012 & Wikipedia, 2012). For the purposes of this research, it is in this broad context that the physical system of public transport is addressed.

A public transport system is composed of the following four interacting component parts, namely, the way, the terminal/ranks, the vehicle, and the operator (Farris, *et al*. 1976). This notion is supported by other public transport researchers' work (Hilling, 1996 & Alam, 2002).

(a) The Way

One approach to the physical characteristics of public transport is to consider the way. The "way" is defined as the public transport infrastructure, which consists of the fixed installations necessary for transport, including roads –providing the glide path for public transportation (Farris, *et al*.1976:31 & Alam, 2002:). The way involves patterns, such as the extent, provision, and financial support of the way. Generally, all these patterns may be categorised as means of support, sources of funds, and reimbursement plans (Farris, *et al*. 1976 & Alam, 2002).

(b) The Terminal/ Ranks

The words terminals or ranks have the same meaning and are used interchangeably. However, it is usual to talk of bus terminals and minibus taxi ranks. The terminal is sometimes regarded as part of the way despite the fact that it is, indeed, a separate component of a public transport system. Terminals may be situated along the way, at the beginning or at end of the way, or they may even be separate from the way itself. However, irrespective of its location, the terminal is integral part of the public transportation system (Farris, *et al*. 1976 & Alam, 2002). A terminal may also be thought of as a transport node, defined as either a point at which to access the transport network or a point through which it is possible to change transport modes (NTA, 2012).

The terminal fulfils the following key five functions:

- Concentration
- Dispersion
- Passenger service
- Vehicle service
- Interchange.

(c) The Vehicle

The vehicle traverses the way between the terminals. The majority of vehicles are private motor cars and they produce the most passenger kilometres. Public transport vehicles, although a small number in comparison, produce astounding numbers of passenger kilometres and vehicle kilometres as a result of their larger capacity, and more intense use in terms of frequencies per day (Farris, *et al*. 1976). Access to these vehicles has been transformed by the introduction of low-floor vehicles, which are used by all commuters, including the physically disabled (Suen & Mitchell, 1985).

(d) The Operator

The operator refers to the bus and minibus taxi organisations supplying the public transportation. The operators have to worry about the number of routes available, the operating revenues, the costs of the service, and the number of employees involved in their public transportation services (Farris, *et al*. 1976).

2.4.1.2 The Pricing System

It is possible to think of pricing in two contexts:

- The first context involves the establishment of a single price for a single commodity at a given period of time. The market forces of supply and demand are traditionally thought to balance one another in an equilibrium that creates the price that clears the market (the clearing price at which the supply equals the quantity demand). However, as regards a complex area such as public transport,

this view is much too narrow and, thus, a broader and more comprehensive approach is preferable (Farris, *et al*. 1976).

- The second context involves considering pricing as a system, that is, as a combination of interacting factors and circumstances. Rather than being concerned solely with an individual price that clears the market for a single commodity at a given time, this pricing system approach takes into account all the multiple forces that come to play in the matter of providing the service. Accordingly, price is not regarded as an independent variable which is determined by the impersonal factors of supply and demand, but rather as a dependent variable that is affected by supply and demand factors and that, in turn, affects them (Farris, *et al*. 1976).

2.4.1.3 Regulatory Systems

Regulation is an extremely broad term and has several meanings. It is widely accepted that the self-regulating mechanisms of the free market are insufficient to provide for the optimal functioning of the economy and this is, thus, the reason why, in certain sectors such as public transport, some form of state intervention is required (Prileszky, 2012).

It is possible to categorise the following three forms of state intervention, based on the level of government participation. Various regulatory systems may be analysed and described according to which of these three forms of intervention are employed and the extent to which they are employed (Prileszky, 2012):

- The setting of standards and regulations in respect of the performance of a given economic activity. For example, those who are entitled to perform the activity, rules for entering and leaving the market and conditions and requirements governing the performance of the activity.

- The use of financial regulatory devices of intervention. For example, investments using national funds, the partial or complete provision of financial assistance as regards the development costs, the provision of favourable credit conditions, tax relief or the introduction of new taxes and intervention in the price fixing process, for example, subsidies.

- The control of the activity by the state, including the founding of state-owned companies to perform the activity. Mainly, this involves the prohibition of others from taking part in the economic activity with the state providing the service.

Government intervention and regulation is generally justified on the grounds of "market failure", "information asymmetries" and/or equity considerations (Mayer & Onyango, 2005:2). Market failure underpins regulation in backbone infrastructure sectors, while asymmetrical information between consumers and the suppliers of services constitutes the rationale for regulatory interventions in the health, education and financial services sectors. Market failure arises when competition is either not feasible or it does not produce results that are compatible with the public interest. The government then introduces economic regulation in order to influence both commuters and suppliers by either encouraging or restraining certain forms of behaviour. The need to achieve equity in the provision of services finds expression in regulations that enhance the ability of poor people to access such services through the reduction of prices. This is often accomplished through direct subsidisation by the state, or through cross-subsidisation from wealthier to poorer segments of the market. From a regulatory perspective, the key issue is the efficacy of such regulations in enhancing access to the service (Mayer, *et al*. 2005).

(a) Goals of Regulation

As regards public transport, regulation is intended to realise two objectives, namely, the protection of the public and the promotion of the best possible system of public transport (Farris, *et al*. 1976).

It is essential that the public not be exploited in respect of either price or service. Nevertheless, conflict does sometimes arise, for example, in respect of the issues of safety and environmental protection. The public demands that its interests be taken into consideration. However, safety and environmental controls both cost money and may weaken the financial wellbeing of the organisation and/or the manufacturer concerned. Thus, the inherent conflict between the two goals is obvious and this conflict must somehow be accommodated. This usually takes the form of a compromise and, as a result, the conflict may be only partly resolved. This, in turn, may mean that the goals of regulation are never realised in their entirety. In other words, the public is not completely protected and nor would the best possible system of public transportation be attained (Farris, *et al*. 1976).

(b) Regulation and Policy Implications

The prime objective of any transport policy must be to create or support an efficient system that provides good transport facilities at the lowest cost in terms of the resources used (Farris, *et al*. 1976). The aims of a public transport policy include the following:

- Give commuters a wider choice of fares as well as enhanced convenience and service levels, and satisfy user needs in exactly the same way as do other businesses.

- Free the operators from the need for state support and the state from a heavy involvement in financial obligations in respect of public transport.

Despite the fact that, overall, there is a net benefit to restrictive regulation in respect of public transport, certain communities may be adversely affected. The effect of deregulation is expected to bring a reduction in the fares of many services in the urban areas as the benefits of increased competition are realised while, in the rural areas, there will be opportunities for innovations on the part of low cost bus operators. The anticipated effect of deregulation is the introduction of a greater choice into local public transport, with the services being more in line with the public's requirements (Kilivington & Cross, 1986).

In opening up the transport sector to commercial competition, those public transport services that are being offered should be identified and their true nature recognised, rather than circumscribing the whole system to regulations aimed at ensuring that essential, non-commercial services are provided. The overall objective of the deregulation policy is to increase competition, reduce costs, reduce fares, ensure value for money from passenger transport subsidies and increase service quality levels.

Regulation in the public transport sector should be considered from the following three perspectives, namely, economic regulation; regulation of the physical aspects of transportation; and regulation by social policy (Farris, *et al*. 1976).

There are three facets to the economic regulation of the public transport sector, namely, control or regulation of price (fares), control of entry of new operators and economic expansion or contraction of existing operators, and control of services from an economic viewpoint. On the other hand, the regulation of the physical aspects of transport refers to control over the conditions of transportation while regulation by social policy refers to both

the positive and the negative results of aiding and supporting one means of transportation over another, to transportation as a function as compared to other economic functions, to the ownership of public transport patterns allowed and to environmental restraints (Farris, *et al*.1976).

In addition, regulation may either be direct or indirect. The economic regulation of transportation may be regarded as direct as it impacts directly on the organisations supplying the transportation service. On the other hand, social regulation is exclusively indirect as it affects the economic climate within which transportation operates as well as the financial conditions under which public transport takes place. The regulation of the physical aspects of transportation may be regarded as a mixture of both direct and indirect. It is very often direct, for example, when safety rules are imposed on operators and private operators. It is, however, less often indirect, for example, when it involves the rules of the road and standard operating procedures (Farris, *et al*. 1976).

(c) Economic Regulation

Economic regulation plays a pivotal role in a number of services, including public transport. This is as a result of the fact that all backbone infrastructure sectors such as transport are natural monopolies. It is, thus, necessary to regulate these sectors to mitigate the negative impact of monopoly pricing. In addition, government has a strong interest in promoting universal access in order to promote equity (Mayer, *et al*. 2005).

Economic regulation becomes imperative when market failures prevent effective competition. The objective of such economic regulation is to mimic competitive conditions in order to steer prices towards more efficient levels. For example, the grid network, integral to the backbone infrastructure industries, in itself constitutes a market failure as it is not possible to duplicate it in an economically viable manner (Storer & Teljeur, 2003).

Economic regulation involves the rate of regulation, rate structure regulation, entry regulation, service regulation, regulatory dilemma, and direct regulation (Farris, *et al*. 1976). Economic regulation that enhances the status quo by favouring the established operators has the effect of forcing people to choose between using the service that is offered and not using the service at all. In some cases, rather than use services that only partially fulfil their requirements, commuters will find ways to satisfy their needs. However, if parts of the system are insulated from market forces it becomes extremely difficult to satisfy the needs in question. Management has no incentive to innovate, no spur to improve operational methods

and lacks any measurement of success. Management do, however, have a strong sense of social duty that may be missing in extremely competitive organisations because management, in this instance, is duty bound often by the public transport authorities to provide the service that meets a social need (Farris, *et al*. 1976).

- Rate Regulation

  Rate regulation in the public transport sector refers to the control of the prices public transport organisations charge for the services rendered. However, more specifically, rate regulation encompasses both the level of rates and the rate structure. These divisions of rate regulation have existed for a long time and involve the two legal and economic concepts of reasonableness and discrimination.

- Rate Structure Regulation

  The structure of fares plays an important role in public transport and involves the economic and legal concept of fares discrimination. It is possible that the schedule of public transport fares may result in unequal treatment as regards a given city or geographical area.

- Entry Regulation

  The main issue in respect of entry regulation pertains to the number of operators that should be allowed to compete on a given route or in a given area. Too much competition between operators may be as bad as too little. The financial well-being of the operator and the need for the public to be served are sometimes two conflicting criteria that must be taken into account in entry decisions. Two regulatory devices which have been used historically to control entry include the franchise and the certificate of public convenience and necessity (Farris, *et al*. 1976).

- Service Regulation

  From a philosophical viewpoint, the goal of regulation in the area of public transport is to ensure that the public is offered good service. Economically, service regulation must accompany price and entry regulation because, when a monopoly or near monopoly is granted and prices are set, there may be a natural tendency on the part of the organisation concerned to maximise profits by decreasing the quality and level of service. Once an operator has been granted

the right to operate exclusively, the natural stimulus of competition is removed. The overall aim of service regulation is to substitute administrative action for the stimulus of the impersonal marketplace with its financial rewards for good service (Farris, *et al*. 1976).

In addition, service regulation is a somewhat outdated concept, and the natural tendency of service levels to deteriorate once entry has been controlled has existed almost as long as regulation itself. There are rights and duties that must be imposed, for example, in exchange for the right to operate exclusively, the regulated organisation assumes the following four duties, namely, the duty to serve, the duty to deliver, the duty to avoid discrimination (price and service, both preferential and prejudicial), and the duty to charge reasonable prices only. In terms of public transport, the duty to serve is perhaps the most important of the four common operator obligations (Farris, *et al*. 1976).

To date there has been little concern about the conditions of service, namely, the physical condition of the equipment, the comfort of the passengers, and the general environment in which the service was rendered. Again, there is the assumption that an operator would render some minimum standard of service in order to meet competition in the marketplace. If the conditions of service were inferior, the passenger would simply transfer his/her allegiance to another operator or another mode. On other words, it is also possible to rely on, inter-modal and intra-modal competition and elasticity to regulate the conditions of service. Thus, in order to ensure that both the rate and the entry regulations are effective, it is essential that conditions of service, as well as extent of the service, be controlled (Farris, *et al*. 1976).

- Regulatory Dilemma

  The constant dilemma faced in respect of regulation involves finding the optimum level of intervention, that is, the level at which the balance of advantages and disadvantages is the most favourable. However, the ideal justifiable level of regulation and the devices which are used to apply this ideal level must be selected according to the unique features of the market in which they are to be employed (Prileszky, 2012).

- Direct Regulation

  It is important to note that the system of economic regulation is imposed directly on public transport. However, in view of the uniqueness of public transport, it merits a specialised regulatory system (Prileszky, 2012). Accordingly, the national regulators of public transport impose these controls directly. In the case of public transport, the action of a city council public authority, in effect, imposes the same three devices of the economic regulatory system, namely, price, entry and service regulation, upon the public transportation system (Farris, *et al*. 1976).

The three devices of economic regulation constitute a system of interrelated controls. It is, sometimes, difficult to regulate one of these devices without affecting another. In other words, a cut in fares may mean a cut in the frequency of the service or a drop in the quality of the service while an increase in fares in order to reach the desired revenue level may cause discrimination and preference. Too many operators in a given market may lead to economic chaos, especially if wasteful service levels are not controlled or the frequency of service becomes too great. Accordingly, all manner of compromises and trade-offs are often necessary, while the whole system of economic regulation must be considered as a whole and as individual regulatory devices (Farris, *et al*. 1976).

Inconsistency in the application of economic regulation to public transport is often matched by inconsistency in the pattern of providing and controlling public transport. In South Africa not all modes are regulated equally while some modes, such as minibus taxis, are not regulated at all (economically).

Finally, there are several possible patterns of competition in public transport. The public itself may choose to provide a service through a municipally owned operator such as a city bus line. The publicly owned operator may compete with a privately owned operator, although this often leads to unfair competition with the municipality as both the referee and a player. There is also the view that passenger transportation should be provided privately, whilst others maintain that the public provision of passenger transportation is important in order to protect commuters (Forshaw & Freeman, 1989).

(d) Regulation of the physical aspect of transportation

The objectives of the regulation of the physical aspects of transportation include the safety of the service and also the reliability of the service. In general, these are regulations which are

imposed on the conditions of transportation both by society as a whole and, in some instances, by the industry itself. All systems must have ground rules. The safety of the service is of paramount importance and, thus, the transport authorities have a duty to protect the commuting public from unsafe vehicles. As a result, regulations play an important role in passenger transport (Farris, *et al*. 1976).

There are rules and regulations which are laid down by transport authorities and these must be respected. Most of the physical regulation of transportation is to be found in three groups or devices of control, namely, regulation of the conditions of the equipment, regulation of the qualification of the drivers, and regulation of the operating procedures (Farris, *et al*. 1976):

The close link between physical reliability and economic reliability illustrates once more that rules are interconnected and interrelated – a system of regulation exists. It should be noted that the objectives of safety and reliability correspond with the general goals of the regulatory system, namely, the protection of the public and the promotion of the best possible system of transportation (Farris, *et al*. 1976).

(e) Regulation by Social Policy

In view of the fact that an agency of government typically imposes the controls, it is common practice to refer to economic regulation as social policy. It is also common practice to refer to the regulation of the physical aspects of transportation as social policy, as society imposes ground rules in respect of safety and reliability in order to protect its members. There is also a broader social aspect of public support and repayment, the ownership patterns and structure of competition permitted, and the relatively new environmental restraints that are extremely important. This area of regulation by social policy, more than any other, results in problems in public transport (Farris, *et al*. 1976).

The policy objectives of the public transport industry in South Africa include funding, service, planning, regulatory and operational objectives (Walters, 2006).

2.4.2 Public Transport Organisational Framework

The National Department of Transport is the government department responsible for regulating and providing efficient public transport and effective public transport infrastructure for rail, road, ports, and airports (Ndebele, 2011a). Specifically, the NDoT seeks to:

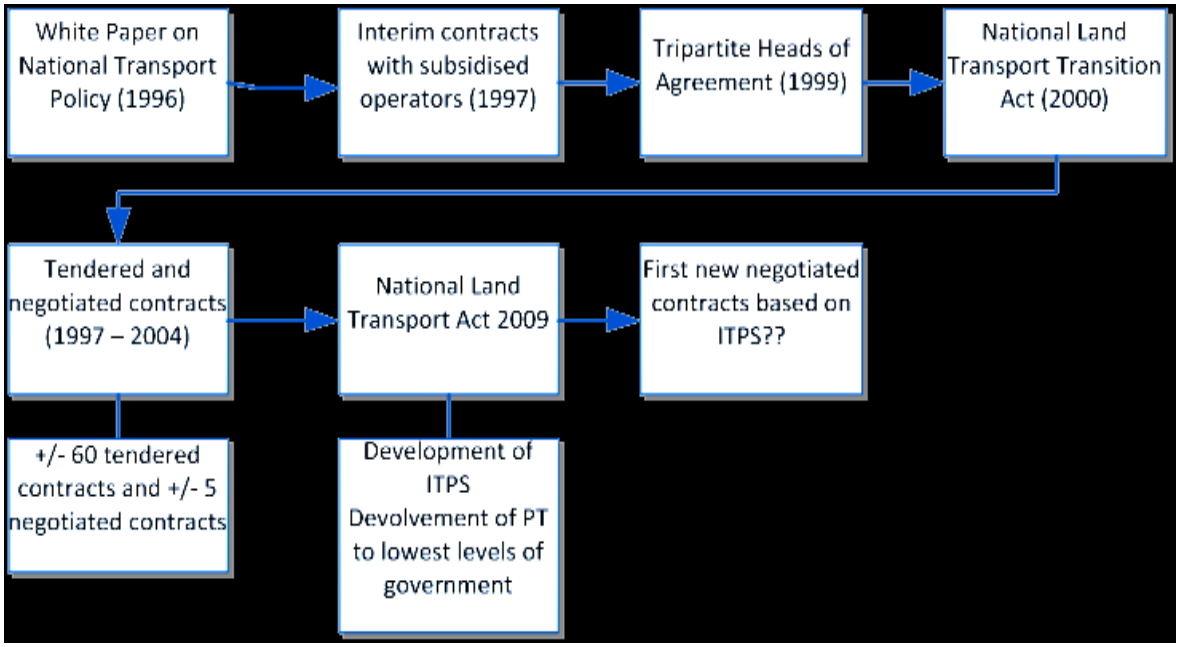
- promote a safe, reliable, effective, efficient, coordinated, integrated and environmentally friendly public transport system by developing norms and standards as well as regulations and legislation to guide the development of public transport for both rural and urban passengers;

- regulate interprovincial public transport services and monitor and evaluate the implementation of the Public Transport Strategy and the National Land Transport Act, 2009 (Act No. 5 of 2009) ;

- regulate road traffic management and to ensure the maintenance and development of an integrated road network through both the development of standards and guidelines and the supervision of the road agencies and provincial road expenditure (Ndebele, 2012).

As depicted in the following Figure 2-1, there are policies that have been developed over many years that govern public transport in South Africa.

Figure 2-1: Flow diagram of the policy process in South Africa



Source: Walters (2012: 23)

The following are the specific policy themes that affect public transport in South Africa, specifically in Johannesburg, Gauteng (Gauteng Province, 2009 & Walters, 2012):

- White Paper on National Transport (1996).

- National Land Transport Policy.
- National Land Transport Strategic Framework.
- Moving South Africa (1998).
- Road Infrastructure Strategic Framework for South Africa (RISFSA), 2005 by the National Department of Transport.
- Gauteng Spatial Development Framework (GSDF), 2009.
- Gauteng White Paper on Transport Policy-1996.

The public transportation legislative framework includes (Gauteng Province, 2009 & Walters, 2012):

- Road Traffic Act, Act 20 of 1998 and National Road Traffic Act, Act 93 of 1990.
- The Public Finance Management Act, No1 of 1999.
- NLTA (National Land Transport Act, Act No 5 of 2009).
- Gauteng Transport Framework Revision Act of 2002.
- Gauteng Planning and Development Act, Act No 3 of 2003.
- Gauteng Transport Infrastructure Act of 2001.
- Gauteng Public Passenger Road Transport Act (Act no. 7 of 2001).

In the past, government's main role in respect of public transport has been that of a regulator of bureaucratic detail, a provider of infrastructure, and a transport operator. However, government has been weak as regards policy formulation and strategic planning. Nevertheless, the government intends to reverse this legacy, and focus on its prime role of policy and strategy formulation as well as on substantive regulation, with reduced direct involvement both in operations and in the provision of infrastructure and services in order to create a more competitive environment (Ryneveld, 2008).

The National Land Transport Transition Act (NLTTA) (Act No. 22 of 2000) was promulgated to facilitate the implementation of the policies contained in both the White Paper (1996) and in Moving South Africa (1998). It re-emphasised government's commitment to devolving the public transport planning and implementation functions to the metropolitan municipalities. The National Land Transport Act (NLTA) (Act No. 5 of 2009) was then promulgated to further the process of restructuring and transformation which had been initiated by the NLTTA (Gauteng Province, 2009 & Institute for Democracy in Africa, 2011).

It is incumbent on the operators of public transport to comply with the NLTA 2009 as regards applying for an operating licence. The operating licence is managed under the Operating Licence Administration System (OLAS) and is maintained by the National Department of Transport in conjunction with the provinces, as required by the Act, which replaces the former Land Transport Permit System (Gauteng Province, 2009).

The NLTA, 2009 provides for regulatory bodies at the national, provincial, and municipal levels. At the national level, the National Public Transport Regulator (NPTR) is responsible for the granting, renewal, amendment, or transfer of an operating licence for an interprovincial service. At the provincial level, the Provincial Regulatory Entities (PRE) is responsible for the granting, renewal, amendment, or transfer of an operating licence while, at the municipal level, the Municipal Regulatory Entities (MRE) is responsible for the granting, renewal, amendment, or transfer of an operating licence (Ndebele, 2012).

The NPTR, PRE, and MRE must work together as regards the licensing of interprovincial services. However, if the NPTR, PRE and/or MRE have not yet been established, the Operating Licensing Board of the province in question must fulfil this function.

The Department of Transport formulated a Public Transport Strategy and Action Plan (PTSAP) which was approved by Cabinet in March 2007 (Institute for Democracy in Africa, 2011). The Department recognised that integrated public transport networks "do not exist – even in part – in any South African municipality" and that "municipal transport planning is still "car infrastructure biased". A public transport infrastructure and systems grant allocation of R19,6 billion was made for the 2007 to 2011 period, of which approximately R9 billion was for improvements to road-based services, predominantly Bus Rapid Transit (BRT) (Institute for Democracy in Africa, 2011:3).

However, it has been difficult to realise the integrated metropolitan transport planning and implementation objectives mandated by the NLTA as a result of the on-going dispersion of responsibilities across all spheres of government, capacity constraints at the municipal level and uncertainty regarding medium to long term funding provisions. Accordingly, there has been almost no progress made in terms of integrating the three main modes of public transport, namely, minibus taxi, bus and rail. Although the transport 'legacy' of hosting the 2010 FIFA World Cup has been widely proclaimed, very little improvement is visible in the basic or 'survival' public transport services on which the poor depend (Institute for Democracy in Africa, 2011:6).

However, the introduction of the BRT system in Johannesburg may be seen as the national onset of restructuring of the road-based public transport system, in terms of which the owners of existing bus and minibus taxi services displaced by the BRT systems may be assisted to form companies. These in turn will be contracted to operate the BRT vehicles according to the city's requirements. In view of the fact that the licensing of minibus taxis and the management of bus contracts are currently functions of provincial government, this should initiate the desired strategic shift to municipal control of public transport networks, as envisaged by the NLTTA 2000 and NLTA 2009 (Institute for Democracy in Africa, 2011).

Having discussed the organisational framework of public road transport, it is important to discuss road public transport specifically in terms of public buses and minibus taxis. However, prior to the discussion of the modes of public transport in question, it is important to first discuss public transport statistics in order to show the significance of the public transport in South Africa and in Johannesburg, in particular.

2.4.3 Public Transport Statistics

Public transport statistics is important and relevant to this study. Public transport statistics demonstrate the significant role of the bus and mini-bus taxi industry to the country's economy. Furthermore, public transport statistics demonstrate service quality dimensions, for example, time taken to arrive at destination. The statistics on the utilisation of public transport, as well as the continuous reliance on private motor vehicles is central as it points to the demand for public transport. In addition, it is essential to comprehend that a large number of commuters use public transport for their daily needs; as a result, an incorrect or unpopular public transportation decision could have major bearing on the perception of service (City of Johannesburg, 2006 & Mashiri, *et al*. 2010).

According to the South African National Household Travel Survey (2003), nearly two-thirds of households in South Africa do not have access to private transport (Lombard, Cameron, Makonyama & Shaw, 2007). According to the Institute for Democracy in Africa (2011), 26% of South African households have access to a car, whilst the remaining 74% are entirely reliant on public transport. However, according to the South African Bus Operators Association (2012), the number of households that are entirely reliant on public transport (buses, trains and minibus taxis for its mobility needs) now could be in excess of 80%. Of South Africa's 10 million commuters, 78% live in urban areas and 48% in metropolitan areas. In the metropolitan areas 39,5% of work trips only are made by private car while the modal split for work trips by public transport was minibus taxis 59,5%, rail 23,5% and buses 17% (versus 62,5%, 15% and 22,5% respectively at national level). The most frequently used motorised mode nationally is the minibus taxi, followed by the motor car (Institute for Democracy in Africa, 2011).

As a result of the growth in both population and employment, the absolute number of trips by both private motor car and public transport is increasing; while the rate of growth is higher for private motor car use than for public transport use. The public transport is in relative decline with its market share dropping (Lombard, *et al*. 2007).

The average travel time to work by all modes is 43 minutes but, if public transport is considered on its own, the average travel time increases to 59 minutes. Some of the 1,3 million public transport commuters travel for longer than one hour to work or for two hours per day if the trip home is also taken into consideration (Arrive Alive, 2012a). A trip of 40 km, for example, between Johannesburg and Pretoria in the morning peak time may take up to two hours or more. Similar situations are to be found in and around the metropolitan corridors of Johannesburg (Walters, 2012).

Walking times to buses are beyond the 15 minute travel target in the case of 52% of metropolitan and urban households and beyond the 30 minute travel target in the case of 43% of rural households. Walking times to minibus taxis are beyond the 15 minute travel target in the case of 18% of metropolitan and urban households and beyond the 30 minute travel target in the case of 20% of rural households (Arrive Alive, 2012a).

The public transport share of all motorised trips is 52% only (market share) and, thus, the ratio of 52:48 (public transport: private motorcars) falls well short of an unrealistic 80:20 (public transport: private motorcars) Department of Transport's target. This South African statistic of 52% market share for public transport is high compared to world standards. It

would be a struggle to maintain this public transport market share if car ownership continues to grow rapidly (Arrive Alive, 2012a).

A total of 30% of households in South Africa spend more than 10% of their income on public transport (Arrive Alive, 2013b). However, in 1995, transport cost as a percentage of household expenditure was 4% and, in 2006, it was estimated to have risen to just over 10% (Institute for Democracy in Africa, 2011 & Arrive Alive, 2012a).

In order to demonstrate the role of the bus industry, as one of the modes of public road transport being discussed in this study, the following depicts the profile of the South African bus industry:

- There are approximately 22 000 buses around the country. Approximately 75% (17 000) of these buses are used for public transport activities, running either scheduled passenger services or private hires and charters for commercial purposes (for reward). The other 25% (5 000) are run by businesses or government for their own in-house purposes (not for profit). The economic impact of buses indicates the following (South African Bus Operators Association, 2012):

    - Buses generate travel of more than one billion kilometres per annum and use an estimated 453 million litres of diesel.

    - Buses undertake approximately 816 million passenger trips a year.

    - It would cost R17 billion to replace the country's bus transportation.

    - There are approximately 30 600 people working directly in the bus industry, with a further 153 000 people being indirectly dependent on the industry for their livelihoods. However, this does not take into account those people working for the suppliers of buses, fuel, tyres and other items required to keep bus services running (South African Bus Operators Association, 2010 & 2011).

In order to demonstrate the role of the minibus-taxi industry, as one of the modes of public road transport being discussed in this study, the following section outlines the profile of the minibus taxi industry in South Africa:

- Of the 3.9 million public transport commuters, 2,5 million minibus taxi commuters account for between 63% and 65% of public transport work trips (Arrive Alive, 2013a & 2013b).

- In addition to the 2,5 million commuters who use minibus taxis as their main mode of travel, there are a further 325 000 commuters who use minibus taxis as a feeder mode to other passenger transport services (Arrive Alive, 2013b).

- The minibus taxi industry is estimated to comprise fleet of between 150 000 and 283 159 minibuses with an estimated turnover of more than R16,5 billion. The industry includes more than 20 000 owners and 200 000 employees (Arrive Alive, 2013a).

- The minibus taxi industry in particular claims a significant portion of and is a substantial contributor to South Africa's GDP; it is estimated to contribute more than R30 billion to the GDP of the country (Ndebele, 2011b). Unfortunately the industry is always overlooked in the calculation of the transport sector's contribution to both the GDP and the other social and developmental objectives of the country, including job creation.

As regards the City of Johannesburg, the focus area of this study, according to the City of Johannesburg (2006):

- 72% of commuters in Johannesburg using minibus taxis for their daily commuting needs.

- There are 1 677 public transport routes.

- There are 903 minibus-taxi routes as of 2002 with these routes divided amongst the 27 operators.

- There are 126 000 minibus taxis, 78 minibus taxi associations and 454 minibus taxi ranks in Johannesburg (formal and informal) (Gauteng Province, 2009).

- 670 bus routes divided amongst the7 main operators.

In addition, the metropolitan area is roughly elliptical (or oblong) in shape, with more development around the core city of Johannesburg as shown in the Figure below:

Figure 2-2: City of Johannesburg

Source: City of Johannesburg (2011: 1) & Wikipedia (2013: 1).

The city is one of the 50 largest metropolitan areas in the world and is also the world's largest city not situated on a river, lake, or coastline (City of Johannesburg, 2011 & Wikipedia, 2013).

In addition, according to the Community Survey (2007), the municipal city's land area is 1,645 km^2 (635 sq mi), and the population of the municipal city increased from 4,000,000 in 2010 to 4,434,827 in 2013 (Chirisa, Magwaro-Ndiweni, Muchindu, Ndlela, Nkonge & Sachs, 2010; Wikipedia, 2013 & Johannesburg Development Agency, 2013).

It is important to take into account that the City of Johannesburg has been decentralized with suburbs like Sandton now of greater economic importance than the city centre. The population of the Greater Johannesburg Metropolitan Area was 7,151,447, and including suburban regions such as Ekurhuleni, the West Rand, Soweto and Lenasia brings the overall population to 10,267,700 as of 2007 (Wikipedia, 2013).

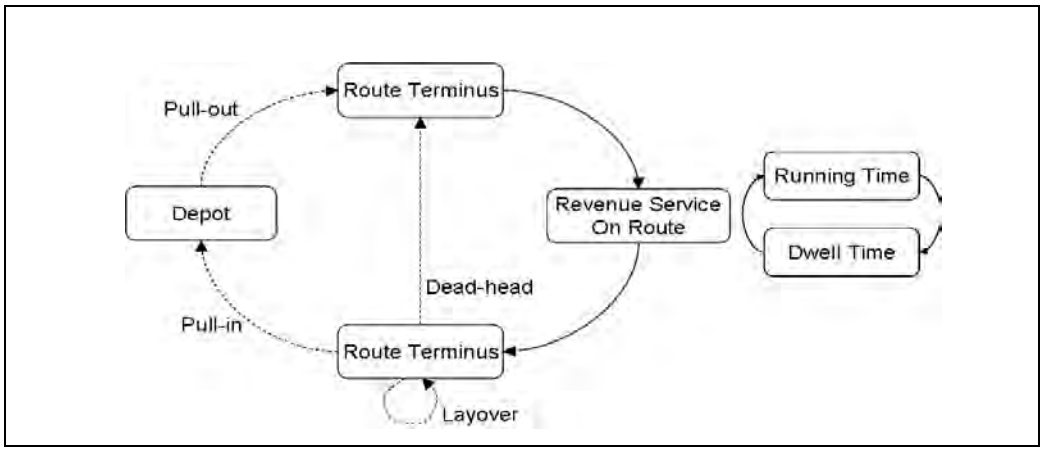
2.4.4 Modes of Public Transport

There are two modes of public transport that will be discussed in the following section, namely, public bus transport and minibus taxi transport. These modes of public transport are important and relevant since they are the focal subjects of this study.

2.4.4.1 Public Bus Transport

It is important to discuss public buses as one of the modes of the public transport system. The general operations of the bus industry will be explained first as depicted in Figure 2-3.

Figure 2-3: Public bus cycle



Source: Levinson (2011: 1)

The public bus cycle begins when a vehicle departs from a depot. The depot serves as a common location where the vehicles are parked or maintained. The vehicle is then moved from the depot to a location where it may begin service. This is commonly at the terminus of a route. Such a movement, from the depot to this location, is termed a "pull-out" (Levinson, 2011:1). The vehicle travels from its starting location to another route terminus, stopping at stations or designated stops along the route to allow passengers either to board the vehicle and to alight from the vehicle. This is termed "vehicle trip". While moving along the route, the vehicle incurs both running time and dwell time. Running time refers to the time spent travelling between stops or stations while dwell time is the time spent stopped at locations to allow passengers either to board and to alight.

While moving along the route, the vehicle is engaged in "revenue service". Accordingly, the time and kilometres spent along the route while providing passenger service are known as "revenue hours" and "revenue kilometres". When the vehicle reaches a route terminus, the vehicle is re-positioned for further service. If it returns along the same route or along another route starting from the same terminus, there may be a short time for recovery before the vehicle re-enters revenue service. This short time of recovery is known as a "layover" (Levinson, 2011:1).

A vehicle may also be moved between termini in order to start service on a different route, resulting in what is known as a "deadhead" trip – not in revenue service – between the two termini. The vehicle continues in revenue service on the fixed routes, repeating the process of stopping at stations or stops to allow passengers either to board and to alight. When the vehicle has reached the final terminus for its set of trips it returns to the depot. Such movement from a route terminus to the depot is termed a "pull-in". This vehicle cycle is common to fixed-route service, especially for bus and rail transit systems. In the case of demand-responsive service, there are no formal "termini" for a route but, rather, the "termini" represent specific locations at which persons are either picked up or dropped off. At any point, if the vehicle becomes empty, then it may dead-head to the next pick-up location, or it may return to the depot (Levinson, 2011:1).

Globally, public buses are celebrating their 100th anniversary in existence while 80% of all public transport commuters worldwide are carried by public buses (International Association of Public Transport, 2011). The bus is an extremely efficient mode of passenger transport, which is cheap, flexible and, in many cases, tailored to the needs of users both in terms of capacity and speed. Buses operate in mixed traffic and are easy to put in service. They do not require much infrastructure except for a depot and a workshop. From an economic,

environmental and social point of view, the public bus still remains the most universal solution as regards balanced and sustainable urban development and transport. Indeed, the bus is the only public transport mode in many of the world's cities. However, in most advanced economies, an efficient public rail system has become extremely popular to the detriment of public buses. Accordingly, the latter is facing a decline and as a result has tended to play a key supporting role (Institute of Civil Engineers, 1987 & International Association of Public Transport, 2011).

The efficiency and performance of buses depend significantly on dedicated lanes and stops. Various forms of traffic segregation are possible, including a mere painted mark on the road, various forms of road treatments, for example, elevated lanes; movable barriers; bus locks; and contra-flow lanes and a dedicated dual lane infrastructure with metro-like stations. The most advanced of such systems is referred to as BRT (International Association of Public Transport, 2011). There is a detailed discussion of the BRT system in section 2.8 of this chapter.

Specific to South Africa, as indicated under the organisational framework in the discussion above, the NLTA, 2009 (Act No. 5 of 2009) is one of the important pieces of legislation applicable to public bus industry.

The bus industry in South Africa has, for many years, been making a vital contribution to the economic and social development of the country. As a provider of bus services, it has delivered, and continues to deliver, mobility to millions of people who are dependent on public transport, for example, learners who require transport to and from school, workers who require transport to and from their jobs, and individuals who are seeking either employment or access to hospitals and other services (Arrive Alive, 2011a).

The bus industry in South Africa is represented by SABOA – the voice of an inclusive, efficient, sustainable and transforming bus industry. The SABOA, which plays a pivotal role in an integrated transport system through safe, reliable and affordable bus services that add value and are attractive to stakeholders, has also been involved in the transport policy formulation process since 1994 (and prior to this date) through the White Paper on National Transport Policy, the Moving South Africa Strategy, the National Land Transport Transition Act, the tendering system, negotiated contract system, the Tripartite Heads of Agreement and the BEE Charter process, as well as being involved in the policy formulation process of the Cross-Border Road Transport Agency and the provinces themselves (Walters, 2008b & South African Bus Operators Association, 2011).

In Johannesburg, PUTCO and Johannesburg Metropolitan Bus are the main public bus organisations in terms of the number of passengers carried per annum (City of Johannesburg, 2003a & 2006). Table 2-1 depicts the SABOA member profile as well as the number of bus operators:

Table 2-1: SABOA member profile

Category	Number of members 1996	Number of members 2011
Principal members		
1-30buses	95(74.8%)	904 (96%)
30+ buses	32 (25.2%)	36 (4%)
International members		
Swaziland	-	2
Namibia	-	1
Lesotho	-	1
Affiliated Associations		
COASA	10	-
PTA Zimbabwe	-	160
Vhembe	-	15
Supplier members	37	56
Total	**174**	**1120**

Source: South African Bus Operators Association (2012: 1)

Table 2-1 shows that, between 1996 and 2011, the number of SABOA members increased from 174 to 1120, thus making SABOA the largest association representing the bus industry and representing more than 76% of the buses used for public transport (South African Bus Operators Association, 2012).

As formal public transport sector in the country, the bus service receives an operating subsidy from the Department of Transport. Subsidised public transport contracts remain 'bus only' contracts. Almost all of them have been managed on a month-to-month basis for a long time. However, as a result of the short term nature of these contracts, most operators have not been able to recapitalise their fleet for some time (Institute for Democracy in Africa, 2011& Ndebele, 2012).

The bus industry subsidy has been increasing with the industry receiving operating subsidies of R3,5 billion in 2011 and R4,3 billion in 2012 for provincial public transport subsidies.

However, no capital investment subsidy structure has been put in place (Institute for Democracy in Africa, 2011 & Ndebele, 2012). In addition, more than two-thirds of this operating subsidy is paid to operators on interim contracts which were originally concluded in 1997 as a stop-gap measure in preparation for the intended introduction of a competitive system of tendering for contracts. These contracts have now all expired and they were, prior to 2007, only being renewed on a month-by-month basis (Walters, 2008a & Institute for Democracy in Africa, 2011).

The uncertainty created by this short-term arrangement has discouraged investment by existing operators while also making it difficult for new players to enter the market. Over the past eight years no new subsidised bus routes have been approved, nor have existing routes been adjusted sufficiently to cope with demand growth (Institute for Democracy in Africa, 2011).

According to the official policy of the Department of Transport any bus service that requires a subsidy should be competitively tendered (Walters, 2008a). Provision is also made for negotiated contracts, especially for provincial and local government-owned bus companies, as a once-off measure to enable such companies to recapitalise as well as to prepare for the anticipated competitive system of tendering for contracts. There are approximately 10 000 commuter buses (excluding municipal buses (+/-1 100)) of which approximately 7 119 are included in the NDoT subsidised system (Walters 2008a). However, there has been little change to the status regarding the types of service reflected in Table 2-2.

Table 2-2: Types of services

Services	**Number of operators/operating areas**	**Number of buses**	**Policy status**
Services under interim contracts (ICs)	35	3 799	Based on previous ticket subsidy and previous service area. Services need to be either tendered or negotiated. Services funded by the DoT through provincial DoTs. Approximately 66% of the subsidy budget is still under interim contracts.
Services under tendered (TCs) and negotiated contracts (NCs)	80	3 320	Based on revenue kilometres and contract requirements. Not based on integrated transport plans. Most services need to be re-tendered. Services funded by the DoT through provincial DoTs. Approximately 34% of the subsidy budget is allocated to these services.
Services provided by local authorities	3	+/- 1 100	Deficit subsidy arrangements. Services funded by metropolitan government.

Source: Walters (2008a: 98)

In 2006, the Department of Transport described the management and monitoring of interim contracts as "non-existent" (Institute for Democracy in Africa, 2011:7). Of major concern is the anecdotal evidence which suggests that the current policy of subsidising bus operators is prone to wide-scale corruption whereby operators often falsify passenger numbers in an attempt to gain more subsidy money from the NDoT. The Treasury is withholding further funding until the problems have been addressed (Farrow, 2009). In addition, National Treasury, dissatisfied with the lack of control over the bus subsidy budget, has been putting pressure on the Department of Transport to change the subsidy system (Institute for Democracy in Africa, 2011).

In a recent discussion on public bus subsidies, the following was articulated:

> "Currently, government concedes that there's a general agreement within the transport family that the current bus contracts have been sparked with many problems and should be renewed through a managed, negotiated process. These negotiations will be with existing operators with provisions for taxi empowerment. This approach will allow for a progressive replacement of current bus contracts and the phased implementation of additional route networks based on new approved integrated municipal transport plans. An agreement on the need to enter into negotiations with bus operators regarding longer term contracts has been reached with the Minister of Transport and provincial Members of the Executive Committees (MECs) on public transport. In addition, the MinMec established a Committee that would provide oversight and monitor the negotiation processes. Provinces and affected municipalities will manage negotiation processes. Given the urgency required to integrate different public transport modes as well as the associated increase in the cost of doing so, a substantial rethink of the method of implementing this process is required. A negotiated approach will provide a win-win solution to numerous challenges that are facing the current contracting system. Government would be able to influence and realise economic empowerment for the previously disempowered, whereas current operators would be guaranteed stability through longer term contracts" (Ndebele, 2012:8).

2.4.4.2 Minibus Taxi Transport

It is important to discuss minibus taxis as another key mode of public transport in South Africa, focusing specifically on the evolution of this industry as well as regulation and safety

aspects. According to Ndebele (2010), there are pitfalls facing the minibus taxi industry that need to be recognised and addressed:

Firstly, the minibus taxi industry is competing against bus and rail operators who have received subsidies from government for many years. Secondly, poor regulation of the industry has resulted in violent conflict within and between taxi associations and, thirdly, the industry is facing the prohibitive costs of financing vehicles.

In an attempt to address these challenges, the National Taxi Task Team offered the following recommendations (Ndebele, 2010):

- Economic empowerment of the industry
  - Refinancing of the taxi industry through the Taxi Recapitalisation Programme and integration into the subsidy system.
  - Corporatisation through the formation of taxi co-operations.
  - Capacity development through education and training programmes.
- Formalisation through the registration of the taxi associations
  - All associations in all provinces of the country have been registered with their routes and members.
- Conversion of permits into operating licences
  - The slow pace at which the regulatory system is being implemented.
- Democratisation of the taxi industry.
  - Members of the current structures in the minibus-taxi industry fear that a more democratic cooperative system may result in their losing some or all of the benefits and perks that they currently enjoy.
  - Some private sector businesses currently have deals with the minibus-taxi industry and, because these business owners fear that they may lose their market, they are capable of deliberately destabilising the minibus-taxi industry in order to retain their market share.

- Individuals who benefit from the negotiations regarding the formalisation and development of the minibus-taxi industry may also prolong the process if they do not receive a fair deal or if the process does not go according to their plans.

- The formalisation plans and strategies are not always explained clearly and in the correct manner to the members of the minibus-taxi industry.

These recommendations were subsequently adopted by Cabinet as the blueprint for the transformation of the minibus taxi industry (Ndebele, 2010).

The status of the minibus taxi industry is such that industry operations are governed by the NLTA, 2009. The minibus taxi associations are required to be registered by the NLTTA, 2000, thus granting them official recognition without requiring that they maintain proper financial records or establish formal accountability mechanisms (Institute for Democracy in Africa, 2011). The challenge is to develop a strategy for transforming the industry which eliminates its unacceptable characteristics but without unduly sacrificing its culture of small enterprise, its operational flexibility and its dynamism. In the context of a formal economy which is becoming less labour intensive the minibus taxi industry should be recognised for the important role it plays in providing business opportunities and employment to members of disadvantaged communities. The fact that it has been able to do this with almost no state support is also noteworthy (Institute for Democracy in Africa, 2011).

It would appear that, unfortunately, the contribution which the minibus taxi industry makes to the national economy, both in terms of turnover and employment, is not sufficiently understood (Arrive Alive, 2011a). The minibus taxi transport industry is proof of the way in which black people, cast aside by the apartheid regime, managed to become the most powerful transporter of commuters in South Africa (Ndebele, 2010). Minibus taxi operations have operated in non-white townships since the late 1950s. The minibus taxis are found mostly on the high density travel corridors and may be stopped on demand. Fares are normally a flat rate and higher than the conventional parallel passenger transport mode which is either the bus and/or the train (Freeman, Ngcoya & Chapman, 1990). However, these are not taxis in the typical western sense of the term as, for example, they do not give the members of the public a lift to their doorsteps. Instead, they are small-scale bus services, operating density routes, often unmarked, operating with neither timetables nor formal stops (Gill, 1998).

Furthermore, until 1977, the law restricted minibus taxi operations to sedan motorcars fitted with fare meters. In 1977, minibuses were introduced to the taxi industry, allowing one driver and fifteen passengers per vehicle. Prior to 1987, the minibus taxi industry was highly regulated and controlled and black minibus taxi operators were declined permits. It was also illegal to operate 16-seater minibus taxis as minibus taxis. Post 1987, the industry has been rapidly deregulated, leading to an influx of new minibus taxi operators, interested in making money from the high demand for this service. Minibus taxi operators began using larger 'kombi' minibuses that could carry up to 15 passengers. Until formal deregulation in 1987, such taxis were illegal. However, they were popular with the black commuters because, unlike other public transport options, they

- ran late-night services;
- travelled to remote places;
- picked commuters up from, and dropped them back at, their homes on a needs or negotiated basis;
- charged reasonable fares for the flexibility of service;
- made convenient stops on long distances; and
- reduced the time spent waiting in long queues at bus and train stations (Arrive Alive, 2011a).

In the absence of state regulation, groups of operators banded together to form local taxi associations, which intervened to regulate loading practices and fares. It was not long, however, before minibus taxi associations began to use their organisational power to extort money, often through the use of violence (Arrive Alive, 2011a).

In addition, these associations sometimes used mafia-like tactics and engaged in anti-competitive price fixing. Legislation has since been enacted to provide for the transformation and restructuring of the national land transport system of South Africa and matters incidental thereto. Currently, the minibus taxi industry is the most critical component of the passenger transport sector and it is the only form of public transport that penetrates every sector in the cities, including the poorest shack settlements (Arrive Alive, 2011a).

The minibus taxi industry represents a model of successful, black economic self-empowerment. It is the only sector over which blacks exercise total control through their ownership of the minibus taxi mode of transportation (Arrive Alive, 2011a & Fobosi, 2013).

However, the biggest challenge lies in making transport in South Africa safe, efficient and affordable. In terms of the 2006 Millennium Development Goals, one of the goals of the 2015 Road Traffic Safety Management Plan (RTSMP) is to reduce by half the rate of accident fatalities arising from road and other transport by 2015 (Road Traffic Management Corporation , 2009). In line with this goal, the government has taken considerable steps to regulate the minibus taxi industry in the best interests of public safety and also to transform it into a more profitable business in which income is derived from a wider basket of income generating enterprises and not just from fares. Minibus taxis are also often perceived both as unsafe and as operating in a way that is harmful or abusive to passengers (Arrive Alive, 2013a).

The most widely publicised and certainly the most ambitious government intervention in the minibus taxi industry is the Recapitalisation Programme (Recap Project) (Arrive Alive, 2011a & 2013a). Through the Recap Project, government sought to challenge the problem of an ageing fleet within the transportation system. The Recap Project represents a comprehensive re-engineering of the minibus taxi industry with two major outcomes:

- The systematic introduction of safe and comfortable vehicles for minibus taxi commuters through a scrapping allowance which is an incentive for minibus taxi operators to hand in, on a voluntary basis, their very old vehicles for decommissioning.

- The economic empowerment of the minibus taxi industry through a package of business opportunities in terms of which the Recap Project affords the minibus taxi industry the opportunity to participate on a national basis, through the SATACO structures, as well as at the level of the provincial co-operatives (Arrive Alive, 2011a & 2013a).

Nevertheless, the minibus taxi Recapitalisation Programme should not be regarded as a quick solution. Government has recognised that the sustainability of this and other interventions does not lie in the scrapping of old minibus taxi vehicles only but should include all of the following:

- the introduction of safety requirements for the new minibus taxi vehicles;
- the scrapping of existing vehicles;
- effective regulation of the minibus taxi industry;
- effective law enforcement in respect of passenger transport; and
- the empowerment of the minibus taxi industry (Ntuli, 2005; Arrive Alive, 2011a & 2013a).

The following are the basic requirements for participation in the minibus taxi recap programme:

- a valid operating licence;
- vehicle legally registered as a taxi;
- proof of ownership of the taxi;
- a valid South Africa identity document as issued by the Department of Home Affairs;
- proof of registration as a taxpayer with the South African Revenue Service; and
- a valid Certificate of Fitness for the taxi (Arrive Alive, 2011a & 2013a).

Nevertheless, progress in respect of the Taxi Recapitalisation Programme has been disappointing. In September 2009 the Department of Transport reported that a total of 34 356 old minibus taxi vehicles had been scrapped in the four years between 2006 and 2010. However, this represents 25% only of the 135 894 vehicles now targeted for scrapping. The Department forecasts that a further 26 963 will be scrapped over the three years from 2010 to 2013, bringing the total for seven years to 61 319 or 45% of the target (Arrive Alive, 2011a).

Globally, another important area involves training of drivers. In order to be granted a minibus taxi driver authorisation (or PDP) to drive within a transport district, the driver must successfully complete the following training and assessment programmes:

- Pass an English assessment at the New South Wales (NSW) Adult Migrant English Service (AMES). This assessment must be satisfactorily completed prior to the individual embarking on training.

- Enrol in TaxiCare Plus, a Certificate 3 Course, at a Vocational Education and Training Accreditation Board (VETAB) accredited taxi training school.

- Study modules 1 to 3 of TaxiCare Plus (Introduction, Localities and Routes and Rules and Regulations).

- Sit for the Sydney Knowledge Test (5 Modules – Street Knowledge, Major Routes, Locations and Destinations, Regulations and a practical Street Directory test)

- Study modules 4 to 8 of TaxiCare Plus at the training school (Customer Care, Driver Safety, Taxi Driving Skills, Driver Health and Stress Management and Passengers with Special Needs).

- Assessment of modules 4 to 8 will be conducted by the training school.

- Taxi assimilation (an on-road assessment of the skills as a taxi driver by the training school) (New South Wales, 2010).

New taxi drivers authorisations or PDP's expire 12 months after the date of initial issue. In order to renew an authority the holder of the authority must complete the TaxiCare Plus Silver Certificate. To meet this requirement in the prescribed time the authority holder must:

- Enrol in the TaxiCare Plus Silver Level training course within two months of the issue of the initial driver authority.

- Provide a written log book (issued on completion of the Silver Certificate) to a school (indicating that the driver has undertaken driving shifts equivalent to 1 per week for a total of 48 weeks).

- Sign a declaration regarding criminal offences.

- Sign a declaration regarding traffic offences.

- Sit for another practical road test conducted by a training school.

- Supply a copy of his/her driver's licence and a photograph (New South Wales, 2010).

In South Africa, the Minibus Taxi Awards, which are managed by the Department of Transport, encourage professionalism, safety and efficiency in this sector. The objectives of Minibus Taxi Awards include the following:

- to increase awareness on the part of the community of the minibus transformation process

- increase awareness among minibus drivers of road safety and customer care levels

- increase awareness on the part of operators that they should ensure that they manage their minibus taxi businesses better and more efficiently and adhere to roadworthy requirements

- Taxi Association executives are encouraged to comply with the basic requirements for ensuring that the administration of their associations and financial matters are in good order with the Provincial Transport Registrar (Arrive Alive, 2011a).

With regard to subsidies, the minibus taxi industry – with an estimated fleet of 150 000 to 275 000 vehicles – remains the largest component of the public transport system and the only one not receiving operating subsidies. Government efforts to transform the industry have been met with limited success, while the sector's blatant disregard of laws and regulations continues. Dangerous vehicles, overloading, and reckless driving remain the trademarks of the minibus taxi industry. Such practices are, however, in part, attributable to the sector not having access to operating subsidies (Arrive Alive, 2011b).

Taking into account the aforementioned discussion on public transportation framework and key modes of public road transport, in question, the following discussion focusses on the public transport networks because these networks, particularly in Johannesburg have an impact on service quality.

2.5 Public Transport Networks

The public transport network discussion is important. Firtsly, this discussion is important because it focuses on the government intervention to improve public transport by focussing on the public transportation systems that are likely to improve public transport service quality in order to increase future utilisation and demand, thus, attracting and retaining users. Secondly, this discussion is important because the research data on commuters' perceptions of bus and minibus taxi service as it relates to the service quality dimensions of McKnight *et al*. (1986) was collected in Johannesburg. This is in line with the objectives of this study as discussed in chapter one.

2.5.1 Systems of Public Transportation

Public transport systems are, in fact, networks. Networks are systems which involve nodes which are joined together by links or arcs. Nodes may be provided externally to the network, for example, settlements and cities, or they may be endogenous to the network. Each node is either the origin or the destination of a flow. Flows occur along the arcs of a network and each arc is associated with a cost per unit of flow. The cost will, in turn, be determined by the distance and the operating characteristics of the transport system, but it will also be related to the volume of flow along that arc. Each arc has a capacity which defines the maximum flow along that arc. This set of factors determines the characteristics of the networks (Farris, *et al*. 1976 & Alam, 2002).

The optimisation problem that is present here involves, firstly, determining the shortest or most cost-effective path, through the network from any one point to any other point; and, secondly, determining the minimum cost of the potential flows in the network as a whole, given the pattern of origins (supply) and destinations (demand). This allows for interaction between the flows on particular arcs in such a way that, when the flow on one arc approaches capacity, other flows are rerouted in order to satisfy the minimum-cost rule.

According to Farris and Harding (1976), there are two sets of interests in optimal networks:

- The optimal use of the network by the user, who needs to know how to find the optimal way of linking nodes and minimising the costs of transport.

- The establishment of the most efficient network by the operator in response to the existing pattern of demands.

However, it may happen that the most efficient network for the operator will not be the network which is to the maximum advantage of the users. In the case of a privately provided network, the main objective of the provider is to maximise profits and, thus, the social welfare of potential users is of little, if any, importance. Accordingly, networks may be developed which are efficient or optimal from the point of view of the provider, but which are not optimal from the point of view of society – by excluding certain groups or geographical areas because serving these groups or areas may not be profitable. It is for this reason that the public sector has moved to provide a number of transport networks (Farris, *et al*. 1976).

There is, however, an efficiency argument as regards preserving unprofitable parts of networks as these may promote wider efficiency in the economy. There are two elements to this:

- Network economies exist only when a network is complete, but which might not be able to be realised by the individual operator or infrastructure provider, and which have an effect on the broader economy.

- Network economies are recognised to be increasingly important in South Africa; although as an economy which is less developed than it needs to be in the context of the move to greater privatisation of both public transport services and infrastructure.

The next section discusses three approaches to public transport systems improvements aimed at improving the service quality, namely, short, intermediate, and long term approaches. This discussion is important because it shows that the successful improvement of public transport network may have a direct effect on improving overall passenger satisfaction. However, the success or failure of any recommended public transport system will depend largely on: the proper engagement of all stakeholders, that is, bus and minibus taxi operators; and also on the ability of government to make a proposal which is acceptable to the majority of the stakeholders in the public transportation industry (Farris, *et al*. 1976).

- Short-Term Outlook

  In the short term, the primary objective of urban transportation planning relates to ensuring maximum impact and efficiency from the existing facilities.

However, this is based on the assumption that existing facilities have been maintained and is in good condition. In most cases, this means the more effective utilisation of a mix of public and private modes of transport. In communities in which public transport is presently operating, the problems experienced tend to be related to upgrading the quality of service and marketing the offering effectively. Thus, the major objective in this case would be to modify the motor vehicle-oriented attitude of commuters through educational programmes and other pro-mass-transit incentives (Farris, *et al*. 1976).

Bus services should continually be evaluated to ensure that commuter needs are being met. Clear and informative signs are a prime requisite together with secure, well-lit shelters at major points of departure. Human factors, including the aesthetics of design, should be recognised as important determinants of passenger satisfaction. Features, such as equipping buses with traffic signal-control devices to avoid unnecessary intersection delays, thus improving reliability and adherence to schedule, have been implemented in various cities in the world.

- Intermediate Term Outlook

  During the intermediate time frame, it would be possible to construct and put into operation new urban transportation facilities.

- Long-Term Outlook

  It is essential that the long-range mass-transit outlook be viewed against the dynamic backdrop of the total urban environment. In the short and intermediate ranges, the structure of cities and metropolitan areas tend to be regarded as given. In other words, these variables are accepted as the parameters of an environment to which urban transport facilities must be adapted. In the long run, however, significant alterations in the residential, commercial, industrial, economic, and political dimensions are to be expected and these must be taken into account together with strictly transportation-oriented issues (Farris, *et al*. 1976).

2.5.2 Passenger Transportation Systems: The Johannesburg Bus Rapid Transport System Case Study

As discussed in the preceding discussion, the research data on commuters' perceptions of bus and minibus taxi service in terms of the service quality dimensions of McKnight *et al*. (1986) was collected in Johannesburg in order to meet the objectives of this study as well as to answer the research questions. Furthermore, the successful improvement of public transport network in Johannesburg may have a direct effect on improving passengers' perceptions of service and satisfaction, while simultaneously improving the economy of the city. Therefore, this discussion is important to this study.

Despite the fact that an efficient public transport system may boost the economy of an area, and the subsequent economic growth may generate an increased demand for transport (Department for the Environment, Transport and the Regions, 1999 & Adarkwa & Boansi, 2011). Developing countries are faced with the dilemma of whether they should follow western models and devote a major portion of their development resources to the construction of mass transit systems or whether they should opt for low cost, capital saving options. The decision often lies both with the political will present and the way in which governments and people in general perceive public transport (Dalvi, 1987).

The South African government took a decision to follow western models and to devote major resources to the construction of a mass transit system, known as the Bus Rapid Transport (BRT) (City of Johannesburg, 2001; 2002; 2003; 2004; 2006; Cox, 2009; Tugwana, 2010; Hudleston, 2011 & Ndebele, 2011a).

The BRT has become government policy which affects all the provinces in the country (Masango & Gadebe, 2007; Dysan1, 2007; Ndaba, 2008 & Radebe, 2008). The Public Transport Strategy and Action Plan 2007 to 2020 were approved with the aim of creating a lasting legacy of public transport in South Africa (Radebe, 2008). The cornerstones of the strategy include the transformation of the public transport through the Acceleration of Modal Upgrade, and the attainment of Integrated Rapid Public Transport Networks (Radebe, 2008).

The public transport model for Johannesburg is being used as a pilot project for the other provinces, and is the only model in the country that has reached an advanced stage in terms of its implementation (City of Johannesburg, 2006 & Tugwana, 2010). Accordingly, this research study focused specifically on the BRT in Johannesburg as a case study.

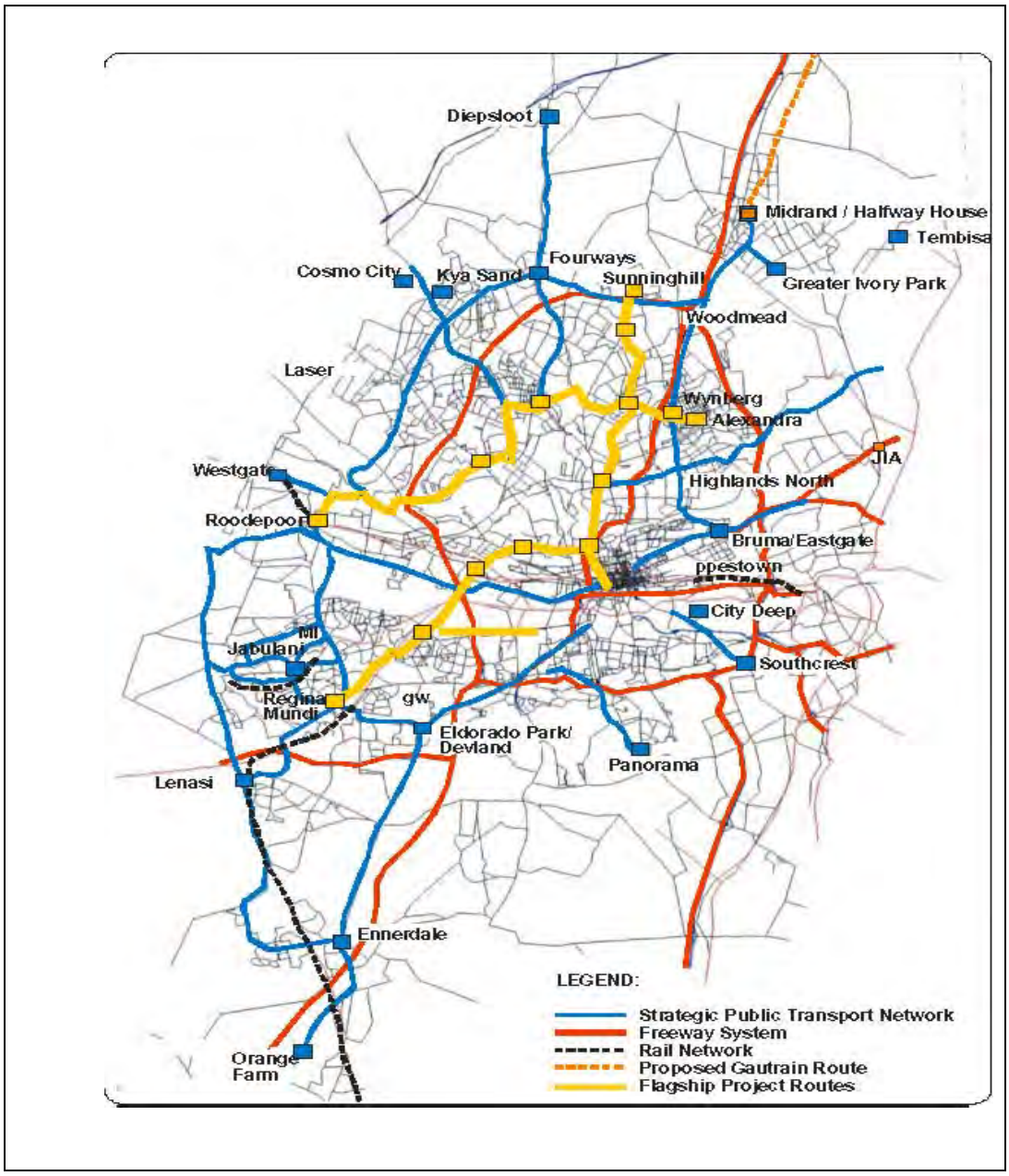
2.5.2.1 Development of the Johannesburg Bus Transport Network

Two most important bus systems were considered for Johannesburg, namely, Strategic Public Transport Network (SPTN) and BRT known as Rea Vaya (Moosajee, 2012). The following section discusses SPTN, BRT, and major changes from SPTN to BRT.

(a) Strategic Public Transport Network (SPTN)

The Strategic Public Transport Network was the approved original public transport improvement project for Johannesburg. However, the project was in its early stages of implementation when it was changed. The SPTN incorporated modest kerbside infrastructure that would have created priority for the existing public transport modes, although there would have been no substantial changes in ownership patterns or dramatic quality improvements. The SPTN formed part of the Integrated Transport Plan (ITP) which, in turn, further highlighted the vision, goals, and objectives of this public transport system. The SPTN was intended to replace the old model which had been developed in the 1970s and which was known as EMME/2. The EMME/2 system had been maintained periodically up to the early part of the 1990s but any maintenance had subsequently stopped (City of Johannesburg, 2003a). Figure 2-4 below presents the SPTN for the City of Johannesburg:

Figure 2-4: Strategic Public Transport Network (SPTN)



Source: City of Johannesburg (2003a: 421)

The main objectives and principles of the SPTN, included, amongst others; channelling public transport routing into more focused, high frequency corridors, rather than the dispersed, less frequently serviced and customised routing; providing links between residential areas and both major economic nodes and significant decentralised nodes, as well as between the nodes themselves; providing Johannesburg with a legible, permanent, recognisable public transport grid made up of east-west and north-south links, and a system of hubs at the intersections of these links on the lattice; enabling public transport

infrastructure decisions and expenditure to clearly focus on the network and the hubs; structuring the fare system in such a way that subsidised services would operate on the strategic network only with fares zoned or staged according to key interchange hubs while flat fares could also be considered on a sub-grid of the network, depending on the fare policy of the City of Johannesburg; and providing a focus for the public transport law enforcement strategy, that is, vehicle safety checks as well as operating licence compliance enforcement (City of Johannesburg, 2003a).

A Rationalisation Plan was also developed in order to mitigate against possible complexities envisaged in the implementation of the SPTN, for example, the Soweto bus services routes; Eldorado Park bus services routes; and Johannesburg Metrobus services routes, all of which involved bus companies operating in Johannesburg (City of Johannesburg, 2003b; Johannesburg Metropolitan Bus, 2003 & 2005b). The criterion for the rationalisation plan was developed in order to ensure effective implementation of the SPTN (City of Johannesburg, 2003b). Furthermore, the amalgamation of the routes resulted in the rationalisation of routes from Soweto and Eldorado Park, and also Metrobus specific routes (City of Johannesburg, 2003b & 2006). However, there were major shortcomings in the SPTN and Rationalisation Plan, including amongst others, the SPTN was not going to assist the City of Johannesburg as regards reducing reliance on private vehicles; there was no clear model for the way in which private transport would be minimised; there was no funding commitment to speed up the SPTN implementation; the affordability problem as well as the minibus taxi recapitalisation strategy remained unsustainable (City of Johannesburg, 2006).

As a result of these shortcomings, the transformation of Johannesburg's public transport operations into a world-class mobility system remained an elusive goal and, thus, an alternative model was sought. Nevertheless, political will and stakeholder buy-in again was considered important as regards support for the alternative model.

Furthermore, the SPTN project struggled to obtain buy-in from the minibus taxi sector, particularly in view of the high levels of antagonism between the Top 6 Minibus Taxi Association and GJRTC at the time. Against this background, the City of Johannesburg decided to undertake a study tour to Guayquil, Ecuador and Bogota, Colombia as these cities had both introduced BRT systems, which the City of Johannesburg then was considering as an alternative public transport model (Moosajee, 2012).

According to the City of Johannesburg (2012), the BRT system was intended to provide an alternative to private motor car use and, in fact, represented the beginning of the

implementation of a public transport strategy for Johannesburg intended both to support and to contribute to the realisation of the overall government Millennium Development Plan (MDP) goals as well as the 2030 vision for the City of Johannesburg (Centre for Scientific and Industrial Research, 2000 & City of Johannesburg, 2003b).

The following table depicts the countries identified by the City of Johannesburg in 2006 as having successfully introduced the BRT system in order to arrive at the most efficient BRT system for South Africa:

Table 2-3: Cities with BRT systems

Continent	Country	Cities with BRT systems
Asia	China	Beijing, Kunming
	Indonesia	Jakarta (TransJakarta)
	Japan	Nagoya (Yurikamome Line)
	South Korea	Seoul
	Taiwan	Taipei
Europe	France	Caen (Twisto), Clermont Ferrand (Léo 2000), Lyon, Nancy (TVR line 1), Nantes (Line 4), Nice (Busway), Paris (RN305 busway, Mobilien, and Val de Marne busway), Rouen (TEOR), Toulouse (RN88)
	Netherlands	Amsterdam (Zuidtangent), Eindhoven, Utrecht
	United Kingdom	Bradford (Quality Bus), Crawley (Fastway), Edinburgh (Fastlink), Leeds (Superbus and Elite)
	Germany	Essen (O-Bahn)
Latin America	Brazil	Curitiba, Goiânia (METROBUS), Porto Alegre (EPTC), São Paulo (Interligado)
	Chile	Santiago (Transantiago)
	Colombia	Bogotá (TransMilenio), Pereira (Megabus)
	Ecuador	Quito (Trolé, Ecovía, Central Norte), Guayaquil (Metrovia)
	Mexico	León (Optibus SIT), Mexico City (Metrobús)
North America	Canada	Ottawa (Transitway)
	United States of America	Boston (Silver Line Waterfront), Los Angeles (Orange Line), Miami (South Miami-Dade Busway), Pittsburgh (Busway)
Oceania	Australia	Adelaide (O-Bahn), Brisbane (Busway), Sydney (T-Ways)

Source: City of Johannesburg (2006: 1)

Table 2-3 shows BRT systems successfully implemented in Asia, Europe, Latin America and the Caribbean, North America, and Oceania.

It is important to take into consideration international examples from other countries, including those in the African continent, that are considered by public transport researchers to have successfully implemented the BRT systems, and which, to some extent, share similar market and socio-economic environment to South Africa (Roth & Wynne, 1982):

- Minibuses in Hong Kong and Kuala Lumpur
- Route associations in Buenos Aires and Calcutta
- The Jeepneys of Manila
- The dolmus of Istanbul, and the minibuses of Cairo
- School buses in Singapore
- The Matatu of Nairobi
- The Bakassi of Khartoum
- Shared taxis in Belfast
- The Publicos of Puerto Rico

Taking into account the aforementioned discussion and contemporary history of moves to establish a modern system for Johannesburg, the next section examines an alternative model of public transport adopted by the city, BRT, which was later branded as the Rea Vaya. The BRT aimed to raise the performance and quality of the SPTN to a car-competitive level.

(b) BRT System for Johannesburg: Rea Vaya

The City of Johannesburg (COJ) adopted an urban development policy which focuses strongly on the need to create compact cities and limit urban sprawl in order to utilise urban infrastructure and land more efficiently and effectively. The primary measure in support of this policy was the Rea Vaya – or the Bus Rapid Transit system. BRT combines the best features of rail with the flexibility and cost advantages of road-based public transport (Tshikalanke, 2010 & City of Johannesburg, 2012). The main objectives of the Rea Vaya Bus Transit System includes, amongst others, providing quality public transport for

Johannesburg residents – public transport on which people feel safe and are able to depend, which saves travel time, which is affordable by conforming to the less than 10% norm, and which is available throughout the day and the week; and provides a credible alternative to car use (South Africa, 1996 & McCaul, 2012).

Rea Vaya, which means "we are going", offers fast, safe and affordable public transport on a network of bus routes across Johannesburg (City of Johannesburg, 2012:1). The goal of Rea Vaya is to improve the quality of life of Johannesburg citizens through the provision of a high-quality and affordable public transport system. The long-term vision is to develop a system that places over 85% of Johannesburg's population within 500 metres of a Rea Vaya trunk or feeder corridor. The principal long-term objectives of the Rea Vaya project encompass the fundamental pillars of Johannesburg's competitiveness as a city, including economic, social, and environmental sustainability (City of Johannesburg, 2012).

Rea Vaya offers three inter-connected levels of service. The largest buses, with a capacity of up to 90 passengers, are articulated and referred to as "trunk" buses. These buses travel on the designated median lane trunk routes only. Complementary buses, with a capacity of 60 passengers, pick up passengers at Rea Vaya stations on the trunk routes and operate on the kerbside. Finally, the Feeder buses, which have a capacity of 32 passengers, transport people from the outer areas which do not have direct access to the trunk routes. This, in turn, extends the Rea Vaya network to areas far beyond the main trunk routes. When complete, Rea Vaya will cover more than 300 kilometres of trunk routes across the city (City of Johannesburg, 2012).

BRT in Johannesburg is being rolled out in a series of phases. The initial Phase 1stage, for example phase 1A, of the Rea Vaya Bus Rapid Transit system has been completed and it comprises approximately 122 kilometres of trunk routes and 150 stations (City of Johannesburg, 2012 & McCaul, 2012). Other phases are in construction and planning stages. Plans to roll out the BRT system in cities in other provinces, including Durban- KwaZulu-Natal, Cape Town- Western Cape, Nelson Mandela Bay- Eastern Cape, have been completed and the BRT system phase 1 implemented (Cox, 2009 & McCaul, 2012).

It is argued that Rea Vaya is not intended to compete with other transport systems such as the SARCC or the Gautrain, but rather to compliment these systems. It is an urban transport network that feeds into and complements existing networks to ensure the most effective movement of people across the city (City of Johannesburg, 2012).

The ensuing discussion focuses on the specific significant and important concept and design changes from the original SPTN transport model, to the BRT system and the reasons thereof. While doing so, it is important to take into account that Rea Vaya is not a major departure from the original design and objectives of the SPTN. The principal addition has been the upgrade of the quality and performance level of Rea Vaya to that of BRT (City of Johannesburg, 2006).

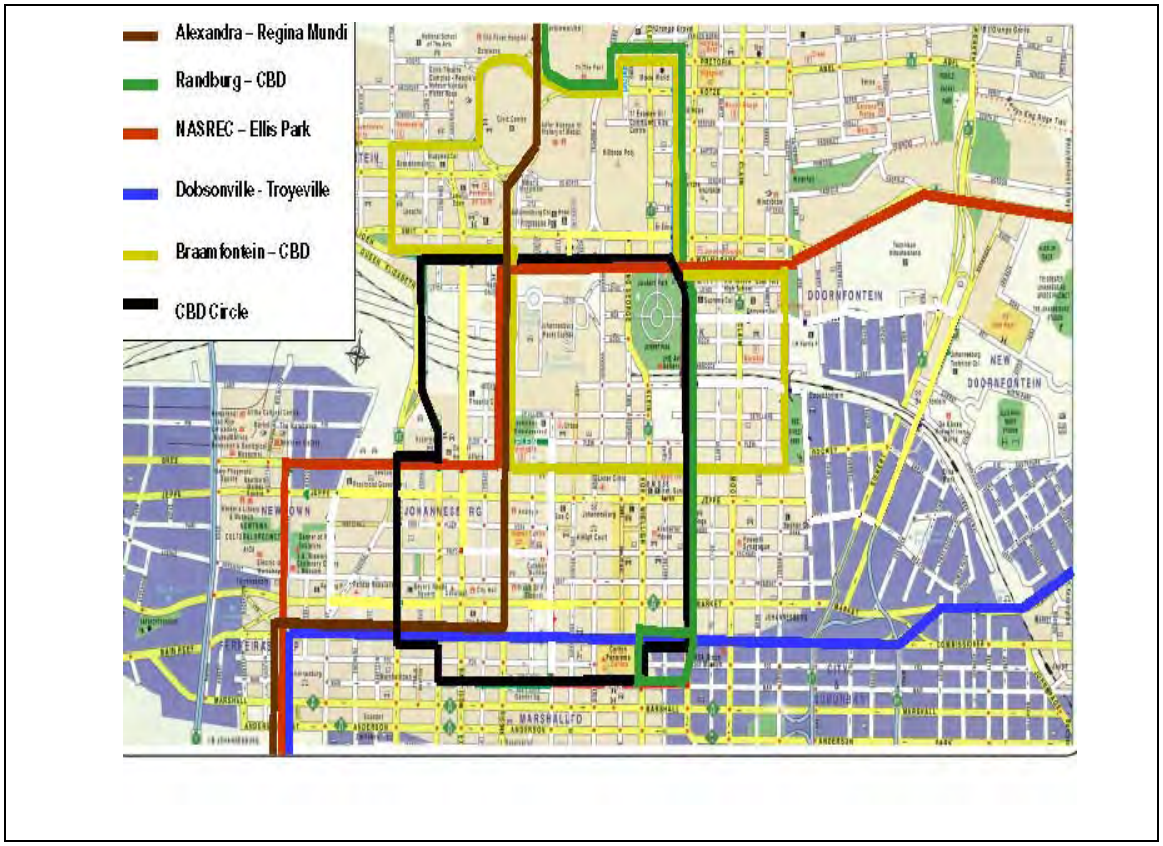
- Median busways instead of kerbside bus lanes

  The most significant difference between the SPTN and the BRT-Rea Vaya system in Johannesburg is the placement of a busway in the central lanes of the roadways. In terms of the SPTN, public transport vehicles were to operate in kerbside lanes.

- Routes and corridors – CBD

  The BRT encompasses the same flagship corridors as the SPTN. Figure 2-5 below depict the inner city routes within the BRT system:

Figure 2-5: Inner-city routes within BRT system



Source: City of Johannesburg (2006: 262)

These corridors include a north–south route between Sunninghill and Soweto as well as an east–west route between Alexandra, Sandton, Randburg and beyond. Therefore, the principal change from the SPTN flagship plan was the addition to the system of the Soweto Highway as well as an extension from Regina Mundi through to Lenasia with further feeder services to Orange Farm.

- Operations

  The operational plan sets the parameters in terms of which system characteristics such as capacity, speed, and service frequency are determined (City of Johannesburg, 2006).

  On a normal weekday, Rea Vaya operates 1 481 one-way trips – 406 on the Soweto-CBD trunk route, 218 on the Soweto-CBD complementary route and 857 on the Soweto feeder and local routes. On Saturdays the service operates at approximately a half of the weekday strength, and a third on Sundays. Approximately 6,5 million scheduled kilometres are operated a year. Of all the kilometres operated, 53% are run on the exclusive busways and, thus, almost half of Rea Vaya kilometres are operated in mixed traffic. The articulated buses make seven one-way trips each a day, while the 13-metre buses make 11,7 trips (average trip distance of 12,5 km compared to the 24,1 km average trip of the articulated buses (artics). At this rate the articulated buses travel approximately 600 000 kilometres in their 12-year contracts while the complementary buses travel approximately 525 000 kilometres. Approximately 400 passenger trips are made in each bus per day while 2,02 passengers are carried per scheduled bus kilometre (McCaul, 2012).

- Technology

  As regards the system's trunk services, BRT utilises 18-metre articulated vehicles to handle the high commuter demand in the city's busiest corridors, especially in the south-western portion of the city. In view of the distances covered by the system, it introduced smart card technology for fare collection and fare verification. The system was designed to ensure that the smart card type selected is compatible with the smart cards used on the Gautrain and the SARCC/Metrorail systems, a significant integration. In addition, BRT uses real-time information displays in order to keep the commuters informed and to reduce waiting stress (City of Johannesburg, 2006).

- Operating costs and fares

  It was envisaged that BRT fares would be equal to or less than the fares charged by existing services. Currently, the more kilometres travelled by passengers the lower the fare compared with minibus taxis (McCaul, 2012). The efficiencies which resulted from the development of a unified network, dedicated infrastructure, and increased passenger numbers has led to fare savings for the commuter. Outside of the BRT system, many passengers are forced to pay multiple fares for a single destination as several transfers are sometimes necessary. The BRT system uses a distance-based fare structure. However, the cost increment for distances is relatively modest in order to ensure that low-income families living on the periphery of the city are not disadvantaged (McCaul, 2012).

  Furthermore, the short-run marginal cost where no additional infrastructure is provided and the infrastructure capital costs are irrelevant. Long-run marginal costs, where the infrastructure is optimally expanded as a result of additional traffic but as a result the additional impact of the traffic in terms of congestion and, perhaps accidents and environment, are reduced, is more relevant in the case of the BRT taking into account the infrastructure expenditure on the public transport system (Button, *et al*. 2001).

- Marketing

  The BRT system has been branded “Rea Vaya” (City of Johannesburg, 2012). The logo and colour scheme used are depicted in Figure 2-6 below.

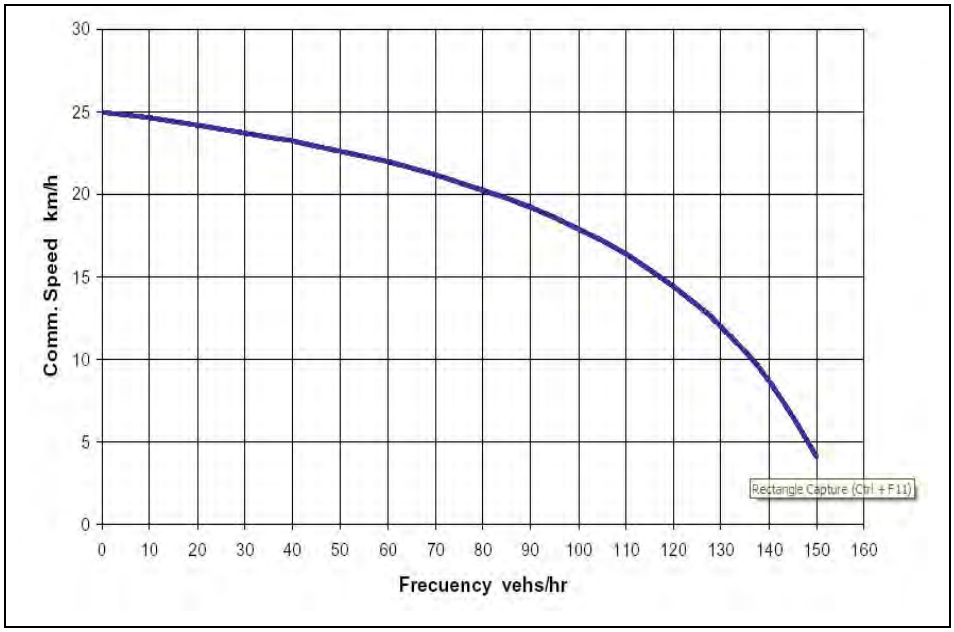
Figure 2-6: Rea Vaya branding

Source: Tshikalanke (2010: 23) & City of Johannesburg (2012: 1)

- Service frequency and load factors
  - Service frequency

    Service frequency refers to the number of buses per hour while the waiting time between vehicles is known as the headway. Figure 2-7 illustrates the relationship between service frequency and congestion.

Figure 2-7: Service frequency and the potential impact on vehicle velocity



Source: City of Johannesburg (2006: 266)

In general, it is desirable to provide frequent services in order to reduce customer waiting times. Commuters often perceive waiting times to be much longer than the actual duration of the waiting time. To a waiting passenger, five minutes may seem like a long time, especially if the passenger is in a hurry to arrive at their destination. At headways of ten minutes or longer, passengers no longer regard the system as a metro-like service and, instead, tend to view the system as a timetabled service (City of Johannesburg, 2006). The Rea Vaya operates according to the following frequency headways in minutes:

Table 2-4: Frequency of the BRT Rea Vaya service in minutes

Service	Peak	Off-peak
Trunk Soweto–CBD	3	10
Soweto–CBD complementary route	5	15
Feeder routes	5, 10 or 15	30
Local complementary routes	10 or 15	15 or 20

Source: McCaul (2012: 9)

Service hours are as follows: First bus (weekdays) is at 4:50 and last bus at 22:00. Over weekends, the first bus is at 5:15 on Saturday and 6:00 on Sunday while last bus is at 19:00 on both days (McCaul, 2012 & Rea Vaya, 2012). Sunday services do not operate in the same way as weekday and Saturday services. The number of passengers travelling on a Sunday is approximately 10% of the number of passengers travelling on weekdays. Accordingly, Rea Vaya operates at 30-minute intervals only. It should, thus, not be necessary for a passenger to wait for longer than 30 minutes if they arrive at a stop or station just after the previous bus has departed (Rea Vaya, 2012).

- Load factors

The load factor refers to the percentage of a vehicle's total capacity that is actually occupied. The actual load factor of any BRT system is determined by the frequency of the public transport vehicles and the demand. While systems with high load factors tend to be more profitable, in the main, the BRT was not planned to operate at a load factor of 100%. At a 100% load factor the vehicle is filled to its recommended maximum capacity. However, such conditions are not only uncomfortable to passengers, but also create negative consequences for operations. At 100% capacity, small system delays or inefficiencies may lead to severe over-crowding conditions (City of Johannesburg, 2006).

In addition, the desired load factor may vary between peak and non-peak periods. In the Bogotá TransMilenio system, for example, typical load factors are 80% for peak periods and 70% for non-peak periods. However, as ridership levels rise, overcrowding is an increasing concern (City of Johannesburg, 2006).

Accordingly, in the Rea Vaya system, the targeted load factor, based on the original scoping of the Rea Vaya BRT system, was in the range of 70-80% during peak periods (City of Johannesburg, 2006). In reality, 60% of the service capacity provided on the trunk and complementary Soweto-CBD routes is used. This includes standing space, all hours, and all directions. In the peak hour 95% of the trunk route capacity is utilised. Capacity utilisation is 30% on feeder and local routes with an overall average of 40% across the whole service. While services run for 17

hours, Soweto–City routes carry 72% of their daily passengers during the three hours of the peak periods while 28% of the passengers on these two main routes are carried in the 11 hours of the off-peak periods (Rea Vaya, 2012 & McCaul, 2012).

- Integration

  This system was planned to ensure the full integration of Rea Vaya with the Gautrain and the Metrorail systems (City of Johannesburg, 2006). Despite the fact that the envisaged integration has not taken place (McCaul, 2012), a significant opportunity still exists for Rea Vaya to help provide feeder services to both Metrorail and the Gautrain.

  In addition, Rea Vaya should intersect with the Metrorail system at several key stations, for example, Lenasia, Orlando, Kliptown, Nancefield, New Canada, Mlamlankunzi and Park Station. Likewise, Rea Vaya should also intersect with the Gautrain at several points, for example, Sandton, Rosebank and Park Station (City of Johannesburg, 2006).

To conclude the discussion on BRT, it is important to discuss other mitigating BRT considerations.

Firstly, the question arises as to whether the BRT will address transport problems in Johannesburg? BRT is merely one component of a larger package of sustainable transport measures that may help mitigate some of the problems Johannesburg is currently experiencing. However, BRT is not a panacea for all problems. Nevertheless, BRT may assist in reducing the negative impacts of the unconstrained vehicle growth that is currently occurring in Johannesburg.

Secondly, does the BRT project make use of Public–Private Partnerships (PPPs) as a financing mechanism? Almost all BRT projects worldwide have been PPPs in the sense that these projects have generally used public capital for infrastructure and private capital for vehicles. In some cases, such as Bogotá, private capital has also been used for fare collection equipment.

Thirdly, will BRT require long-term subsidies? It was envisaged that BRT would use public funding for the development of its infrastructure with fare revenues paying for all operational costs, including vehicles, spare parts, fuel, driver salaries, and staff salaries. Accordingly,

BRT represents an opportunity to end the need for the long-term subsidies that are currently required to maintain the operations of Metrobus and various privately owned bus companies.

Fourth, does BRT represent either a threat or an opportunity for the minibus taxi industry? BRT is an opportunity to ensure the minibus taxi industry is operating on a level playing field with the existing bus operators. Much of the minibus taxi industry's current dissatisfaction stems from the fact that some passenger transport providers are being given subsidies while the taxi industry continues to struggle with no subsidy support. However, the minibus taxi industry perceives the BRT project as a serious threat to its business. The 585 taxis which have been taken off the roads and replaced by Rea Vaya represent approximately 10% of all the minibus taxis operating in and from Soweto. Approximately 8% of Soweto-based public transport users have switched to Rea Vaya. The minibus taxi associations now own 66% (worth R2,2 bn) of the BRT (Rea Vaya) system. The Johannesburg minibus taxi operators and the South African Taxi Passengers Association demanded that the council allow minibus taxi drivers to drive in the BRT lanes in the early mornings up to 9:30 and again after 15:00, until a long-term solution is found to the public transport policies that is perceived to exclude the minibus taxis, and therefore are deemed by the minibus taxi associations as unfair (Cox, 2009; Masondo, 2010; Hudleston, 2011; Ndebele, 2011a & McCaul, 2012).

Fifth, how would it possible to integrate BRT with the minibus taxi recapitalisation process? The minibus taxi recapitalisation process and the BRT are distinct, yet potentially synergistic, initiatives. Minibus taxi recapitalisation should assist minibus taxi operators to purchase new vehicles. However, recapitalisation will do little to change the underlying structure of the minibus taxi industry. In contrast, BRT addresses profitability and sustainability through a reformed business structure. Nevertheless, funding from recapitalisation could be instrumental in helping the minibus taxi industry purchase the vehicles required for operation in the BRT.

Sixth, is the quality of BRT sufficient to convince current motor car users to change to passenger transport? The convenience, status, and security of the private motor car use represent formidable quality standards as compared to any public transport service. However, many car users may not use public transport regardless of the quality of the service. Nevertheless, by offering a highly-affordable service that exceeds the speed at which motor cars are able to travel in mixed traffic lanes, BRT has been successful in this regard. The first phase of BRT aims to capture 10 to 20% of its customer base from current car users. After the implementation of BRT, it was found that 11% of Rea Vaya passengers were

formerly private motor car users, 63% taxi users, 17% train users and 8% bus users. The average distance previously driven by the car users per trip was 18,6 kilometres (McCaul, 2012).

Taking into account the aforementioned discussion on the literature review into public transport, it becomes evident that service quality dimensions are factors that are likely to be important to the design of the public transport network, from both the operators' and the commuters' perspectives. The success of the public transport network is likely to largely depend on improving the service quality dimensions of the BRT Rea Vaya service in Johannesburg. Since, service quality dimensions are key to meeting this study's objectives; the next chapter will discuss the service quality dimensions of McKnight *et al.* (1986).

2.6 Conclusion

This chapter contained a literature review which focused on public transport. The chapter discussed the challenges involved in formulating a definition for the term public transport. A distinction was made between public transport and transportation and the importance of public transport was also explained. The latter discussion focused specifically on the structure of public transport with reference to the systems of public transport including physical, economic, pricing, and regulatory. The organisational framework of public transport was also discussed, with a particular focus on public transport policies and legislation in South Africa. The chapter revealed that public transport in South Africa is regulated by the NLTA (Act No, 5 of 2009), Public Transport Strategy, and various policies which describe the vision and future of public transport. Other important regulatory bodies and systems were also discussed, for example, OLAS, NPTR, PREs, and MRE's.

Public transport statistics and modes of public transport, namely, public buses and minibus taxis, were also discussed. The chapter was finalised by examining passenger transport networks, focusing specifically on the SPTN and BRT system in Johannesburg. It was explained that in Johannesburg the BRT system, which is known as Rea Vaya, resembles those systems found in Bogota (TransMileno) in Latin America and Rouen in France. Rea Vaya aims to improve public transport in the city and promote the efficient movement of people while also focusing on the integration of services in order to ensure its long term success.

The definition, importance, and the structure of public transport, as well as the establishment of the public transport networks in Johannesburg provide an important context of the public

transportation system. The following discussion on the specific service quality dimensions (RECSA) are important to public transport, firstly mentioned in chapter one and originally developed by McKnight *et al*. (1986).

As discussed in this chapter as well as in chapter one, the importance of public transport can only be fully appreciated when the service quality dimensions are fully developed in the following chapter three. Notwithstanding the service quality gaps discussed in the following chapter and public transport challenges, the public transport networks, such as the BRT, will only reach its maximum impact when the dimensions that affect the BRT are fully understood in terms of their importance, required improvements as well as the extent to which service quality dimensions influence the future utilisation of and the demand for public transport.

It is essential that the literature reviewed in this chapter be developed by testing the theory described in the literature. Therefore, chapter four will test the theory described in the literature, specifically focussing on the research design, sampling, data collection, analysis, and the validity and reliability.

CHAPTER THREE

Service Quality in Public Transport

3.1 Introduction

The state of crisis in the public transport sector –is widely known and well documented – has given rise to a need to focus on the quality of service provided (Mashiri, *et al*. 2010; Cape Regional Chamber of Commerce & Industry, 2011 & Johannesburg Press Club, 2011). The aim of the public transport sector should be to provide a service that aims to meet and even exceed commuters' expectations, thus maximising their satisfaction and minimizing their dissatisfaction (Hunt, 1979 & Mashiri, *et al*. 2010). It is essential that people be moved from a place of origin to a preferred destination safely, economically and in accordance with a timetable. This does not, however, mean at the fastest possible speed, but in a way which is consistent with both the fare demanded and the quality of service on offer (Gubbins, 1988). Public transport must, thus, be differentiated from other modes of transport, such as private vehicles, by providing a superior service than that offered by the other modes of transport; and by making the commuters aware of the service being provided without compromising either convenience or comfort. The aforementioned is important because transport permeates the whole of civilised life in the same way as do the arteries and veins in the human body (Richard, 1983 & Mashiri, *et al*. 2010).

The question often arises as to the reason why people choose one mode over another. Surveys have highlighted the crucial and, sometimes, overwhelming importance of the factors which play a role in this decision. These factors may be grouped under the general heading of quality of service and include, amongst others, speed of delivery, certainty of timing (reliability and scheduling), freedom from interruption (extent of service) and avoidance of damage (safety) (Gubbins, 1988). Commuters use public transport to satisfy desires other than merely the pleasure of travelling and, hence, the derived demand nature of transport. Changes to the status quo will occur when peoples' needs and desires change.

This chapter discusses service quality in public transport, focusing on perceived service quality, and includes the gaps model of service quality. The chapter will also discuss the service quality dimensions that are applicable in service industries, especially in public transport, including reliability, extent of service, comfort, safety, and affordability.

The utility of a given public transport mode is measured by the total bundle of the mode's dimensions, for example, reliability, comfort, extent of service, safety, and affordability. This total bundle is then translated into its monetary value, or worth, to the passengers (Bingfeng & Ziyou, 2007).

The mode's dimensions are affected by both supply factors and the structure of public transport economics, with passengers exercising rational choice by using the service that best meets their requirements in terms of fares, accessibility, quality, comfort, safety, and speed. Passengers will also choose the service that most closely matches their perceptions of their needs and values (Button, *et al*. 2001).

3.2 Perceived Quality of Service

Perceived quality of service refers to the consumer's judgement about a product's overall excellence or superiority (McKnight, *et al*. 1986). Thus, perceived quality of service differs from objective quality as it is a form of attitude and is related, but not equivalent, to satisfaction. Perception of quality results from a comparison between expectations and perceptions of performance. Researchers have defined service quality as conformance to requirements (Crosby, 1979). Garvin (1983) defines quality in the context of internal failures, whereas Gubbins (1988) defines quality, specifically within the context of public transport, as referring to the way in which a transport organisation cares for the passengers during a journey.

However, a challenge arises with regard to the definition of public transport. Quality of service in the context of public transport is extremely difficult to define as it is made up of numerous dimensions which may be in competition with each other, including such factors as fares, comfort, schedule, reliability, extent of service and safety of service. This same challenge applies to both objective and perceived service (McKnight, *et al.* 1986).

3.2.1 Objectives and Perceived Service Quality

Certain researchers have emphasised the difference between objective and perceived quality in the conceptualisation of service quality (Garvin, 1983; Holbrook & Corfman, 1985; Dodds, *et al*. 1985; Jacoby & Olson, 1985 & Zeithhaml, 1988):

- Quality service is a form of overall evaluation of the product or services and may be regarded as similar in many ways to attitude (Olshavsky, 1985).

- Service quality acts as a relatively global value judgement (Holbrook, *et al*. 1985).

- Service quality is a global judgement or attitude relating to the superior excellence of a service, whereas satisfaction is related to a specific transaction (Parasuraman, *et al.* 1986; 1988).

Existing studies unambiguously support the notion that service quality, as perceived by consumers, stems from a comparison between their expectations of the services they will receive and their perceptions of the performance of those organisations/individuals in providing the services (Gronroos, 1982; Lehtinen & Lehtinen, 1982; Holbrook, *et al*. 1985; Parasuraman, *et al.* 1985; 1986; 1988 & Shonhiwa, 2001).

3.2.2 Service Expectations

It is important to distinguish between the term 'expectations' as used in service quality literature and the term as used in consumer satisfaction literature. In the service quality literature, expectations are specifically viewed as the desires or wants of consumers, that is, what consumers feel a service provider should offer rather than would offer (Oliver, 1981; Winer, 1985; Parasuraman, *et al.* 1986 & 1988).

In this study, the following definitions of service will apply:

- Service quality is the degree and direction of any discrepancies between the service perceptions and expectations of a passenger.

- Expectations (or expected service quality) are perceived as the passengers' wants or desires; in other words, what the passengers feel a service provider should offer rather than would offer.

- Perceptions (or perceived service quality) refer to the passenger's judgement about the overall excellence or superiority of a service and are similar to attitudes.

3.2.3 Service Quality Gaps

In contrast to the quality of goods, which may be measured objectively by such indicators as durability and number of defects, service quality is an abstract and elusive construct because of the following three features which are unique to services:

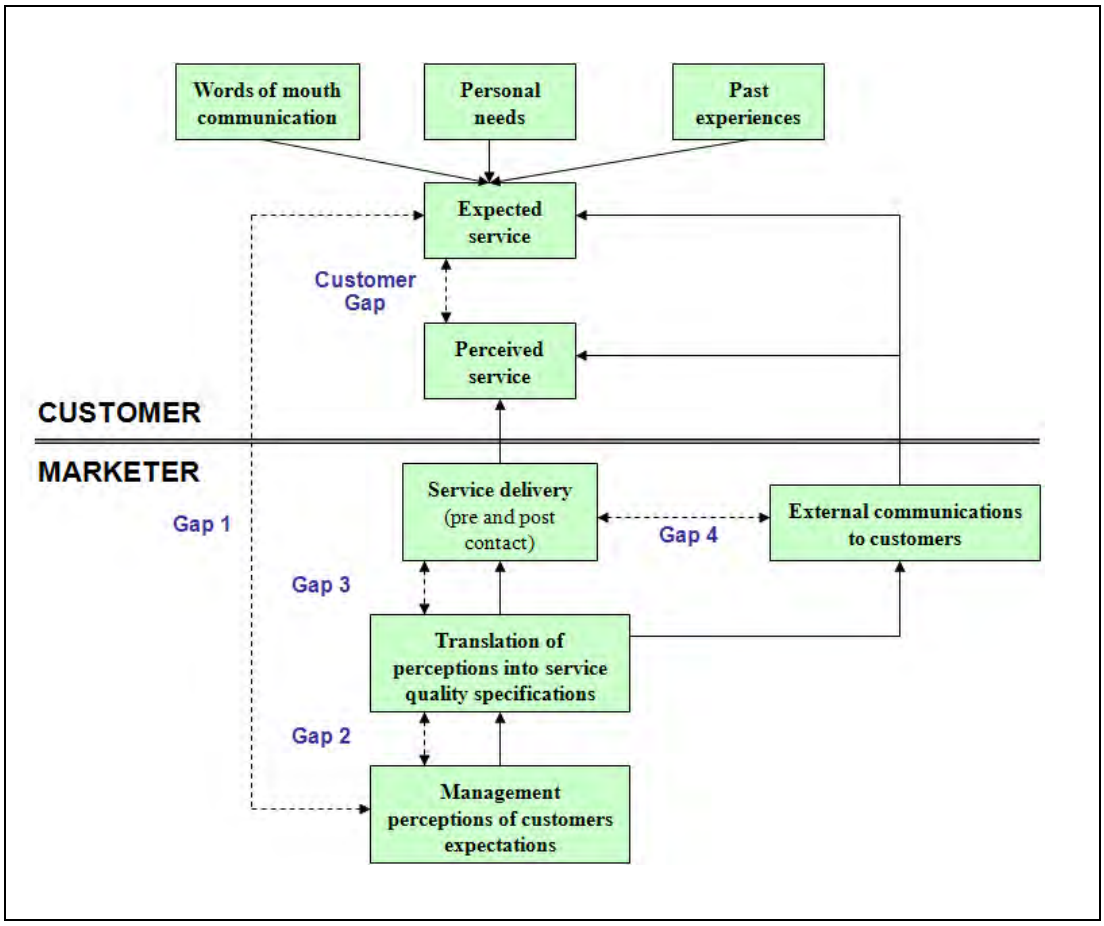
- intangibility;
- heterogeneity; and
- inseparability of production and consumption (Parasuraman, *et al.* 1986; 1988 & Patna, 2011).

In the absence of objective measures, a useful and appropriate approach to assessing the quality of a transport organisation's services would be to measure the commuters' perceptions of quality (Thompson, *et al*. 1985 & Dodds, *et al*. 1985). Accordingly, what would be needed is a quantitative yardstick for gauging such perceptions. For more than a decade, academics and practitioners have been trying to conceptualise and assess service quality. Research papers have appeared in numerous reputable journals, both in Europe and the United States of America (USA), offering insight into service quality, its complexities, both in theory and in practice, and how it may be measured (Thompson, *et al*. 1985).

It is possible to study comprehensive models of service quality and also their limitations (Patna, 2011). However, understanding exactly which dimensions of quality are of importance to customers is not always easy in evaluating dimensions of quality. It is not sufficient for companies to set quality standards in accordance with misguided assumptions about customers' expectations. A further problem in defining service quality lies in the importance which customers often attach to the quality of the service if the service provider is distinct from the service it offers. In other words, it is possible to separate the two as readily as in the case of goods (Patna, 2011).

It is, thus, essential that service organisations take into account service quality dimensions. The Gaps Model of Service Quality, as depicted in Figure 3-1 below, is an effective framework that service organisations could use (Parasuraman, *et al*. 1985 & Theo, 2012).

Figure 3-1: Gap 5- model of service quality



Source: Theo (2012: 1) & Zeithaml *et al*. (2000: 26)

According to the model depicted above, perceived service quality may be defined as the difference between consumers' expectation and perceptions which, in turn, depends on the size and the direction of the four gaps in respect of the organisation's delivery of service quality (Zeithaml, *et al*. 2000 & Theo, 2012).

The service quality gaps are described as follows:

- Gap 1: Distance between what the customers expect and what the managers think they expect.

- Gap 2: Distance between management perception and the actual specification of the customer experience.

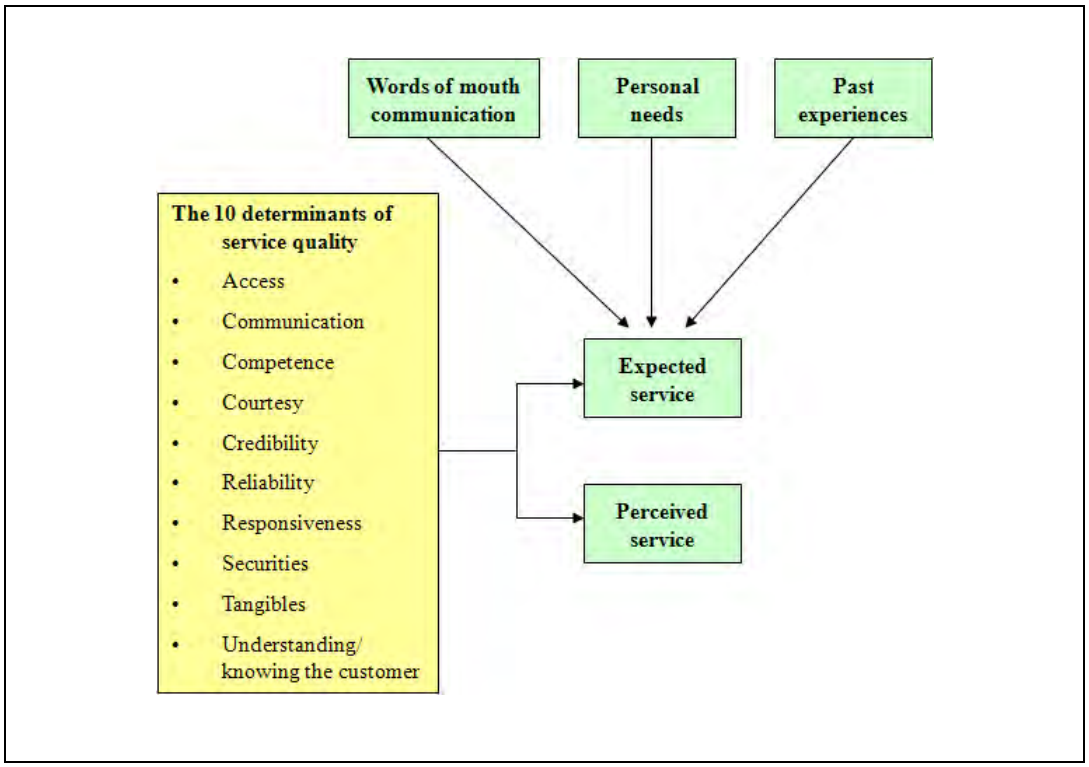
- Gap 3: Distance between the experience specification and the delivery of the experience.

- Gap 4: Distance between the delivery of the customer experience and what is communicated to the customers.

- Gap 5: Distance between a customer's perception of the experience and the customer's expectation of the service.

According to Theo (2012), in order to reduce the customer gaps, as described in Figure 3-1 above, service organisations should seek to understand the 10 determinants of service quality (see Figure 3-2 below). This would, in turn, help service organisations to focus on removing non value-adding processes or "muda" from their delivery systems (Theo, 2012:2).

Figure 3-2: Ten determinants of service quality



Source: Theo (2012: 2)

It is essential that those service organisations, that wish to be world-class, adopt a Business Excellence Framework (BEF), which involves a systems-thinking approach to building and sustaining organisational excellence (Theo, 2012). A BEF framework typically includes the following categories, namely, leadership, planning, information, people, processes, customers and results.

Managers in the service sector are under increasing pressure to demonstrate that their services are customer focused and that there is on-going performance improvement (Theo, 2012). In view of the financial and resource constraints under which service organisations operate, it is essential that customer expectations are properly understood and measured and that, from the customers' perspective, any gaps in service quality are identified. This information may then assist a manager to identify cost-effective ways of closing service quality gaps and prioritising key focal gaps– a critical decision if resources are scarce (Theo, 2012).

In applying the Gaps Model, it is also important that the service gaps in public transport be closed, given the negative state of public transport (Crous, *et al*. 1993 & Godard, *et al*. 2002 & Mashiri, *et al*. 2010).

It is against this background that the service quality dimensions for services industries are discussed in the next section.

3.3 Service Quality Dimensions

The words constructs, attributes and dimensions all have the same meaning and are used interchangeably to describe the research. The quality of service may be measured by means of quantitative research. SERVQUAL is a measurement instrument which is often applied in the service industries (Parasuraman, *et al.* 1986 & 1988). In view of the complexities found in SERVQUAL, the dimensions were reduced to five, known as RATER, and depicted in Table 3-1(a) below:

Table 3-1(a): SERVQUAL – five dimensions (RATER)

Reliability	Ability to perform the promised service dependably and accurately
Assurance	Knowledge and courtesy on the part of employees and their ability to convey trust and confidence
Tangibles	Physical facilities, equipment, and the appearance of personnel
Empathy	Caring, individualised attention which the organisation provides to its customers
Responsiveness	Willingness to help customers and provide prompt service

Source: Parasuraman *et al*. (1986:14)

Secondly, passengers do not perceive quality as a one-dimensional concept. In other words, customers' assessments of quality include perceptions of the following multiple dimensions that apply to all services (see Table 3-1(b) below) (McKnight, *et al*. 1986 & Zeithaml, *et al*. 2000):

Table 3-1(b): Multiple dimensions for service industries

• Performance • Features • Reliability • Conformance	• Durability • Serviceability • Aesthetics • Perceived quality (equivalent to prestige).

Source: Zeithaml *et al*. (2000: 82); McKnight *et al*. (1986: 434)

Thirdly, it is not easy to apply the general service quality dimensions which are applicable to service industries to passenger transportation (McKnight, *et al*. 1986). Thus, in order to measure service quality in the passenger transport context, a different approach is required. As depicted in Table 3-1(c), the following have been found to be the most frequently mentioned dimensions of such transport:

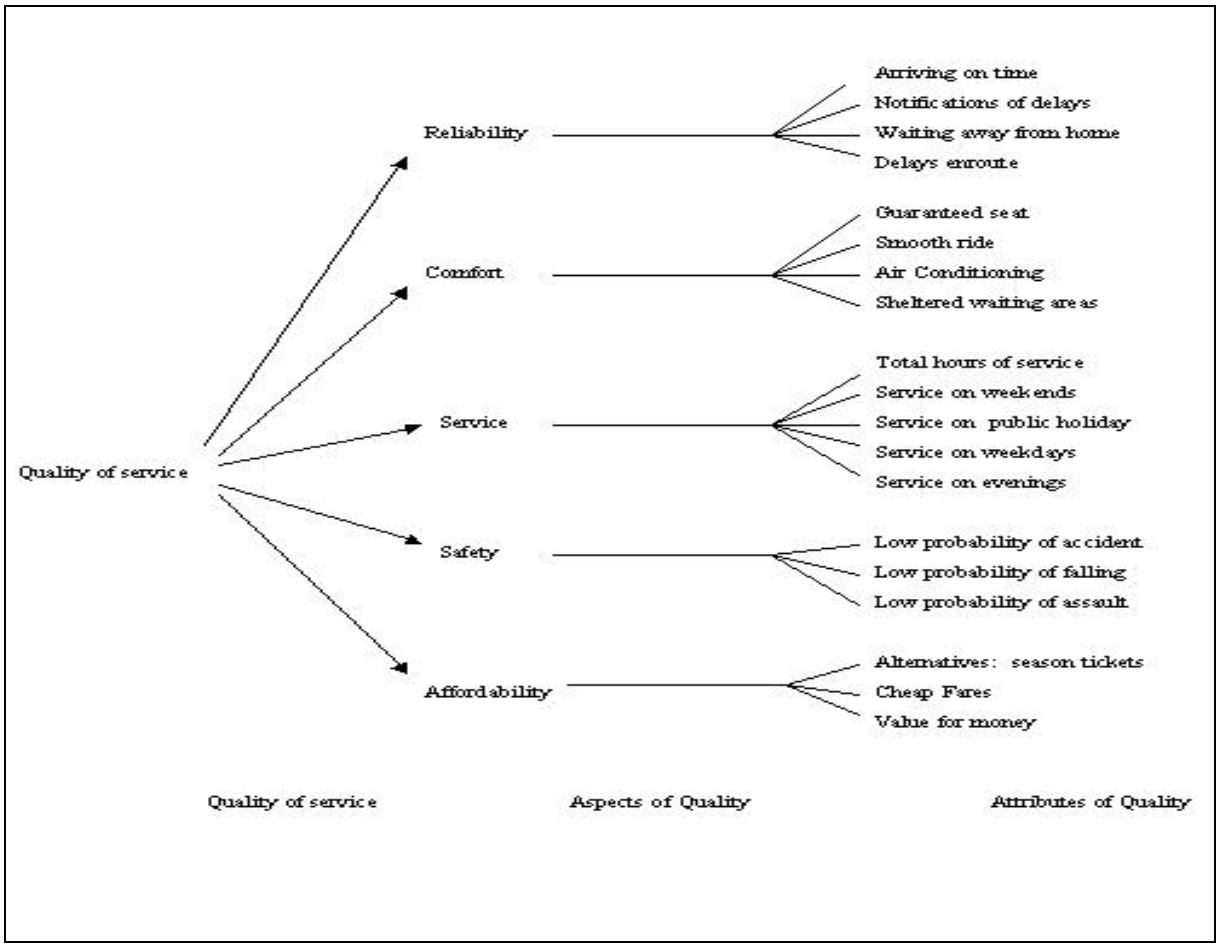
Table 3-1(c): Pi-more frequently mentioned dimensions

• Delays on routes • Traffic safety • Personal security • Frequency of service or convenience of pick up times • Directness of service (no transfers) • Ride comfort • Temperature control	• Noisiness • Availability of seats • Availability of service • Crowdedness • Walking distances to vehicles • Sheltered waiting areas

Source: McKnight *et al*. (1986: 425)

These dimensions were frequently mentioned by passengers during the research conducted by McKnight *et al*. (1986) as being important to their choice of mode of passenger transport. As depicted in Figure 3-3 below, these frequently mentioned dimensions have been grouped into a cluster of five important service dimensions.

Figure 3-3: Clusters of service quality dimensions



Source: McKnight *et al*. (1986: 427)

Each of the service quality dimensions described in Figure 3-3 above is discussed in the next section.

3.3.1 The Reliability of Service

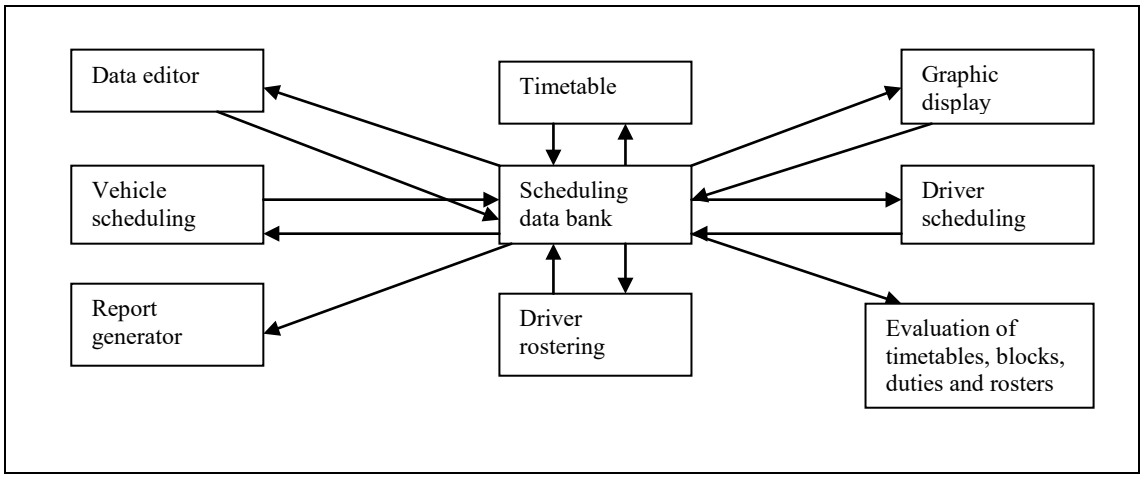
The first service quality dimension mentioned in Figure 3-3 above is that of the reliability of service. Service reliability refers to the ability to perform the promised service dependably and accurately in terms of service punctuality, adherence to timetable (including arrival at destination, journey length, and communications), and adherence to scheduled routes (McKnight, *et al*. 1986).

Commuters will want to utilise those transport operators who keep their promises, particularly promises pertaining to the core service dimensions. In its broadest sense, reliability means that the public transport operator will deliver on promises about being punctual or on time. However, in order to deliver on this promise, the operator requires

efficient operating systems (or scheduling systems). The scheduling process is important to the effective management of transport operations while the complexity of the public transport operational planning and scheduling process has challenged researchers to develop automated, computerised procedures. This, in turn, has led to a number of software packages being made available on the market (Button, *et al*. 2001).

An overall view of such a piece of software is illustrated in Figure 3-4.

Figure 3-4: Overall view of passenger transport scheduling system



Source: Button & Hensher (2001: 15)

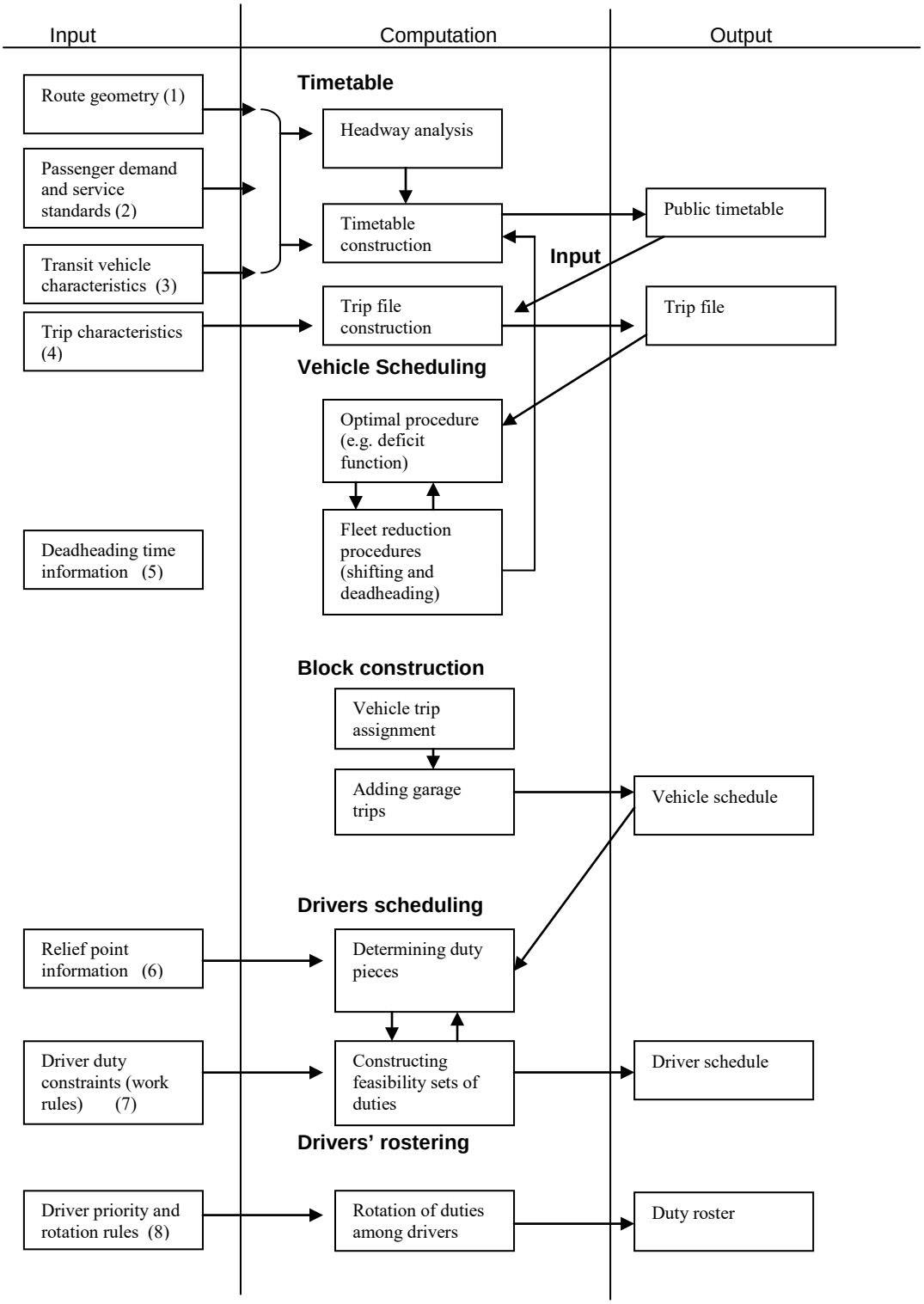
It is worth mentioning that the evaluation module of a software package such as the one indicated above should be based on both an external input related to cost coefficients and on performance criteria. The cost coefficients include vehicle cost (fixed and variable), driver cost (fixed and variable) and service benefit while the performance criteria include measures of commuter service, measures of vehicles and drivers, drivers schedules and measures of duty rosters (Button, *et al*. 2001). In many instances, transport operators are not enthusiastic about implementing these software packages as a result of a lack of the skills required to operate them and limited budgets.

According to Button *et al*. (2001), the functional diagram below, which depicts the important features of the scheduling system and the operational process, includes four basic components:

- network route design;
- setting timetables;

- scheduling vehicles to trips; and
- assignment of drivers.

Figure 3-5: Functional diagram of passenger transportation scheduling system (system architecture)



Source: Button & Hensher (2001: 17)

Firstly, the purpose of the vehicle scheduling component, as depicted in Figure 3-5, is to plan and schedule vehicles to trips according to given timetables. A transport trip may be planned either to carry passengers along its route or to make a deadheading trip in order to connect two service trips efficiently (Button, *et al*. 2001).

Timetables are important to the scheduling process because the dissemination of information to passengers is critical for the successful operation of public transport services, and in maintaining and stimulating demand. In view of the fact that the existing sources of information are fragmented, it is often a daunting task for current and prospective passengers to access the correct information. Timetables are not available from most operators and, where they are available, the quality is often poor or the timetables are difficult to comprehend. In addition, because information dissemination processes are mainly paper based, there are numerous problems relating to presentation, distribution and accuracy. It is, therefore, necessary to develop systems that will be sufficiently flexible to respond appropriately to the needs of commuters (Mashiri, *et al.* 2010).

With the advances in information technology (ICT), those commuters who have access to mobile telephones are able to access both the internet and social media in order to access timetables. Social marketing programmes may be of value as information instruments in support of transportation demand management (IDM) policies. Such programmes may function as effective channels of communication in building dialogue, garnering public support for the demand management policy in question and in delivering important transport messages directly to commuters (McGovern, 2005).

A research study conducted on public transport established that key influences for the respondents when considering alternative modes of travel is, among others, the poor image they had of public transport and the issue of poor time-tabling. The importance of the timetable arose from the fact that the respondents had interpreted the timetable either as a form of contract or as a declaration of commitment on the part of the public transport company to provide them, as commuters, with certain travel services. However, it appeared that the respondents had soon determined that the timetable was of little value as they had confirmed that the bus companies rarely adhered to it with any sense of urgency (McGovern, 2005).

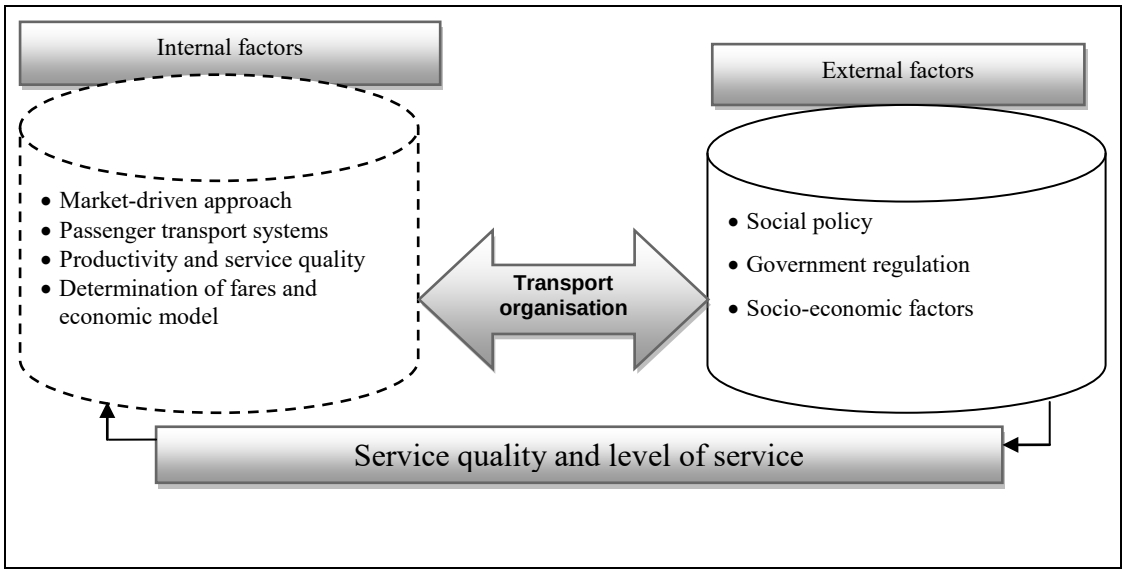
It also emerged that the poor image of public transport had generated a lack of trust among the respondents in the information being supplied by the public transport providers. The respondents claimed they had initially been prepared to work through difficult situations

when using public transport but that this had become impossible as they had continuously been let down by the public transport providers. These problems had been on-going for a number of years, and the respondents had expressed a degree of anger that they were still hearing the same excuses. The respondents had expressed reservations as to whether it would ever be possible for public transport to be improved to such a degree that they would be able to use it with any degree of confidence (McGovern, 2005).

Secondly, the purpose of the driver scheduling component, as in Figure 3-5 above, is to assign drivers to the outcome of vehicle scheduling. This assigning of drivers must be in accordance with certain constraints, which are usually dependent on labour contracts. The driver rostering component in the Figure usually refers to priority and rotation rules, rest periods and driver preferences (Button, *et al*. 2001).

It is important to note that all the components in Figure 3-5 are extremely sensitive to both internal and external factors (described below in Figure 3-6), as well as to other factors which are often evident when buses operate in mixed traffic. It is well known that maintaining a schedule may be a challenge as signal timing, traffic congestion, traffic incidents, and other factors may disrupt the expected running timetable. All these factors have a direct bearing on the public transport industry as they may give rise to service interruptions (Gubbins, 1988 & Levinson, 2011):

Figure 3-6: Internal and external factors



Source: Gubbins (1988: 168)

Internal factors include those factors that are within the control of the organisation, for example, internal systems, quality of service, fares and operational strategies. Conversely, external factors include those factors that are outside of the control of the organisation and which affect the organisation's performance, for example social policy, government regulation and other socio-economic factors which often affect fares and the quality of service. These internal and external factors may easily result in an inefficient public transport solution or scheduling of service.

Furthermore, the items under the heading of input in Figure 3-5 are numbered and their general description is presented below. However, their values differ according to the time of day and the day of the week:

Table 3-2: Functional description of passenger transportation scheduling system

Route geometry	**Passenger demand and service standards**	**Transit vehicle characteristics**
Route number	Passenger loads between adjacent stops on a route	Vehicle type Vehicle capacity
Nodes, stops, and time points on a route	Load factor – the desired number of passengers on board the transit vehicle	Running time, vehicle travel time between stops and/or time points on a route
Pattern and sequence of nodes on a route	Policy headway – the inverse of the minimum frequency standard	
Trip characteristics	**Deadheading time information**	**Relief point information**
Trip layover time (maximum and minimum)	List of garages, names, and locations	Relief point location (stops, trip start and end points, garages)
Trip departure time tolerances (maximum departure delay and maximum departure advance)	Deadheading times from garage locations to each trip start location (pull-outs)	Travel times between the relief points
	List of trip start and end locations	
	Deadheading times from trip end locations to garage locations (pull-ins);	
	Deadheading time matrix between all trip end and start locations	
Driver duty constraints (dependent on a labour contract)	**Driver's priority and rotation rules**	
Type of duty (early, late, split, full, and tripper)	List of drivers by name and type (e.g. part-time, full-time, seniority)	
Duty length (maximum spread time)	Driver priority or equality rules	
Number of vehicle changes on duty	Workday on and off patterns	
Meal breaks		
Duty composition		
Other work rules		

Source: Button & Hensher (2001: 33-110)

There are municipalities which have implemented efficient scheduling systems successfully, for example, the Dubai municipality. The Dubai Public Transport Department caters for a quarter of a million commuters with approximately 550 buses and 1 000 drivers working on almost 55 routes (Shaibani, 2005). However, the opening of the Metro system, partially operational from 2009 and currently heading toward full operation has attracted passengers away from the bus system (Dubai City, 2011).

In view of the increase in the number of passengers, buses, drivers and routes in Dubai, the Dubai Public Transport Department implemented a system known as MICROBUS in order to raise efficiency levels. MICROBUS is vehicle and dispatch software that consists of different modules that may be used to optimise the internal workflow of public transport operators of all kinds and sizes (Shaibani, 2005).

Commuters who use the bus benefit from the system as a result of the comprehensive and simple bus timetable which is available at bus stops. This guarantees the predictability of service in terms of arrival/departure schedules, which may be sent to the commuters via SMS. Dubai residents are also able to conduct Web-based searches for bus schedules, routes and connections. An efficient and streamlined public transport system yields several benefits, including the following: the productivity of the work force is improved, fuel, time and resources may be allocated optimally depending on passenger needs on certain routes and unnecessary traffic congestion may be avoided (Shaibani, 2005).

Singapore residents were also given access to PublicTransport@SG website in 2008 to help commuters plan their journeys using public transportation (Land Transport Authority, 2013). The site's interactive map covers bus and rail trips that can be made across the island and the site also features a simple calculator to compute fares. In 2011, the transport department in Singapore launched MyTransport.SG, a portal that consolidates information and e-Services for all land transport users, including motorists and cyclists. MyTransport.SG Mobile gives commuters this information on mobile devices, including real-time bus arrival information that is also shown on display panels at over 50 bus stops across the island (Land Transport Authority, 2013).

Mentor Streets® Schedule Software Suite is another scheduling software program which was developed for transport agencies that wanted to eliminate slow, inefficient manual processes and streamline schedule creation. As route information is entered, the scheduling system handles all the mathematics required, enabling the scheduler assign runs, blocks and rosters

simply by dragging the mouse. When the schedule has been completed it may be exported to Google Maps with a single click (Gregory, 2011).

In addition, Mentor Streets® scheduling software effortlessly guides public transport organisations through a step-by-step scheduling process, including plotting bus stops, cutting runs, and assigning drivers to generating paddles. Building a schedule involves several steps, and each step has its own software module in Streets Schedule. Each module is seamlessly integrated, allowing for changes to information in one module to be automatically reflected in the other modules (Gregory, 2011).

In order to ensure success in implementing these systems, it is essential that all public transport stakeholders be involved. In addition, the success of any scheduling system will depend on the involvement of the public transport authorities, communities and operators. The public transport authorities in particular need to be perceived as performing in terms of communication with commuters. In a focus group study conducted in 2005 on Social Marketing and Transport Demand Management (TDM), commuters said, among others, they had not been informed nor had they been consulted on important public transport matters and, thus, they had no influence or power as regards addressing transportation issues, specifically in their own localities. They reflected on the fact that there were no effective channels or forums for them to either express their concerns or to put forward possible solutions. Acknowledgment of this during the focus group discussions appeared to generate a degree of scepticism among the commuters as regards their dealings with the authorities, particularly the local authorities (McGovern, 2005).

This research further suggested that social marketing programs could be of value as information instruments in support of transportation demand management (TDM) policies. Such programs can function as an effective channel of communication in building dialogue and garnering wider public support of demand management policy, and in delivering important transportation messages directly to commuters (McGovern, 2005).

Furthermore, the commuters, in the focus group study conducted in 2005, as stated in the above-mentioned discussion, expressed a concern that the authorities did not always take the correct action or, more importantly, authorities often took no action at all on public transport matters requiring their actions. Examples of this sense of powerlessness emerged strongly during this focus group discussions, especially as regards the performance of the bus companies. Many of commuters were of the view that, since the bus companies had been privatised, the public had no voice or power in terms of establishing the criteria for an

acceptable level of service. One example often cited was the problems with the scheduling and cancelling of services at short notice. The research study concluded that it was essential that the local authorities constantly review their efforts to communicate with the public on local transportation-related issues and to understand that buy-in from the local community is critical as regards decisions related to transportation. Ignoring the buy-in factor would lead to local people becoming frustrated and unwilling to support transportation policy at large, and commuters would continue to perceive public transport as poor compared to the private motor cars (McGovern, 2005).

It is clear from the discussion above that implementing appropriate systems and making joint and correct public transport decisions will improve the reliability of the public transport service, encourage continuous co-operation between commuters and public transport authorities, and enhance commuter satisfaction.

3.3.2 The Comfort of Service

The comfort of service provided is the second service quality dimension indicated in Figure 3-3 above. Service comfort involves the availability of service aesthetics, and includes the availability of seats and space (often referred to as passenger density), smooth journeys, the availability of air conditioning and the conditions of shelters (McKnight, *et al.* 1986; Wardman, 2001 & Litman, 2008). The qualitative aspects of transport are increasingly being discussed as factors influencing the choice between individualised and public transport (Martin & Haywood 2011). Existing literature on transportation today is demonstrating the fact that the qualitative dimensions of public transport may affect the welfare of individuals and their modal choices (Litman, 2008).

Public transport researchers have also found that, when deciding which mode of transport to use, service comfort is one of the issues that is often taken into consideration (Samson & Thompson, 2007), with service comfort being rated as one of the top 11 key dimensions that are important to determining the mode of transport used (Solvoll & Mathisen, 2010). In addition, the findings of the research study on customer satisfaction in public transport showed that comfort of service was one of the top four factors that positively correlated with overall satisfaction (Budiono, 2009). Service comfort is, thus, clearly extremely important to public transport and it must not be ignored as one of the service quality dimensions.

In practice, it is often found that public transport lacks comfort because, among other things, loading conditions often prevent people from boarding at the desired time as crowding

imposes relatively severe discomfort. Passenger comfort is a decisive asset to transport organisations. It is, thus, essential that travelling in an air-conditioned, temperature-controlled, filtered atmosphere become an inalienable passenger right and that the slightest shortcoming in this field be remedied immediately. A major incentive for selecting public transport should be the positive on-board experience of travelling. Service comfort plays an important role in ensuring that passengers enjoy their journeys while increased comfort may also improve the on-board health and environment status. The end result may, in turn, be improved productivity in the workplace (Mashiri, *et al.* 2010). The extent to which public transport comfort improves productivity in the workplace is an important area of study which should be pursued although it is beyond the scope of this study.

3.3.3 The Extent of Service

The third service quality dimension indicated in Figure 3-3 above is the extent of service, which involves service availability, the extent to which a public transport mode take commuters to their exact destinations, and the friendliness of the frontline staff (McKnight, *et al.* 1986). Public transport accessibility and availability are both important. "Public transport accessibility is about commuter's ability to get to and from places – it is about enabling access" (Public Transport Victoria, 2013: 1). An accessible public transport system incorporates concepts of availability and usability of services, as discussed below. An accessible system looks at the connectivity of various modes and the ease of use, which contribute to the desirability of public transport as a transport choice.

Accessible public transport benefits everyone involved – it is easy and quicker to use, can reduce travel times of vehicles and can assist with managing traffic congestion in shared road environments – and takes account of the interaction between land use and transport planning (Public Transport Victoria, 2013).

The availability of service refers to the availability of a transport service on weekdays, evenings, weekends and public holidays. A service provider should plan the daily schedule irrespective of the demand. Scheduling is a potentially important operator service strategy. When used as a marketing tool, the schedule of an operator aligns operator capacity with commuter needs and the result is an optimisation of the service offering. For example, each city market has two basic classifications of commuters, namely, business and pleasure. However, both business and pleasure have different peak demand periods according to the day of the week or the hour of the day (Farris, *et al.*1976; McKnight, *et al.* 1986; Alam, 2002 & Mashiri, *et al.* 2010).

Table 3-3 illustrates the four apportionments of days within a normal calendar week, namely, Monday through to Thursday, Friday, Saturday, and Sunday.

Table 3-3: Service availability and demand

Day of the week	Business demand	Pleasure demand
Monday through to Thursday	Heavy early morning and early evening. Very heavy Monday morning	Generally light
Friday	Very heavy Friday afternoon and early evening	Very heavy Friday early evening
Saturday	Light mornings. Very light afternoons and evenings.	Moderate early mornings, light afternoons and very light evenings
Sunday	Very light mornings. Moderate evenings	Moderate mornings. Very heavy afternoons and evenings

Source: Farris & Harding (1976: 171)

The demand for business travel tends to peak on Monday mornings and Friday afternoons and is heavy during the morning and early evening hours on Mondays to Thursdays. The demand for pleasure commuting tends to peak on Friday evenings or on Sunday afternoons and early evenings. Saturday is usually the lightest travel day of the week. The uses of the operator's schedule as a marketing tool implies both the recognition of these demand characteristics and the allocation of individual offering of service to meet the needs of both classifications of commuters (Farris, *et al*. 1976 & Alam, 2002). The convenience of service is also important and is, in fact, the key to increasing the number of public transport users (Ahmad, 2010).

Public transport organisations should consider demand and adjust the service according to the service requirements as presented below. Furthermore, commuters have become more aware of information resources to determine the quickest, or most reliable, route options - they are empowered to make quick and informed decisions about reliable route options (Farris, *et al*. 1976; Federal Highway Administration, 2006 & Brithaupt and Limanond, 2006).

- Expansion or contraction of the service offering

  Expansion or contraction of the service offering refers to actions such as increasing the capacity of the public transport operator in certain markets, that is, increasing the frequency of service or other activities that have the effect of expanding the quantity of service offered. As the demand for public transport service increases and as the adult population grows, the expanding of capacity is a natural reaction. Expansion, however, necessarily requires heavy capital expenditure in equipment and may require long production cycles, creating financial obligations for an operator for extended periods. Operator management must, thus, plan carefully before making capacity-expansion decisions as management would be forced to suffer overly optimistic expansions of capacity for a long time.

  Contracting the service offering is the opposite of expanding the service offering. In view of the fact that both entry and exit from markets are controlled in the regulated public transport industries, it is not easy either to expand or to contract the service offering. Accordingly, contraction is often a difficult decision for management to make and also for regulatory agencies to approve and contraction is a strategy often likened to defeat.

  Certain routes or markets are protected for either political or social reasons. As a result, attempts by operators to contract service in these areas may be interpreted as antisocial acts on the part of management. Finally, there is the problem of tradition. After serving particular city-pair markets for long periods of time, the operators may be perceived as residents of the communities by the regulatory agencies. As a result, the operators may not be permitted to contract operations if demand diminishes. However, even in the face of these difficulties, management should continually review its service offerings as regards both expansion and contraction possibilities as both these strategies may be of merit in achieving profitable and efficient levels of operations.

- Alteration

  Another service availability strategy involves altering the service mix in response to a market change. Urban public transport operators are currently attempting to upgrade the quality, dependability, and security of the service. Many cities, including cities in the United States of America, have resorted to express type bus services during peak hours. In such cases, the operators are

utilising the strategy of service-mix alterations in order to achieve a greater balance between the changing wants and needs of their customers.

- New uses for existing service offerings
  Another service mix strategy involves finding new uses for present service offerings. Urban highway systems are most efficiently used when other modes are limited to non-peak hours while future urban rapid-transit systems should include freight-carrying capacity to help offset operating costs. In all such cases, finding new uses for existing operations has resulted in a more complete utilisation of facilities and, hence, greater returns on capital and labour investments.

3.3.4 The Safety of Service

The safety of service is the fourth service quality dimension indicated in Figure 3-3 above. Safety of service may be defined as the number of accidents involving a transport mode and refers to the passengers' fears that they are more likely to be involved in an accident as a result of using a particular transportation mode, the condition of vehicles, driving behaviour and obeying the rules of the road (McKnight, *et al.* 1986).

It is important that service safety is viewed from three, equally important, angles:

- safety of passengers;
- safety of drivers; and
- safety of buses and minibus taxis (McKnight, *et al*. 1986).

Each of these safety aspects will be discussed below. It is, however, important to note that, in order to achieve a high degree of safety, all three of these areas must work together smoothly and efficiently.

3.3.4.1 Safety of Passengers

As regards the safety of passengers, a research study conducted showed that households were becoming insular in the way they lead their lives or how artificial bubbles were being created to enable them to feel more secure when undertaking day-to-day journeys (McGovern, 2005). While the passengers had expressed that it was difficult it is to feel completely safe in any mode of transportation, there was a general consensus that private

transportation provided the greatest sense of safety to those who considered it a priority. However, the issue of personal safety carried with it a negative connotation for many of the passengers contemplating public transportation (McGovern, 2005).

The goal of service safety is to reduce vehicle fatalities and injuries and the associated costs. Thus, the objective is to ensure that transport operators maintain the minimum standards for both their drivers and their vehicles, thus ensuring road safety through lower numbers of safety-related offences, vehicles out of service and, ultimately, crash rates. The reason for this is that transport operators are responsible both for the mechanical maintenance of their buses and minibus taxis and for the actions of the drivers over which they exercise control (McKnight, *et al.* 1986).

As regards international approaches to public transport safety, it has been shown that various countries approach public transport safety in different ways, and that the measures adopted to improve safety often vary (World Bank, 2006). For instance:

- In Sweden, the approach to public transport safety has been that of the quality management of the transport component of the transport organisation concerned (whether government or private). Quality assurance of transport aims to ensure that people arrive at the right place, at the right time and in the right way (that is, without danger of serious injury or damage to the environment as a result of the mode of public transport). Thus, road safety and environmental outcomes are linked.

- In France, a programme has been introduced to increase the involvement of private companies in the road safety related to their use of vehicles. Agreements have been drawn up between government, insurance companies, the national occupational health fund and volunteer companies. The programme focuses on motivating transport organisations to undertake road safety programmes designed to increase awareness of the cost of road crashes to the organisation concerned with worker compensation and vehicle insurance premiums being decreased if the programmes are implemented. Some of the programmes have also concentrated on drunk driving because of the significant role played by alcohol in both work- and non-work-related road accidents in France.

- In Germany, the Traffic Safety Council has promoted the establishment of voluntary safety circles in which employees from the transport organisations meet both to discuss critical issues and to devise solutions under the leadership of an experienced moderator. The Traffic Safety Council also runs a one-day training course in safe, economical and environmentally friendly driving.

- In the United Kingdom, various measures have been implemented to improve safety in organisations. They include driver training programmes, incentive schemes, penalties, accident reviews, driver monitoring systems and driver feedback procedures. However, it is unclear whether these measures have had an effect (World Bank, 2006).

The profiteering nature of the minibus taxi industry, in particular, is a cause for concern as regards passenger safety. Minibus taxi operators feel driven to maximise revenue and minimise the costs of the service. This, in turn, translates into passenger overloading, wars between taxi associations, and a general failure to observe the rules of the road. "The minibus taxis transport most people to their destinations, sometimes even in record time but often at the expense of other road users, even at the expense of their lives" (Govender, *et al.* 2006:106).

3.3.4.2 Safety of Drivers

Regarding driver safety, it is essential that transport organisations invest in research and development aimed at enabling operators to control their vehicles better. On-board computers provide public transport managers with detailed reports on the behaviour of drivers and the performance of vehicles. These reports may be used to modify driver behaviour and may also be used for the purposes of accident prevention, accident analysis and accident reconstruction (World Bank, 2006).

One single factor is unlikely to cause an accident and therefore it is probable that a combination of causes would result in an accident. The factors involving drivers and their driving habits referred to here include:

- Ease of obtaining a heavy vehicle licence.

- Lack of professional driver training.

- Lack of knowledge of the highway code.
- Driver fatigue as a result of long working hours.
- Overloading of vehicles in order to maximise revenue.
- Night drivers consuming alcohol or drugs.
- Speeding (Maunder, Pearce & Babu, 1999).

The most frequent causes of bus accidents, in particular, include poor driver behaviour, poor behaviour on the part of other road users and the mechanical condition of buses. However, the overriding factor that needs to be addressed is how to improve bus driver behaviour. The BRT Rea Vaya in Johannesburg is also concerned about driver behaviour (Maunder, *et al.* 1999 & Rea Vaya, 2012). The following are possible solutions to the problem of driver behaviour:

- Drivers should be taught the social and psychological skills involved in being a safe and responsible professional driver.
- Refresher driver training courses to eliminate the inevitable bad driving habits acquired should be encouraged.
- Awards for accident-free driving should be promoted.
- Medical and health checks should be compulsory for all drivers, especially those who are ageing.
- The enforcement of legal maximum hours should be accorded a higher priority (Maunder, *et al.* 1999).

3.3.4.3 Safety of Vehicles

With regard to vehicle safety, it has been shown that the condition of the minibus taxis gives rise for concern, as these are the vehicles with the potential for causing large numbers of casualties if they are involved in accidents. The fact that all minibus taxis have (ought to be have) certificates of fitness (or roadworthy certificates – COFs) illustrates the irrelevance (or

challenges) of the roadworthy testing system and the ease with which it is possible to obtain a certificate, whatever the condition of the bus or minibus taxi (World Bank, 2006).

Overall, the factors affecting vehicle condition have been found to include the following:

- lack of maintenance as a result of cost;
- worn tyres and fake parts in an effort to minimise costs;
- age of the vehicles – the average age of the bus fleet has increased from 10,1 years in 1991 to 12,7 years in 1996 (Van der Merwe, 1999) while the average age of the minibus taxi fleet is 13 years (Govender & Allopi, 2006); and
- irrelevance of the annual vehicle fitness test (Maunder, *et al.* 1999).

Addressing these factors may increase costs but is likely to be less expensive in the longer term as compared against the cost of human tragedy, vehicle replacement and other third-party costs. It is essential that owners and operators be encouraged to maintain their vehicles to a much higher standard than the present standard. Preventative maintenance may improve both the performance and productivity of vehicles and also extend the operational life of the vehicle. A safe, smart vehicle is more likely to attract passengers than an unsafe and poorly maintained vehicle, particularly in a highly competitive market. Owners and operators need to understand that vehicle maintenance is a sound, effective business practice which may minimise vehicle downtime and costly, time-consuming breakdowns whilst the vehicle is in service (Maunder, *et al.* 1999).

3.3.4.4 Other factors affecting safety

Road condition, a lack of road maintenance, poor wheel alignment and a lack of traffic signs and safety features have all been identified as possible causes of accidents together with the weak enforcement of traffic regulations. A lack of road sense on the part of pedestrians, especially in rural areas when herding animals or crossing the roads, has also been cited as a factor affecting road safety (Robertson, 2006).

However, it is not possible for either a single individual or discipline to bring about improvements in safety. On the contrary, it is a collective responsibility and spirit is required of all those involved, including:

- bus and minibus taxi owners, drivers, conductors and mechanics;
- bus and taxi operator associations and unions;
- police and government transport departments;
- road safety associations and driver training schools;
- manufacturers of vehicles, spare parts and tyres; and
- all road users (Maunder, *et al.* 1999).

There are specific features of the bus industry as well as particular challenges facing the industry with regards to safety. However, it would not appear that the same features are enforced with the minibus taxi industry. For example:

- The rivalry and mistrust between bus and minibus taxi operators, and intimidation which is prevalent in the taxi industry, remain a challenge for both government and the traffic authorities.
- Constant attention is given to the roadworthiness of buses but not to that of minibus taxis.
- Government and the bus industry have been cooperating for a number of years in setting the technical standards for all aspects of bus construction and bus components.
- These technical standards are contained in road traffic legislation, regulations and through the manufacturing standards system regulated by the South African Bureau of Standards.
- The standards are monitored and updated based on the findings of accident investigations.
- Recent additions to the standards include specifications for roll-over protection as well as the construction and anchoring of bus seats.

- Steering, braking and tyre standards are included in the areas which are specifically focused upon during the testing process.

- In addition to pre-trip safety checks, safety procedures require drivers to conduct safety checks on all vehicles during journeys (Arrive Alive, 2010).

It has been argued that the minibus taxi industry does care about the service and safety of its passengers and drivers and, hence, the launch of the Hlokomela campaign, which was designed to change the behaviour of the minibus taxi owners, operators, drivers and, to a certain extent, passengers (Mthembu, 2010 & 2011).

Finally, the Administration Adjudication of the Road Traffic Offences Act (AARTO) represents a step in the right direction. However, vigorous and speedy implementation of the act is likely to be a challenge as drivers question its relevance (Moss, 2010).

3.3.5 The Affordability of Service

The affordability of service is the fifth service quality dimension as indicated in Figure 3-3 above. Service affordability involves value for money and, thus, includes fares charged by the public transport modes (McKnight, *et al.* 1986). The commuting public will always try to equate the quality of service and the fares paid. Thus, determining the correct fares is always a challenge. How should a transport operator price their service? What would an acceptable fare be for the quality of the service rendered? In the United Kingdom, for example, transport operators submit fare increase applications to the city council every year. In considering whether or not to grant a fare increase application, many authorities tend to take into consideration the measure of affordability. However, there is, unfortunately, no internationally agreed-on method of measuring affordability when it is applied to bus services (Maunder, *et al.* 1999).

The usual approach involves dividing the price of a number of standard journeys by some measure of income. While, conceptually, this is a simple measure, it is, however, not easy to measure either parameter. The cost of a journey may vary significantly, depending on the distance travelled and whether monthly passes are used or not. It is equally difficult to measure income on a standard basis. Unless there is reason to select a specific journey, it is probably best to take the average fare paid by all passengers as the measure of the fare, and

either the average income of all groups concerned or the GDP per capita, if available, as the measure of income (World Bank, 2006).

The figures (average fare, average income, GDP per capita) are usually compared on a monthly basis and, therefore, the cost of a standard number of trips, for example, 50 trips per month, is usually compared with the average monthly salary. This measure is most useful when used to compare a fare–income ratio in a particular city over a period of time as incomes change. Considering an average fare paid per boarding, this indicator (average fare paid per boarding) may be used in conjunction with information on income levels to assess the affordability of bus fares and, unless there is a flat fare structure, it is also useful as a guide to the average distance travelled by passengers.

The lower the average fare, the shorter the average distance travelled. However, an extremely low average fare may also indicate that there is a problem with pilferage or fare evasion, principally through over-riding (travelling on public transport further than the fare allows), and this should be investigated. The average fare will be influenced by the average distance travelled, and also by the number of passengers in the various fare categories, for example, students and other passengers paying fares at concessionary rates. The average monthly wage for the population in the area served by the bus system may be useful in determining the affordability of bus fares. However, this information is not always available. In some countries the figure is calculated for the country as a whole although urban incomes are usually significantly higher than average incomes. The other measure of affordability is the percentage of monthly wage of 50 average boardings. A typical urban bus user will make approximately 50 boardings per month. The lower this percentage, the more affordable the bus fare (World Bank, 2006).

3.3.5.1 Efficiency and Pricing

Focusing specifically on the issue of pricing, it is evident that the pricing in public transport is important as it affects the affordability of service (Button, *et al*. 2001). However, it is essential that the correct balance be established between service and fares charged. At the same time, public transport organisations are concerned about maximising the efficiency of their operations. Therefore, in economic terms, the concept of efficiency relates to the notion of maximising output per unit of input. However, in economic terms, efficiency has an even more precise meaning, for example, efficiency refers to the realisation of a situation in which it is impossible, with the resources available, to make one person better off without making

another worse off. Economists refer to such a situation as a Pareto optimum (Button, *et al*. 2001).

In a practical sense an improvement in economic efficiency is deemed to occur whenever a change is made, the benefits from which may be redistributed in such a way so as to make at least one person better off, without making anyone worse off – a so-called potential Pareto improvement in welfare. This occurs whenever those benefiting from the change are willing to pay enough for the benefits so as to be able to compensate the losers fully and still be better off themselves. This is the competition test that forms a basic principle of cost-benefit analysis. Technical efficiency refers to the physical relationship between inputs and outputs (Button, *et al*. 2001).

These concepts (Pareto analysis, cost-benefit analysis, relationship between inputs and outputs) translate directly into simple rules for pricing and project appraisal, if economic efficiency is to be derived. Economic efficiency introduces the prices of both inputs and outputs so that it is possible to obtain some idea of value. As regards pricing, the implication is that goods should be supplied as long as those receiving the goods are willing to pay at least the marginal social cost of providing the goods concerned, where marginal social cost includes both those costs which are borne directly by the supplier as well as the external costs imposed upon third parties by their use.

The optimal output of a good is the amount that consumers are willing to pay. Consumers would not be willing to pay an amount for the final units of the good that would be sufficient to compensate both those bearing the external costs of the good and also the producers of the good for the costs they would have incurred in producing the good. The intervention which is usually recommended is that the government impose a tax equal to the amount of the external costs created by the good, so that equilibrium is reached. In terms of project appraisal, the appropriate approach involves examining the costs and benefits of the proposed course of action, valuating the benefits in terms of the willingness on the part of the beneficiaries to pay and the costs in terms of the compensation required by the losers. In this way, it is possible to determine the economically efficient levels of service provision, investment and fares (Button, *et al*. 2001).

The objection to this analysis, however, is that it ignores the issue of who enjoys the benefits and who bears the costs. There is not one Pareto optimum but many. It is therefore possible to improve the utility of one person by lowering that of another. The point at which the economy ends up depends on the initial distribution of resources between the groups.

Notionally, it should be possible to redistribute the benefits of the public transport policy in such a way that everyone is better off than under any alternative public transport pricing and appraisal system (Button, *et al*. 2001).

The tax and income supplementation system is often too complex to effectively and fairly redistribute the benefits of the public transport policy in such a way that everyone is better off than under any alternative public transport pricing and appraisal system. Even if decision makers wished to ensure the equitable redistribution of public policy benefits, it is usually impossible to identify the specific gainers and losers, and identify the taxes and subsidies that achieve the desired redistribution. In addition, there are political constraints in respect of the extent to which particular taxes may be raised. In any case, taxes and income supplementation introduce their own inefficiencies into the system by distorting relative prices and prejudicing the incentive to earn more income. Nevertheless, as long as it is accepted that optimal pricing and appraisal policies will not be accompanied by optimal distribution policies, then it is essential that the distributional aspects of passenger transport systems decisions be addressed (Button, *et al*. 2001).

While there is at least consensus among economists as to what constitutes efficiency, there is no such consensus as regards equity and there are often various perspectives of equity among those commenting on transport policy. However, this discussion is concerned only with the view that states that equity demands that those who benefit from the provision of a facility must pay for the facility. However, this is a form of equity which is hard to justify in terms of any reasonable social welfare function as it appears to be based on the assumption that, in the absence of the facility, the distribution of income would be fair. Accordingly, all that would be needed to preserve that fairness is that the provision of the facility would not change the distribution of either income or utility. The rule that equity demands that the users of each facility should pay its cost remains cogent both in practical politics and amongst public opinion. However, a more sophisticated version of this view recognises the existence of joint costs, as well as the fact that each group of users should pay at least their avoidance cost (future costs), but not more than the stand-alone cost of providing the facility for themselves alone. In other words, they should benefit rather than lose from the fact that they share the facility with others (Button, *et al*. 2001).

It is important also to consider both the implications of these views of equity for the derivation of fares and also the appraisal rules as discussed below:

- The concept of marginal-cost pricing for transport has been long debated but has not been implemented to any degree. The marginal social cost of infrastructure use may be defined as the sum of the following marginal costs:
  - costs borne directly by the user (provision of vehicle and fuel, user's time);
  - costs imposed on the infrastructure provider (provision and maintenance of the infrastructure);
  - costs imposed on other infrastructure users (delays, increased risk of accidents); and
  - costs imposed on society in general (air pollution, noise, and global warming (Button, *et al*. 2001)).

  A distinction must be made between short-run marginal cost where no additional infrastructure is provided (and the infrastructure capital costs are irrelevant) and long-run marginal cost where the infrastructure is optimally expanded as a result of additional traffic and as a result of the additional impact of the traffic in terms of congestion, accidents and environment. It is generally accepted that short-run marginal cost is the appropriate pricing concept but that long-run marginal cost is relevant to the decision as to whether or not to provide additional capacity. The economically efficient charge for the use of infrastructure is then the sum of these costs (both short-and-long-term marginal cost) but not including those costs already being borne by the infrastructure user. In other words, the marginal social cost is the sum of the costs imposed by an additional user on the transport operator, on other transport users, and on society at large (Button, *et al*. 2001).

  In the short-run, where the service level does not adjust, the extra costs on the transport operator will be confined to any delays caused by the passenger boarding and alighting, and insignificant additions to fuel and wear and tear as a result of no adjustment to the actual level of service. However, the costs of crowding and the possibility of being left behind by a full vehicle (bus or minibus taxi) imposed on other passengers may be severe, at least at peak times.

Furthermore, in the longer-run, when service levels adjust, the operator will bear a higher marginal cost although passengers will actually benefit from an improved level of service. In view of the speed at which services may be adjusted, it is typically considered that this slightly longer-term marginal cost is the appropriate basis for the pricing of public transport services.

Public transport appraisal is usually perceived as a way of taking decisions on investment projects, although the same public transport appraisal techniques may be applied to a range of decisions, including whether or not to subsidise a public transport service and, if so, the service level to be provided.

The pure efficiency approach to public transport appraisal involves the application of a social cost-benefit analysis to assess the benefits and costs in terms of willingness either to pay or to accept compensation, and then to compute the net present value of these items.

- However, there are other views which state that accessibility should be provided to all, regardless of cost and ability to pay. Accordingly, a more adequate measure of the transport system may be in terms of the level of service provided and accessibility criteria. These may be defined in terms of either simple journeys, such as the proportion of the population within x minutes travel of each relevant type of facility, or more complex measures based on trip distribution models (Button, *et al*. 2001).

  Transport systems, and particularly those based on the private motor car, result in an intrinsically unfair distribution of accessibility. This argument may be broken down into a number of propositions:

  - Transport systems are typically planned and managed by middle-class males who have no understanding of the other segments of the population and of the fact that the mix of fares and quality is based on average needs and this does not take into account the needs of the poorer sectors of the community.

  - Even with the increase in the number of motor cars, motor car ownership and availability are heavily concentrated among adult males and, thus, the growth of transport systems based on the motor car favours these adult

males to the exclusion of the young and the old, and even of adult women, who have much lower levels of access to the motor car than do males.

- It is widely accepted that the development of public transport systems leads to social exclusion and inequality of access to facilities. Public transportation is a necessary element in the consumption of several other important services and its absence may create a major problem. Public transportation is also subject to economies of scale and, thus, equity issues in the provision of transport services are of particular importance. However, this clearly does not mean that it is possible for high-quality transport systems to be available at all locations. Economic efficiency may not be totally neglected, and it is in dealing with these sorts of issues that the trade-off between equity and economic efficiency is at its most pronounced (Button, *et al*. 2001).

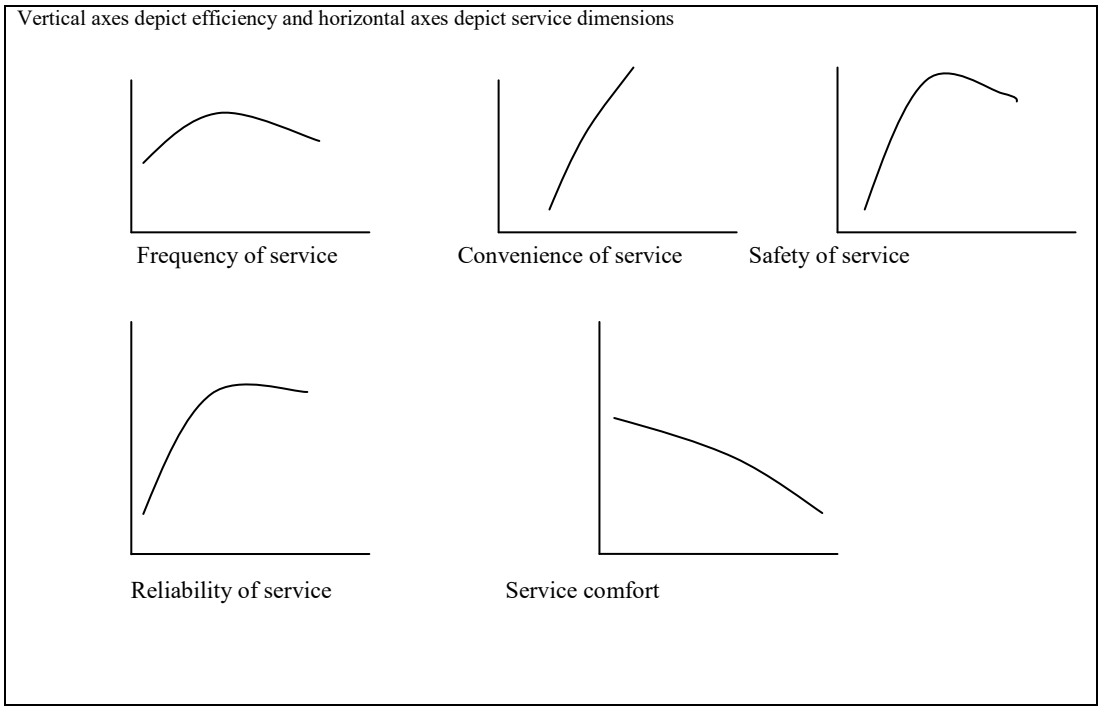
3.3.5.2 Trade-off between Equity and Efficiency

There is always a trade-off between the efficiency and quality of the service provided and it is, in fact, the presence and the feasibility of such trade-offs that foster one of the major controversies in the field of public transportation. For the supplier of the system, the measurement of the quality of the system is made in terms of the dimensions of efficiency and productivity. The more efficient and productive the system, the better the system is considered to be by the operator-supplier of the system. However, for the commuter, this is not necessarily the case. Despite the fact that aspects of efficiency also have major appeal for the commuter, their concerns far exceed those included in any notion of efficiency based on the operator-supplier's point of view (Tomazinis, 1975).

For example, in a study into the significance that commuters attach to the quality characteristics of public transportation systems, it became clear that, in terms of both the entire population surveyed and the three major subgroups of users (under 20 years and single, elderly and low income) it was the service quality items rather than the strict efficiency items that received top ratings. Among the 32 quality dimensions that were included in the study, items such as arriving as scheduled, having a seat, no transfer trips, less waiting time, availability of shelters at pick up points, and availability of service, emerged as the definite choice of users instead of the traditional emphasis on such service quality items as faster trips and more direct routes (Tomazinis, 1975).

Furthermore, in many respects, unless the system produces services for consumption, it makes very little difference how productive and efficient the system is in its operation. For example, unutilised vehicle-kilometres make little difference to the costs of the system except for the fact that these vehicle-kilometres add to the cost of the entire system and sometimes succeed in attracting some stray users. Figure 3-7 depicts the relationship between service dimensions and efficiency.

Figure 3-7: Efficiency versus quality dimensions



Source: Tomazinis (1975: 10)

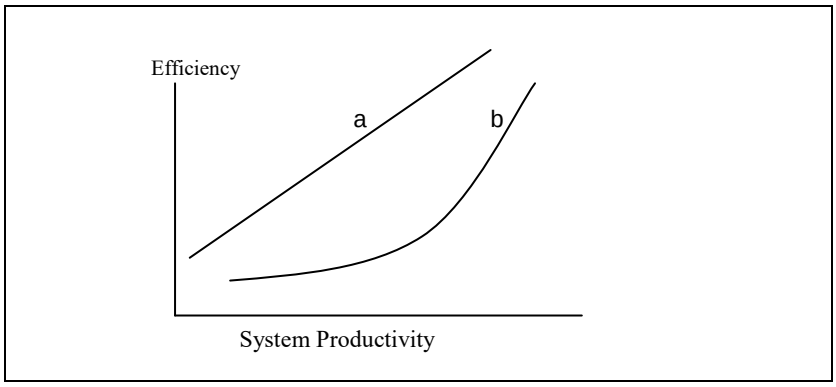
Unless the service supply profile matches over time and over space with the profile of the demand for service, but also includes the requirement that the services produced meet the quality characteristics that the commuters desire, the commuters will not use the service of the system. In such cases, there is the paradox of a system that is most efficient from the operator's point of view, but is both going bankrupt, and being also castigated by its users and would-be users as being completely inefficient. The dimensions of the quality services of a public transportation system that are intrinsically associated with the extent to which the services of the system are considered desirable and, therefore, usable from the point of view of the consumers, may be perceived as constituting a multidimensional space. Among the multitude of dimensions that may be distinguished in defining quality of service a few are used to indicate the multidimensional space that may be formed and the association between

this multidimensional space and efficiency measures (see Figure 3-7 above) (Tomazinis, 1975).

These dimensions of quality may be divided into two groups. The first group is associated primarily with short range considerations in forming trip patterns. This group includes quality dimensions such as convenience of getting to and from the vehicle, comfort in riding (such as finding a seat), and frequency of service. From the point of view of the commuter, the second group of quality dimensions for urban transportation systems is pervasive in nature, with pronounced, long-range, delayed impact on ridership patterns and modal choices. Among such dimensions, the reliability of the system as regards its current and long range performance often receives the highest rating, followed by the availability of service when it is needed. From the conceptualisation to the implementation of the transport system, the relationship and trade-offs between the productivity, efficiency, and quality of service of urban public transportation systems appear to be potentially complex and, on occasion, indefinable (Tomazinis, 1975).

Figure 3-8 below depicts the two general trends that may be expected of the relationship between efficiency and productivity:

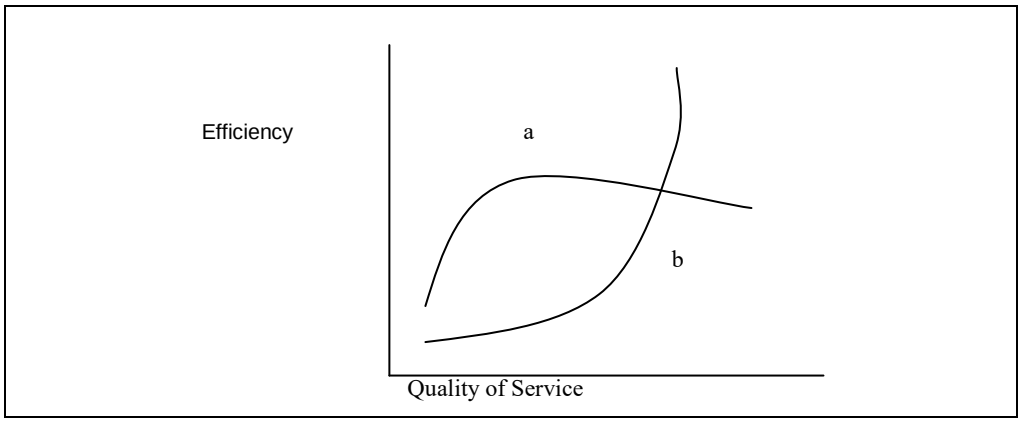
Figure 3-8: Efficiency versus productivity improvements



Source: Tomazinis (1975: 11)

As the efficiency of the various system components increases so does the overall productivity of the entire system. This relationship may have one-to-one correspondence curve, (a), or it may have a correspondence either significantly smaller or significantly greater than unity, depending on the specifics of the application curve, (b). Figure 3-9 below depicts the entire range of variations of the relationship between efficiency improvements and quality improvements:

Figure 3-9: Efficiency versus quality of service improvements

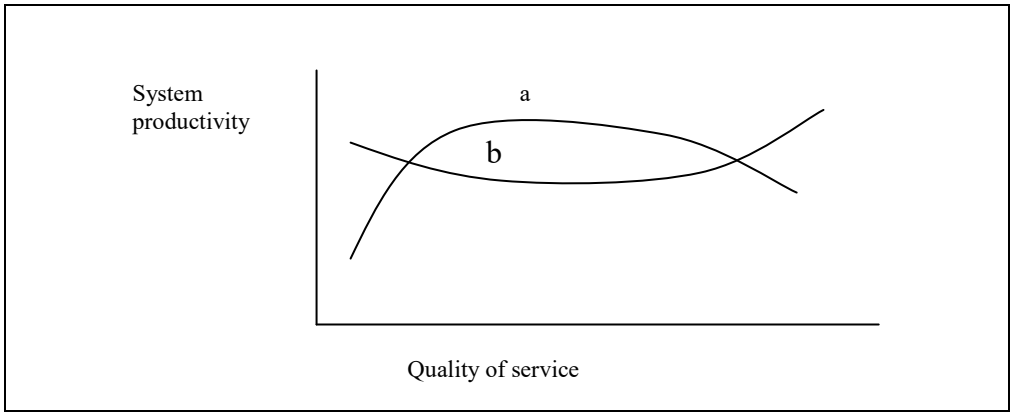


Source: Tomazinis (1975: 13)

It is to be expected that initial improvements in efficiency measures would be matched by corresponding improvements in quality measures and vice versa. However, after a particular point, improvements in one set of measures may correspond to deterioration in the other set of measures. Both curves (a) and (b) in Figure 3-9 above indicate this reversal of the correspondence between quality and efficiency improvements. Several examples may be drawn from the public transport arena/ environment that explain these relationships shown by the two curves in Figure 3-9 (Tomazinis, 1975).

Figure 3-10 below depicts two other potential forms of the relationship between system productivity and quality of service:

Figure 3-10: System productivity versus quality of service improvement



Source: Tomazinis (1975: 14)

Up to a certain point, curve (a) above suggests an increase of productivity as the quality of service improves. However, beyond this point the reverse takes place. This relationship may

be seen within the context of the reaction of the commuter to the services available. As the quality of service improves the commuter makes greater use of the system and, thus, more public transport service is purchased by the public. However, beyond a certain point the commuter's response may not match the on-going improvements in quality and, therefore, the overall productivity of the system may decline (with respect to either labour or capital). Curve (b) above represents the reverse sequence of events. The plausibility of this scenario may easily be constructed for each stage of the transport service. However, it is important to communicate improvements in service if demand is to be increased (Tomazinis, 1975).

The aforementioned discussion described the service reliability, comfort, extent, safety, and affordability of public transport. Other researchers have grouped public transport service quality dimensions into primary and pervasive. Primary service quality dimensions include convenience, comfort, and the frequency of service, while pervasive service quality dimensions include reliability and the availability of service (Public Transport Victoria, 2013). The next discussion describes the influence of service quality dimensions, particularly fares on future demand for public transport. Affordability of service, in particular, plays an important role in influencing the demand for public transport service.

3.4 Demand for Public Transport

As one of the objectives of this study, increasing the future utilisation and the demand for public transport is important to the sustainability of the industry. The demand and supply of public transport has an influence on the utilisation of the service (Farris, *et al*. 1976; Alam, 2002 & Adarkwa & Boansi, 2011). The demand for and supply of passenger transport services have some unique characteristics which are not present in case of demand for and supply of various goods and services. For instance, the demand for and supply of passenger transport depends on peak and off-peak times during a day, and weather conditions.

One of the most pronounced economic characteristics is that the demand for the vast majority of transport services is derived. This derived nature of the demand for transport services explains another characteristic of the transport market which is the regular fluctuation in its demand over time. The derived nature of the demand for transport arises due to the fact that transport is not really demanded in its own right. Individuals travel because they want to benefit from the social, recreational,

educational, employment, transaction, and other opportunities which become accessible with movement (Alam, 2002).

Furthermore, passengers will evaluate the service offering and form a perception of service based on the promises made and image created by the service operator. The supply of transportation exerts a significant influence on the demand as regards all modes of transport. For example, scheduling and frequency of service are characteristics of supply with important demand implications for both buses and minibus taxis. Despite the fact that the supply of public transportation services is influenced by the marketing function, traditionally the major thrust of public transport service has been toward the demand for these services (Farris, *et al*. 1976; Alam, 2002 & Adarkwa & Boansi, 2011).

Public transport planners may seek to increase utilisation by providing a new service to previously under or un-served areas; by providing more frequent service to existing areas; by providing more efficient service types, for example, limited and express service; by making service more accessible through the addition of new stops; or by providing amenities at bus stops (El-Geneidy & Kimpel, 2004). From the passengers' perspective, the ideal service is an efficient service with few stops, characterised by high and predictable demand, and few service reliability problems. Each passenger would like nothing more than for buses to arrive promptly at stops and termini that are conveniently located (Koffman, 1990) in such a way that access and egress times are minimised (Kittelson & Associates, 2003 & Murray, 2001).

Various researchers have described the following eight important demand characteristics that must be taken into consideration in public transport as these all influence fares (Farris, *et al*. 1976; Koffman, 1990; Alam, 2002 & Adarkwa & Boansi, 2011):

3.4.1 Demand Characteristics

This section discusses the demand characteristics that are likely to influence fares:

- Instantaneous demand

  While it is true that, as regards certain segments of the public transportation market, reservations are often made in advance, much commuter movement happens without either reservations or prior knowledge by the operator as to who will be travelling. People prefer simply to board a bus, train or minibus taxi and go. Thus, such passenger transportation does not involve devices such as

backlogs, back orders, inventories, and channel pipelines. The demand is instantaneous. However, this type of demand may be problematic for the service provider. For example, how many vehicles need to be available at a given time on a given route by a given operator? Thus, the degree of uncertainty is significantly greater than in many other types of business. Naturally, experience is important in predicting demand, and an operator is able to use past trends and past usage of facilities in the planning process. Nevertheless, there is no certainty that the present and the future will follow the trends of the past.

It is not uncommon for passenger transport operators to have more vehicles and capacity on the way and at terminals than would be necessary to address the needs of the majority of their customers for most of the time (Alam, 2002). Overcapacity is a feature of passenger transportation and is partly the result of the instantaneous demand also a characteristic of passenger transportation and partly the result of yet another characteristic, namely, variability of demand. In order to meet the needs of passengers, a balance must be found, that is, where there are sufficient buses and minibus taxis, particularly during the peak times.

- Extreme variability of demand

  Demand is highly variable with almost all modes of passenger transportation suffering from the peaks and valleys of demand. Both the demand and need for passenger transportation vary according to the hour of the day, day of the week, time of the month, and season of the year (Alam, 2002 and Rantzien & Rude, 2013). Most commuters travel during rush hours in the morning and the evening, while there are significantly less passengers during day and night times. These variations in demand over the 24 hours of the day leads to peak-load problems; and the transport organisation has to invest in enough capacity to satisfy the peak-load demand, but these investments are not utilised when the demand drops (Rantzien, *et al*. 2013). Accordingly, it is essential that sufficient capacity be available to handle the peak load or demand although this capacity may be either unutilised or under-utilised during other periods. As a result much of passenger transportation is supplied with excess capacity (empty seats) for much of the time.

  Urban passenger transportation demand provides the best example of the variability problem. In most cities of the world, the peak demand occurs in the

hours between 06:00 and 09:00 and again between 16:00 and 19:00 (Farris, *et al*.1976 & Alam, 2002) with buses, minibus taxis, and commuter trains being packed to capacity during rush hour. The labour force that caters for this demand (as well as the capital invested in vehicles, ways, and terminals) may be under extreme pressure for this short period of time, although underutilised for the rest of the time. This, in turn, means that there must be systems developed which are capable of addressing the rush hour demand through expanding the peak hours, for example, by having schools open early and close early. However, in reality not much has been done to address the rush hour demand.

The variability of demand in passenger transportation causes a further problem as regards pricing. The revenue received must be sufficient to cover the overall costs. However, the tendency has been to charge the peak user no more than the off-peak user and, thus, in effect, a type of cross subsidisation is involved.
Certain passenger transport operators have suggested that peak period users should be charged more and off-peak users less (City of Johannesburg, 2006). The rationale behind this suggestion is that the capabilities to move people are designed almost entirely in accordance with the necessity of covering the peak demand. However, the extra capacity in terms of the capital and labour required to cover the peak demand should be paid for by the peak user. This is the so-called peak-load pricing solution and is part of the marginal-cost pricing argument-where users should be charged the marginal costs of the service.

- Multiplicity of demand

  Yet another important complicating factor is that there is not one demand for passenger transportation but several demands. Demand has to be segmented into its various parts and these parts analysed separately as regards motivation, responses to price, frequency, and so on. Several segmentations of demand are possible with the simplest possibly being to consider demand as either business demand or pleasure demand. These two demands are characterised by different motivations, frequencies, and responses to price. Another somewhat allied segmentation of demand involves considering demand as either primary or derived although it is, in fact, not easy to separate the two. However, some passenger transportation demands involve more derived elements than others. The notion of “let’s go somewhere and it does not particularly matter where” is an example of a primary demand.

However, by far the largest segment of passenger transportation demand is of a derived nature with the demand to travel being derived from the demand for something else (Alam, 2002). Derived demand may respond more to forces quite outside of the passenger transportation industry than primary demand. For example, a change of fares may affect primary demand but may not, necessarily, affect derived demand.

- Inter-modal competition and elasticity

  There is a considerable opportunity for substituting one mode of transportation for another and demand may shift readily from one mode to another. All modes of passenger transportation compete (within obvious limits) with all other modes of transportation and, thus, the people who make up the demand for a given means of transportation will be highly sensitive to both the price and service of a competitive means of travel. Economists use the term "elasticity" to indicate this sensitivity. Strictly speaking, an economist considers price elasticity and income elasticity to refer to the sensitivity of the quantity demanded to changes in price or changes in income. As explained by Perloff (2007), the price elasticity of demand measures the price sensitivity, which is defined as the percentage change in demand resulting from a one percent change in price, ceteris paribus. A high price elasticity of demand indicates that the demand for the service is sensitive to changes in price, namely that a small change in price has a large effect on the demand. A low price elasticity indicates that a price change has a small effect on demand (Perloff, 2007).

  The degree of elasticity of demand depends on several things. When demand is segmented, the potential competition as regards a given segment of demand would be an important factor in terms of elasticity. Within a given segment of demand (travel from A to B) several means of travel or modes of transportation may be regularly available and, thus, potential substitutes for one another. The term "inter-modal competition and elasticity" is used for this phenomenon.

  Price has traditionally been thought of by economists as the most important factor as a determinant of the elasticity of demand and, as such, the price of one service relative to the price of the substitute service on a given segment of demand may play an important role in choosing the service. However, the managers of passenger transportation services often tend to overlook this. Some demands are price elastic. For example, pleasure travel is generally thought to

have a higher degree of price elasticity than business travel. In other words, a business trip or a trip to work is rarely cancelled in response to a price rise, but this is often the case as regards a holiday.

Primary demand may be significantly more price elastic than derived demand. The price of movement from the place of residency to the place of work, while an expense to the commuter, is generally considered as part of the costs of employment. It may happen occasionally but one rarely finds a person changing jobs because the price of commuting to work has increased. However, as regards primary demand, the commuting public may avoid the journey simply because it is not worth the cost. In economic terms, this may mean that the utility or satisfaction derived from the journey is not equal to the disutility or price of the movement.

Other researchers have supported the view that business travel demand in particular seems to be relatively more inelastic than other types of trips, for example, personal travel (Oum, Gillen & Noble, 1986 & Oum, Waters & Yong, 1992).

- Intra-modal competition and elasticity

  Not only is there a competition between such modes as air, rail, bus, minibus taxi, and private motor car, but there is also competition between transporters within a given mode. This competition between the various forms of a given mode of passenger transportation is known as intra-modal competition.

  According to a number of empirical studies (McGillivany, 1970; Lave, 1970; Smith & MacIntosh, 1974; Collings, Rigby & Welsby, 1976; Oldfield & Tyler, 1981; Gilbert & Jalilian, 1991; Goodwin, 1992; Perloff, 2007& Rantzien, *et al*. 2013) demand, in the short run, for a particular passenger transport mode does not fluctuate significantly with the price of that particular mode. That is, in the short run price elasticity of demand for a particular mode is relatively very low.

  The results of research conducted in Stockholm on peak-load pricing in public transport showed that short run price elasticity of demand for a particular mode is relatively very low is supported by the previous international studies; that the demand is inelastic (Rantzien, *et al*. 2013).

Overall, prices or fares are similar, if not identical, between competing organisations. One of the reasons for this is transportation regulation (see discussion later in the chapter). However, where regulation is inconsistent or where all competitors are not regulated in the same way (as is the case with scheduled airlines as compared to supplemental air carriers), price comparisons between organisations are possible and, indeed, they become a very real factor in elasticity or substitutability.

However, it would appear that intra-modal competition is concerned with the conditions of service. This includes a whole series of factors such as routes, frequency of service, type of equipment used, treatment by employees, perhaps meals, or even the free movie is shown by an airline. Elasticity or substitutability of one organisation for another would probably take place in response to any of these factors.

It is essential that a transport organisation always bear in mind not only its own price and the conditions of service it offers but also the prices and conditions of service offered by its competitors in the same mode. An extremely small change in price, time of departure, frequency of service, and/or type of equipment may either increase or lose demand for an individual organisation. To some degree this explains why passenger transportation organisations offer the commuter fewer options at night or during certain days of the week, and on public holidays. Clearly substitutability or elasticity exists between such organisations.

- Intra-class substitutability and elasticity

  Most passenger transportation organisations offer two or more classes of service. Classes of service refer to the various classes of service in public transportation, for example, first class, economy, and so forth (Farris, *et al.*1976; Barnes, 1989 & Alam, 2002). Classes of service are also found in subways and buses with local and express services. European railways typically have three or more classes of service. Even in the case of private motor cars, the concept of class of service may be found in the different makes or brands of cars and involves prestige, comfort and speed. The concept of different classes of service is widespread in passenger transportation although passenger transportation is somewhat unique in this regard with most goods and services being offered as a single homogeneous entity. It is rare to find first- and second-class steel, cigarettes, aluminium or radios (Barnes, 1989).

Passenger transport organisations offer several levels or classes of service at different prices to the consumer. This notion of classes of service often results in the organisation concerned competing with itself, a unique demand characteristic. It becomes extremely difficult to ascertain any determinants of the boundaries of classes or to find the definition of a class of service. However, the conditions of transportation must be compared to the price and a compromise made. One class of service often competes with another class of service offered by the same organisation in passenger transportation (Farris, *et al*.1976 & Barnes, 1989).

- Rand competition and income elasticity

  It is a truism that all organisations and all goods and services compete for the consumer's rand. Some organisations emphasise this type of competition and even such single suppliers as a regulated telephone monopoly often declare that they are in a fairly competitive business although this is, of course, is true. However, what the economist means by competition (usually price competition) is not necessarily what the businessman may mean by competition. In order to distinguish exactly what is meant here, the term "rand competition" may be used. This means that there are several goods and services available at a given moment in time and all sellers are in competition with all other sellers for the consumer's rand.

  Rand competition is fairly prominent in certain types of passenger transportation and is a real force to be considered in the demand for passenger transportation. In addition, each consumer unit has certain needs that must be fulfilled. For example, the rent must be paid, an adequate diet provided and the utility companies satisfied. All these consume varying amounts of a consumer's income. For low-income groups, these essentials may use up all or nearly all (sometimes even more) of the available income. For the higher income groups, some income is usually left over after the essentials have been purchased. This excess may be spent in various ways. Typically, this amount of income is termed discretionary income.

- Conditions of service and non-price competition

  The issue of conditions of service is also an important factor in the passenger transportation sector. According to Farris and Harding (1976), traditional

economic theory visualises demand as a function of several factors which may be expressed in terms of the following mathematical formulation:

$$Quality\ demanded\ (Qd) = f\ (X1 + X2 + X3 \ldots Xn)$$

Conditions of service may be thought of in terms of frequency of service, type of equipment, conditions and appearance of equipment, courtesy of employees, speed, comfort and availability of service. In addition, it is essential that non-price competition and conditions of service responsive to the external factors affecting the market for passenger transportation.

As shown above, it is clear that the demand characteristics are important to the pricing system with disposable income, elasticity, competition, conditions of service, and non-price competition impacting on the pricing system. These factors all affect the affordability of service. The following section discusses the pricing system with particular reference to the supply characteristics. In chapter one, it was pointed out that transport operators have to reach a positive compromise between quality of service and productivity (and the maximisation of profits).

There are nine separate supply characteristics that must be taken into account in public transport pricing, and these are all discussed below (Farris, *et al*. 1976; Alam, 2002; Adarkwa & Boansi, 2011 & Rodrigue, 2013). However, these supply factors are complicated, unique and perplexing. The question arises as to whether there are any peculiarities in the supply of public transport. In terms traditional economic theory, supply is determined by the cost of production plus the market structure within which the organisation operates, which will affect the amount of profits over cost that may be charged. As with other industries, it is essential that the supply of public transport reflect, over time, the prices of the factors of production; and the costs may be grouped as either fixed or variable and average or marginal (Farris, *et al*.1976).

3.4.2 Supply Characteristics

Various researchers have described the following supply characteristics that are vital to public transport and could influence fares (Farris, *et al*. 1976; Alam, 2002; Adarkwa & Boansi 2011 & Rodrigue, 2013).

- Capital-intensive and fixed costs

  In general passenger transportation is a capital-intensive industry with large amounts of capital being invested in creating and maintaining the way, in equipment, and in terminals. Therefore public transport development requires heavy investment (Alam, 2002 & Rodrigue, 2013). Despite the fact that the labour costs are considerable, the capital costs are often greater and, more importantly, as a result of their indivisibility, they present management with a greater opportunity to gain economies of use. If capital is used effectively, per-unit costs may decrease with the resultant increases in profit.

  This pressure on management to utilise capital and meet fixed costs may result in discriminatory pricing in the sense that not all passengers are charged the same amount. It may also lead to abnormal financial results. In addition, the pressure of fixed costs may result in equipment being used at less than full capacity on the basis that any revenue is better than no revenue at all. However, whether or not such reactions take place, it is indisputable that passenger transportation organisations are faced with high fixed costs.

- Sunk cost with few alternatives

  Sunk costs are a subcategory of fixed costs, and refer either to the existence of few alternatives for a given capital asset or the substantial capital costs involved in merely starting up production. Most capital investments are specialised to some degree. This is particularly true in the case of passenger transportation for, once vehicles have been purchased, ways established and terminals created, they have few other uses. Most transportation terminals have few alternative applications. In addition, while it is true that it is possible to resell vehicles (buses and minibus taxis) as a used market does exist; mainly, their use is limited entirely to transportation. In general, the more specialised the capital, the fewer alternatives there are and the greater the sunk-cost nature of the vehicle.

The significance of sunk cost with few alternative uses for the pricing system is that, once capital has been committed to a specialised use, the only way in which to recover the investment is by use. In other words, the existence of sunk costs exerts huge pressure on management to use its capital goods. It is only through use that it is possible to convert the capital from capital goods back to liquid capital. Idle capital equipment does not earn money and, if no alternative use for the capital exists, it must be used in its sunk capacity, if at all possible.

- Long cycles

  Passenger transportation operates under the constraints of a series of three long cycles. Although demand is instantaneous, production is not. In order to supply passenger transportation, considerable preparation is required. Vehicles must be acquired, terminals built, employees hired and trained, and, sometimes, ways built. In addition, substantial preparation and activity is often needed long before the supply is furnished to the passenger and, even after service has started, vehicles must be cleaned, serviced, prepared for use, and maintained. Accordingly, a long production cycle prevails. Likewise, it is essential that planning is completed well in advance of the production of the service and the obvious factor of capital planning and acquisition is merely an aspect of the long planning cycle.

- Small incremental cost of operation

  Passenger transportation usually involves small incremental costs. This is partially as a result of the high degree of fixed costs noted above and also the sunk cost and long-cycle nature of capital, but also as a result of the ease of adding more service up to capacity. Indeed, incremental costs may be defined as the cost of an increment or added unit of production.

  Once a passenger transportation organisation has acquired vehicles and terminals (and perhaps a way as well), hired labour, and set up operating schedules and procedures, the added cost of adding more services is negligible. Additional passengers may be added at relatively little cost until capacity has been reached. Even when vehicle capacity has been reached, the incremental cost may be small if additional system capacity exists. The cost of running another bus is minimal. Bearing in mind that the analysis of demand revealed a tendency to overinvest as a result of both the necessity to cover peaks in demand and the instantaneous nature of demand, it is probable that system

capacity may prove a hurdle for most organisations for short periods of time only.

The significance of this incremental cost is evident primarily in pricing. In view of the small incremental costs, if a decrease in price would attract additional passengers, an extremely low fare may be offered to the incremental or marginal commuter. Until capacity has been reached, the organisation could add more and more customers at progressively lower rates and still show a considerable profit. Of course, it should be recognised that this is the concept underlying the various discount fares offered periodically by airlines, some rail passenger organisations, and some bus companies. The actual pricing decision will be of direct concern to operators. At this point it is, however, sufficient to realise that one of the characteristics of supply is a low incremental cost up to capacity.

- Non-storable supply with high wastage factor

  Non-storability and a high wastage factor are aligned with a small incremental cost. Once a vehicle has been acquired, scheduled, and used, its capacity is committed (Alam, 2002). Vehicle inputs come in capacity lumps, i.e. so many seats per model of bus. Unless all of the capacity is used, it may be regarded as being wasted. It is not possible to store passenger seats not occupied for future use. There is no inventory of passenger kilometres and, for pricing purposes, this translates into pressure to use the service. Not only is the incremental cost of an additional passenger relatively small but the capacity to serve is perishable. The maxim in the transportation industry that empty seats are wasted transportation and add no revenue illustrates the pressure to use capacity.

- By-product problem and common cost

  Freight transportation is a by-product of passenger transportation in the sense that passenger transportation rarely happens in isolation and this creates problems. There are two problems which arise from by-product effect, namely, the subsidy problem and the cost-allocation problem. The subsidy problem arises because the modes of transportation developed during a different time, and with different degrees of support continue to compete with one another. For example, minibus taxis and bus passenger transportation compete. The question remains as to which service is the most heavily subsidised by public expenditures and what the proper cost allocation should be. To a significant

degree, the entire matter revolves around the economics of common costs. Common costs refer to expenditures involving the entire operation and are not easily and clearly assignable to any one function or service. Much of the cost allocation between passenger and freight service is purely arbitrary and, hence, one service may well subsidise a companion service.

The significance of this by-product effect and common costs problem is broader than merely the issue of a subsidy. If costs are reflected in fares, then the allocation of common costs may become extremely important.

- Continuity and reliability factors

  Passenger transportation has to operate for 24 hours a day, 30 days a month, and 365 days a year. Thus, in view of the fact the services must be available on an on-going basis, 8-hour days and 40-hour weeks are not possible. However, this need to supply on a continuous basis results in several problems not experienced in other industries (Farris, *et al.*1976 & Oldfield & Tyler, 1981).

  In addition, inferior production is not possible. The public expects the passenger transportation at night to be as reliable as the transportation during the day. In other words, passenger transportation is expected to operate for 24 hours a day and to maintain high levels of reliability. Thus, in view of the fact that passenger transportation is continuous and involves a high reliability factor, there is little opportunity either to cut costs or to institute lower pricing for a slightly inferior service at unusual hours.

  If management should cut fares for, for example, night time commuting, this would represent an effort to stimulate demand and utilise the valley in demand and would reflect any cost economy. The cost to the organisation to supply service is approximately the same at any time during the day. However, the significance of continuity and reliability is that these factors add to the total cost of the service and, because reliability and continuity are both demanded and expected by the public, the cost is greater than if there were a lower level of expectation. Costs are reflected in both supply and in fares. Reliability and continuity must be paid for and that cost becomes a part of the charge for transportation.

- Labour and Responsibility

  In view of the requirements as regards on-going, highly reliable production, the situation in respect of transportation labour is different from that of most other labour. As indicated above, there are no 8 hour workdays and 40 hour workweeks. Transportation labour has a 24 hour schedule and must be as alert and responsible at 02:00 as at 16:00. The safety of the public is involved and, thus, a high level of responsibility rests on transportation labour (Farris, *et al*.1976 & Oldfield & Tyler, 1981).

  In addition, the level of skill demanded is often considerably greater than that demanded from the typical production worker. It is essential that people driving buses and minibus taxis be well trained and highly skilled. In view of the fact that public safety is involved, various rules and regulations concerning not only level of skills but also conditions of employment have evolved. Licensing procedures that demand proof of skill are usually imposed on operators while there are also regulatory rules relative to hours of continuous work and rest periods. Transportation labour is, typically, well compensated in order to ensure the degree of skill and responsibility necessary. The labour cost for passenger transportation organisations is not negligible, and there is little opportunity to substitute capital for labour in the passenger transportation industry.

- Public regulation and the supply of public transportation

  Passenger transportation is a regulated industry (transportation regulation systems are discussed later in the chapter). From a pricing system perspective, regulation constitutes an important supply factor. Public bodies decide the extent of the transportation offered- the routes and the conditions. Passenger transportation organisations are not at liberty to decide whom they will serve and they must serve all, without discrimination or prejudice. The removal of discrimination and prejudice in servicing commuters refers to the so-called "common carriage obligations" which is derived from common law (Farris, *et al*.1976).

3.4.3 Market Structure

The market structure under which public transport operates is important because it influences service quality dimensions, particularly pricing or the fares determination. The importance of pricing is different depending upon the type of market structure because each market

structure has special components that affect the pricing schema and determination of output. The next section discusses the market structure of public transport.

Market structure may be thought of in terms of a model or a system with predictive attributes. Accordingly, various economists have discussed the market structure of public transport (Farris, *et al*.1976; Friedman, 1983; Goodwin, 1984; Smith, 2002; Fontini, 2005; Cantos-Sanchez & Moner-Colonques, 2006; Millard & Glaister, 2008; Blackstone, Darby, Fuhr Jr., 2011; Daniels, 2011; Rantzien, *et al*. 2013; Tejvan, 2013; Land Transport Authority, 2013 & Basic Economics, 2013). The most common market structure and characteristics is depicted in Table 3-4 below:

Table 3-4: Market structure characteristics

Market structure	**Number of organisations**	**Product characteristics**	**Entry - exit**
Pure competition	Many	Homogeneous	Easy
Monopolistic competition	Many	Differentiated	Relatively easy
Oligopoly	Few	Homogeneous, differentiated	Relatively difficult
Pure monopoly	One	Indifferent	Closed

Source: Farris and Harding (1976: 91)

The question that needs to be asked is which market structure best describes public transport? It would appear that public transport is a differentiated oligopoly (Tejvan, 2013). However, the mass rapid transit (MRT) system, for example, in Singapore started off with a monopoly before evolving to a duopoly today. With lower barriers to entry and more firms entering the market, taxi services operate in an oligopoly (Land Transport Authority, 2013).

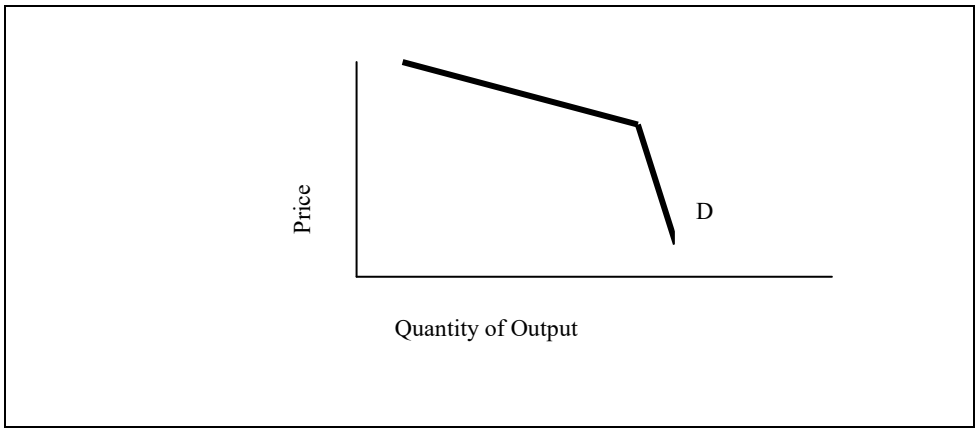
In general, in a differentiated oligopoly market structure, the number of transport organisations in a given route is few. The main key to behavior in an oligopoly is that transport organisations must take into account what other transport organisations will do. Oligopolists are torn between cooperating to increase profits by obtaining the monopoly outcome or competing to try to gain an advantage over competitors.

Transport organisations in this regard are theoretically defined as being so few that the fare actions of any one will appreciably affect the demand of any other (hence the interdependency of all organisations serving a given market). Both theoretically and legally, no competition is permitted on a given route.

If public transport is, indeed, a differentiated oligopoly, what actions may be predicted in terms of the model? Based on the interdependency factor, the model predicts a minimum of price action and a maximum of action to differentiate the service. Thus, price would tend to be sticky and change slowly. However, where change did take place, a price leadership pattern would tend to prevail, with one organisation assuming leadership as regards the price change, either upward or downward. This price leader may be the largest organisation or it may be the barometric organisation – the one that tests the market response. The role of price leader would probably shift from time to time and the organisation leading price up at one time may not be the organisation that leads price down at another time (Farris, *et al*. 1976).
According to economic theory, a kinked demand curve for the industry may well exist. No organisation would have an individual demand curve unless the service offering was sufficiently differentiated to overcome the inherent interdependency (Farris, *et al*.1976; Friedman, 1983; Goodwin, 1984; Smith, 2002; Fontini, 2005; Cantos-Sanchez & Moner-Colonques, 2006; Millard & Glaister, 2008; Blackstone, Darby, Fuhr Jr., 2011; Daniels, 2011; Rantzien, *et al*. 2013; Tejvan, 2013; Land Transport Authority, 2013 & Basic Economics, 2013).

Hence, as depicted in Figure 3-11 below, the industry demand curve may have a kink in it:

Figure 3-11: Kinked demand curve of oligopolistic industry



Source: Farris and Harding (1976: 95)

In considering its price policy each organisation would reasonably assume that a decrease in price would be matched by all its competitors. Thus, a price decrease would lead to an extremely small increase in the share of the market. In effect, the organisation would view demand below the kink as price-inelastic. On the other hand, the organisation may decide that a price increase would not be matched by its competitors and, thus, the organisation would view demand above the kink as highly price-elastic. A price rise in such an instance would probably mean considerable loss of demand as others failed to follow the increase (Goodwin, 1984; Tejvan, 2013; Land Transport Authority, 2013 & Basic Economics, 2013).

Furthermore, the upshot of a kinked demand curve is the tendency to do nothing; that is, to maintain a stable price situation and avoid upsetting the status quo. The only price change under such circumstances would take place as a result of all organisations moving together (a price leadership situation) with concerted or identical action on the part of all organisations at a given time.

The offsetting feature to the kinked demand curve, live-and-let-live pricing and concerted or parallel price action with intermittent sticky or stable prices, is service differentiation. In view of the fact that organisations are competitive, it is to be expected that this competition would take the form of service differentiation, and not price competition with every attempt being made to make the service as unique as possible, but still substitutable or competitive. This is precisely the action which is taken in many parts of passenger transportation industry.

It is clear that it is not possible to overlook the importance of pricing in influencing demand for public transport. In addition, much of public transport planning is also based on demand analysis which, supposedly, outlines a certain level of service that must be maintained, whether it be: auto-oriented, transport systems, parking, bicycles or even pedestrian systems. This level of demand is portrayed as being both pre-set and inelastic (Taxan, 2007).

The next section further discusses fares determination theory:

The economics of pricing in public transport involve four interrelated concepts, namely, differential pricing, the contribution theory, the incremental concept, and actual pricing (Farris, *et al*.1976; Perloff, 2007; Frost, 2013 & Rantzien, *et al*. 2013). In all instances, managerial judgement is the final decision-making factor as regards price.

- Differential pricing theory

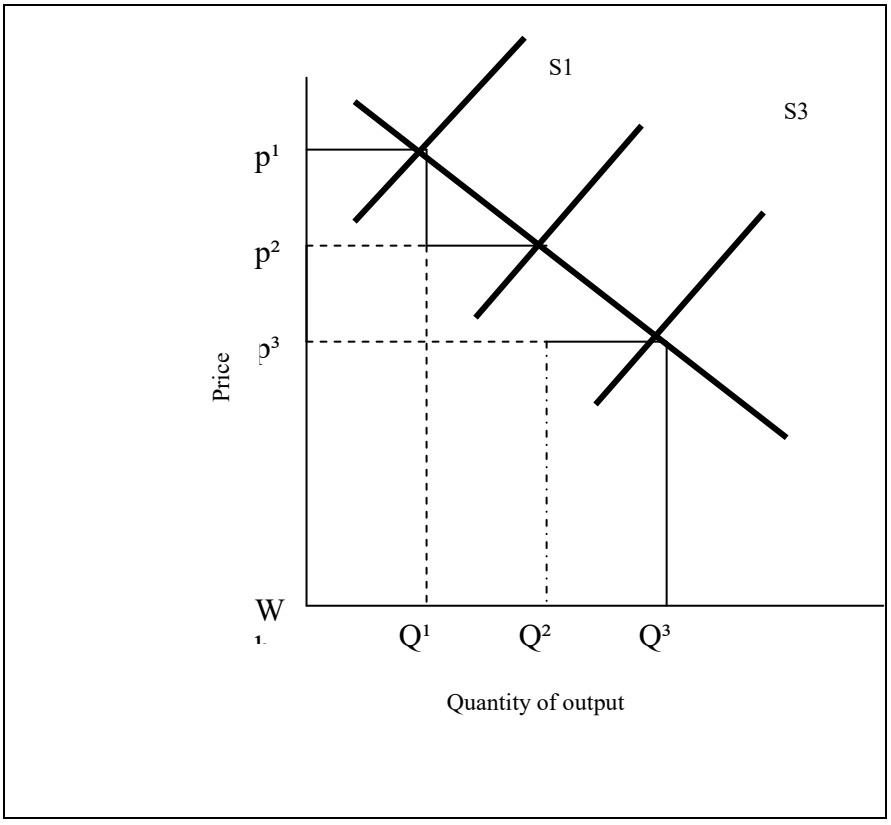
  Generally, for a transport organisation to successfully practice differential pricing, the following are conditions that have to be fulfilled:

  - Market power – the transport organisation has to have market power otherwise it cannot charge passengers more than the price of the competitors; and

  - Sensitivity – passengers must have different demand elasticities and the transport organisation must be able to identify how the passengers differ in their sensitivity of demand (Perloff, 2007).

  Taking into account the market structure of public transport- that of being an oligopoly- Figure 3-12 below shows that the oligopoly possesses considerable market power and may maximise the demand curve by creating several prices:

Figure 3-12: Multiply supply curves of oligopoly



Source: Farris and Harding (1976: 97)

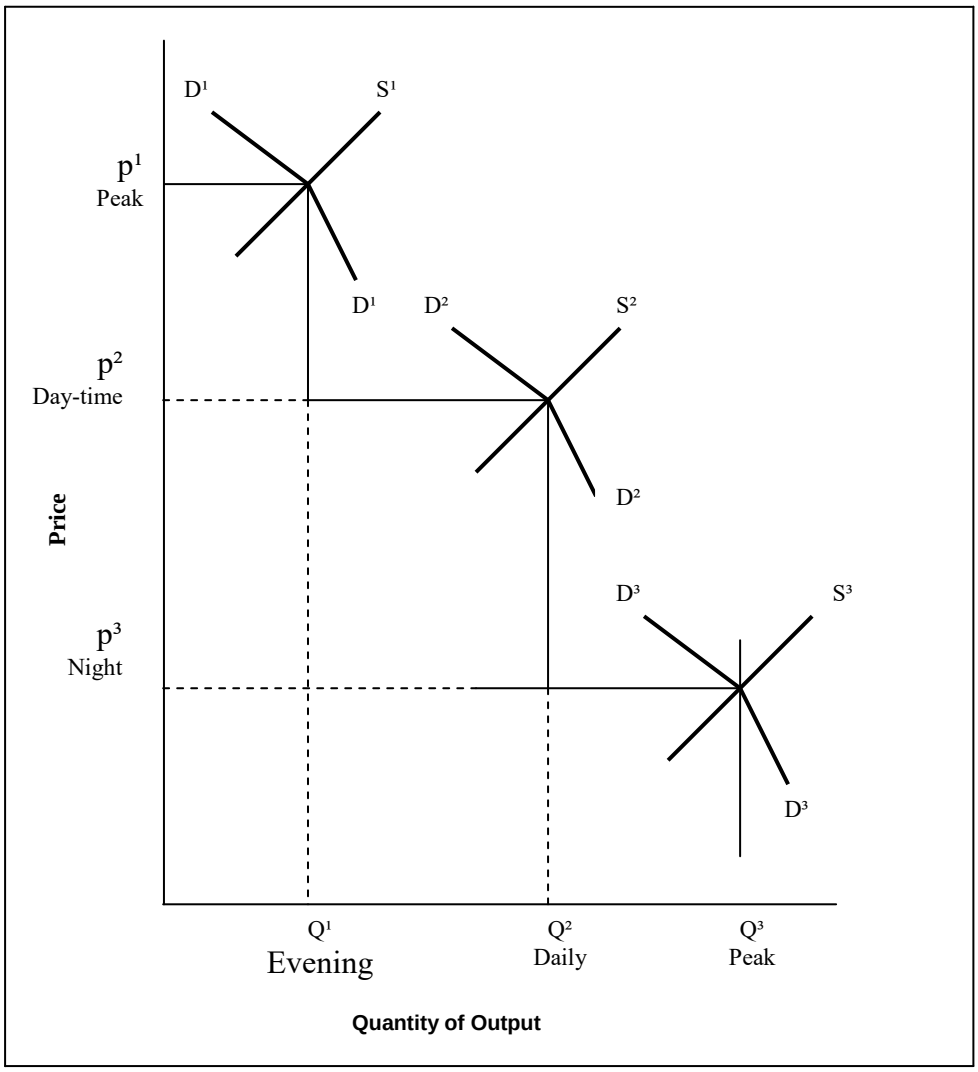
This economic power of maximising the demand curve by creating several prices is reinforced by legal price-making. In view of this legal power and if the organisations do, indeed, move in concert with parallel action, the industry may establish not one but several separate supply curves. In the Figure above, three prices for three supply curves are the result of several separate supply curves. In this instance, the organisation will offer three separate services at three separate prices and take advantage of a larger portion of the demand curve than a single price would permit.

Thus, in this instance, the organisation has differentiated pricing, and several classes of service are supplied – each slightly different from the other and each at a separate price. However, it is important to ascertain how these customers will be classified in order to accomplish differential pricing. Several factors may be used to classify customers. They all revolve around the various elasticities of demand. In other words, taking into account the factor of potential substitutability, management is able to establish a low price where potential substitutability is high and both an intermediate price and a high price where potential substitutability is low.

However, drawing on demand analysis, it is often found that the establishment of low price where potential substitutability is high and both an intermediate price and a high price where potential substitutability is low becomes somewhat more complicated. Nevertheless, demand can, and should, be segmented. No single demand curve for passenger transportation exists. In addition, the elasticities are multiple. Furthermore, there is a tendency in passenger transportation for the industry to have a kinked demand curve. In fact, separate demand curve exists for each class. The situation may be depicted graphically as illustrated in Figure 3.13 below.

While Figure 3-12 above presents a situation that is closer to reality, as depicted in Figure 3-13 below, even more complications may exist:

Figure 3-13: Differential pricing with varying degrees of elasticity and a kinked demand curve



Source: Farris and Harding (1976: 97)

Firstly, there would be numerous demand curves, perhaps even one for each destination. Secondly, several supply curves would certainly be involved. At the very least, a supply curve for each class of service exists. Consequently, the basic supply and demand equilibrium exists in numerous times, and for each specific differential price.

- Contribution theory

  As regards the supply or cost side, the question of what factors would be important to maximising revenue in this passenger transportation pricing decision is prominent. Contribution theory from applied economics is vital in

this context. In view of the fact that many costs are fixed and of a sunk-cost nature – and also incremental costs are small although a common-costs problem exists – it is recommended that management should set each price or fare at such a level that the price or fare is able to make the greatest possible total contribution to fixed costs and still allow the traffic to move. This, in turn, means that each fare should cover its share of incremental costs plus as much of the fixed and common costs as possible while taking into account the elasticities of demand. Where demand is highly elastic, fares may be extremely low on that segment of demand.

Nevertheless, the question arises as to how low? Certainly, no lower than the incremental costs but high enough to make the greatest possible total contribution to both fixed and common costs and still serve the demand. Where demand is inelastic, fares may be relatively high on that segment of demand. Also, how high? Certainly, high enough to cover the incremental costs and to maximise their contribution to the fixed and common costs but still serve the demand.

In the first instance, the fare may not cover the total costs as they are traditionally considered. In the second instance, the fare would more than cover total costs and substantial profit may be involved. A type of cross-subsidisation from the passengers with an inelastic demand to the passengers with an elastic demand is involved. In addition, a type of price discrimination exists where passengers are charged different prices (Rantzien, *et al*. 2013).

The rationalisation of the use of incremental costs theory lies in the fact that fixed costs and common costs for passenger transportation are often high. It is essential that fixed costs be covered over time by total revenue and, if the high fare excluded those passengers with an elastic demand curve, the entire burden of the fixed costs would fall on those passengers with an inelastic demand curve. Thus, as long as the differential fares cover incremental costs and make some contribution to fixed costs, all the passengers would be better off. The passengers with inelastic demand would pay less than if they carried the entire burden of the fixed costs. On the other hand, the passengers with elastic demand commute and, thus, they would not travel at a higher price. The passenger transport resources in terms of vehicles, labour, and kilometres committed would have been used more completely and effectively due to the perishable

nature of passenger tranportation, meaning the passenger transportation service cannot be stored for future use, once a vehicle is acquired, scheduled, and used, its capacity is committed, and passenger seats not occupied cannot be stored for future use – there is no inventory of passenger kilometres. Two absolute limits are imposed on how high the fares for the passengers with inelastic demand may rise. One of these limits is demand itself. At a certain price and condition of service, even the passengers with inelastic demand will refuse to travel. The second limit is the regulation that is imposed to prevent undue discrimination in fares and to prevent organisations from charging too high a fare.

- Incremental concept

  Drawing upon both the differential pricing concept and contribution theory, it is essential that management approach the issue of price setting with great caution. Considerable judgement is required in analysing demand and cost factors.

  It is incredibly difficult to make estimates of potential substitutability – fares that are too high may easily discourage passengers, particularly in the light of the low disposable income of most passenger transport users, while fares that are too low may not be sufficient to make the greatest possible total contribution to the fixed and variable costs. Each fare is a separate problem. As already noted, each segment of demand must be analysed and all unusual characteristics of that particular segment taken into account. Each segment of supply will also have varying costs characteristics. However, the general pricing rule is that each fare should cover its incremental costs and make the greatest possible total contribution to the fixed and common costs, and yet still move the traffic.

  The proper process to be used in establishing a total fare schedule would involve adopting the incremental concept. Each aspect of the problem should be considered separately and, after careful analysis, each fare should be established separately. The general rule of the contribution theory should be followed as regards each segment. If each fare is analysed in this way, revenue will be maximised as will travel on that increment of the business. As each fare is adjusted properly, a total fare schedule emerges. Finally, total revenue and profit will be maximised as each segment is analysed incrementally, the total use of the resources committed will be maximised, and total travel will be maximised.

- Actual pricing

  It is important to determine whether differential pricing, contribution theory, and the incremental process are, indeed, used in the public transport sector. If the contribution theory were followed, each fare would be studied and analysed separately. Conversely, differential pricing would reflect demand differences, and each fare would maximise its contribution. Some fares would be lower, such as night time fares, while some would be higher, such as the fares during peak periods (See discussion below). Much effort would be involved in solving the peak and valley problems of demand. Some customers with elastic demands, such as the young and the elderly, would pay a lower fare, while businesspeople may be charged a higher fare (Alam, 2002).

  It should be obvious even to the casual observer that actual pricing is only partly in accordance with the theoretical possibilities noted above. One of the reasons for this is administrative. So many fares only may be easily administered and an absolute limit imposes itself here. Regulation is another reason why the theory of fare changes is not always taken into account. Public commissions do not always look favourably on price experimentation and they tend to prefer fares to remain stable.

  Unfortunately, many operators have become used to blaming their economic troubles on regulators with the regulatory boards acting as a ready scapegoat at such times. However, it is worth noting that fare changes originate with the operators and are only either approved or disapproved by the regulators. No one knows how many fare changes the regulators would be prepared to approve. Accordingly, blaming regulators is not a valid reason for not studying the economic situation facing organisations and endeavouring to take action.

  However, the main biggest reason why actual pricing does not more closely resemble the economic pricing model is simply a matter of operator's choice. Acquiring knowledge of all demands, analysing them, and setting up different classes of fares is both time-consuming and expensive while an awareness of all the cost characteristics and applying them to each demand segment requires considerable analytical ability and much effort. Even if the operators in question were capable of applying these principles, it is easier to follow the path of less resistance and avoid the price decision entirely.

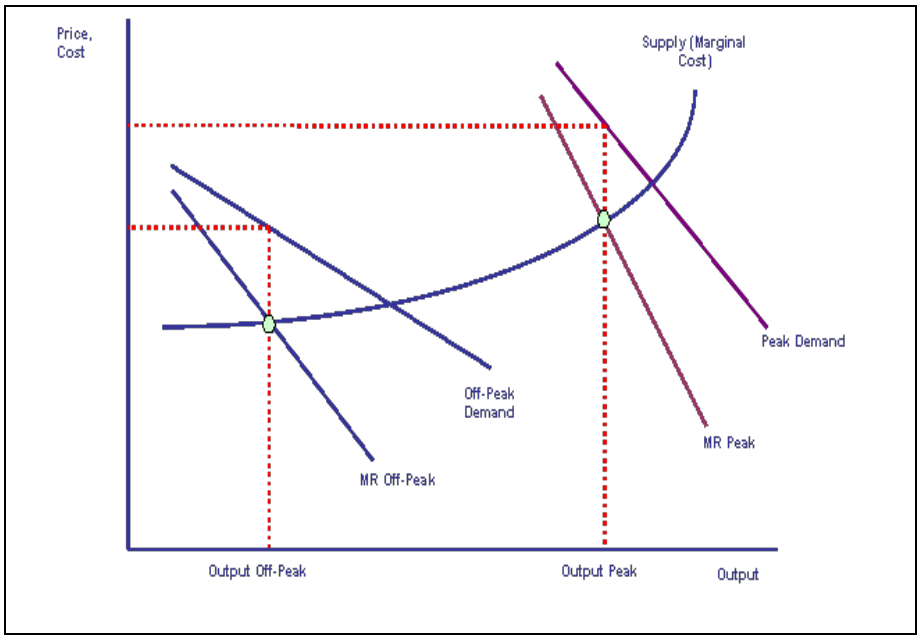
Certain organisations use economic pricing more than others. However, few operators make use of the all concepts while some may not actually be completely cognisant of the full ramifications of these concepts. Nevertheless, in actual practice, it is easier to ignore price and economic considerations and to concentrate on marketing and the conditions of service. It would appear that this easier path is the most popular in the passenger transportation industry.

- Peak and off-peak pricing

  Peak and off-peak pricing are common in other industries, although less common in the public transport industry. Nevertheless, it is possible to apply the concept in the public transport context (Riley, 2006). The elasticities of demand for each period are calculated in order to find Ramsey prices that can be used when a monopoly firm maximizes profit and minimizes the welfare loss. The price elasticities of demand differ between the peak- and the off-peak period, a higher price should be charged in the peak-period and a lower price in the off-peak period to both increase the revenue, the total number of passengers, and reduce the associated with the peak-load demand (Rantzien, *et al*. 2013).

  This price discrimination system is presented in Figure 3-14 below:

Figure 3-14: Price discrimination – peak and off-peak

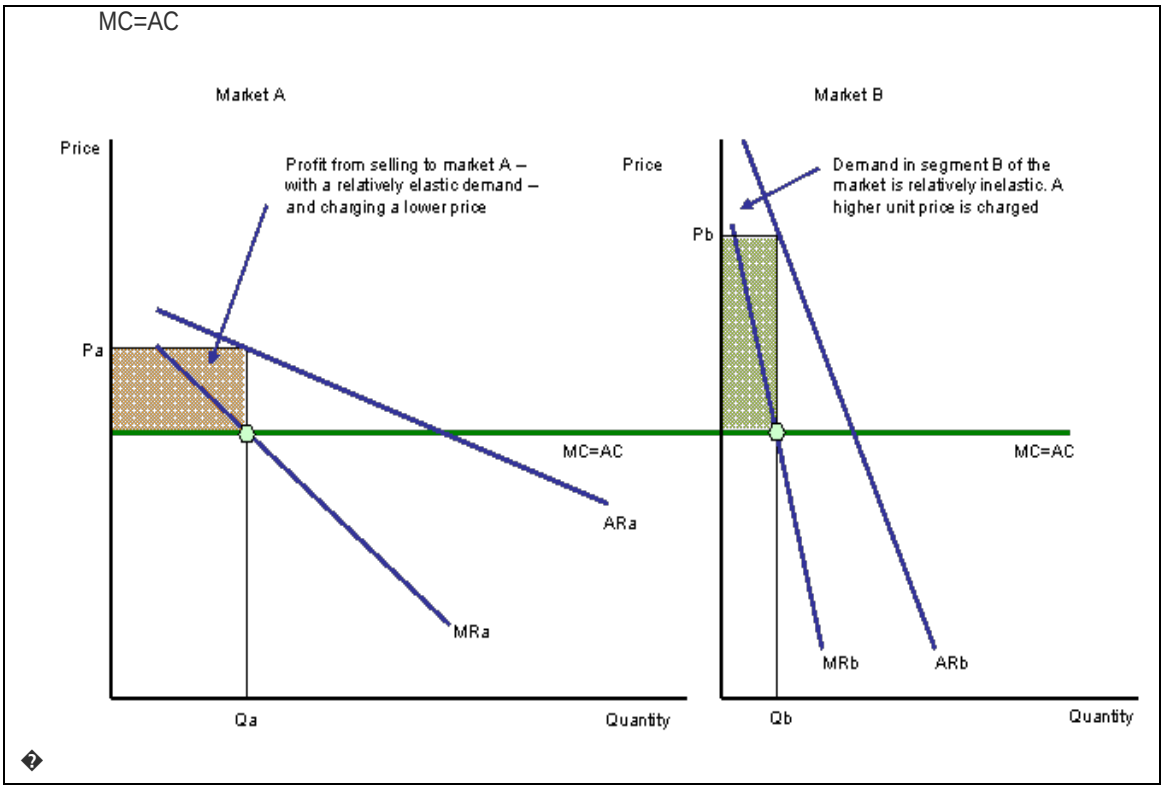


Source: Riley (2006: 1)

Both telephone and electricity companies separate markets according to time. For example, there are three rates for telephone calls – a daytime peak rate, an off peak evening rate and a cheaper weekend rate. Electricity suppliers also offer cheaper off-peak electricity during the night. At these off-peak times, there is ample spare capacity while the marginal costs of production are low (the supply curve is elastic), whereas, at peak times when demand is high, it is to be expected that short run supply will become relatively inelastic as the supplier reaches capacity constraints. Thus, a combination of higher demand and rising costs forces up the profit-maximising price (Riley, 2006).

In addition, as depicted in Figure 3-15 below, consumers may be charged based on their willingness and ability to pay for the service. This, in turn, means that the prices charged may bear little or no relation to the cost of production.

Figure 3-15: Price discrimination: consumers' willingness and ability to pay



Source: Riley (2006: 1)

As illustrated in the diagram above, an organisation has separated a market by time into a peak market with inelastic demand (market B) and an off-peak market with elastic demand (market A). The demand and marginal revenue curves for both the peak market and the off-peak markets are labelled A and B respectively. Assuming a constant marginal cost for supplying to each group of consumers, the organisation aims to charge a profit maximising price to each group. In the peak market the organisation will produce at the point at which MRa = MC at a charge price (Pa), and in the off-peak market the organisation will produce at the point at which MRb = MC and charge price (Pb). Thus, consumers with an inelastic demand for the product will pay a higher price (Pa) than those with an elastic demand who will be charged (Pb) (Riley 2006).

It is crucial to take into account that not all researchers agree with the marginal-cost pricing theory as explained in the previous discussion. Bingfeng and Ziyou (2007) maintain that marginal-cost pricing theory considers the benefits of the transportation suppliers, but loses sight of transportation demand, that is, the passengers. Under the condition of market competition, public transport prices should reflect the relations between supply and demand in the transportation market and should take into account the passengers' mode choosing behaviour in the context of multi-mode transportation. This concern is also shared by other researcher where it is maintained that marginal cost pricing with regards to urban transport is problematic, due to some special features of both supply and demand (Fearnley, 2004 & Rantzien, *et al*. 2013).

3.5 Importance of Service Quality Dimensions

The service quality dimensions, RECSA, as described in the aforementioned discussion, are important to commuters in that commuters judge the quality of services in terms of their perceptions of the technical outcome provided and on the way in which that outcome is delivered. If the service has a specific outcome, for example, riding a bus from departure to destination, the commuter will judge the effectiveness of the service on the basis of that outcome (Zeithaml, *et al*. 2000).

The existence of both process and outcome quality may explain why a bus operator with marked technical skills, including effective planning and scheduling of trips, may fail to compete effectively with another bus operator who is able to deliver superior, interpersonal

quality in the manner in which the service is provided. However, if the commuters are able to judge the technical quality of the outcome effectively, they will base their quality judgements on process dimension such as the bus operator's ability to solve passenger complaints, as well as on their ability to offer quick solutions and show empathy and courtesy.

If commuters are not able to evaluate the technical quality of service accurately, they form impressions of the service, including its technical quality, based on whatever sources exist, using either their own understanding or cues that may not be apparent to the operator. Transport operators should ensure it is possible to evaluate the service objectively in order to improve the service encounter experience, for example, in situations in which promises are either kept or broken and where the proverbial rubber meets the road – sometimes termed real-time marketing. Commuters build their perceptions based on these service encounters. A service encounter may be potentially critical in determining customer loyalty. If, for example, the commuter is interacting with a bus operator for the first time, that initial encounter will create the commuter's first impression of the organisation. In this instance, the commuter has no other basis for judging the quality of the service offered. This initial encounter may take on excessive importance in the commuter's perceptions of quality. However, even in situations in which the commuter has had multiple interactions with the bus company, each individual encounter is important as regards creating a composite image of the organisation in the commuter's memory (Zeithaml, *et al*. 2000).

Several positive experiences add up to a composite image of high quality, while several negative interactions will have the opposite effect. On the other hand, a combination of positive and negative interactions will leave the passenger unsure about the organisation's quality, doubtful of its consistency as regards service delivery, and vulnerable to the appeal of competitors. Nevertheless, logic suggests that not all encounters are equally important for building relationships. For every organisation, certain encounters are probably crucial to passenger satisfaction although it is the early encounters that are the most important. With the exception of common key encounters, there are certain momentous encounters that simply ruin all other encounters and drive passengers away, no matter how many or what type of encounters have occurred in the past. These momentous encounters may be related to extremely important events or they may seem inconsequential. Similarly, momentous positive encounters may sometimes bind a passenger to a transportation service for life (Zeithaml, *et al*. 2000).

These momentous positive encounters may result from improvements effected by the service operators which, in turn, may positively affect the utilisation of and the demand for service. However, it is important to discuss other factors that may, potentially, affect modal choice (Mashiri, *et al.* 2010):

- Building passenger transport patronage

  Passenger needs generally revolve around convenience. The level of these needs often change over time and this, curiously, often has the effect of spawning a truism: the better passengers are served, the better they will expect to be served. How best then may the transport industry serve these needs, given the financial and historical circumstances which characterise the industry (Mashiri, *et al.* 2010)?

  Passenger transport will best serve its customers when fares and routes are integrated and when the passenger transport offers access to a wide range of destinations with easy transfers. These easy transfers are made possible by purpose-built interchanges (where passengers may change modes in safety, and are protected from the elements).

  Passenger transport must be given preference in the road system, which is appropriate to its greater economic use of road space, in order to compete with the private motor car.

- Integration of marketing research into transport management

  Passenger transport operates in a difficult economic environment and, increasingly, it is facing austerity measures, lay-offs and the elimination of nonessential services and programmes. A key policy objective is, thus, to acquire new riders and to retain existing ones in a cost-effective way. An effective market and customer research programme may make a significant contribution to clarifying and finding solutions to such a policy objective (Mashiri, *et al.* 2010).

- Maintaining existing client base

  It is essential that passenger transport operators be responsive to a wide range of objectives and influences, including concerns about maintaining established services, balancing budgets (in which user revenues are usually a minority

component), legal constraints, public safety; and social equity and political considerations. However, responding to marketplace signals about demand is often far down on the list of priorities. Nevertheless, in balancing the many competing objectives, it is imperative that the factors affecting demand not be taken for granted (Mashiri, *et al.* 2010).

- Adapting the service to customer needs and attracting infrequent riders

  An important consideration is whether building transport ridership has more to do with persuading people to use the transport every day, once a week, or a few days a month? This basic question has profound implications for transport marketing, pricing strategies, and transport financing. The transport industry has long focused on regular riders, large numbers of trips, and daily commuting. In addition, captive and public transport dependency concepts are also common in the industry's view of its markets (Mashiri, *et al.* 2010).

- ICT as a communication method

  ICT is important to public transport. In the context of public transport, ICT refers to methods and processes which are aimed at increasing the effectiveness, efficiency, and capacity of existing transportation systems, including information processing, communications, control and electronics (Mashiri, *et al.* 2010). Furthermore, the specific benefits of ICT solutions are primarily increased efficiency, lower costs and higher productivity levels, which translate, in turn, into increased reliability, shortened travel times, and greater convenience. ICT technology may also result in higher passenger satisfaction, and the ability to promote passenger transport.

  Another important consideration with regards to ICT involves the introduction of Integrated Circuit Card (ICC), Ticketing and Automatic Vehicle Location (AVL) systems that improve the quality, efficiency, and transparency of the passenger transport sector (Mamatkulov, 2010).

  As regards the BRT Rea Vaya service, there are existing communication systems at the stations, namely, Variable Messaging Screen (VMS). However the systems at the stations do not work properly. Rea Vaya has had a number of problems with the VMS signs, caused mainly by optical cable breaks by contractors along the route and cable thieves. No communications operate when

the cable is broken. Rea Vaya and Gautrain are the first systems in South Africa to use this sophisticated technology (Rea Vaya, 2012).

In addition, it is recommended that intercoms be installed inside the stations so that passengers may be informed of the time the next bus's arrival. The existing intercoms are used only to notify passengers about safety deviations and any change of operations should there be any changes in the operations of the buses. Information regarding the next bus is available from the variable message signs in the stations (Rea Vaya, 2012).

3.6 Promoting Public Transport Services

Promoting public transport is important because it provides commuters with information about the quality of services rendered by the transport operators. Promoting public transport involves the marketing of service quality dimensions in order to increase demand. Public transport marketing may be defined as a totally integrated system of activities organised to achieve an effective relationship between the needs of present and potential passengers and the service offering of operators (Farris, *et al*.1976; Gubbins, 1988 & Barnes, 1989).

Traditionally, marketing has not played a major role in public transport. However, marketing is fundamental to the public transport sector as a result of the characteristics inherent in the mobility services. If the transport product consists of a ride between two points, the design of the vehicle and the facilities, as well as ticketing, information, and behaviour, may influence the mode of transport chosen (International Association of Public Transport, 2011).

In addition, a marketing strategy represents a systemic tool enabling transport operators to identify a market's expectations, to define the level of quality offered depending on the corporate strategies, and to measure the customers' perception and to process readjustment accordingly. At the operational level, marketing provides a wide range of tools that have been proven to increase revenues, improve quality, and reduce costs. The use of marketing also enables a permanent improvement in all customer relations activities such as sales, advertising, branding, network design, product specification, complaint management and customer service (International Association of Public Transport, 2011).

Despite the fact that marketing is the most significant key success factor (KSF) to public transport, there has been little progress made in this respect on an industry-wide basis (Gubbins, 1988 & Barnes, 1989). There are several important steps that public transport

service providers should take into account in order to enhance their marketing prowess. These include:

- strategic thinking and service planning;
- staying close to the passenger and address their needs; and
- transforming market knowledge into concrete measurable actions.

From the point of view of the passenger, a bus service, in common with all other modes of transport, suffers from being a prescribed service which, although structured and timetabled to meet average customer needs, is inflexible and, thus, the passenger has to fit their journey pattern to the services on offer. Rising passenger expectations is an emerging trend that is negating much of the transportation industry progress. The commuting public is no longer prepared to settle for less than satisfactory service and commuters are finding several, small niche organisations that are able to serve their needs more effectively than the large transport organisations. Opportunistic small organisations should recognise this trend and offer services that meet these higher expectations (Gubbins, 1988).

In the long term travel will be affected by, for example, urban change, new infrastructure, government policy, rising disposable income and new lifestyles. Young professionals in transport suspect that transport integration, today's mantra, may give way to efforts to integrate public transport planning with attitudes and lifestyles. Communities have various services from which to choose. This, in turn, is coupled by the fact that the private motor car is becoming more affordable to communities which may not have been able to afford cars in the past (Independent Transport Commission, 2001).

In Singapore, the transport authority adopted a model that is expected to attract more users while retaining the existing one. The Singapore transport model emphasises more connections, better service, liveable and inclusive community, all of which will enhance commuters travel experience (Land Transport Authority, 2013).

3.6.1 Segmentation of the Commuter Market

Understanding the commuter market is important for increasing the demand for public transport. Market segmentation is a process in terms of which prospective passengers (the market) are categorised into a number of subgroups or segments. Another definition of

market segmentation, which is more commuter-oriented, states that market segmentation is an analytical tool for breaking down a roughly defined mass market into segments or subgroups (Lovelock, Lewin, Bateson & John, 1987; Barnes, 1989; South Africa, 1996 & Ryneveld, 2008). Furthermore, the objective of marketing segmentation, in this context, is the division of markets into categories that have certain geographic, economic, demographic, or life-style similarities.

In addition, mass segmentation provides an understanding of who really rides passenger transportation and the reason for riding passenger transportation, as well as who does not ride passenger transportation and the reason why not. An understanding of the different types of people who ride transport (or stop commuting, or never use transit) and their motivations, may help public transport operators make decisions ranging from pricing, service design and advertising messages (Farris, *et al*. 1976 & Barnes, 1989).

There are six groups or passenger segments that may be identified in the public transport context, namely, the strider, the stranded, the survival, the sensitive, the selective and the stubborn (South Africa, 1996 & Ryneveld, 2008). Each of these passenger segments is discussed below:

- The strider

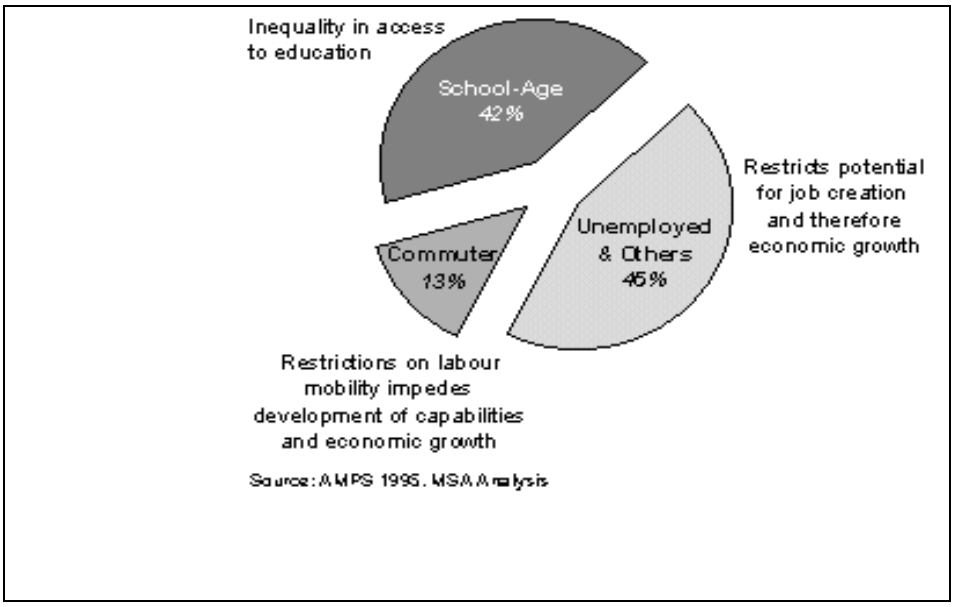
  The strider segment accounts for a significant number – 5,4 million or 25% – of the urban South African population. This segment of the population prefers to walk or cycle as the most convenient way to travel. This group is generally satisfied with the dimensions of travel time, affordability and availability of transport since, by definition, they enjoy sufficient low-cost access to their preferred destinations.

- The stranded

  The stranded segment accounts for approximately 2,8 million citizens, or 13% of the urban population, and is expected to grow by 28% between now and 2020 if nothing is done to address their needs (South Africa 1996). The transport system is failing more egregiously for this group than for any other group as the group lacks affordable basic access to motorised transport and, therefore, has little ability to integrate with the rest of society or participate in the broader economy. The principal customer need for this group is low cost passenger transport. However, in the absence of low cost passenger transport, there are two factors driving this group's current lack of access to low cost transport,

namely, income levels and distance as discussed below. Figure 3-16 below illustrates income levels and distance:

Figure 3-16: Breakdown of the stranded population (currently = 2,8m, 2020 = 3.6m)



Source: South Africa (1996: 5)

The income levels of this group are low because a substantial majority of the stranded are either scholars or they are unemployed. This, in turn, has negative implications for the ability of this group to create jobs and contribute economic growth, or to extend educational opportunities.

In addition, the distances for the stranded tend to be long with 67% living in townships on the peripheries of urban centres and an average of 20 km away from the central business districts (CBD) or other work locations. Even on the formal modes such as bus and commuter rail, these distances mean high prices, which are unaffordable to this segment. The stranded who live in areas closer to the central business districts or other work locations (suburbs, informal settlements, or inner cities) generally have access to minibus taxis only – the highest priced mode.

- The survival

  The next segment, survival passengers, includes 4,1 million people, or 19% of the population. Their principal need is for low cost, high speed public transport.

This group is able to afford to use public transport, but is "captive" to the least expensive option and they have few choices, even in the context of passenger transport. More than 70% of this group spends above 10% of their household income – the standard set in the White Paper on National Transport Policy in 1996 – on transport services. In addition, 46% of this group spends more time travelling than they would like with this resulting in a high level of dissatisfaction with both service and cost; and causing stress.

- The sensitive

  The sensitive segment is captive to public transport although the members do have enough income to enable them to select the best transport option for their needs. This is the smallest segment of urban customers, comprising 2,1 million customers only, or approximately 10% of the urban population. The key dimensions of dissatisfaction for this group centre on speed and choice, with a degree of additional dissatisfaction with prices. Of the sensitive users, 47% maintained that their travel times were in excess of what they would have preferred while it appeared that 12% only had a choice of three modes, while 51% had a choice of two modes.

- The selective

  The selective segment, which today includes 4,1 million people, or 19% of the urban population, will be one of the fastest growing segments in the future, with an expected growth of 39% between 1998 and 2020.

  This segment is able to afford a motor car but is willing to use public transport if it meets their primary requirements of higher speed, and greater choice and convenience. It appeared that 43% of this group was in excess of their preferred waiting time, while even fewer – 10% only – had a choice of three modes. In terms of the twenty year view, this will become a critical segment because of the ability of the segment to afford motor cars. This segment will stay with passenger transport only if it offers sufficient convenience and choice so as to render it attractive.

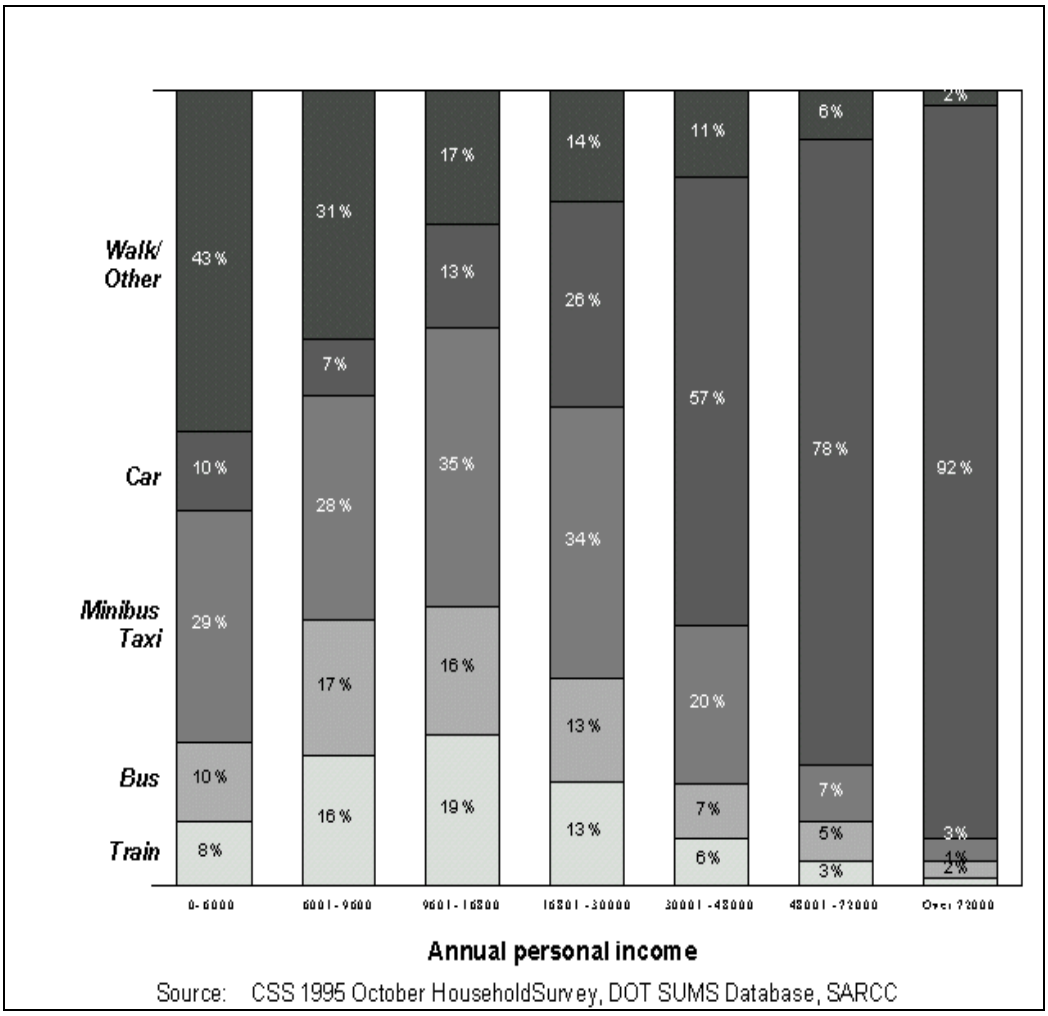
- The stubborn

  The final segment comprises the stubborn customers. This group will use private motor cars only, and represents 3 million people, or 14% of the current

urban population. This group is expected to grow significantly by 2020. This, in turn, will create significant challenges for urban areas in terms of road infrastructure and traffic congestion. Members of this segment opt out of the public transport system altogether by choosing using their motor cars. Cost is a minor issue for them, as compared to the much more important issues of convenience and speed. Their dependence on their motor cars is enabled by the excellent urban road network in both cities and adjacent suburbs in which the stubborn tend to live.

Several factors are fuelling this growing dependence on motor cars. Figure 3-17 illustrates the relative income levels and motor car utilisation:

Figure 3-17: Percentage of modal choice by income band (national commuters)



Source: South Africa (1996: 11)

> Figure 3-17 above, illustrates the relatively low income levels at which South Africans begin to use motor cars as their primary mode. Once household incomes rise above R30 000 per annum, motor car use begins to dominate. The result is a situation in which there is a much higher than average vehicle population per capita among middle income groups, as compared to other developing countries (South Africa, 1996).

When viewed in its entirety, the urban transport system is performing relatively poorly in terms of the needs of the key groups of customers, as well as against the overall national objectives. The stranded and survival segments are particularly badly served in terms of cost, travel times, and choice. One segment that is well-served, however, is the stubborn, with this segment benefiting from high income levels and a good road network for their motor cars. Despite the fact that the members of the stubborn segment are somewhat dissatisfied with the convenience of the system, by both international and local standards, they are exceptionally well served (South Africa, 1996 & Ryneveld, 2008).

Another important group of users of public transport comprises young people, defined as those members of the community who are between the ages of 18 and 35 (National Youth Commission, 2009). This group constitutes the largest number of people who use public transport. There are strong and mutual links between public transport and young users with young people being heavily dependent on public transport as it is often the only means available to them to reach school, placer of work, sports facilities and any other locations where they live and build their futures (International Association of Public Transport, 2012; McKenzie 2012).

As regards international transport use, young people represent almost half of the total number of people in transit while they travel more than do adults. One of the major concerns for public transport organisations is, thus, to slow the decline in the use of public transport by young people when they reach adulthood (SA The Good News, 2007). A study conducted into youth satisfaction recorded the following results:

> "Young people's experiences of public transport within their local area were generally positive. 72 (33,5%) of respondents felt that buses in their area were reliable, however, 43 (20%) disagreed and 34 (15,8%) strongly disagreed that buses were reliable in their local area. In regards to availability, 72 young people (34%) felt that public transport took them where they needed to go and 111 (51,9%) knew how to access information about public transport. 62 young people (29%), overall, felt

that public transport currently satisfied their needs. However, 42 (19,3%) disagreed that public transport met their needs, and 41 (19,3%) strongly disagreed that public transport met their needs (British Youth Council, 2012:2)."

Taking into account the aforementioned discussion, an understanding of consumer behaviour and modal choices is essential. Changes will occur when peoples' needs and desires change. Commuters have the choice between competing modes, for example, buses and minibus taxis, and also the choice not to use the passenger transport mode at all and, for example, resort to using private motor cars (Bingfeng, *et al*. 2007). Thus, understanding the behaviour of commuters, especially as regards their choice of mode is important to modelling optimal strategies for public transport. Commuter mode choice is based on the theory of discrete choice models, which describes individuals' choices between competing alternatives. The hypothesis underlying the discrete choice models states that when, faced with a choice situation, an individual's preference as regards each alternative may be described by a utility measure associated with each alternative (Bingfeng, *et al*. 2007).

Taking into account the reviewed literature above in chapters two and this chapter, it is essential that the literature reviewed is developed by testing the theory described in the literature. The research data is presented in chapter four of the study. Specific questions arise out of the discussion and include, for example: How do commuters perceive the bus and minibus taxis in Johannesburg? To what extent do the factors affecting public transport industry discussed in this chapter influence demand for the service? What is the importance of service dimensions when deciding on a mode of public transport?

The research results provide specific insights into the passengers' perceptions of the bus and minibus taxi services; the extent to which service dimensions influence the demand for passenger transport; and the importance of service dimensions as regards choosing a mode of transport.

3.7 Conclusion

Public transport in South Africa is in a state of a crisis. There is a need to focus attention on the service dimensions that affect public transport, namely, reliability, comfort, extent of service, safety, and reliability. Understanding these factors is important as gaps often emerge between service perceptions and expectations. The successful promotion of the public transport service dimensions will depend on the ability of government and public transport organisations to market service quality dimensions effectively. Segmentation and the

understanding of commuter behaviour plays an important role as it is essential that marketing of service dimensions are targeted at the correct audience and the correct intervention are instituted. The marketing process is, therefore, critical if public transport organisations are to retain existing users and attract new users.

The service quality dimensions, as stated in the above discussion, are important to developing the research design that will answer the research questions and satisfy the research objectives discussed in chapter one of this study. Furthermore, it is essential that the literature reviewed in this chapter and chapter two be developed by testing the theory described in the literature. Therefore, the following chapter will test the theory specifically focussing on the research design, sampling, data collection, analysis, and the validity and reliability.

CHAPTER FOUR

Research Methodology

4.1 Introduction

This chapter describes the research methodology and research design utilised in the study. The chapter lays out the plan in accordance with the research design, the questionnaire developed, the participants selected, information collected, data analysed and conclusions drawn. The research design also includes a discussion of the sampling procedure, sample parameters, and sample frame. A sample size of 902 respondents participated in the study. These respondents were mainly from the Johannesburg area as the study focus was singularly on the Johannesburg Public Road Transportation System.

4.2 Aims and Objectives of the Study

The aim of the study was to evaluate passengers' perceptions of the service offered by the bus and minibus taxi industries.

The primary objectives of the study include the following:

- to explore passengers' perceptions of the bus and minibus taxi services in terms of the service quality dimensions outlined by McKnight *et al*., (1986), namely, reliability, comfort, extent of service, safety; and affordability (RECSA);

- to ascertain the extent to which the service quality dimensions would influence future demand for public transport;

- to determine the importance of each service quality dimension in choosing a public transport mode; and

- based on the research findings to recommend strategies designed to improve public transport service quality.

4.3 Research Design

The research design of a study is the overall plan for relating a conceptual research problem to the empirical research conducted. Empirical research is conducted in order to establish the optimal plan, structure and/or approach to answering the research questions, within the given constraints (Research Design and Methodology, 2009; Ghauri, Gronhaug, & Kristianslund, 1995 & Cooper, *et al*. 2001). There are multiple and variable research designs often utilised in research for collecting data from the respondents. These designs include but are not limited to sequential design, observational design, experimental design, exploratory design, cohort design, and descriptive design (Kirshenblatt-Gimblett, 2006 & Anastas, 1999).

In this study, the researcher used descriptive research design for collecting the data from respondents. According to Anastas (1999) & Kirshenblatt-Gimblett (2006), descriptive studies collect a large amount of data for detailed analysis that can yield rich data and lead to important recommendations. Through this, the researcher attempts to describe and explain conditions of the present by using many subjects and questionnaires to fully describe a phenomenon. The design is preferred because it is concerned with answering questions of "what" developed within and during the study. A descriptive study was carefully designed to ensure complete depiction of the context and situation, making sure that there was minimum bias in the collection of data and reduction of errors in interpreting the data collected.

4.3.1 The Population

The population refers to the total collection of elements about which the researcher wishes to make certain inferences (Cooper, *et al*. 2001). All commuters within the City of Johannesburg (800 000 daily commuters) comprised the population of interest (Johannesburg Development Agency, 2012). The primary data was collected from commuters who utilise public buses and minibus taxis (often referred to as the element) in the City of Johannesburg, although it may have been possible that some of the commuters forming the population were not permanent residents of Johannesburg.

4.3.2 The Sampling Design

According to Trochim (2005), Sampling is the process of selecting units from a population of interest so that by studying the sample the results may be fairly generalised back to the population from which they were chosen. Sampling is a technical procedure utilised to rationalise the collection of information and to choose in an appropriate way the restricted

set of objects from which the actual information will be drawn (Bless & Higson-Smith, 2005).

As a result of the complexities involved in the process of sampling in the public transport context, the choice of a probability sample is always a challenge (McKnight, *et al*. 1986; Cooper, *et al*. 2001). The research conducted by the Burbidge City Bus Company applied non-probability sampling techniques in order to select the sample required. As a result, area sampling technique, a form of cluster sampling, is often used in studies in which there are obvious problems of the unavailability of a practical sampling frame for the individual elements (Cooper, *et al*. 2001).

In the Burbidge City Bus Company study, Cooper *et al.* (2001) found that some regular bus riders used monthly passes while infrequent riders usually paid cash for their fares. This, in turn, meant that choosing a sample frame was extremely challenging. However, Cooper *et al*. (2001) did not consider a sample frame which was available to bridge the gap in terms of sampling the public transport riders. They should have also considered the list of bus routes as a sample frame. The bus routes list would have enabled them to draw a probability sample using a cluster sampling technique. However, a further challenge in terms of the Burbidge City Bus Company study would have been the availability of bus and minibus taxi routes and the willingness of bus and minibus taxi operators to supply a list of their routes. Thus, the selection of bus terminals using a map and choosing a sample from the list of bus terminals concerned was deemed to be a realistic and acceptable solution to overcoming this challenge (Cooper, *et al*. 2001).

For the purposes of this study, an area sampling technique (often referred to as the geographical sampling technique) was used to select the respondents. The area sampling technique is a probability cluster sampling procedure which, for the purposes of this study, involved plotting bus and minibus taxi terminals on a geographical map and randomly selecting the bus and minibus taxi terminals to be included in the sample. Thus, sampling bus and minibus taxi terminals provided a sample of commuters using public bus and mini-bus taxi transport services.

4.3.3 The Sample

There are generally four reasons for selecting a sample, namely, a) lower costs, b) greater accuracy of results, c) greater speed of data collection, and d) availability of population elements (Cooper, *et al*. 2001). The ultimate test of a sample design is how well it represents

the characteristics of the population it purports to embody. In measurement terms, the sample must be valid (Cooper, *et al*. 2001). For the purposes of this study, the sample size of 902 was selected based on the four reasons given above, namely, costs, greater accuracy, speed of data collection, and availability of population elements. The sample is representative of the population as discussed in the foregoing discussion. In order to select the sample, the following procedure was undertaken:

- A letter was sent to the City of Johannesburg, Transport and Planning Department requesting detailed maps of Johannesburg's bus and minibus taxi terminals, including maps showing location of the minibus taxi ranks. An emergent challenge was that certain minibus taxi ranks were also being utilised as bus terminals and vice versa, for example, Bree Street bus and minibus taxi rank in the City of Johannesburg; which had implications for a concrete, separate definition of bus terminal and minibus taxi terminal.

- Upon receipt the maps were scrutinised for accuracy to ascertain whether they were correct and whether they highlighted all the bus and minibus taxi terminals in Johannesburg, checked against the register of known bus and minibus taxi terminals from the City of Johannesburg. This process validated the maps, which were then utilised in the sampling process.

- Geographical sampling was used in terms of which bus and minibus taxi terminals were grouped into homogeneous clusters. For example, terminals in townships were grouped together, terminals in the suburban areas were grouped together, and terminals in the CBD were grouped together to ensure the homogeneity of the subjects in each cluster. According to Cooper *et al*. (2001), clusters are usually homogeneous with regard to specific characteristics. For example, families in the same block (a typical cluster) are often similar in terms of, inter alia, social class, income level, and ethnic origin. However, clusters may also be heterogeneous in the sense that two clusters may not have similar characteristics

4.4 Data Collection

This section discusses the data collection strategy adopted in the study.

4.4.1 Construction of the Measurement Instrument

The study followed a structured process in developing the questionnaire, which is presented in Annexure A. The scales selected were aimed at obtaining specific information about the constructs. The researcher used primary sources to collect data using the researcher administered questionnaires. The questionnaire contained mainly closed-ended questions. Each respondent received the same set of questions in exactly the same way.

Sections 1 to 3 of the questionnaire utilise a multiple-choice, single-response scale, whereas section 4 utilises a combination of the Likert and semantic differential scales which often produce interval data. It was deemed advantageous by the researcher to include a semantic-differential scale to obtain the required information on the considered importance of service constructs (Forsyth, Hills, James, Silcock & Smyth, 1984 & Forsyth & Smyth, 1986).

Based on previous research conducted (McKnight, *et al*. 1986), Table 4-1 reflects the characteristics of the user sample included in the questionnaire. These characteristics were used in the development of sections one to three of the research instrument:

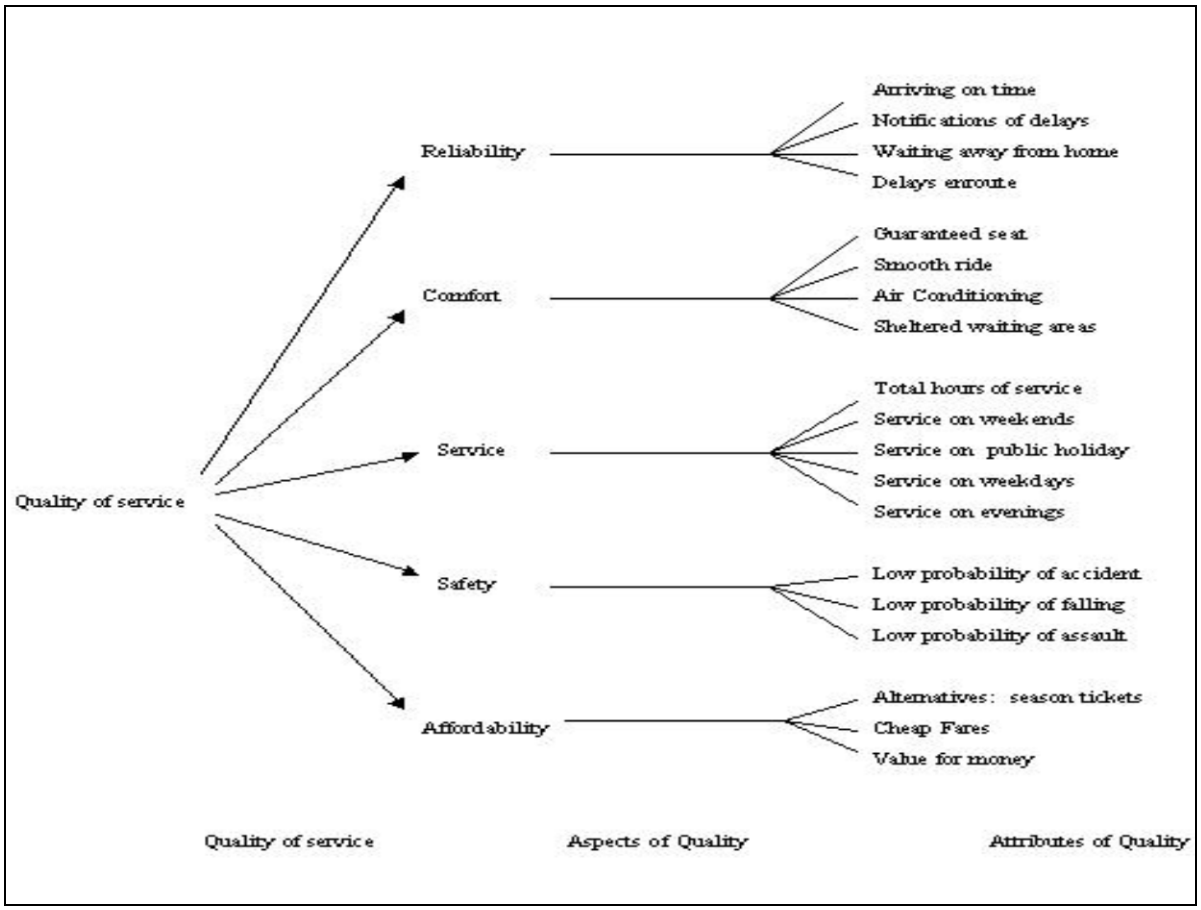
Table 4.1: Sample characteristics

User sample characteristics	
• Age • Gender • Employment Status	• Household income • Transportation utilisation
Respondents sample characteristics	
• Frequency of utilisation of public transport • Residential area • Income level	• Ethnic race • Gender • Employment status • Educational status • Age

Source: McKnight *et al*. (1986: 426)

The service quality dimensions, originally developed by McKnight *et al*. (1986) and depicted in Figure 4-1 below, were utilised in the development of section four of the research instrument. The service quality dimensions were introduced in chapter one and are repeated again below for ease of reference.

Figure 4-1: Service quality dimensions



Source: McKnight *et al*. (1986: 427)

4.4.2 Recruitment of the Study Participants

The respondents were intercepted at bus and minibus taxi terminals while waiting for their chosen mode of transport. According to Forsyth *et al*. (1986) and McKnight *et al.* (1986), on-bus and terminal interviews achieve a higher response rate than conventional postal surveys, although substantial differences between respondents in the quality of the responses emerged according to the area in which their study questionnaires were administered. It was established by the above-mentioned researcher that personal interviews and on-bus/terminal distribution aided willingness to contribute, and the same process was followed in this study.

4.4.3 Validation of the Measurement Instrument

Prior to conducting quantitative research and gathering data on a large scale, it is essential to conduct an item analysis in order to test the construct validity of the measurement instrument, namely, to ascertain the extent to which the instrument measures what it is supposed to measure (Aaker, Kumar & Day, 2007). Pretesting is conducted in order to

ensure that the measuring instrument meets the objectives of the study in terms of the information to be collected. Thus, the objective of the pre-test is to remove errors, including questions which are too long, a lack of important variables and ambiguity such as ill-defined, loaded, or double-barrelled questions which could have two varied responses (Aaker, *et al.* 2007). The same process was followed in the study. The following objectives of pretesting were relevant to this study:

- establishing acceptable levels of variation;
- ensuring that the questions are understood in the same way by all the respondents;
- minimising task difficulty; and
- maintaining the interest and attention of the respondents.

Aaker *et al.* (2007) argue that there should be ease of item administration and interpretation in different settings and situations. In addition, the, generalisability of items is important, as researchers are not concerned with isolated events, but with the commonality of a series of events. In formulating a generalisation, the researcher should avoid the danger of committing the particularistic fallacy, which arises from an inclination to generalise on the basis of insufficient or incomplete and unrelated data. This may, in turn, be avoided by the accumulation of a large body of data and by the employment of comparisons and control groups (Dekeba, 2001).

Taking the aforementioned into account, in order to remedy any measuring instrument deficiencies in the study, the interviewer first answered all questions himself. Thereafter, 27 randomly selected commuters were interviewed in Johannesburg to pre-test the questionnaire. In addition, academics and other key stakeholders in public transport, on the one hand (Department of Transports in KwaZulu-Natal, Rea Vaya, Gautrain, City of Johannesburg, Gauteng, and National Department of Transport) all provided views-in relation to the objectives of this study- on the state of public transport in the country, and on the other hand, provided insight to whether the items used for each variable were relevant and meaningful as regards measuring the constructs in question, and if so, how important each item was to the variable in question. The same process, as outlined above, was followed with professionals in public transport. Public transport organisation's managing directors

(Johannesburg Metrobus and PUTCO – the two largest bus organisations in the country by turnover, number of buses, number of passengers carried) provided invaluable insight into public transport. Finally, bus and minibus taxi organisations, such as Top 6 Minibus Taxi Association, SANTACO, and SABOA, also gave insight to the state of public transport in the country, and gave examples of the countries with successful public transport systems, among others, Brazil, India, Paris, and Kenya. Their views supported the literature reviewed in this study, they provided insight into public transportation framework and public transport networks, both concepts were discussed in chapter two.

As regards the measurement instrument, the aim of the above exercise was also to ensure content validity, which refers to the extent to which the measuring instrument provides adequate coverage of the research questions guiding the study (Cooper, *et al*. 2001).

The following conclusions were then drawn regarding the questionnaire:

- The questionnaire was reliable. Reliability estimates were used to evaluate (a) the stability of the measures administered at different times to the same individuals (test – retest reliability), and (b) the equivalence of sets of items from the same test (internal consistency) and of different observers scoring a behaviour using the same instrument (inter-rater reliability). A reliability coefficient 0.80 was achieved, thus indicating a high level of reliability (Kimberlin & Winterstein, 2008; Shuttleworth, 2008 & Miller, 2012).

- The questionnaire was also valid in that the questions measured exactly what they were intended to measure (face validity satisfied), namely, commuter perceptions of buses and minibus taxis. Thus, for the purposes of the study, construct validity was achieved, namely, examining the relationship between commuters' perception of service and service quality dimensions. Content validity was also achieved in that the measure adequately covered the content area (Kimberlin, *et al*. 2008; Shuttleworth, 2008 & Miller, 2012).

- There was a concern that the questionnaire might be too long. Initially, the interviewing process lasted approximately 20 minutes. However, the questions were reworded and shortened where possible. After this exercise, the interviewing process lasted approximately 15 minutes.

4.4.4 Administration of the Measurement Instrument

A total of 902 questionnaires collected by means of a two-way conversation initiated by the researcher, who had been trained to conduct personal and face-to-face interviews was included in the study. However, of the 902 questionnaires administered, only 690 questionnaires could be utilised. A total of 212 questionnaires were excluded due to high non-response of questions – a common challenge in public transport studies (McKnight, *et al*. 1986).

The data was collected through personal interviews as the greatest value of personal interviews, as regards passenger transportation studies, lies in the depth of information and the detail that may be secured. The information obtained in this way surpasses the information secured from telephone and self-administered studies (McKnight, *et al.* 1986 & Cooper, *et al*. 2001).

The respondents were directed to a selection of possible answers. At the onset of the interview, it was made clear what the purpose of the study was and the academic purpose was also clarified. Respondents were also reassured that they would not experience negative affects when contributing to the study.

4.5 Data Analysis

Data analysis is not an end in itself, and its purpose is to produce information that will help address a problem at hand. The following factors influence the selection of the appropriate technique for the purposes of the data analysis, for example, (a) type of data, (b) research design, and (c) assumptions underlying the test statistic and related considerations (Aaker, *et al.* 2007).

In view of the fact that the data involved mainly two variables, that is, the dependent and independent variables, cross tabulations were used in the data analysis. The choice of data analysis technique was also determined by the nature or scale of the data.

Since other aspects of the data scales are interval, the arithmetic mean may be used as a measure of central tendency. The study used the standard deviation as the measure of dispersion with the data showing normal distribution. The standard deviation indicates how far away from average the data values typically are. It has been found to be the most frequently used measure of spread because it improves interpretability by removing the

variance's square and expressing deviations in their original units (Cooper, *et al*. 2001). The measurement scales were assessed for internal consistency using the Cronbach's alpha measure. The summary statistics and histograms for each of the individual scales were assessed as well as the summary statistics for both the Perception of Service Quality (PSQ) Index and the Importance-Weighted Perception of Service Quality Index.

The Jarque-Bera test was used to test whether the PSQ Index data followed a normal distribution while the non-parametric test, the Mann-Whitney Test, was used to compare the medians.

Multiple linear regression was used to analyse the relationship between the Perceived Quality of the Service Index for buses and the demographic variables. Multiple linear regression was also used to analyse the relationship between the Perceived Quality of Service Index for minibus taxis and the same demographics variables. The study used the test of significance at a 95% confidence level, with a 5% margin of error. Generalised Linear Regression analysis was also used in the analysis.

The correlation coefficient between certain variables of interest was also used while Spearman's rank correlation coefficient was used to measure the association between each of the individual scales, and the self-stated intention of whether or not to continue using that method of transport in the future.

The Structural Equation Modelling (SEM) was utilised in the analysis for the goodness of fit statistics.The principal component analysis was used as the method of estimation. Varimax rotation was applied in both cases of bus and minibus taxi transport. The criteria for choosing the number of factors were the Eigenvalues of the correlation matrix that were greater than 1. The Scree plot was also used to determine the cut-off point at which the plot tapered off.

Collinearity diagnostics were performed to determine the Variance Inflation Factors (VIF). Finally, the outlier detection-PSQ Index for buses and minibus taxis was performed.

The data analysis was conducted using both SPSS and SAS; which are widely used packages in advanced statistical analysis.

4.6 Conclusion

This chapter discussed the research design, sampling, data collection, analysis, and the validity and reliability of the study. The study evaluated public road transport service quality in the bus and minibus taxi transport industry in the City of Johannesburg context; with the following as the primary objectives of the study (a) exploring passengers' perceptions of bus and minibus taxi service in terms of McKnight's *et al.*'s (1986) service quality dimensions, namely reliability, comfort, extent of service, safety; and affordability (RECSA); (b) ascertaining the extent to which service quality dimensions influence future demand for public transport; and (c) determining the importance of each service quality dimension in choosing a public transport mode. The ensuing chapter will discuss the study findings as they relate to the research objectives, starting with sample characteristics, followed by the passengers' perceptions of service in terms of the service quality dimensions, future utlisation (demand) for public transport (buses and minibus taxi service). The chapter will conclude with a discussion on the importance of service quality dimensions.

CHAPTER FIVE

Study Findings

5.1 Introduction

This chapter discusses the study findings. The research problem and research questions were discussed in chapter four of this research study. This chapter aims to present the research data as it relates to the research objectives described below:

Table 5-1: Research objectives and research questions

Research objectives	Research questions
• Exploring commuters' perceptions of the bus and minibus taxi services in terms of the service quality dimensions of McKnight *et al*. (1986), namely, reliability, comfort, extent of service, safety and affordability (RECSA)	• What are the passengers' perceptions of the service quality in the bus and minibus taxi industries?
• Ascertain the extent to which the service quality dimensions may influence the future demand for public transport	• To what extent would the passengers' perceptions of service quality influence the future demand for buses and minibus taxis?
• Determine the importance of each service quality dimension in choosing a public transport mode	• What is the importance of each service quality dimension in choosing a passenger transport mode?

The data presented in this chapter focuses on the sample characteristics; passengers' perceptions of service quality, namely, RECSA; future utilisation and demand; and the importance of service quality dimensions. The chapter concludes with a discussion on the validity of the model as it relates to the service quality.

5.2 Sample Characteristics

The respondents included the users of public buses and minibus taxis and, thus, passengers who did not use public transport were excluded from the sample. The sample was obtained at bus and minibus taxi ranks in Johannesburg and, thus, passengers residing in other areas or those who did not use public transport in Johannesburg were excluded from the sample.

5.2.1 Response Rate

Table 5-2 depicts the sample size.

Table 5-2: Sample size

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	yes	690	100,0	100,0	100,0

A total of 902 of the respondents were selected and personal interviews were conducted with the respondents. All the questionnaires were administered, however, it was not possible to include 212 of the questionnaires in the analysis either because of a high non-response of questions, respondents not utilising public transport at all, or passengers residing in other areas other than in Johannesburg. As a result, 690 questionnaires were utilised in the data analysis. Each interview lasted less than 15 minutes.

5.2.2 Geographical Location

The table below depicts the geographical area in which the data was collected

Table 5-3: Geographical area

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Johannesburg	690	100,0	100,0	100,0

A total of 690 of the respondents resided in Johannesburg and, as a result, they were included in the study. Those respondents who lived in other areas were excluded from the study.

5.2.3 Utilisation of Public Transport

The following table illustrates the utilisation of public transport by age and by occupation.

Table 5-4(a): Utilisation of public transport and occupation

Occupation			Age					Total
			19	20-24	25-34	35-50	51+	
F-T employed	Used most often	Bus		4,7%	13,4%	10,3%	4,7%	33,2%
		Taxi	0,4%	9,9%	31,5%	15,9%	9,1%	66,8%
	Total		0,4%	14,7%	44,8%	26,3%	13,8%	100,0%
P-T employed	Used most often	Bus	1,0%	10,2%	11,2%	6,1%		28,6%
		Taxi	2,0%	24,5%	42,9%	2,0%		71,4%
	Total		3,1%	34,7%	54,1%	8,2%		100,0%
Student	Used most often	Bus	10,8%	10,8%	1,0%	1,0%		23,5%
		Taxi	31,4%	33,3%	10,8%	1,0%		76,5%
	Total		42,2%	44,1%	11,8%	2,0%		100,0%
Scholar	Used most often	Bus	36,6%					36,6%
		Taxi	62,2%	1,2%				63,4%
	Total		98,8%	1,2%				100,0%
Self-employed	Used most often	Bus		1,8%	7,1%	10,7%	1,8%	21,4%
		Taxi		10,7%	25,0%	33,9%	8,9%	78,6%
	Total			12,5%	32,1%	44,6%	10,7%	100,0%
Unemployed	Used most often	Bus		6,1%	3,0%	3,0%		12,1%
		Taxi		18,2%	27,3%	24,2%	18,2%	87,9%
	Total			24,2%	30,3%	27,3%	18,2%	100,0%
Other	Used most often	Taxi			25,0%	25,0%	50,0%	100,0%
	Total				25,0%	25,0%	50,0%	100,0%
Total	Used most often	Bus	10,4%	5,1%	7,0%	5,5%	1,7%	29,8%
		Taxi	19,9%	13,8%	21,8%	9,9%	4,9%	70,2%
	Total		30,3%	18,9%	28,7%	15,4%	6,7%	100,0%

It emerged that 29,8% of the respondents used public buses, while 70,2% used minibus taxis as a preferred mode of transportation.

A large percentage of public transport users are aged 19 years and between the ages of 25 and 34 years; for example, 30,3% of the public transport users are aged 19 years, while 28,7% are between the ages of 25 and 34.

Public buses and minibus taxis are used predominantly by students and scholars. However, their preferred mode of transport is the minibus taxi.

Table 5-4(b): Utilisation of public transport and gender

Gender			Area	Total
			Johannesburg	
Male	Used most often	Bus	33,2%	33,2%
		Taxi	66,8%	66,8%
	Total		100,0%	100,0%
Female	Used most often	Bus	27,3%	27,3%
		Taxi	72,7%	72,7%
	Total		100,0%	100,0%
Total	Used most often	Bus	29,7%	29,7%
		Taxi	70,3%	70,3%
	Total		100,0%	100,0%

It emerged that 66,8% of the male respondents used minibus taxis, while 33,2% used buses; whereas 72,7% of the female respondents used minibus taxis, while 27,3% used buses.

Table 5-4(c): Utilisation of public transport and income

Income		Used most often		Total
		Bus	Taxi	
Income	R0-R1000	13,4%	33,4%	46.7%
	R1001-R2000	1,7%	7,5%	9.3%
	R2001-R3000	3,6%	8,0%	11.6%
	R3001-R4000	3,6%	7,4%	11.0%
	R4001-R5000	2,2%	4,4%	6.5%
	R5001-R6000	1,5%	1,9%	3.3%
	above R6000	3,8%	7,7%	11.5%
Total		**29.8%**	**70,2%**	**100,0%**

The study found that 46,7% of the public transport users earn between R0 and R1000 and that the majority of these users (33,4%) use minibus taxis for commuting.

The preceding discussion focused on the main characteristics of the respondents in the sample. The following section discusses the passengers' perceptions of service quality as regards both public buses and minibus taxis in relation to the objectives of the study.

5.3 Service Quality in Public Road Transport

The below discussion is aimed at exploring passengers' perceptions of bus and minibus taxi service in terms of the service quality dimensions of McKnight et al. (1986), namely, reliability, comfort, extent of service, safety; and affordability (RECSA); ascertaining the extent to which service quality dimensions can influence future demand for public transport (future utilisation); determining the importance of each service quality dimension as regards choosing a public transport mode in relation to the study objectives and research questions.

5.3.1 Passengers' Perceptions of Service

The questions which focused on perceptions of service quality in respect of buses and minibus taxis were divided into five categories, each of which was used to construct a measurement scale (see Table 5-5).

Table 5-5: Internal consistency of scales

Scale	Buses	Minibus Taxis
Reliability	0,767	0,832
Comfort	0,712	0,650
Service	0,642	0,820
Safety	0,734	0,883
Affordability	0,789	0,837

Separate scales were constructed for buses and minibus taxis, respectively. The five scales were Reliability (6 questions), Comfort (4 questions), Service (6 questions), Safety (5 questions) and Affordability (5 questions).

The five scales were rescaled so that each ranged from 0 to 10, with 0 being the worst possible perception and 10 being the best. The scales were assessed individually for internal consistency (coefficient of reliability) using the Cronbach's alpha (α) measure. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is most commonly used when multiple Likert questions in a questionnaire form a scale, and in order to determine if the scale is reliable (Nagel, 2007). A high value of alpha is often used as evidence that the items measure an underlying (or latent) construct. However, a high alpha does not imply that the measure is unidimensional (Institute for Digital Research and Education, 2013). Factor analysis is one method of checking dimensionality, which has been utilised below in this chapter.

As indicated in Table 5-5, most values were above 0,70 (the lowest value is service at 0.64 and highest value is affordability at 0.88), indicating an acceptable level of internal consistency for all the buses and minibus taxis scales. Researchers insist on a reliability score of 0.70 or higher, values ranges between minus infinity and 1, however this rule should be applied with caution when α has been computed from items that are not correlated (Choudhury, Streiner & Norman, 1989).

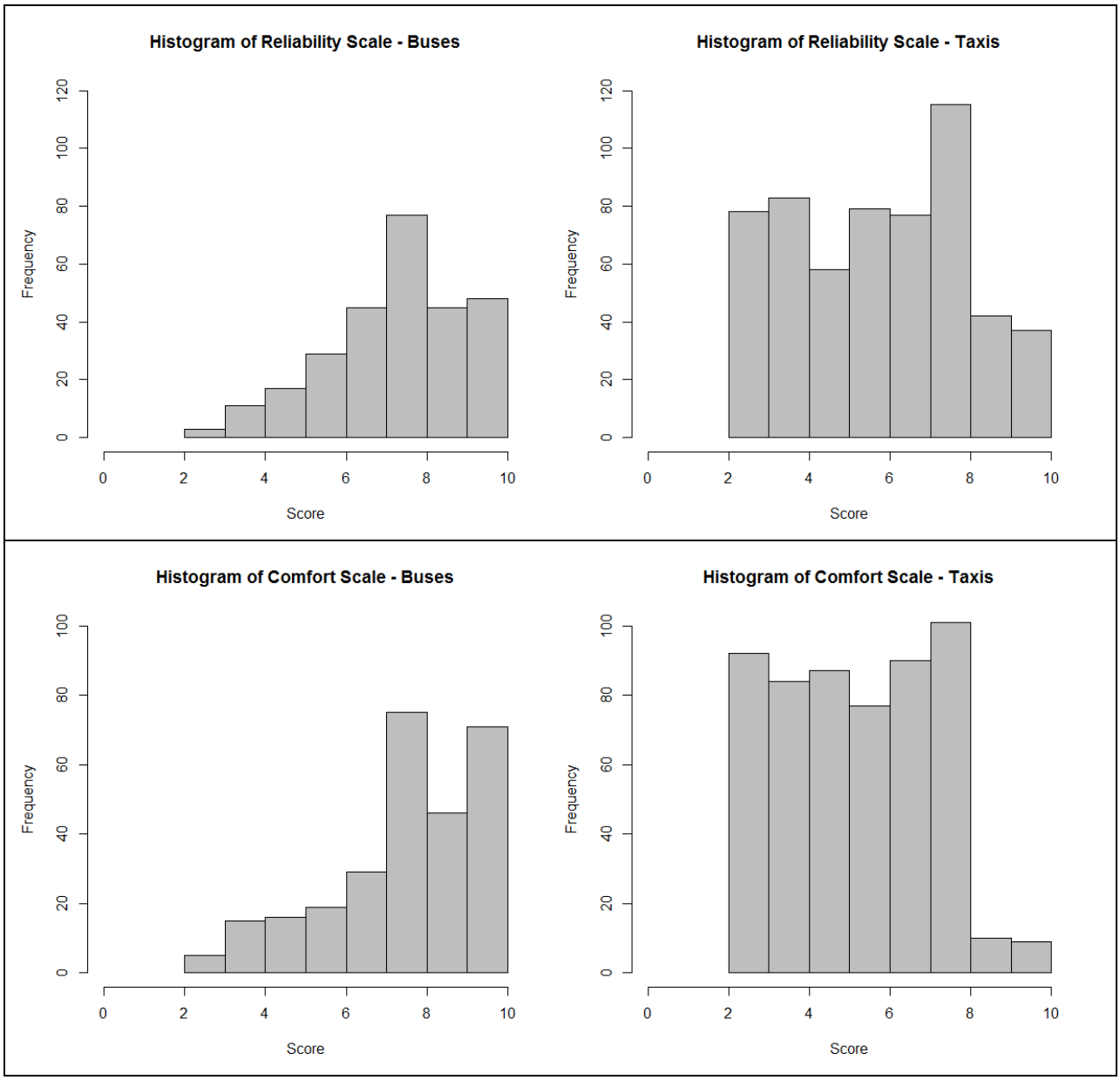
The five scales were then combined into a cumulative index which was termed the Perceptions of Service Quality Index. Each scale was weighted equally in the index, so that it was possible for index scores to range from 0 to 50. In view of the fact that respondents had been asked their opinions about the importance of each of the five categories, it was also possible to create a cumulative index in which the individual categories were weighted according to their perceived importance for each individual. The result was termed the Importance-Weighted Perceptions of Service Quality Index (see Table 5-6).

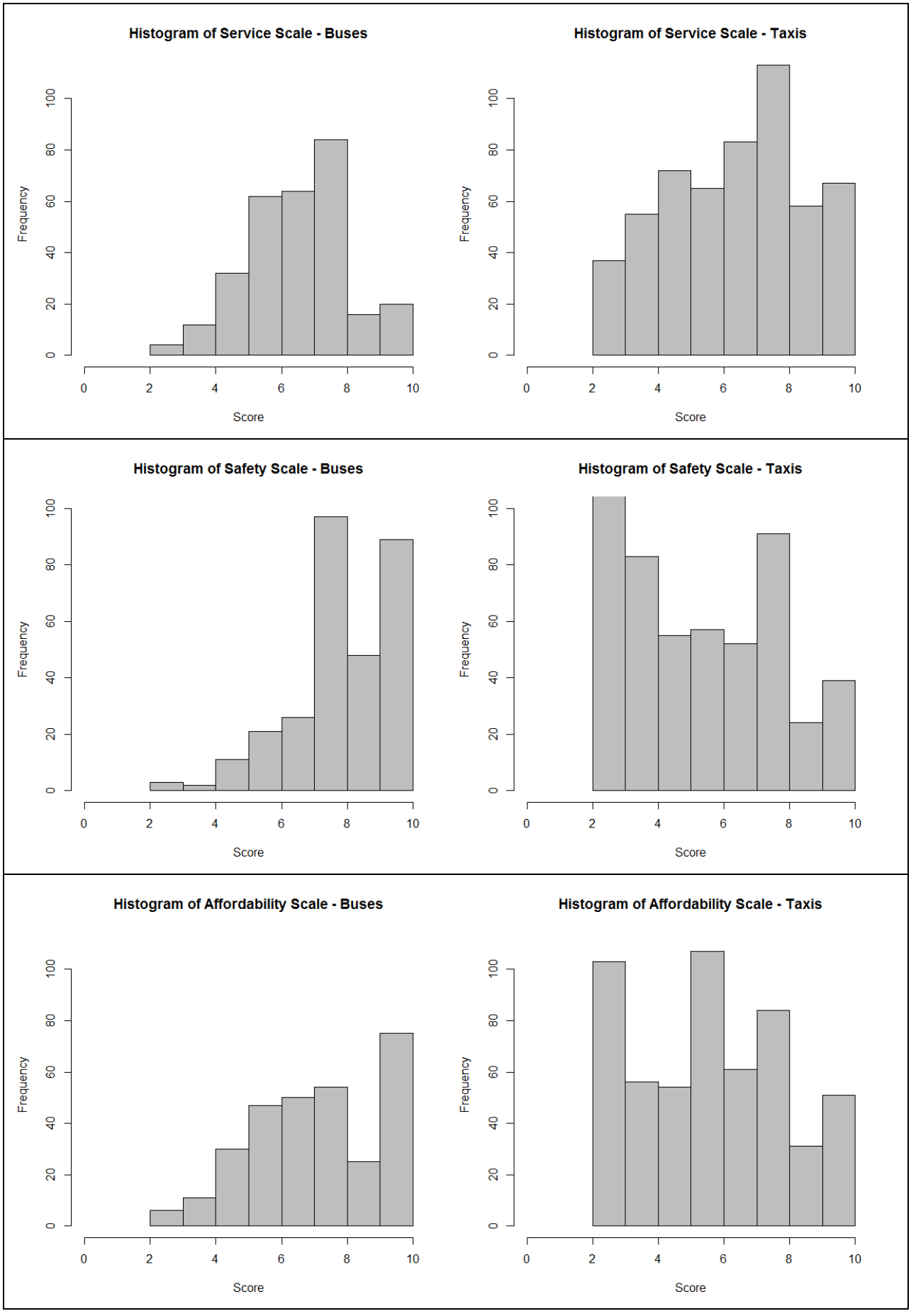
The summary statistics and histograms for each of the individual scales are displayed below, as well as summary statistics and histograms for both the Perceptions of Service Quality Index and the Importance-Weighted Perceptions of Service Quality Index.

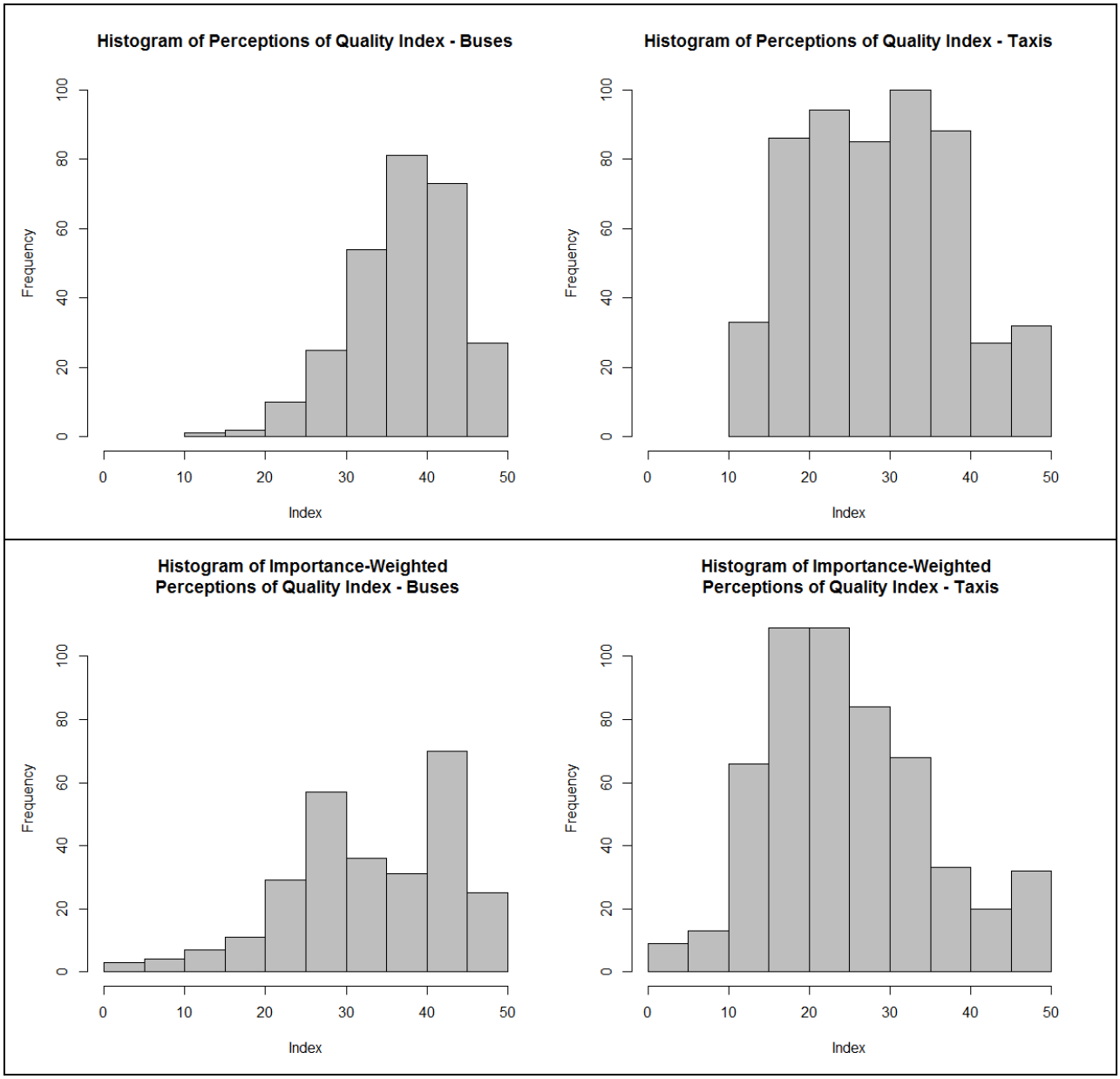
Table 5-6: Summary Statistics

	Buses		**Minibus Taxis**	
	Mean	**Median**	**Mean**	**Median**
Reliability	7,4	7,7	5,8	6,0
Comfort	7,8	8,0	5,4	5,5
Service	6,7	6,7	6,5	6,7
Safety	7,9	8,0	5,1	4,8
Affordability	7,2	7,2	5,6	5,6
PSQ Index	37,1	37,5	28,5	28,3
Importance-Weighted PSQ Index	33,0	33,5	24,6	23,1

Figure 5-1: Histograms




Histogram of Service Scale - Buses
Frequency
Score
Histogram of Service Scale - Taxis
Frequency
Score
Histogram of Safety Scale - Buses
Frequency
Score
Histogram of Safety Scale - Taxis
Frequency
Score
Histogram of Affordability Scale - Buses
Frequency
Score
Histogram of Affordability Scale - Taxis
Frequency
Score



The Jarque-Bera Test was used to test whether the PSQ Index data followed a normal distribution. For both buses and minibus taxis, the null hypothesis of normality was rejected with p-values of 0,000017 and 0,00015 respectively. It was, thus, not possible to use a t-test to compare the mean perceived service quality of buses and that of taxis and, instead, a non-parametric test, the Mann-Whitney Test, was used to compare the medians. The p-values and decisions from these tests are presented below:

Table 5-7: Hypotheses

Scale or Index	*p-value	Decision
Reliability	2,2e-06	Reject H0; buses are perceived as more reliable than minibus taxis
Comfort	4,6e-14	Reject H0; buses are perceived as more comfortable than minibus taxis
Service	0,572	Do not reject H0; there is no significant difference in the perceived service level between buses and taxis
Safety	2,2e-16	Reject H0; buses are perceived as safer than minibus taxis
Affordability	5,5e-06	Reject H0; buses are perceived as more affordable than minibus taxis
PSQ Index	7,8e-15	Reject H0; buses are perceived as offering better quality overall than minibus taxis
Importance-Weighted PSQ Index	5,4e-14	Reject H0; buses are perceived as offering better quality overall than minibus taxis after weighting each scale according to its perceived importance

*p-value (2,2e-06 means 2.2 x 10^-6, (2.2×10^{-6}) or 0.0000022. Similarly 4.6e-14 means 4.6 x 10^-14, (4.6×10^{-14}) or 0.00000000000004587049. The same applies to the rest of the p-values, whereby 0,572 means 0.5721328; 2,2e-16 means 0.0000000000000000004167642; 5,5e-06 means 0.000005519435; 7,8e-15 means 0.00000000000000773039; and 5.4e-14 means 0.00000000000005433447).

For all of the individual scales, except service, as well as the overall index (and weighted index), it was possible to draw a definite conclusion that the perceived quality of bus transport exceeds that of minibus taxis by a significant margin.

5.3.1.1 Service Quality Dimensions and Demographic Variables

The multiple linear regression and generalised linear regression models were also considered. The multiple linear regression model was used to analyse the relationship between the Perceived Quality of Service Index for Buses and the demographic variables (mode of transport used the most often, age, gender, educational level, and income). In this case, only the coefficient of mode of transport was statistically significant and was estimated to be -5.43 with a p-value of 2.69e-10. This suggests that those who use buses more often tended to have a higher opinion of the quality of bus transport. This finding is not surprising since, presumably, they would not use buses if they had an extremely very low opinion of this mode of transport.

Similarly, multiple linear regression was used to analyse the relationship between the Perceived Quality of Service Index for minibus taxis and the demographic variables as mentioned above (mode of transport used the most often, age, gender, educational level, and income). In this case, it was interesting to observe that the coefficient for the mode of

transport used the most often was not significant. This may suggest that those who use minibus taxis as their primary mode of transport did not do so because they have a high opinion of the quality of the minibus taxi experience.

In addition, age, gender and level of education were all statistically significant in this model at the 5% level. Age had a negative coefficient, indicating that, on average, younger people have a more favourable perception of minibus taxis than older people. Gender had a positive coefficient, indicating that, on average, females perceive minibus taxis more favourably than males. On the other hand, educational level had a negative coefficient, indicating that less educated people viewed minibus taxis favourably as compared to more highly educated people.

5.3.2 Service Quality Dimensions and Future Utilisation

The correlation coefficients between certain variables of interest were also analysed. In view of the fact that the indices did not follow a normal distribution according to the Jarque-Bera Test, the non-parametric Spearman method was used in preference to the Pearson method.

The correlation coefficient between the Perceived Quality of Service Index for buses and the Perceived Quality of Service Index for minibus taxis (for those who offered opinions on both modes of transport) was 0,068 and not statistically significant (p-value = 0,41). This suggests that the respondents' opinion of buses was independent of their opinion of minibus taxis.

Spearman's rank correlation coefficient was also used to measure the association between each of the individual scales, and the self-stated intention of the respondents regarding whether they would continue to use that method of transport in the future. The results of this analysis are presented in Table 5-8 (an* indicates that the result is statistically significant).

Table 5-8: Association of Scales

Scale or Index	Buses	Taxis
Reliability	0,59*	0,66*
Comfort	0,26*	0,57*
Service	0,39*	0,59*
Safety	0,48*	0,73*
Affordability	0,51*	0,61*
PSQ Index	0,66*	0,79*

The table above indicates that for each individual scale and mode of transport, the perceived quality of the mode of transport is strongly associated with the intention to continue using that mode of transport.

5.3.3 Importance of Service Quality Dimensions

The table below presents summary statistics in respect of the importance attached to each of the five dimensions of quality of service, on a scale of 1 (less important) to 5 (very important).

Table 5-9: Importance of service quality dimensions

Dimensions	Buses		Minibus Taxis	
	Mean	**Median**	**Mean**	**Median**
Reliability	4,3	5,0	4,4	5,0
Comfort	4,4	5,0	4,2	5,0
Service	4,3	5,0	4,3	5,0
Safety	4,3	5,0	4,3	5,0
Affordability	4,4	5,0	4,3	5,0

The table above reveals that all five dimensions were considered very important, and equally so.

After discussing the multiple regression model above, the generalised linear regression model was also considered as discussed below.

Since the multiple regression model discussed above was not sufficient in isolation, in the current scientific setting, by fitting a model with the overall service quality as the response variable and the demographic variables with age, gender, income, and so forth as the explanatory variables, it was decided to also utilize the generalized linear model with a uniform link and a normal distribution. This decision was taken because the explanatory variables are not continuous nor normally distributed, but categorical – and in the multiple regression model this requires the use of dummy variables which become bulky and tedious. The generalized linear model caters for categorical and continuous explanatory variables and a response variable that may or may not necessarily normally distributed. Since, the average of several variables was taken to calculate the overall service quality, it is a well-established fact that the response variable will be normally distributed.

The Generalized linear model-Buses

The fitted model was:

Overall service quality=β_0+ β_1 *age+ β_2*gender+ β_3*occupation+ β_4*education+ β_5*income+ε

Table 5-10: Tests of model effects - Public Buses

Source	Type III		
	Wald Chi-Square	**df**	**Sig.**
(Intercept)	851.160	1	.000
age	15.725	4	.003
gender	.428	1	.513
occupation	9.790	6	.134
education	34.957	5	.000
income	21.798	6	.001

Dependent Variable: quality service bus

Model: (Intercept), age, gender, occupation, education, income

The Type III test showed that age, education and income were all significant at the 5% level since their p-values are all less than 0.05 in influencing the overall service quality provided by the bus. Gender and occupation were not significant in influencing the overall service quality provided by the bus. The following table reveals the differences in the influence in the categorical explanatory variables by comparing each level of the explanatory variable with a baseline level of the variable with respect to the response variable.

Table 5-11: Parameter Estimates - Public Buses

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	4.313	.8532	2.641	5.986	25.558	1	.000
[age=1.00]	-.364	.2438	-.842	.114	2.228	1	.136
[age=2.00]	-.086	.1897	-.458	.286	.205	1	.651
[age=3.00]	.248	.1708	-.087	.583	2.109	1	.146
[age=4.00]	-.104	.1734	-.443	.236	.357	1	.550
[age=5.00]	0[a]	.	.	.	.	.	.
[gender=1.00]	.050	.0758	-.099	.198	.428	1	.513
[gender=2.00]	0[a]	.	.	.	.	.	.
[occupation=1.00]	-.623	.4883	-1.580	.335	1.625	1	.202
[occupation=2.00]	-.763	.4967	-1.737	.210	2.362	1	.124
[occupation=3.00]	-.479	.5086	-1.476	.517	.888	1	.346
[occupation=4.00]	-.656	.5265	-1.688	.376	1.554	1	.213
[occupation=5.00]	-.632	.4985	-1.609	.345	1.609	1	.205
[occupation=6.00]	-.969	.5117	-1.972	.034	3.589	1	.058
[occupation=7.00]	0[a]	.	.	.	.	.	.
[education=1.00]	1.613	.6886	.263	2.963	5.486	1	.019
[education=2.00]	1.544	.6844	.202	2.885	5.087	1	.024
[education=3.00]	1.353	.6823	.015	2.690	3.931	1	.047
[education=4.00]	.522	.6971	-.844	1.888	.561	1	.454
[education=5.00]	1.015	.8039	-.561	2.590	1.593	1	.207
[education=6.00]	0[a]	.	.	.	.	.	.
[income=1.00]	.407	.1828	.049	.765	4.953	1	.026
[income=2.00]	.297	.1856	-.067	.661	2.559	1	.110
[income=3.00]	.120	.1659	-.205	.445	.522	1	.470
[income=4.00]	.214	.1638	-.107	.535	1.703	1	.192
[income=5.00]	-.171	.1855	-.535	.192	.853	1	.356
[income=6.00]	-.556	.2294	-1.006	-.106	5.874	1	.015
[income=7.00]	0[a]	.	.	.	.	.	.
(Scale)	.896[b]	.0482	.806	.995			

Dependent Variable: quality service bus

Model: (Intercept), age, gender, occupation, education, income

There were significant differences at the 5% level since the p-values were less than 0.05 in the education group between respondents with less than matric, matric and matric plus a tertiary qualification groups when comparing all those groups to respondents in the group with some other form of education with respect to the overall service quality. There were also differences in those who were in the “0-R1000” and “R5001-R6000” when comparing

to these groups of passengers to those that were in the "Above R6000" group with respect to the overall service quality.

The Generalized linear model-Taxis

The fitted model was:

Overall service quality=β_0+ β_1 *age+ β_2*gender+ β_3*occupation+ β_4*education+ β_5*income+ε

Table 5-12: Tests of model effects - Minibus Taxis

Source	Type III		
	Wald Chi-Square	**df**	**Sig.**
(Intercept)	454.546	1	.000
age	11.306	4	.023
gender	.455	1	.500
occupation	18.879	6	.004
education	17.164	5	.004
income	11.617	6	.071

Dependent Variable: overall service quality taxis

Model: (Intercept), age, gender, occupation, education, income

The Type III test showed that age, education and occupation are all significant at the 5% level since their p-values are all less than 0.05 in influencing the overall service quality provided by the minibus taxis. Gender and income were not significant in influencing the overall service quality provided by the minibus taxis. The following table reveals the differences in the influence in the categorical explanatory variables by comparing each level of the explanatory variable with a baseline level of the variable with respect to the response variable.

Table 5-13: Parameter Estimates - Minibus Taxis

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	3.407	.9975	1.452	5.362	11.666	1	.001
[age=1.00]	.631	.2850	.073	1.190	4.907	1	.027
[age=2.00]	.626	.2218	.191	1.061	7.964	1	.005
[age=3.00]	.572	.1997	.181	.963	8.201	1	.004
[age=4.00]	.655	.2027	.258	1.052	10.438	1	.001
[age=5.00]	0[a]	.	.	.	.	.	.
[gender=1.00]	-.060	.0886	-.233	.114	.455	1	.500
[gender=2.00]	0[a]	.	.	.	.	.	.
[occupation=1.00]	.022	.5709	-1.097	1.141	.002	1	.969
[occupation=2.00]	-.454	.5807	-1.592	.684	.612	1	.434
[occupation=3.00]	-.604	.5946	-1.770	.561	1.032	1	.310
[occupation=4.00]	-.268	.6155	-1.475	.938	.190	1	.663
[occupation=5.00]	-.200	.5828	-1.342	.943	.117	1	.732
[occupation=6.00]	-.663	.5982	-1.836	.509	1.230	1	.267
[occupation=7.00]	0[a]	.	.	.	.	.	.
[education=1.00]	.777	.8051	-.801	2.355	.932	1	.334
[education=2.00]	.566	.8002	-1.002	2.134	.500	1	.479
[education=3.00]	.743	.7977	-.820	2.307	.868	1	.351
[education=4.00]	.033	.8150	-1.565	1.630	.002	1	.968
[education=5.00]	-.134	.9399	-1.976	1.708	.020	1	.887
[education=6.00]	0[a]	.	.	.	.	.	.
[income=1.00]	.556	.2137	.138	.975	6.778	1	.009
[income=2.00]	.081	.2170	-.345	.506	.138	1	.710
[income=3.00]	.083	.1940	-.298	.463	.181	1	.670
[income=4.00]	.063	.1916	-.312	.439	.109	1	.741
[income=5.00]	.246	.2169	-.179	.671	1.288	1	.256
[income=6.00]	.053	.2683	-.473	.579	.039	1	.844
[income=7.00]	0[a]	.	.	.	.	.	.
(Scale)	1.224[b]	.0659	1.102	1.360			

Dependent Variable: overall service quality taxis

Model: (Intercept), age, gender, occupation, education, income

There were significant differences at the 5% level since the p-values were less than 0.05 in the age between respondents in the " under 19yrs" , "20-24 yrs" , "25-34 yrs", "35-50 yrs" when comparing all those groups to respondents in the group "51 yrs and above" with respect to the overall service quality. There were also differences in those who were in the

"0-R1000" group when comparing to this group to those that are in the "Above R6000" group with respect to the overall service quality.

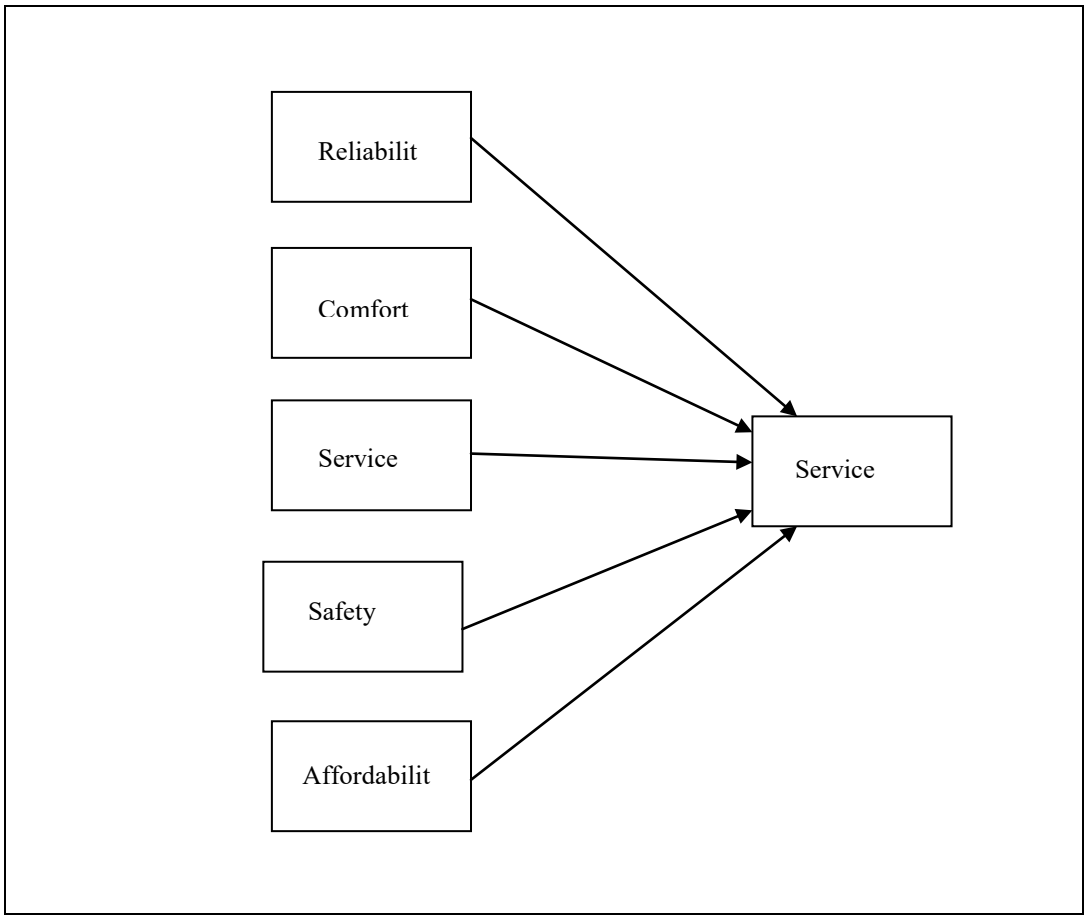
5.4 Validation of the Model

Structural Equation Modeling was used by the researcher to determine whether the model is valid. Therefore, this section seeks to derive unbiased estimates for the relations between latent constructs. To this end, SEM allows multiple measures to be associated with a single latent construct as shown below in the case of public buses and minibus-taxis.

(a) Public Bus Transport Service

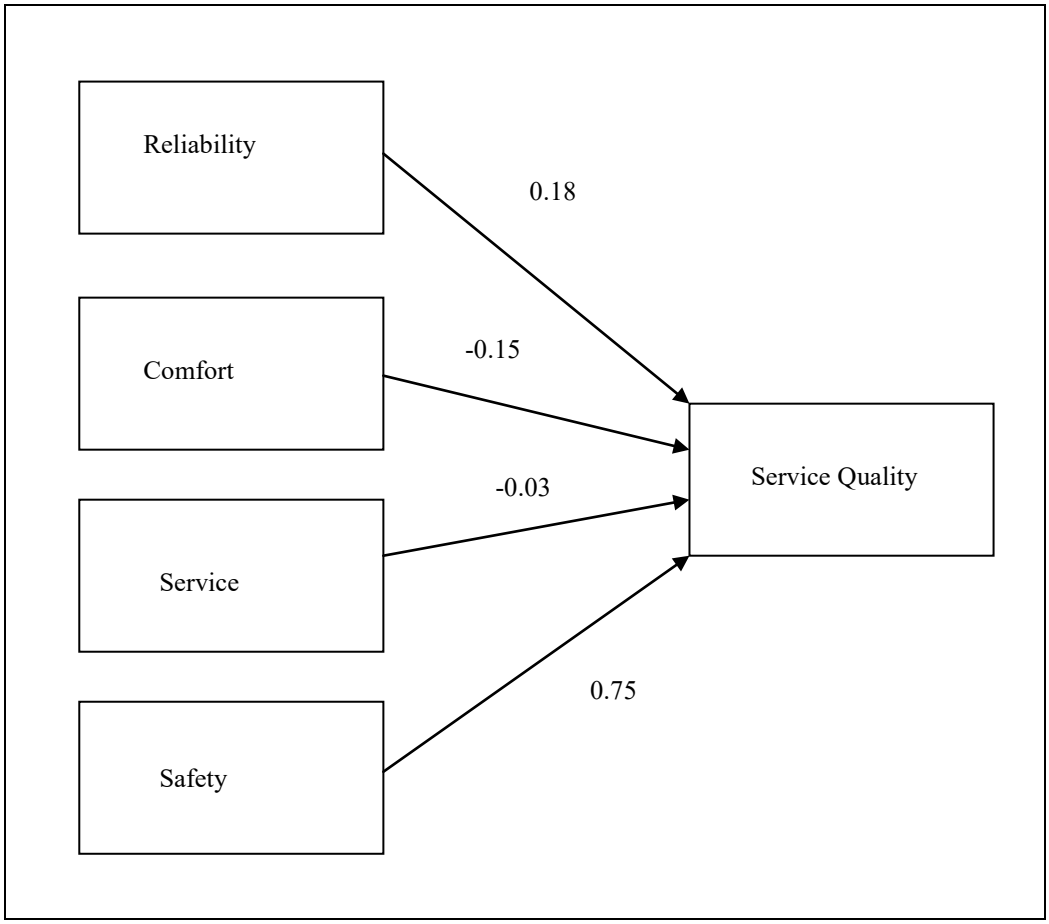
There were 2 models fitted, one was a latent variable model and the other was a model depicted by the Figure 5-2 below. The latent variable model did not fit the data well and is not commented on. The fitted model was:

Figure 5-2: Structural Equation Modeling - Public Buses



The model did not fit the data well and after exploring several models the appropriate model that fitted the data well was given as depicted in Figure 5-3:

Figure 5-3: Structural Equation Modeling - Public Buses



Byrne (2010:75-80) reports several goodness of fit statistics that are standard AMOS outputs and, some namely, chi-square, Relative Fit Index (RFI), Root Mean Square Error of Approximation (RMSEA) and, Incremental Fit Index (IFI), were considered, since most of them are interrelated and, lead to the same conclusion regarding the fit of the model to the sample data.

The RFI which should be close to 0.95 if the model fits the data well and, the RMSEA which should be less than 0.05 and, have a p-value greater than 0.05 based on a narrow confidence interval from the RMSEA (called PCLOSE in the AMOS output), indicating superior fit of the model (Byrne, 2010:80). The IFI which addresses issues of parsimony and sample size of the model relative to the data, which, according to Byrne (2010:79) is also a measure of the goodness of fit, should be close to 0.95, if superior model fit is to be achieved.

The fitted model had a chi-square test statistic of 0.032 with a p-value of 0.876, which is non-significant at the 5% level, thus implying that the conceptual model fitted to the research data was indeed a good one (Byrne , 2010: 76 & Bollen, 1989: 263). Furthermore, the RFI was 0.981, the RMSEA was 0.0085 with a p-value (PCLOSE) of 0.897 and, the IFI was reported as 0.969, all further confirming a good fit of the model.

The regression weights were given as:

Table 5-14: Regression Weights - Public Buses

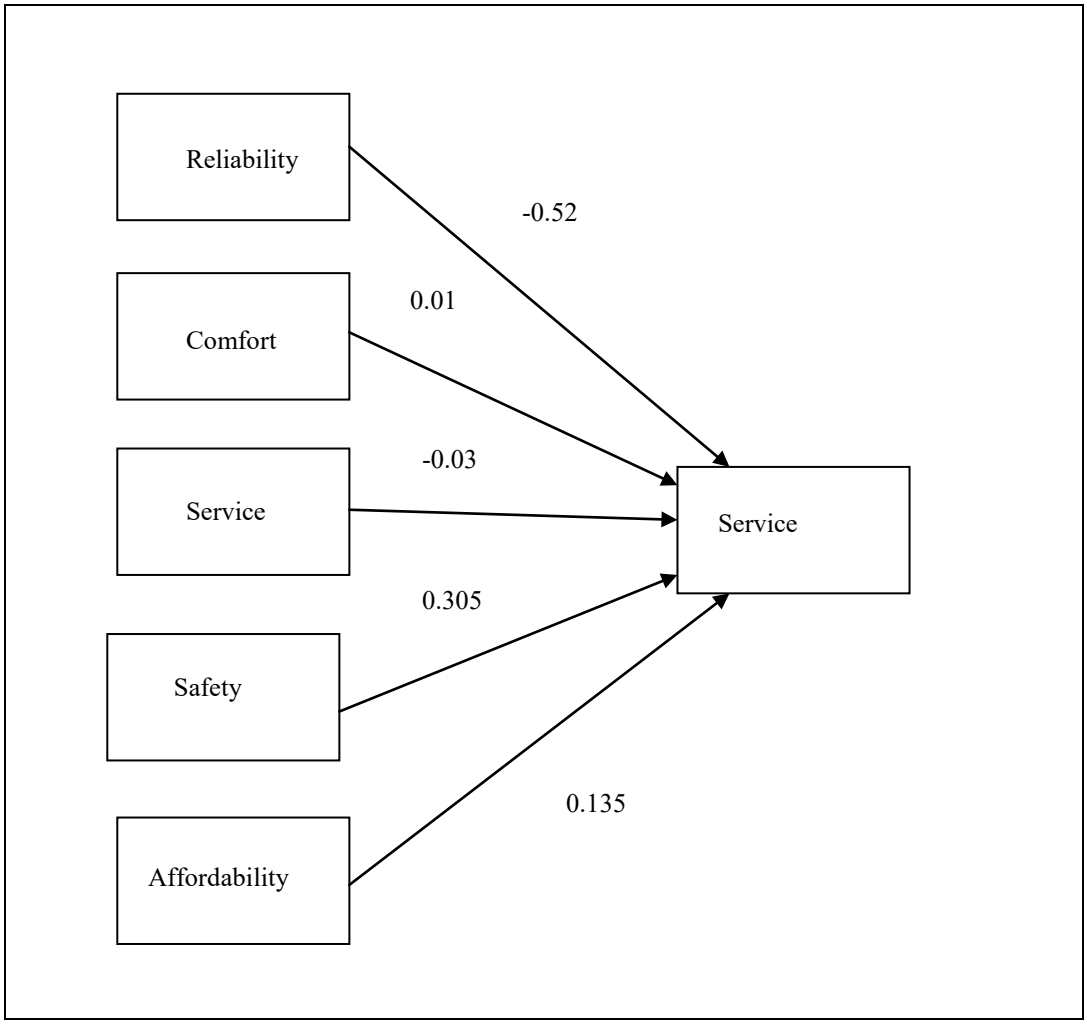
		Estimate	S.E.	C.R.	P
Service quality	<--- Reliability	.181	.017	10.569	.000
Service quality	<--- Comfort	-.146	.018	-7.977	.000
Service quality	<--- Service	-.035	.015	-2.269	.023
Service quality	<--- Safety	.745	.019	39.949	.000

From the above table it is evident that the reliability, comfort, service and safety are influential at the 5% significance level on the overall service quality that the public buses provided. It is also interesting to note that the comfort and the service have negative coefficient estimates whilst reliability and safety have positive coefficients.

(b) Minibus Taxi Transport

Once again the latent variable model did not fit the data well and the following model as depicted in Figure 5.4 was fitted to the data. The model fitted the data well and the results are reposted below.

Figure 5-4: Structural Equation Modeling - Minibus Taxis



The model was fitted with a chi-square statistics with 5.716 with 10 degrees of freedom and a p-value of 0.835. This implied that the model fitted the data well. Furthermore, the RFI was 0.995, the RMSEA was 0.0089 with a p-value (PCLOSE) of 0.901 and, the IFI was reported as 0.979, all further confirming a good fit of the model.

The regression weights were:

Table 5-15: Regression Weights - Minibus Taxis

			Estimate	S.E.	C.R.	P
Service quality	<---	Reliability	-.052	.025	-2.102	.036
Service quality	<---	Comfort	.001	.024	.028	.977
Service quality	<---	Safety	-.003	.025	-.111	.911
Service quality	<---	Affordability	.305	.025	12.235	.000
Service quality	<---	Service	.135	.026	5.114	.000

One can ascertain from the above table that reliability, affordability and service all are influential on the overall service quality since their p-values are less than 0.05.

5.4.1 Variability of Variables

The factor analysis was run separately for the questions related to buses and minibus taxis. Principal component analysis was used as the method of estimation with varimax rotation being applied in both cases. The following steps were undertaken in order to analyse the underlying factors in the service quality of public transport:

- Determine the number of factors. This was done through the scree plot (or a plot of the eigenvalues against the number of factors, in order of extraction) and the eigenvalues of the correlation matrix. In this case, the principal components with eigenvalues greater than 1 only were retained. An eigenvalue represents the amount of variance in the original variables that is associated with a factor (Aaker, *et al*. 2007). The factor with eigenvalues of less than 1,0 were no better than a single variable, as, as a result of standardisation, each variable had a variance of 1,0.

- A rotation was performed in order to ensure that the factor loadings were more meaningful. In this case a varimax rotation (for orthogonal rotation) was performed for the both the minibus taxi and the bus variables.

- The significance test was deemed to determine the statistical significance of the separate Eigenvalues in order to retain only those factors that were statistically significant. However, in view of the fact that the size of the sample was greater than 200, several factors were likely to be statistically significant.

- In order to determine which variables were related to their respective factors, the loadings which were greater than 40 were taken into account (please note that all loadings and correlations were expressed as a percentage). In some cases it was possible to exclude items where the loadings were small across all the factors.

Exploratory factor analysis was performed on all the scale items as regards the reliability, comfort, service (or extent of service), safety and affordability of both buses and minibus taxis together. Explanations of the exploratory factor analysis are provided for the bus service; however they may also be extended to minibus taxis.

The data revealed that the number of records read as 690, and the number of records used for significance tests as 129, and the variables were 37. The following table shows the variables included in the analysis:

Table 5-16: Variables for public bus transport

No	Variables	No	Variables
1	Punctuality of buses	21	Rate of bus accidents
2	Bus timetable	22	Injuries as a result of bus accidents
3	Timely arrival of bus at destination	23	Condition of buses
4	Failure of bus to be on time	24	Driving skills of bus drivers
5	Arrival of bus at destination	25	Bus drivers obeying rules of the road
6	Adherence of bus to routes	26	Safety – future utilisation of buses
7	Reliability – future utilisation of buses	27	Buses offer value for money
8	Find seat on buses	28	Bus fares
9	Smoothness of bus rides	29	Bus fares worth it
10	Coolers/air-conditioners on board bus	30	Bus fares fair
11	Reaction to lack of coolers on buses	31	Bus fare affordable
12	Condition of bus shelters	32	Affordability – future utilisation of buses
13	Comfort – future utilisation of buses	33	Importance of reliability of buses
14	Exact location of buses - destination	34	Importance of comfort of buses
15	Availability of buses on weekdays	35	Importance of service of buses
16	Availability of buses at weekends	36	Importance of service of buses
17	Availability of buses on holidays	37	Importance of affordability of buses
18	Availability of buses in the evenings	38	Default variable
19	Friendliness on the part of bus drivers		
20	Availability – future utilisation of buses		

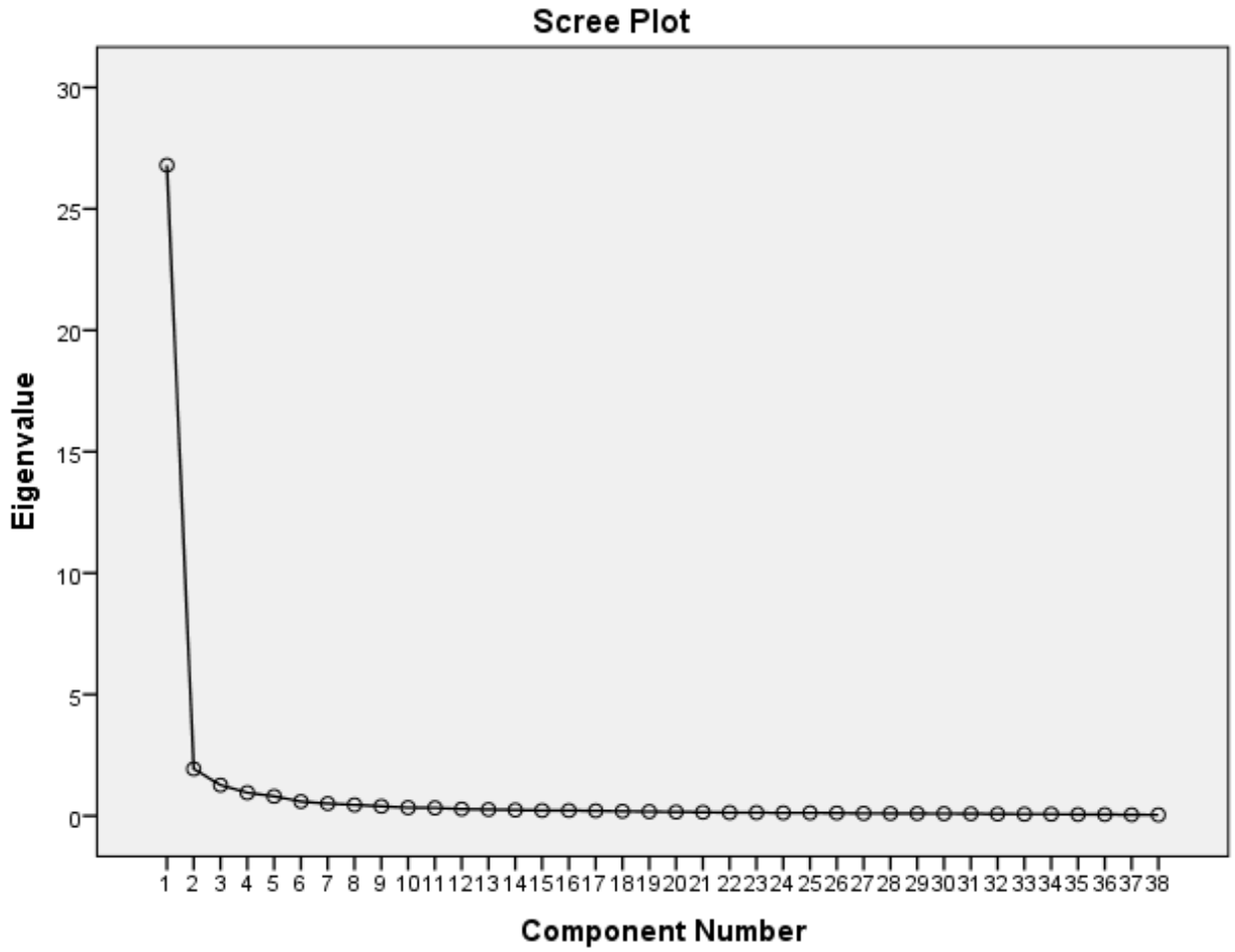
Factor Analysis: Buses

Table 5-17: Total Variances Explained - Public Buses

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	26.801	70.528	70.528	26.801	70.528	70.528	12.340	32.473	32.473
2	1.930	5.079	75.607	1.930	5.079	75.607	9.632	25.347	57.821
3	1.268	3.336	78.943	1.268	3.336	78.943	8.026	21.122	78.943
4	.955	2.513	81.456						
5	.804	2.115	83.571						
6	.590	1.554	85.125						
7	.505	1.328	86.454						
8	.452	1.191	87.644						
9	.394	1.038	88.682						
10	.340	.894	89.577						
11	.329	.867	90.443						
12	.282	.741	91.185						
13	.259	.682	91.866						
14	.243	.639	92.506						
15	.223	.587	93.093						
16	.217	.572	93.664						
17	.209	.549	94.214						
18	.191	.503	94.717						
19	.173	.454	95.171						
20	.161	.423	95.594						
21	.151	.396	95.990						
22	.134	.353	96.343						
23	.133	.349	96.693						
24	.124	.327	97.019						
25	.122	.320	97.339						
26	.116	.305	97.644						
27	.103	.272	97.916						
28	.099	.259	98.176						
29	.097	.256	98.431						
30	.091	.239	98.670						
31	.084	.222	98.892						
32	.077	.201	99.093						
33	.073	.192	99.286						
34	.071	.187	99.473						
35	.059	.156	99.629						
36	.054	.141	99.770						
37	.046	.121	99.891						
38	.041	.109	100.000						

Extraction Method: Principal Component Analysis.

Figure 5-5: Scree Plot – Public Bus



Factor analysis was carried out in this study as an exploratory tool in order to reduce a set of items to a smaller set that could adequately explain the data and account for being a set of sub-constructs. The Principal Components method was used with varimax rotation.

From the above Table 5-17, the cumulative variance that three factors (punctuality, timetables, and timeous arrival at destination) are explaining is 78.943%. Furthermore all of these 3 factors have eigenvalues over 1. The scree plot also confirms the existence of the 3 factors. The first factor (punctuality) accounts for 70.528% of the variation. This is normally the case in factor analysis. The next step was to look at the rotated loadings table to find out which questions were not loading at all on the factors and could hence be eliminated from the data set and then re-run the factor analysis.

Table 5-18: Rotated Component Matrix[a] - Public Buses

Factors	Component		
	1	2	3
Importance of service buses	.882	.188	.299
Importance of affordability buses	.867	.214	.294
Importance of service buses	.861	.217	.291
Importance of comfort buses	.841	.231	.313
Importance of reliability of buses	.787	.348	.300
Affordability future bus utilisation	.714	.421	.333
Safety bus future utilisation	.689	.450	.340
Bus drivers obeying rules of the road	.682	.460	.307
Driving skills of bus drivers	.677	.507	.303
Bus fare affordable	.656	.450	.322
Bus fares fair	.646	.515	.337
Bus fares worth it	.642	.462	.342
Availability bus future utilisation	.633	.459	.391
Buses offer value for money	.617	.521	.315
Injuries due to bus accidents	.609	.522	.353
Buses exact location-destination	.578	.505	.361
Comfort future utilisation of buses	.576	.514	.412
Availability of buses on weekdays	.563	.418	.449
Friendliness of bus drivers	.533	.483	.468
Bus arrival at destination	.458	.742	.304
Bus timely arrival destination	.460	.735	.323
Bus coolers on board	.316	.722	.429
Smoothness buses	.455	.715	.330
Find seat on buses	.470	.707	.267
Punctuality buses	.454	.667	.388
Feel about lack of coolers buses	.012	.643	.371
Reliability future bus utilisation	.490	.639	.344
Bus failure to be on time	.335	.619	.537
Bus adherence to routes	.541	.592	.258
Condition of buses	.534	.588	.392
Availability of buses on holidays	.342	.363	.819
Rate of bus accidents	.347	.282	.815
Availability of buses in the evenings	.348	.342	.813
Availability of buses on weekends	.391	.330	.756
Buses fares	.399	.253	.732
Often use buses	.282	.390	.729
Bus timetable	.307	.510	.623
Bus shelters condition	.475	.485	.486

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Most literature suggests that a factor loading of 0.3 or greater can be considered to be significant (Kline, 1994). Given the large number of items on the scale, it was advisable to adopt the principle of factor loadings of 0.4 or higher to be significant, otherwise the number

of item in the data set will not be reduced and the key reason/purpose of Factor analysis, which is to reduce the number of items to a comprehensible set of items, will be defeated.

From the above rotated component matrix, none of the questions have loadings that are less than 0.4 and therefore no questions will be dropped. In this case the model selected the underlying factors, namely, punctuality of buses, bus time-table, timely arrival of buses at destination, failure of buses to arrive on time. In total, 74,79% of the variation in the data may be explained by the first three principal components. Factor 1 is heavily loaded on the importance of the dimensions and using public bus transport in the future as regards to safety, availability, comfort and affordability. Factor 2 is heavily loaded on the combination of comfort and timely arrival at destination. Factor 3 is heavily loaded on the extent of service (or availability).

Regarding the minibus taxi transport, there were 37 variables considered for the minibus taxis (see Table 5-19), and the factors extracted (see Figure 5-20).

Table 5-19: Variables for Minibus Taxis

No	Variables	No	Variables
1	Punctuality of taxis	21	Rate of taxi accidents
2	Taxi timetable	22	Injuries as a result of taxi accidents
3	Timely arrival of taxis at destination	23	Condition of taxis
4	Failure of taxis to be on time	24	Driving skills of taxi drivers
5	Arrival of taxis at destination	25	Taxi drivers obeying the rules of the road
6	Adherence of taxis to routes	26	Safety – future utilisation of taxis
7	Reliability – future utilisation of taxis	27	Taxis offer value for money
8	Able to find seats on taxis	28	Taxi fares
9	Smoothness of taxis	29	Taxi fares worth it
10	Coolers on board taxis	30	Taxi fares fair
11	Reaction to lack of coolers on taxis	31	Taxi fare affordable
12	Condition of taxi shelters	32	Affordability – future utilisation of taxis
13	Comfort – future utilisation of taxis	33	Importance of reliability of taxis
14	Taxis exact location - destination	34	Importance of comfort of taxis
15	Availability of taxis on weekdays	35	Importance of service of taxis
16	Availability of taxis at weekends	36	Importance of service of taxis
17	Availability of taxis on holidays	37	Importance of affordability of taxis
18	Availability of taxis in the evenings	38	Default variable
19	Friendliness on the part of taxi drivers		
20	Availability – future utilisation of taxis		

Factor Analysis: Minibus Taxis

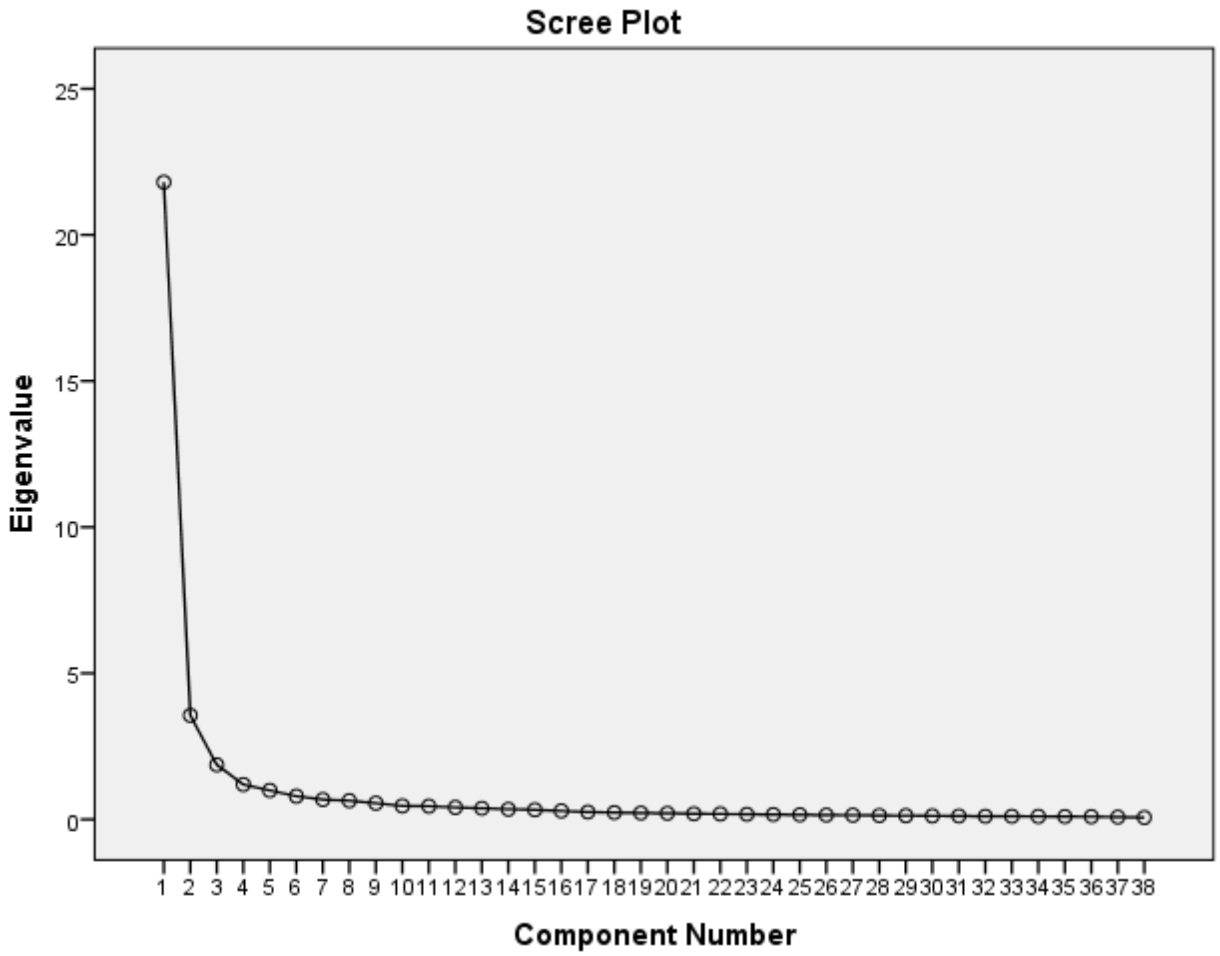
Table 5-20: Total Variance Explained - Minibus Taxis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	21.805	57.382	57.382	21.805	57.382	57.382	15.322	40.322	40.322
2	3.560	9.368	66.750	3.560	9.368	66.750	5.190	13.659	53.981
3	1.865	4.907	71.657	1.865	4.907	71.657	4.673	12.297	66.278
4	1.194	3.141	74.799	1.194	3.141	74.799	3.238	8.521	74.799
5	.992	2.612	77.410						
6	.795	2.093	79.503						
7	.678	1.784	81.287						
8	.642	1.690	82.977						
9	.555	1.461	84.438						
10	.461	1.213	85.651						
11	.452	1.188	86.839						
12	.411	1.082	87.921						
13	.378	.994	88.915						
14	.349	.918	89.833						
15	.328	.863	90.695						
16	.289	.762	91.457						
17	.252	.664	92.121						
18	.238	.625	92.746						
19	.220	.578	93.324						
20	.211	.555	93.879						
21	.194	.511	94.390						
22	.188	.495	94.885						
23	.174	.459	95.344						
24	.167	.439	95.783						
25	.159	.418	96.201						
26	.147	.386	96.588						
27	.144	.379	96.966						
28	.135	.354	97.321						
29	.129	.338	97.659						
30	.121	.318	97.977						
31	.118	.310	98.286						
32	.109	.287	98.573						
33	.105	.275	98.849						
34	.102	.268	99.117						
35	.097	.256	99.373						
36	.093	.244	99.617						
37	.081	.212	99.829						
38	.065	.171	100.000						

Extraction Method: Principal Component Analysis.

From the above table 5.20, it is evident that only four factors will be extracted since they account for approximately 75% of the variation. The scree plot below (see Figure 5-6) further confirmed this result.

Figure 5-6: Scree Plot - Minibus Taxis



The following Table 5-21 depicts the Rotated Component Matrix

Table 5-21: Rotated Component Matrix[a] - Minibus Taxis

Factors	Component			
	1	2	3	4
Driving skills of taxi drivers	.857	.172	.214	.201
Taxi drivers obeying rules of the road	.855	.175	.193	.214
Safety taxi future utilisation	.842	.208	.255	.113
Condition of taxi shelters	.841	.138	.251	.171
Taxi fares fair	.841	.213	.209	.137
Friendliness of taxi drivers	.835	.173	.275	.194
Injuries due to taxi accidents	.834	.217	.178	.097
Taxi fares worth it	.821	.202	.213	.130
Smoothness taxis	.810	.097	.333	.196
Taxis offer value for money	.809	.164	.248	.063
Affordability future taxi utilization	.800	.240	.265	.079
Availability taxi future utilization	.793	.221	.313	.060
Comfort future utilisation of taxis	.786	.219	.340	.084
Availability of taxis in the evenings	.697	.089	.359	.290
Reliability future taxi utilization	.686	.175	.489	.061
Taxi timetable	.683	.054	.303	.399
Taxi fare affordable	.672	.332	.256	.082
Availability of taxis on holidays	.670	.068	.463	.224
Feel about lack of coolers taxis	.659	.006	.003	.556
Taxi failure to be on time	.657	.056	.394	.303
Taxis coolers on board	.647	.124	.146	.590
Find seat on taxis	.624	.163	.453	.127
Taxi arrival at destination	.621	.110	.582	.060
Punctuality taxis	.586	.119	.570	.115
Taxi shelters condition	.541	.363	.232	.220
Importance of service taxis	.167	.921	.078	.133
Importance of comfort taxis	.187	.921	.117	.119
Importance of service taxis	.191	.908	.152	.097
Importance of affordability taxis	.190	.865	.134	.118
Importance of reliability of taxis	.178	.838	.213	.185
Availability of taxis on weekdays	.268	.281	.690	.209
Availability of taxis on weekends	.389	.219	.687	.200
Taxis timely arrival destination	.598	.123	.607	.052
Taxis exact location-destination	.483	.300	.494	.046
Taxi adherence to routes	.449	.187	.476	.176
Taxis fares	.171	.197	.095	.797
Rate of taxi accidents	-.037	.252	.138	.767
Often use taxis	.484	.126	.225	.633

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

The rotated matrix revealed that four factors were accounting for the data, namely the punctuality, timetables, timely arrival at destination, and reasons for failure to arrive at destination on time.

Furthermore**,** Factor 1 denotes friendliness of drivers, driver skills and rules of the road, safety, comfort, and extent of service. Factor 2 denotes importance of the dimensions as regards choosing public transport. Factor 3 denotes the availability of service, and Factor 4 denotes affordability, and the rate of accidents.

Taking into account the above discussion, the data has shown passengers' perceptions of service quality, future utilisation and the importance of service quality dimensions, RECSA, in public transport. Furthermore, the model was proven to be valid and the data fitted this model well.

The collinearity and outlier detection analysis, for buses and minibus taxis, discussed below, is important for concluding the study findings. In multiple linear regression model, discussed above, problems arise when a serious multicollinearity or influential outlier present in the data. Failure to include significant quadratic or interaction terms results in model specification errors (Pimpan & Prachoom, 2009 & Fernandez, 2013).

5.5 Collinearity and Outlier Detection

5.5.1 Collinearity diagnostics

In the multiple linear regression model with the Perceived Quality of Service Index for buses as the dependent variable and the mode of transport which was used the most often, and age, gender, education and income level as the independent variables, the Variance Inflation Factors (VIFs) for the coefficients were all between 1 and 1.9. This, in turn, implies there is no problem with multicollinearity as there was no VIF greater than 3.

5.5.2 Outlier Detection

The outliers describe the abnormal data behavior, that is, data which are deviating from the natural data variability (Filzmoser, 2010). The standard method for multivariate outlier detection is robust estimation of the parameters in the Mahalanobis distance and the comparison with a critical value of the Â2 distribution (Rousseeuw & Van Zomeren, 1990).

(a) PSQ Index for Buses

Casewise diagnostics revealed three observations (Nos. 614, 615 and 665) which had a standardised residual of less than -3, thus denoting that the observed value of the Perceived Quality of Service Index for buses was more than three standard deviations less than the value predicted by the model. In view of the fact that the model had an adjusted R squared value of 0,156 only, it may make sense to attribute these cases to the absence of some other important predictor variable rather than calling them outliers.

(b) PSQ Index for Minibus-Taxis

As regards this regression model, the casewise diagnostics revealed that there were no observed cases of more than three standard deviations away from their predicted value. Accordingly, it would appear that there were no outliers in this index.

5.6 Conclusion

This chapter presented the research data as it relates to the research objectives in three sections. The first section discussed the characteristics of the data as it related to the selection of respondents as well as the response rate, geographical location of respondents, sample characteristics and utilisation of transport modes. A total of 902 respondents were selected and personal interviews conducted. It emerged that 29,8% of the respondents used public buses, while 70.2% of the respondents used the minibus taxis as their preferred mode of transport. A significant percentage of public transport users were aged 19 years and between the ages of 25 and 34 years with public buses and minibus taxis being used predominantly used by students and scholars. However, their preferred mode of transport is the minibus taxis.

The second section discussed the passengers' perceptions of service in terms of the five service quality dimensions, namely, reliability, comfort, extent, safety, and affordability (RECSA). It emerged that the perceived quality of bus transport exceeded that of minibus taxis by a significant margin with those who use buses tending to have a higher opinion of the quality of bus transport. However, this is not surprising since, presumably, they would not use buses if their opinion of this mode of transport was extremely low.

It would appear that those who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience. However, on average, younger people perceived minibus taxis more favourably than older

people while, on average, females perceived minibus taxis more favourably than males; and less educated people viewed minibus taxis favourably as compared with more educated people. The perceived quality of the mode of transport is strongly associated with the intention to continue using this mode of transport. It was found that all five of the service quality dimensions were deemed to be extremely important. As regards the bus service, in total, 78.94% of the variation in the data may be explained by the first three principal components; while 74.79% of the variation in the data for the minibus taxi service may be explained by the first four principal components. Finally, the coefficients implied there was no problem with multicollinearity, and no outliers were found in the index.

The aforementioned discussion provided an insight into passengers' perceptions of service quality in public road transport. The study findings will be discussed in the following chapter as they relate to the objectives of the study, that is, to explore commuters' perceptions of bus and minibus taxi service in terms of the service quality dimensions, originally developed by McKnight et al. (1986); to ascertain the extent to which service quality dimensions can influence future demand for public transport; and to determine the importance of each service quality dimension as regards choosing a public transport mode. The study findings will support or reject the literature reviewed in chapter two and three of this study.

CHAPTER SIX

Discussion:
Passengers' Perceptions of the Public Road Transport Service in Johannesburg

6.1 Introduction

The previous chapter presented the research data as it relates to the study objectives. This chapter discusses the research findings as they relate to the study objectives, and focuses on exploring commuters' perceptions of the bus and minibus taxi services in terms of service quality dimensions, namely reliability, comfort, extent of service, safety, and affordability (RECSA). Thereafter, this chapter focuses on the extent to which the service dimensions influence the future utilisation (demand) of public bus and minibus taxi transport. The chapter concludes with a discussion on the importance of each service quality dimension as regards choosing a mode of public transport.

6.2 Passengers' Perceptions of Service

At the onset, it is important to state that the literature reviewed in chapter two and three showed that in the absence of objective measures to measure service quality in public transport, a useful and appropriate approach to assessing the quality of a transport organisation's services would be to measure the commuters' perceptions of service (Farris, *et al.*1976; Thompson, *et al*. 1985; Dodds, *et a*l. 1985; McKnight, *et al.* 1986; Alam, 2002 & Adarkwa & Boansi, 2011). Accordingly, what is needed is a quantitative yardstick for gauging such perceptions. In this study, the RECSA model was used as a measure of the passengers' perception of service. The results of the study will be discussed hereafter, starting with the important characteristics of service concerning the utilisation of service.

6.2.1 The characteristics of Service

Regarding the demographic variables, the study findings showed that 29,8% of the respondents used public buses, while 70,2% used minibus taxis as a preferred mode of transportation. The study findings support the literature reviewed in the aforementioned discussion in chapter two. According to City of Johannesburg (2006), 72% of commuters in Johannesburg use minibus taxis for their daily commuting needs. Furthermore,

other research showed that the minibus taxi industry transports approximately 70% of the country's public transport commuters (Thomas, Ryneveld & Pascarel, 2010 & Ndebele, 2011). This, in turn, means that the minibus taxi industry has an estimated 70% market share while public buses have a market share of just over 20%, with the railway containing a market share of just over 14% (South Africa. 2012).

As regards the service perception of the various market groups, the study findings showed that age, gender, and level of education all influence the perception of service. Age, gender and level of education were all statistically significant at the 5% level since their p-values were all less than 0.05 in influencing the overall service quality provided by the bus. Furthermore, a large percentage of public transport users were aged 19 years and between the ages of 25 and 34 years; for example, 30,3% of the public transport users were aged 19 years, while 28,7% were between the ages of 25 and 34. Public buses and minibus taxis were used predominantly by students and scholars. However, their preferred mode of transport was the minibus taxi.

The study findings support the literature reviewed in chapter two and three; younger people (aged between 19 and 34) are the largest users of public transport and, on average, they perceived minibus taxis more favourably than older people (since age had a negative coefficient). Females perceived minibus taxis more favourably than males (since gender had a positive coefficient), and less educated people viewed minibus taxis more favourably as compared with more educated people (since educational level had a negative coefficient). Young people are heavily dependent on public transport, and it is often their only way to reach school, places of work, sporting facilities, and any other locations that contribute towards them gaining access to opportunities which build their future (International Association of Public Transport, 2012 & McKenzie, 2012).

In addition, the researchers generally define young people as those members of the community who are between the ages of 18 and 35 (National Youth Commission, 2009 & British Youth Council, 2012). This group comprises the largest number of people who use public transport and there are extremely strong and mutual connections between public transport and young users. In terms of international transport use, young people represent almost half of the total number of people in transit and they tend to travel more than adults (International Association of Public Transport, 2012 & McKenzie, 2012).

One of the major challenges for public transport organisations is, thus, to maintain the usage of public transport when young people mature into adults (SA The Good News, 2007). A study conducted by the British Youth Council (2012) showed the following results:

> "Young people's experiences of public transport within their local area were generally positive. 33,5% of respondents felt that buses in their area were reliable, however, 20% disagreed and 15,8% strongly disagreed that buses were reliable in their local area. In regards to availability, 72 young people (34%) felt that public transport took them where they needed to go and 111 (51,9%) knew how to access information about public transport. 62 young people (29%) overall felt that public transport currently satisfied their needs. However, 42 (19,3%) disagreed that public transport met their needs, and 41 (19,3%) strongly disagreed that public transport met their needs" (British Youth Council, 2012:2).

After the discussion of the characteristics of service, the subsequent discussion focuses on the passengers' perceptions of service in terms of the service quality dimensions as they relates to the objectives of this study and the research questions.

6.2.2 The Reliability of Service

As discussed in chapter three of this study, reliability refers to the ability to perform the promised service dependably and accurately (McKnight, *et al*. 1986). The study findings showed that buses were perceived as being more reliable than minibus taxis. Furthermore, those who use public buses more often tended to have a higher opinion of the quality of the bus transport. The coefficient of mode of transport was statistically significant and was estimated to be -5.43 with a p-value of 2.69e-10).

It emerged that those who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience – the coefficient for the mode of transport used the most often was not significant. However, it is possible to draw a definite conclusion that those who use minibus taxis tended to do so for reasons other than their opinion of this mode of transport, for example, they may use the minibus taxis for the convenience of this mode of service as opposed to safety and reliability.

The factor analysis revealed that it was possible to explain factor 1 by the punctuality of service. Structural equation modeling showed that the reliability is influential at the 5% significance level on the overall service quality that the public buses and minibus taxis

provided. In line with the study objectives, reliability was a factor that influences passengers' perceptions of service. The study findings support the literature reviewed in the aforementioned discussion; even though minibus taxis are being utilized by a large number of commuters, as stated in the above-mentioned discussion, there are other factors that are important to the utilization of the minibus taxi service; for example, the literature showed that the minibus taxis are widely utilized because they are found mostly along the high density travel corridors and may be stopped on demand (Freeman, Ngcoya & Chapman, 1990) and this improve its accessibility; the minibus taxis are also more available route than buses which operate on pre-defined routes, and this is due to the minibus taxis operational model, which is based on a small enterprise that guarantees its operational flexibility and its dynamism (Institute for Democracy in Africa, 2011); and the minibus taxis generally operated a late night service.

As regards the punctuality of the service, in particular, the study findings showed punctuality as an important factor that was significance to the overall service quality. The study findings support the literature reviewed in chapter two and three; commuters want to utilise those transport operators who keep their promises, particularly their promises pertaining to the core service dimensions. In its broadest sense, reliability means that the public transport operator will deliver on punctuality promises (Button, *et al*. 2001). However, interruptions often upset timeous service delivery. As stated in the aforementioned discussion bus organisations, in particular, tend to take into account service interruptions during the planning phase. It is well known that maintaining a schedule may be a challenge as signal timing, traffic congestion, traffic incidents, and other factors disrupt the expected running timetable. All these factors have a direct bearing on the public transport industry as they can and often do give rise to service interruptions (Gubbins, 1988 & Levinson, 2011).

Planning for efficient service becomes even more important to those bus organisations that operate government contracts. In this instance, service interruptions may result in the bus organisation being in breach of contract with the concomitant penalties in place.

However, it would appear that the situation is different as regards the minibus taxi industry. In view of the informal nature of the operations, the planning and scheduling of routes is not structured and neither is it co-ordinated through advanced planning systems. However, this invariably tends to affect the scheduling process adversely and limits a swift response to any service interruptions. Thus, as regards the minibus taxi industry, there are no efficient planning systems in place to improve service and to take into account interruptions that may occasionally occur. Unlike in the case of the bus transport, when service interruptions do

occur, the industry is not accountable to anybody, and often not even to the passengers who may have had their trips delayed as a result of the service interruptions. As discussed in chapter two the industry is accountable to itself only. The industry associations are responsible for operational planning and the rules are not always the same for the various associations.

As a result of the lack of scheduling and planning systems, the minibus taxi industry often finds it difficult to effect quick changes to operations in the short-term. Minibus taxi associations could utilise planning and scheduling systems in order to maximise economic and operational efficiencies. Such a move would be extremely important to the future integration of the minibus taxi service, as the dominant mode of public transport, into the formal passenger transportation system, particularly, the integration with the Rapid Transit Systems in Johannesburg and South Africa, at large.

Predominantly, there is a need for a concerted effort by public transport organisations, and particularly the minibus taxi industry, to learn from those other countries which have implemented efficient scheduling and planning software systems as discussed in chapter two. In chapter two it was shown that the Dubai municipality, for example, introduced a state–of--the-art bus scheduling and planning system, known as MICROBUS solutions in order to improve reliability (Shaibani, 2005). The objective of the scheduling and planning system in Dubai was to raise the operational efficiency levels due to the increase in the number of passengers, buses, drivers and routes. Other countries in Europe, such as in Germany, have also implemented scheduling and planning systems that assist them to plan for any eventuality. MICROBUS remains an important scheduling and planning system. However, there are other systems that could be considered and that would result in the improved reliability and punctuality of the public transport service in South Africa (Gregory, 2011). Mentor Streets® Schedule Software Suite, for example, is another planning system (a scheduling software program) developed for transport agencies that wanted to eliminate slow, inefficient manual processes and streamline schedule creation that should be considered (Gregory, 2011). In Singapore, the scheduling system allows their residents to access PublicTransport@SG website to plan their journeys (Land Transport Authority, 2013).

The following should be taken into account in an effort to further improve the perception of the public transport service:

- proper consultations with commuters, drivers and passenger transport authorities;

- changes to routes and operations should use sophisticated electronic planning and scheduling systems;

- the scheduling system should be capable of devising a roster within a short period of time; and

- personnel should be well trained in the use of the planning tools and equipped to respond quickly to changes in market forces.

The effective implementation of a planning and scheduling system is likely to result in the improvements to the reliability of service, with the resultant positive impact on the passengers' perception of service.

As regards the communication, the study findings did not show communication as one of the factors highly influencing perceptions of service nor did the study findings support communications as a factor in terms of the factor analysis. However, communication is an important variable to the overall service quality. The literature reviewed in the aforementioned discussion, showed a need to implement ICT systems to improve communication with passengers, and is an important consideration to South African public transport organisations (Mashiri, *et al*. 2010). Some of the important communication systems, as was discussed in chapters two and three, include time-tables, internet messaging, smart messaging systems, terminal electronic displays, on-board communication, mobile communications and call centres. The specific benefits of most of the ICT solutions, apart from these solutions being a channel through which information may be shared, include increased operational efficiency, lower costs of transacting, and increased productivity amongst internal employees, all of which may translate into the enhancing positive perceptions of service.

Another important factor that may result to the perception of the quality of bus transport exceeding that of minibus taxis is the availability of timetables in the bus industry. The factor analysis performed confirmed the availability of timetables as were explaining factor one for both bus and minibus taxi service. The study findings showed that timetables for both the bus and minibus taxi transport were considered as important compared with the

other factors, such as punctuality and the timely arrival at destinations. The study findings supported the literature reviewed in this study; timetables were found to be important to the scheduling process because the dissemination of information to passengers is critical to the successful operation of public transport services, and in maintaining and stimulating demand (Mashiri, *et al*. 2010). Other researchers have also shown that timetables, as used by passengers as a point of reference, are important (McGovern, 2005) and a lack of timetables may be construed as a breaking of trust between operator and passengers. Timetables are important because passengers interpret them as a form of contract or as a declaration of commitment on the part of the transport organisation to provide them, as the passengers, with certain travel services (McGovern, 2005). In addition, timetables may be utilised as a marketing tool as they should, at least, reflect the frequency of the service on each route as well as the fare.

Since timetables are considered as important, it is therefore concerning, as discussed in chapter two, that the minibus taxi industry, unlike the bus transport industry, does not issue timetables. This may also be as a result of the fact that the minibus taxi transport operates a non-scheduled transport service. Word of mouth is more important to the minibus taxi industry as regards the dissemination of information to passengers regarding routes and service than the issuing of timetables, which are often seen as a cost to the minibus taxi operations.

As regards the timely arrival at destination, the study findings showed that timely arrival at destination is an important factor influencing the perception of service. In fact, a total of 74,79% of the variation in the data may be explained by the first three principal components, which includes timely arrival at destination of the bus service. The study findings support the literature reviewed in the aforementioned discussion. On the one hand, buses operate trips from departure to destination even if there are few or even no passengers aboard while, on the other hand, the minibus taxis do not depart until the vehicle is full, although, if they do, they would probably pick up more passengers along the routes, especially during the off-peak periods (Levinson, 2011). In addition, those vehicles that do pick up passengers along the route will often transfer passengers to another vehicle and go back to the starting point again if the vehicle reaches a certain point and it is still not full or has few passengers aboard, this practice is commonly found in the minibus taxi industry (Arrive Alive, 2013a). Regarding the public bus cycle, the vehicle travels from its starting location to another route terminus, stopping at stations or stops along the route to allow passengers either to board the vehicle or to alight from the vehicle (Levinson, 2011).

It is essential that the correct balance be found between the number of passengers aboard and the need to arrive at a destination on time. What is the relevance of arriving at a destination on time if there are no passengers aboard? This has been a dilemma facing public transport operators for some time. However, being on time brings an element of certainty to the service while also enabling passengers to estimate their time of arrival at destinations. However, at the same time, the public transport operator may be going bankrupt if he/she is not operating at either full or near full capacity. From the passengers' perspective, the ideal service is an efficient service with few stops, characterised by high and predictable demand, and few service reliability problems. Each passenger would like nothing more than for buses to arrive promptly at stops, termini, and destination (Koffman, 1990), in such a way that access and egress times are minimised (Kittelson & Associates, 2003 & Murray, 2001).

Another important factor, worth considering as it may have an impact on the timely arrival at destination, is the length of the journey or the distance between departure and destination. Service interruptions may increase the length of the journey as the time taken to arrive at destination may be unacceptably high. The study findings showed that time taken to arrive at destination is important to explaining factor one for minibus taxi service and factor two for the bus service, meaning that timely arrival at destination is a factor influencing service for both bus and minibus taxis. The study findings support the literature reviewed in chapter three. In a study which was conducted in order to calculate a service quality index for bus transport, it was established that journey length is often the cause of most of the dissatisfaction on the part of the commuters. In other words, the majority of passengers are often dissatisfied with the time taken by public transport to arrive at destination (Hensher & Bullock, 2003). Journey length is important because it impacts on the well-being, health and productivity of the passengers. According to Lovelock *et al.* (1987), there is a need to publicise medical research studies that have linked the stress of commuting for hours to a range of health problems, including high blood pressure and pulse rates, reduced mental capacity and bad moods.

If the public transport service is not able to reduce the travelling distances between departure and destination, it should at least consider ensuring that the vehicles are comfortable (as discussed in the following section under service comfort) as this would improve the conditions inside the vehicles and minimise passenger fatigue. However, commuters should also consider living in neighbourhoods that are close to their places of work. This is prevalent in Johannesburg where a large number of commuters live far from their places of work for historical reasons, thus resulting in long commuting trips (South African Transport Allied Workers Union, 2006). The average travel time to work on all the modes is 43

minutes but, if public transport is considered on its own, the average travel time increases to 59 minutes (Arrive Alive, 2012a). Approximately 1.3-million public transport commuters travel for longer than one hour to work or for two hours per day if the return trip is also taken into consideration (Arrive Alive, 2012a). The spread of work and residential re-location to the suburban areas makes a dramatic increase on the public transportation's market share a long-term task (Lovelock, *et al.* 1987). However, the residential areas should be much closer to places of work. Such a strategy will reduce travelling distances, improve health and productivity, and reduce environmental degradation (Lovelock, *et al.* 1987).

As regards adherence to the routes, it would appear from the study findings that adherence to the routes for both bus and minibus taxi commuters are not necessarily a factor in public transport. The literature reviewed in this discussion seemed to suggest otherwise. There are other researchers who maintain that adherence to route is important because it improves the predictability of public transport while it enabling passengers to plan effectively (Shaibani, 2005). From the supply side, it is important to public transport operators to maintain a vehicle cycle that is cost-effective and which leads to an improvement in operational efficiency.

Taking into account the above-mentioned discussion, as well as the objectives of the study – exploring passengers' perceptions of service – the study findings showed that the reliability of service is an important factor that is likely to influence passengers' perceptions of service. Therefore, public transport organisations should take into account reliability in order to improve service. Furthermore, those commuters who used buses more than minibus taxis, often tended to have a high opinion of the quality of bus transport; and buses were perceived as being more reliable than minibus taxis.

6.2.3 The Comfort of Service

Service comfort involves the availability of service aesthetics (McKnight, *et al.* 1986). The aesthetics of service include the availability of seats and space (often referred to as passenger density), smooth journeys, the availability of air-coolers, and the condition of the shelters as discussed in chapter three (Mcknight, *et al*. 1986; Wardman, 2001 & Litman, 2008).

The study findings showed that, with regard to the perceived service comfort, buses were perceived as more comfortable than minibus taxis. The factor analysis showed that factor one may be explained by the comfort of service. Furthermore, the structural equation modeling showed comfort as being influential and significant on the overall service quality

of public buses. The study findings support the literature reviewed in chapter two and three. Human factors, including the aesthetics of design, should be recognised as important determinants of passenger satisfaction. (Farris, *et al*.1976). Furthermore, qualitative dimensions of public transport may affect the welfare of individuals and their modal choices (Litman, 2008). According to Samson & Thompson (2007), when deciding which mode of transport to use, service comfort is one of the issues that is often taken into consideration with it being rated as one of the top 11 key dimensions that are important to determining the mode of transport used. These findings were also supported by other researchers (Solvoll & Mathisen, 2010). In addition, the findings of the research study on customer satisfaction in public transport showed that comfort of service was one of the top four factors that positively correlated with overall satisfaction (Budiono, 2009). Service comfort is thus extremely important to public transport and it must not be ignored as one of the service quality dimensions.

The study findings showed seat availability is an important factor to both bus and minibus taxis, and these findings supports the literature reviewed in the preceding discussion. The literature discusses seat availability as one of the variables of service comfort and indicates that the seat availability should be displayed on public transport vehicles, on the electronic information boards at bus and minibus taxi ranks, and at bus stops.

In addition, the load factor may play an important role to controlling the seat availability by ensuring that vehicles are not uncomfortably full. The load factor, as discussed in chapter two of this study, is the percentage of a vehicle's total capacity that is actually occupied (City of Johannesburg, 2006).

The load factor is intended to improve the comfort of the journey while also minimising the possibility of the vehicle capacity being exceeded or overloading. At a 100% load factor, the vehicle is filled to its recommended maximum capacity. However, at 100% capacity, small system delays or inefficiencies may result in severely overcrowded conditions. Such conditions are not only uncomfortable for the passengers, but may also have negative consequences for operations. The BRT (Rea Vaya) operates on a load factor ranging between 70% and 80% during peak periods in order to avoid overcrowding and to increase comfort while, in the Bogotá TransMilenio system, typical load factors are 80% for peak periods and 70% for non-peak periods (City of Johannesburg, 2006).

However, it is evident that the Rea Vaya buses in Johannesburg operate at near capacity during peak periods with 95% of the Rea Vaya trunk route capacity being utilised during

peak hours. In other words, buses are always extremely full between 7am and 8am in the morning and after 4pm in the afternoons because these are the times when most passengers prefer to catch a bus so as to arrive just in time for work or to leave for home immediately after work (Rea Vaya, 2012 & McCaul, 2012). The fact that buses in Johannesburg operate at almost near capacity, thus causing discomfort to passengers, suggest a need to increase the capacity or bus frequency especially during peak hours.

It emerged from the study findings that the condition of the bus shelters was somewhat less a factor for the bus commuters than for the minibus taxi commuters. The factor analysis showed bus shelters as not rated highly as a factor to commuters compared to minibus taxi commuters. This means that minibus taxi commuters considers shelters at ranks a factor influencing service quality that needs to be taken into account. The study findings support the literature reviewed in chapter two. As discussed in chapter two, the continuous refurbishment of bus shelters, either at ranks or along the routes, has continued for decades to attract private sector investment. Gandhi Square Bus Terminal and bus shelters along the routes in Johannesburg, for example, were upgraded with the assistance of the private sector (Johannesburg Metropolitan Bus, 2005b).

However, this is not the case as regards the minibus taxi ranks and shelters at taxi ranks. As a result, it is understandable why minibus taxi commuters would consider shelters at ranks an important factor. In fact, the minibus taxis have no access to shelters along the routes as they stop anywhere it is most convenience. Nevertheless, local municipalities, particularly in Johannesburg, have been building new minibus taxi ranks and upgrading the existing ones, for example, the minibus taxi ranks in Bree Street, Wanderers and Noord (City of Johannesburg, 2006). Notwithstanding the failed attempts at Bree Street terminal, not much else seems to have been done to address the integration of the infrastructure for bus and minibus taxis in Johannesburg.

Government requires private sector investment so as to be able to continue to refurbish and build public transport infrastructure. Public transport infrastructure programmes that include a maintenance plan should be encouraged and supported. For example it is stated that, over the twenty-year period 1964 to 1984, US$45-billion worth of road infrastructure assets were lost in eighty-five developing countries as a result of inadequate maintenance (World Bank, 1996). In addition, every rand's worth of essential maintenance which is postponed increases the costs of operating a vehicle by more than R25 (World Bank, 1996).

This postponed maintenance also ultimately increase the costs incurred by the road agencies. The BRT, Gautrain and Motorway Tolling, particularly in Johannesburg are all examples of public transport programmes that are financed both by government and by the private sector. However, it is essential that the financial model be well structured so as to lessen the burden on the citizens in order to focus on other urgent socio-economic needs. A failure to prioritise the socio-economic needs of the citizens in favour of costly public transport programmes will result in unhappiness because of the knock-on effect which these projects have on the economy.

The literature review showed that it is imperative that public transport operators find a solution to satisfy the needs of those commuters who are seeking individuality, comfort and mobility. Private motor cars have many features that guarantee the comfort and convenience of passengers while a high degree of comfort will increase both the satisfaction and the safety of passengers. Comfort may be used as a unique selling proposition for a public transport service. In addition, increased comfort may also improve health, the environmental situation on-board in terms of the conditions, as well as productivity at the workplace (Lovelock, *et al*. 1987). When deciding which mode of transport to use, passengers tend to take comfort into account (Samson & Thompson, 2007). In addition, service comfort was rated as one of the top 11 key dimensions that are important to determining the mode of transport used (Solvoll, *et al*. 2010). In another study, it was found that comfort of service was one of the top four factors that positively correlated with overall satisfaction (Budiono, 2009).

Taking into account the above-mentioned discussion, as well as the objectives of the study- exploring passengers' perceptions of service, the study findings showed that, with regards to the perceived service comfort, buses were perceived as more comfortable than minibus taxis. In addition, the comfort of service is important as it is likely to affects the passengers' perception of service for both bus and minibus taxis. Furthermore, the Structural Equation Modeling showed comfort as being influential and significant on the overall service quality of public buses. Therefore, public transport organisations should take into account comfort in order to improve service.

6.2.4 The Extent of Service

The extent of service often includes service availability, the extent to which a public transport mode take commuters to their exact destinations, and the friendliness of the frontline staff (McKnight, *et al*. 1986). Public transport accessibility and availability are

both important. The availability of service refers to the availability of a transport service on weekdays, evenings, weekends and public holidays. Public transport accessibility is about commuter's ability to get to and from places - it is about enabling access" (Public Transport Victoria, 2013: 1).

The extent of service involves taking passengers to their direct location (with no transfers involved); the availability of service during the day (peak and off-peak), in the evenings, over weekends, and on public holidays; and driver friendliness (McKnight, *et al*. 1986). Extent of service was found to be one of the top five important factors that correlate positively with the perception of service on the part of both bus and minibus commuters.

Taking passengers to their exact destination appeared to be more important than the availability of the service for bus commuters. Furthermore, driver friendliness was an important factor to both bus and minibus taxi commuters. Structural equation modeling showed the extent of service as being influential and significance on the overall service quality that the public buses and minibus taxis provided. Factor analysis showed that for minibus taxis, availability of service in the evenings and on public holidays are factors that influence service, while availability of service for buses on weekdays was considered important. The study findings support the literature reviewed in the preceding discussion.

Taking passengers either to their exact destinations or as close to their destination as possible is an important factor considered by the commuters. In addition, this should be done timeously, safely and with minimum discomfort to the passenger. As discussed in chapter two of this study, one of the challenges with the existing public transport system in Johannesburg, is the lack of proper public transport integration, thereby putting further strain on the already stressed commuters, who have either to transfer or to walk to reach their final destinations, often at additional cost. The optimisation problem in public transport remains an issue that needs to be addressed (Farris, *et al*.1976 & McKnight, *et al*. 1986). It is essential that the shortest path through the network be identified (by both the commuters and the public transport providers) in order to minimise the costs of travelling, on the one hand, and, on the other hand, to determine the minimum cost of the potential flows in the network as a whole, given the patterns and destinations. The network should also take into account the maximisation of the user's welfare instead of the maximisation of profits – a trend which is prevalent in the privately owned networks.

In order to address the integration and the optimisation problem, the BRT Rea Vaya was therefore designed to change the routeing of the SPTN and the ICDS (City of Johannesburg,

2006). The BRT system was planned in such a way so as to ensure the full integration of Rea Vaya with the Gautrain and the Metrorail systems and, despite the fact that this integration has not taken place, a significant opportunity does still exist.

Furthermore, as long as passengers are required to transfer from one mode to another in order to reach their final destinations, the efficiency of the system will remain an elusive dream. It would appear that the integration of BRT with other modes of transport is still far in the future while such integration would depend upon on-going investment in BRT so as to be able to complete the project. Accordingly, a lack of investment may mean that the full potential of BRT may never materialise. It is critical to the success of BRT in that the system should enable passengers to access their destinations without having to transfer between vehicles and Johannesburg should have a single, road-based public transport system that would enable commuters to travel further without transfers and additional costs. However, this objective has not been adequately achieved, as this should have been implemented during phase 1 of the BRT project together with the circulation routes under the ICDS to provide a wide range of inner-city network coverage (McCaul, 2012).

As regards the availability of service, the study findings revealed the availability of service in the evenings and on public holidays as being relevant factors that influence passengers' perceptions of the minibus taxi service, while the availability of service on weekdays was perceived as being important to influencing the passengers' perceptions of the bus service.

The literature reviewed in the aforementioned discussion showed that in a study that was conducted on the availability of service, it was revealed that frequency of service was related to positive satisfaction with the availability of public transport having a positive effect on the demand. In other words, commuters would be likely to increase their utilisation of the service as a result of the increased availability of the service, especially in the evenings (Hensher, *et al*. 2003).

Therefore, it is essential that public transport organisations consider various options as regards the expansion or contraction of the service offered as well as alterations to and new uses for the existing service offering. Large fluctuations in demand, congestion and insufficient priority measures will often force the introduction of peak and off peak running times. High frequencies would offset some of the disadvantage in the peak running times but, outside of peak periods, a fixed-minute (clock face) timetable should be the norm. Routes that are not operated in large parts of the general service period (peak services, night

services) should not be included in the main network structure but dealt with as part of the supplementary access service (Nielsen, *et al*. 2008)

As regards the availability and frequency of BRT service, the Rea Vaya operates at the following frequencies:

Table 6-1: Frequency of the BRT Rea Vaya service in minutes

Service	Peak	Off-peak
Trunk Soweto–CBD	3	10
Soweto–CBD complementary route	5	15
Feeder routes	5, 10 or 15	30
Local complementary routes	10 or 15	15 or 20

Source: McCaul (2012: 9)

As discussed in chapter two of this study, the Rea Vaya service hours are as follows: the first bus (weekdays) is at 04:50 a.m. and the last bus is at 22:00. Over the weekends, the first bus is at 05:15 on Saturday and 06:00 on Sunday while the last bus is at 19:00 on both days (Saturdays and Sundays) (McCaul, 2012 & Rea Vaya, 2012).

The Sunday services do not operate in the same way as the weekday and Saturday services. The number of passengers travelling on Sundays is approximately 10% of the number of passengers travelling on weekdays and, thus, Rea Vaya operates at 30-minute intervals only on Sundays. It should, thus, not be necessary for passengers to wait for longer than 30 minutes if they arrive at a stop or station just after the previous bus has departed (Rea Vaya, 2012).

The Rea Vaya operating times are an improvement on the previous EMME/2 model in terms of both availability and frequency. However, in view of the fact that the Rea Vaya system lacks efficient integration with other modes of transport, such as the minibus taxis, there is no feeder service that supplements these operating times, particularly in the evenings. During the day, there are both buses and minibus taxis that commuters may use to reach their final destinations, albeit at additional costs. However, these buses and minibus taxis often compete with the Rea Vaya instead of providing a feeder service.

While taking into account the integration and optimisation of service, as well as improving the frequency of service, it is important that the customer service is not compromised. Public transport drivers provide a service to commuters.

Therefore, the study findings showed that driver friendliness is one of the important factors that correlate highly with the perception of service of the bus and minibus taxi commuters. The study findings support the literature reviewed in the preceding chapters. The public transport personnel are at the front line of the service business and, therefore, the quality of service, as perceived by the commuters, tends to be based on the conduct, behaviour and attitude of the public transport personnel. Bus and minibus taxi drivers are the face of the service and their conduct, behaviour, and attitude should be acceptable. Compulsory customer service training for drivers would be one method of improving friendliness with this training being even more critical for the minibus taxi drivers than for the bus drivers. As a result, there is an urgent need for training and testing programme for minibus taxi drivers (New South Wales, 2010). This training and testing program could include the following:

- A language assessment for the driver. This assessment should be satisfactorily completed prior to commencing training.

- Enrolment in TaxiCare Plus, a Certificate 3 Course, at a Vocational Education and Training Accreditation Board (VETAB) accredited taxi training school.

- Study modules 1 to 3 of TaxiCare Plus (Introduction, Localities and Routes and Rules and Regulations).

- Complete the Knowledge Test (Street Knowledge, Major Routes, Locations and Destinations, Regulations and a practical Street Directory test).

- Study modules 4 to 8 of TaxiCare Plus at the training school (Customer Care, Driver Safety, Taxi Driving Skills, Driver Health and Stress Management and Passengers with special needs).

- Assessment of Modules 4 to 8 is conducted by the training school.

- Taxi assimilation (an on-road assessment of the required skills of the taxi driver by the training school).

In addition, new minibus taxi drivers' PrDPs should expire 12 months after the date of initial issue (New South Wales, 2010) and, in order to renew a PrDP, the holder of the PrDP should be required to complete the TaxiCare Plus Silver Certificate. According to NWS (2010), in order to fulfil this requirement in the set time the PrDP holder should:

- Enrol in the TaxiCare Plus Silver Level training course within two months of the issuing of the initial driver authority.
- Provide a written log book (issued on completion of the Silver Certificate) to a school (indicating that the driving shifts undertaken are equivalent to 1 per week for a period of 48 weeks).
- Sign a declaration regarding criminal offences.
- Sign a declaration regarding traffic offences.
- Complete another road practical test, conducted by a training school.
- Supply a copy of his/her driver's licence and a photograph.

If the commuters are not satisfied with driver friendliness or behaviour, they should complain. As regards addressing passenger complaints, public transport organisations should consider the establishment of an effective national call centre capable of capturing and appropriately dealing with passenger complaints. The objective of the call centre should be to create a channel for passengers to lodge both their complaints and their compliments about driver behaviour and general service (Bolani, 2010). However, at present, it is not clear how drivers would be disciplined or held accountable or who should pay for the aforementioned training, particularly of those working as drivers in the minibus taxi industry. The industry should be more vocal in promoting such a call centre.

As regards the BRT Rea Vaya service in terms of driver friendliness and behaviour, both the passengers and the City of Johannesburg have been extremely concerned about the behaviour of the bus drivers, particularly in view of the City’s commitment to providing a quality public transport service. There is, thus, an urgent need to ensure that drivers are properly trained while driver behaviour should be monitored on a regular basis (Rea Vaya, 2012).

Taking into account the above-mentioned discussion, as well as the objectives of the study – exploring passengers' perceptions of service –the study findings showed that, with regards to the perceived extent of service, taking passengers to their exact destination appeared to be more important than the availability of the service for bus commuters. Furthermore, driver friendliness was an important factor to both bus and minibus taxi commuters. Structural equation modelling showed the extent of service as being influential and significance on the overall service quality that the public buses and minibus taxis provided. Factor analysis showed that for minibus taxis, availability of service in the evenings and on public holidays are factors that influence service, while availability of service for buses on weekdays was considered important. Therefore, public transport organisations should take into account the extent of service in order to improve service. The convenience of service is important and is, in fact, the key to increasing the number of public transport users (Ahmad, 2010). Increasing the frequency of service or other activities that have the effect of expanding the quantity of service offered is important (Farris, *et al*. 1976; Federal Highway Administration, 2006 & Brithaupt and Limanond, 2006).

6.2.5 The Safety of Service

Safety of service involves the number of accidents related to a transport mode, particularly the passengers' fears that they are more likely to be involved in an accident as a result of using a particular transportation mode; the condition of vehicles; driving behaviour; and obeying the rules of the road (McKnight, *et al*. 1986).

Regarding the safety of service, the study findings showed that buses were perceived to be safer than minibus taxis. The factor analysis further revealed the importance of safety as a factor in passengers' perception of service for both bus and minibus taxi commuters. Structural equation modelling revealed safety as being significant and influential on the overall service quality that the public buses provided. The study findings support the literature reviewed in the aforementioned discussion. The literature reviewed shows that safety should be viewed from three equally important perspectives, namely, safety of commuters, safety of drivers, and safety of buses and minibus taxis (McKnight, *et al*. 1986). The safety of the service is such an important factor to all commuters that it merits the rigorous attention of all the public transport stakeholders. Public transport authorities, working together with other interested stakeholders in the industry, have been developing plans that have, however, done very little to drastically improve the safety of public transport (McGovern, 2005).

Public transport safety should be addressed with the diligence and exigency that it requires. If the issue of safety is not seriously addressed, commuters are likely to resort to using private motor cars. Other research studies have revealed that commuters find it difficult to feel completely safe in any mode of public transport; while there was a general consensus that private transport provided the greatest sense of safety for those commuters who considered safety to be a priority with many of the commuters contemplating public transport expressing negative opinions about the safety of public transport (McGovern, 2005).

In addition, it would appear that the profiteering nature of the public transport industry contributes to the general lack of safety. The minibus taxi service, in particular, is mainly driven by the maximisation of revenue and the minimisation of costs. This, in turn, often translates into passenger overloading, wars between minibus taxi associations, and a general failure on the part of the drivers to observe the traffic rules. The latter finding is supported by other researchers, for example, it has been stated that "the minibus taxis gets most people to their destination, sometimes in record time and at the expense of other road users, but it also kills many users" (Govender, *et al.* 2006: 106).

It is essential that traffic officials and other law enforcement agencies enforce traffic laws strictly and monitor compliance more effectively; while the public transport authorities should create an environment that makes non-adherence to traffic laws difficult. In addition, one of the most effective ways of controlling safety levels may be by self-regulation. For example, in Germany, the Traffic Safety Council promoted the establishment of voluntary safety circles where employees from the transport organisation met to discuss critical safety points and devise solutions (World Bank, 2006). In addition, other safety programmes that have worked in other countries should be considered; these programmes include driver training programmes, incentive schemes, penalties, accident reviews, driver monitoring systems, and driver feedback procedures.

A dedicated national task team that focuses on public bus and minibus taxi safety should be established, perhaps in the form of the Traffic Safety Council adopted in Germany. However, if it were to be successful, there would have to be decisive action on the part of the local transport authorities. Heavy penalties should be imposed on offenders who do not observe the traffic laws while drivers and owners should be held jointly and severally responsible for passenger safety. The owner of the vehicle, in particular, should have to prove that he/she did everything necessary to reduce the risks of accidents, including providing proof that drivers have been attending regular training. As discussed in chapter

three of this study, the rationale behind this strategy is the fact that public transport operators are responsible both for the mechanical maintenance of their buses and minibus taxis and for the actions of the drivers over which they exercise control (McKnight, *et al.* 1986).

The condition of the vehicles is another important factor in respect of safety of service. The condition of the buses and minibus taxis emerged from this study as an important factor that correlates with the consumer's perception of service, and these findings supports the literature reviewed in the preceding discussion. Several of the many minibus taxis are unsafe, poorly maintained and prone to accidents; while others are old and in poor condition, thus, contributing to the high rate of accidents (Ntuli, 2005). Although there is constant attention to the roadworthiness of buses; it does not appear that there is the same attention given to minibus taxis.

However, the minibus taxi recapitalisation programme is a step towards achieving the roadworthiness of minibus taxis, in particular. Through the minibus taxi Recap Project, as it is often called, government is attempting to overcome the problem of an ageing minibus taxi fleet in the transportation system. According to Arrive Alive (2011a & 2013a), the minibus taxi Recap Project represents a comprehensive re-engineering of the minibus taxi industry with two major outcomes:

- The systematic introduction of safe and comfortable vehicles for minibus taxi commuters through scrapping allowance which will be an incentive for minibus taxi operators to hand in, on a voluntary basis, the very old vehicles for decommissioning; and

- The economic empowerment of the minibus taxi industry through a package of business opportunities through which the minibus taxi Recap Project is affording the industry an opportunity to participate nationally through the SANTACO structures, as well as at the level of the provincial co-operatives (Arrive Alive, 2011a).

A safe vehicle is more likely to attract commuters than an unsafe and poorly maintained vehicle. This is especially true in a highly competitive market (Maunder, *et al.* 1999). It is therefore essential that operators understand that vehicle maintenance is a sound effective

business practice, which can minimise vehicle downtime and costly time-consuming breakdowns whilst in service.

Furthermore, crash statistics have shown that the human factor contributed to 82,85% of the fatal crashes during 2009, the vehicle factor to 9,13%, and road and environmental factors 8,02% (Road Traffic Management Corporation, 2009). Other researchers support these findings – minibus taxi drivers, rushing their fares to destinations as quickly as possible in order to maximise returns, are often seen as the most dangerous drivers on the road, ducking wildly from lane to lane and stopping without warning whenever a passenger wishes either to climb on or off (Ntuli, 2005). However, government efforts to transform the minibus taxi industry have met with limited success, and the sector's blatant disregard of laws and regulations continues with dangerous vehicles, overloading, and reckless driving remaining its trade marks (Arrive Alive, 2011b).

The TRL research on the safety of public transport services in Nepal and India, for example, discovered that the most likely causes of bus accidents may be categorised as vehicle condition and driver attitude (Maunder, *et al.* 1999). It is, therefore, important that transport organisations ensure their vehicles are roadworthy and clean, free of oil leaks, greasy seats, rusty bodies, and exhaust fumes; and that their drivers are well trained in customer service so as to improve their behaviour and, most importantly, change their attitude.

However, passengers are also responsible for the high rate of accidents when they themselves demand to be dropped off and loaded anywhere, even where it is dangerous to do so. It is, essential, that passengers and drivers collaborate so as to improve safety. The customer service charter should be formulated in order to communicate specific service commitments and expectations. This charter should be placed inside each public transport vehicle, and both passengers and drivers should commit to adhere strictly to the charter.

Public transport drivers require training on customer service and, as discussed in chapter two, they should undergo a comprehensive screening process before being employed. Once employed, they must be subjected to stringent driver tests on an on-going basis so as to improve driving behaviour. As difficult as it may be to change behaviour, it is essential that programmes that support good behaviour be initiated and implemented (New South Wales, 2010).

There is also a need to develop a campaign designed to improve driver knowledge of the Road Traffic laws. Drivers should attend refresher courses every year and they receive

certificates for displaying a sound knowledge of the law. The minibus taxi awards, which are coordinated by the Department of Transport, encourage professionalism, safety and efficiency in this sector (Arrive Alive, 2011a).

With the introduction of the Administration Adjudication of Road Traffic Offences Act (AARTO), it is envisaged that there will be increased compliance to the law in the future, despite other possible, unintended consequences, such as increased bribery (Moss, 2010).

As regards the other service dimensions, the study findings showed that, on the one hand, the passengers' perceptions of the rate of accidents were less important as a factor to public transport. On the other hand, obeying the rules of the road, driving skills of drivers, and fear of sustaining injuries were all factors considered as important to both bus and minibus taxis. The study findings support the literature reviewed in chapter three. The literature showed that the most frequent causes of bus accidents, in particular, include poor driver behaviour, poor behaviour on the part of other road users and the mechanical condition of buses. However, the overriding factor that needs to be addressed is how to improve bus driver behaviour. The BRT Rea Vaya in Johannesburg is also concerned about driver behaviour in terms of the skills as well as obeying the rules of the road (Maunder, *et al.* 1999 & Rea Vaya, 2012). Addressing these factors may increase costs but is likely to be less expensive in the longer term as compared to the cost of human tragedy, vehicle replacement and other third-party costs. It is essential that owners and operators be encouraged to maintain their vehicles to a much higher standard than the present standard in order to minimise, amongst others, the rate of accidents and instil comfort to passengers (Maunder, *et al.* 1999).

Taking into account the above-mentioned discussion, as well as the objectives of the study – exploring passengers' perceptions of service – the study findings showed that, with regards to the perceived safety of service, buses were perceived to be safer than minibus taxis. The factor analysis further revealed the importance of safety as a factor in passengers' perception of service for both bus and minibus taxi commuters. Structural Equation Modelling revealed safety as being significance and influential on the overall service quality that the public buses provided. The condition of the buses and minibus taxis emerged from this study as an important factor that correlates with the consumer's perception of service. Therefore, public transport organisations should take into account safety in order to improve service.

6.2.6 The Affordability of Service

Service affordability involves value for money and the fares charged by the public transport modes (McKnight, *et al*. 1986).

The study findings showed that buses were perceived to be more affordable than minibus taxis. The factor analysis further showed the affordability of service as an important factor influencing the perceptions of bus and minibus taxi commuters, as may be explained by factor one in both instances. The Structural Equation Modelling showed the affordability as being significance and influential on the overall service quality for minibus taxis. The study findings support the literature reviewed in chapter two and three. Minibus taxi fares are normally a flat rate and higher than the conventional parallel public transport mode which is either the bus and/or the train (Freeman, Ngcoya & Chapman, 1990).

Other researchers agree that the bus service is more affordable than other modes of public road transport (International Association of Public Transport, 2011; South African Bus Operators Association, 2011). In addition, BRT provides cost advantages of road-based public transport (City of Johannesburg, 2006; 2012 & McCaul, 2012). The efficiencies which resulted from the development of a unified network, dedicated infrastructure, and increased passenger numbers has led to fare savings for the commuter. Outside of the BRT system, many passengers are forced to pay multiple fares for a single destination as several transfers are sometimes necessary. The BRT system uses a distance-based fare structure. However, the cost increment for distances is relatively modest in order to ensure that low-income families living on the periphery of the city are not disadvantaged (McCaul, 2012).

The literature review showed that minibus taxi associations determine and regulate their own fares without any involvement on the part of the transport authorities. This practice has been in place since the deregulation of the minibus taxi industry in 1987 (Arrive Alive, 2011a). The efforts of the transport authorities to regulate this industry have met with little success, leaving passengers often dissatisfied with the minibus taxi fares.

The minibus taxi industry does not appear to apply economic models in arriving at the correct fare, which is based on the economics of demand and supply. Nevertheless, economic models have been developed to assist arriving at the correct fares – fares that would have less impact to the disposable income of the commuters, and models that take into account equity and efficiency (Tomazinis, 1975; Farris, *et al*.1976; Centre for Scientific and Industrial Research, 2000; Button, *et al*. 2001; City of Johannesburg, 2003a; 2003b & Meyer

& Onyango, 2005). In addition, it is essential that a fare/income ratio be calculated in order to address the escalation of fares. The average monthly wage for the population of the area served by public transport may be of some use in determining the affordability of the public transport fares (World Bank, 2006). However, it is imperative that the correct balance be found between service and fares charged. Accordingly, the public transport industry should utilise pricing models in order to achieve a balance between service and fares, and take into account the trade-off between equity and efficiency.

Taking into account the above-mentioned discussion, as well as the objectives of the study- exploring passengers' perceptions of service, the study findings showed that, with regards to the perceived affordability of service, buses were perceived to be more affordable than minibus taxis. The factor analysis further showed the affordability of service as an important factor influencing the perceptions of bus and minibus taxi commuters, as may be explained by factor one in both instances. The Structural Equation Modelling showed the affordability as being significant and influential on the overall service quality for minibus taxis. As a result, public transport organisations should take into account affordability in order to improve service.

6.3 Market Structure and Demand for Public Transport

The discussion above focused on the passengers' perceptions of service quality in order to meet the first objective of the study, that is, to explore passengers' perceptions of the bus and minibus taxi services in terms of the service quality dimensions of McKnight *et al*. (1986), namely, reliability, comfort, extent of service, safety; and affordability (RECSA). This section, consequently discusses the extent to which service quality dimensions influence the demand for passenger transport in order to meet the second objectives of this study.

The study findings showed that for each individual scale (RECSA) and mode of transport (buses and minibus taxis), the perceived quality of the mode of transport is strongly associated with the intention to continue using that mode of transport in the future, thus impacting the demand for public transport. Table 6-2 depicts the use of Spearman's rank correlation coefficient to measure the association between each of the individual scales, and the self-stated intention of the respondents of whether to continue using at particular method of transport in the future.

Table 6-2: Association of scales

	Buses	**Taxis**
Reliability	0,59*	0,66*
Comfort	0,26*	0,57*
Service	0,39*	0,59*
Safety	0,48*	0,73*
Affordability	0,51*	0,61*
PSQ Index	0,66*	0,79*

Furthermore, the factor analysis showed the service quality dimensions (affordability, safety, availability, and comfort) as important factors to using public bus transport in the future, whereas safety and comfort may be essential factors to using minibus taxis in the future. The study findings support the literature reviewed in chapter three as discussed below.

A better understanding of the demand for public transport is vital to the provision of an efficient and reliable service (El-Geneidy, *et al*. 2004). The service quality dimensions of a public transportation system are intrinsically associated with the extent to which the services of the system are considered desirable and, therefore, usable from the point of view of the consumers (Tomazinis, 1975).

Unless the service supply profile matches over time and over space with the profile of the demand for service, but also includes the requirement that the services produced meet the quality characteristics that the commuters desire, the commuters will not use the service of the system. In such cases, there is the paradox of a system that is most efficient from the operator's point of view, but is both heading toward bankruptcy and being castigated by its users and would-be users as being completely inefficient from their points of view.

From the passengers' perspective, the ideal service that is likely to increase demand is an efficient service with few stops, characterised by high and predictable demand, and few service reliability problems. As discussed in the preceding discussion, each passenger would like nothing more than for buses, for example, to arrive timeously at stops and termini that are conveniently located (Koffman, 1990), so that that access and egress times are minimised (Murray, 2001 & Kittelson, *et al*. 2003). As regards the Rea Vaya, there are a sufficient number of stops and the average distance between the Rea Vaya stations is approximately 500 metres (City of Johannesburg, 2006).

A major incentive for the increased demand of public transport should be the on-board experience of travelling. Thus, service comfort (an important factor to the future utilisation of service) plays an important role to ensuring that passengers enjoy their journeys, if public road transport in particular is to compete effectively with the private motor vehicle; it is also essential that the aesthetics of public transport should be improved (Mashiri, *et al.* 2010).

Public transport accessibility and availability, discussed in chapter three, are important factors to the demand for public transport, and when used as a marketing tool, the schedule of an operator correlates operator capacity to commuter needs. The result is the optimisation of the service offering that, in turn, increases passenger demand (Farris, *et al.*1976). As regards the Rea Vaya service, on a normal weekday, the Rea Vaya operations have improved the availability of public bus transport (McCaul, 2012).

In order to realise a high degree of safety –as it is important to the demand for public transport – it is essential that all three of the following areas work together smoothly and efficiently, namely, safety of passengers, safety of drivers, and safety of vehicles (McKnight, *et al.* 1986). It is not possible by one individual to bring about improvements in safety – this exercise should be a collective responsibility and a collective spirit is required of all those involved. The convenience, status, and security of the private motor car represent formidable quality standards as compared to any public transport service and several motor car users would, probably, not use public transport regardless of the quality of the system. Accordingly, it is imperative that the marketing of the public transport services be both strategic and tactical because the private motor car offers most of the service quality dimensions not found in public transport (Mashiri, *et al*. 2010).

As regards the affordability of the service, which is a factor in the future utilisation of service, the literature reviewed in the preceding chapters showed that the BRT service has been successful in offering a highly affordable service that is faster than that of private motor cars travelling in mixed traffic lanes. The average distance previously driven by the car users per trip was 18,6 km (McCaul, 2012). The first phase of the BRT system (phase 1A) aimed to capture 10 to 20% of its customer base from the car users (McCaul, 2012), evidence shows that after the implementation of BRT in Johannesburg, 11% of the Rea Vaya passengers had formerly been private motor car users; 63% minibus taxi users; 17% train users; and 8% bus users (McCaul, 2012). This statistics effectively signals to the much increased demand for the bus service, and could be a valuable future study.

To improve demand, the public transport organisations should strive for a better understanding of public transport demand management. These organisations should utilise advanced and sophisticated systems in order to plan and predict demand for the service, while taking into account the many demand curves that exist in the industry, arising from the oligopolistic nature of public transport.

One of the biggest challenges facing public transport is that commuters perceive commuting by public transport as the activity of the poor class in society. Accordingly, there is a need to implement an effective marketing campaign that is aimed at:

- Promoting passenger transport services;
- Eliminating the ignominy associated with passenger transport;
- Opening up access to private motor cars users; who should be prepared to use public transport because it provides all the necessities and the comfort they require;
- Ensuring it is reliable, safe, affordable and available

Social marketing programs could be of value as information instruments in support of transportation demand management (TDM) policies. Such programs can function as an effective channel of communication in building dialogue and garnering wider public support of demand management policy and in delivering important transportation messages directly to commuters (McGovern, 2005).

The literature review showed that traditionally, marketing has not played a major role in the management of most public service sectors. However, marketing is fundamental to the public transport sector as a result of the characteristics inherent in the mobility services. If the transport product consists of a ride between two points, the design of the vehicle and the facilities, as well as ticketing, information, and behaviour, may influence the mode of transport chosen (International Association of Public Transport, 2011). Thus, understanding the behaviour of commuters, especially as regards their choice of mode is important to modelling optimal strategies for public transport management. Commuter mode choice is based on the theory of discrete choice models, which describes individuals' choices between competing alternatives. The hypothesis underlying the discrete choice models states that

when, faced with a choice situation, an individual's preference as regards each alternative may be described by a utility measure associated with each alternative (Bingfeng, *et al*. 2007).

Thus, the key to increasing demand for public transport is to ensure consideration of the service quality factors influencing the demand for public transport use, and to ensure that the service is continuously improved and is also perceived to have been improved, relative to the alternative of travelling by private motor car. Simultaneous improvements to both motor car and public transport travel are not likely to result in an increase in the public transport mode share.

Taking into account the above-mentioned discussion, as well as the objectives of the study – the extent to which service quality dimensions influence the demand for passenger transport –the conclusion may, thus, be drawn that it would be possible to improve the current use of the public transport system through behaviour change and through improvements to comfort, availability, safety, affordability of the bus service, and improvements to safety and comfort of the minibus taxi service as these were important factors to public transport future utilisation.

6.4 Importance of Service Quality Dimensions

The study findings showed summary statistics in respect of the importance attached to each of the five dimensions of quality of service, on a scale of 1 (less important) to 5 (very important). All five service quality dimensions, namely, reliability, extent, comfort, safety, and the affordability of service were considered as important service quality dimensions to public buses and minibus taxis. Both the factor analysis and structural equation modelling confirmed this; the factor analysis showed the service quality dimensions (reliability, extent, comfort, safety, and affordability) as being important factors to the bus service and the minibus taxi service. The study findings supports the literature reviewed in chapter two and three, as shown the following discussion.

Other researchers, who conducted a study on the public transport services in Oradea, support these findings. In this study in Oradea, it was established that, amongst others, safety and reliability were the important dimension of public transport services in Oradea. This was evaluated on a scale ranging from 1 to 5, from not important to major importance with the score of the most important characteristic being 4,33 (Simona, 2010). The study findings are also supported by the findings of the other researchers (Budiono, 2009). In this latter study

conducted on the overall customer satisfaction with public transport, the factor analysis grouped fourteen specific service quality dimensions into two factors, namely, the functional factors focusing on variables such as reliability, punctuality, and so forth and the soft factor focusing on comfort. Both the functional quality factors and the soft quality factors demonstrated a significant effect on the overall customer satisfaction with public transport. In addition, comfort of service was one of the top four factors that positively correlated with overall satisfaction (Budiono, 2009).

According to Tomazinis (1975), the dimensions of quality may further be divided into two groups. The first group is associated primarily with short range considerations in forming trip patterns. This group includes quality dimensions such as convenience of getting to and from the vehicle, comfort in riding (such as finding a seat), and frequency of service.

From the point of view of the commuter, the second group of quality dimensions for urban transportation systems is pervasive in nature, with pronounced, long-range, delayed impact on ridership patterns and modal choices. Among such dimensions, the reliability of the system as regards its current and long range performance often received the highest rating, followed by the availability of service.

Taking the aforementioned into account, it is, thus, clear that a focus on improving the service quality variables may yield the desired positive results as regards attracting new users and retain existing ones. It is, thus, important that more attention be paid to the functional and soft factors, as demonstrated in this study and supported by other researchers (Budiono, 2009 & Simona, 2010) in order to improve and develop attractive and marketable public transport. Commuters choose the mode of transport that delivers on the important dimensions as perceived by them. A passenger transport service that delivers on these dimensions is also likely to increase the future demand for its service, as stated in the preceding discussion. However, public transport organisations should understand that if passengers are dissatisfied with the service quality of one particular transport provider, theoretically they would not be able to switch to alternatives instantaneously without severe discomfort in the short-term as a result of the inelastic nature of demand as discussed in this study (Taxan, 2007). However, according to Texan (2007), in the medium to long term, switching modes is significantly more practical and feasible.

Taking into account the above-mentioned discussion, as well as the objectives of the study- the importance of service quality dimensions, the study findings provided essential information as to the important service quality dimensions in public transport. As stated in

the aforementioned discussion, all five service quality dimensions, namely, reliability, extent, comfort, safety, and the affordability of service were considered as important service quality dimensions to public buses and minibus taxis.

6.5 Conclusion

This chapter discussed the research findings as they relate to the study objectives. The focus of public transport should be the provision of service that aims both to meet and to exceed the expectations of commuters, thus maximising their satisfaction and minimising their dissatisfaction. This chapter discussed the passengers' perceptions of service. The discussion was based on the study findings and the literature reviewed in chapter two and three of this study.

As regards the study findings, the PSQ index showed that buses were perceived as offering better quality of service overall than minibus taxis, while the Importance-Weighted PSQ Index showed that buses were perceived as offering better quality overall than minibus taxis after weighting each scale according to its perceived importance. In addition, for all the individual scales except extent of service, as well as the overall index (and weighted index), it was possible to reach a definite conclusion that the perceived quality of bus transport exceeded that of minibus taxis by a significant margin. Those commuters who used buses more often tended to have a higher opinion of the quality of bus transport than those who used minibus taxis had of the quality of minibus taxi transport. In addition, those commuters who used the minibus taxis did not do so because they had a high opinion of the quality of the minibus taxi experience. For each individual dimension and mode of transport, the perceived quality of the mode of transport was strongly associated with the intention to continue using that mode of transport. The service dimensions were all considered very important. Factor analysis and structural equation modelling further confirmed the factorability and influence the dimensions have on the service quality provided by buses and minibus taxis. The study findings were rated to the study objectives. Furthermore, the study findings supported the literature reviewed in chapter two and three, with regards to service quality dimensions as being a factor in passengers' perceptions of service, future utilisation-demand, and importance of service quality dimensions.

The study findings allows the researcher to reach conclusions and make recommendations about public road transport in the following chapter - specifically about the passengers' perceptions of service, the future utilisation of bus and mini-bus taxi service, the importance

of service quality dimensions in modal choices, and the strategies to improve service if public transport organisations are to retain existing users and attract new users.

CHAPTER SEVEN

Conclusions and Recommendations

7.1 Introduction

This section discusses the conclusions drawn on the study objectives and the research problem, as well as the recommendations of the study.

7.2 Conclusions

The conclusions drawn from the study are based on the following research objectives and research questions:

Table 7-1: Research objectives and research questions

Research objectives	Research questions
• Exploring commuters' perceptions of the bus and minibus taxi services in terms of the service quality dimensions of McKnight *et al*. (1986), namely, reliability, comfort, extent of service, safety and affordability (RECSA)	• What are the passengers' perceptions of the service quality in the bus and minibus taxi industries?
• Ascertain the extent to which the service quality dimensions may influence the future demand for public transport	• To what extent would the passengers' perceptions of service quality influence the future demand for buses and minibus taxis?
• Determine the importance of each service quality dimension in choosing a public transport mode	• What is the importance of each service quality dimension in choosing a passenger transport mode?

The study findings met the research objectives and resolved the research questions as discussed below.

7.2.1 Passengers' Perceptions of Service

Considering the research objective and the research question related to the passengers' perceptions of service, the study findings showed that the reliability, comfort, extent of service, and safety all were influential on the overall service quality that the public buses provided, while reliability, affordability and service all were influential on the overall service quality that the minibus taxis provided. Furthermore, the summary statistics and histograms for each of the individual scales, as well as summary statistics and histograms for both the Perceptions of Service Quality Index and the Importance-Weighted Perceptions of Service Quality Index, in the aforementioned discussion showed that for all of the individual scales – except extent of service (service), as well as the overall index (and weighted index) - it was possible to draw a definite conclusion that the perceived quality of bus transport exceeds that of minibus taxis by a significant margin. Put differently, public buses were perceived by the commuters more positively than minibus taxis in terms of the reliability, comfort, safety, and affordability of service.

The multiple linear regression analysed the relationship between the Perceived Quality of Service Index for Buses and the demographic variables (mode of transport used the most often, age, gender, educational level, and income). In this case, only the coefficient of mode of transport was statistically significant and was estimated to be -5.43 with a p-value of 2.69e-10.

A conclusion could be reached that those commuters who used buses more often than minibus taxis, on the one hand, tended to have a high opinion of the quality of bus transport. However, this is not surprising since, presumably, they would not use buses if they had an extremely low opinion of this mode of transport. On the other hand, those commuters who used minibus taxis as their primary mode of transport, as suggested by the study finding, did not do so because they had a high opinion of the quality of the minibus taxi experience. This outcome was explained by the multiple linear regression, which indicated that the coefficient for the mode of transport used the most often was not significant.

In addition, the multiple linear regression showed that age, gender and level of education were all statistically significant in this model at the 5% level. Age had a negative coefficient, indicating that, on average, younger people have a more favourable perception of minibus taxis than older people. Gender had a positive coefficient, indicating that, on average, females perceive minibus taxis more favourably than males. On the other hand, educational

level had a negative coefficient, indicating that less educated people viewed minibus taxis favourably as compared to more highly educated people.

Furthermore, there were significant differences in the age between respondents in the " under 19 years", "20-24 years" , "25-34 years", "35-50 years" when comparing all those groups to respondents in the group "51 years and above" with respect to the overall service quality. In addition, there were significant differences in the education group between respondents with less than a matric qualification, those with a matric and those possessing a matric and a tertiary qualification with respect to the overall service quality. There were also differences in those who are in the "0-R1000" and "R5001-R6000" income groups when compared to those in the "Above R6000" group with respect to the overall service quality.

The conclusion could be drawn that on average, younger people have a more favourable perception of minibus taxis than older people; on average, females perceive minibus taxis more favourably than males; and on average, less educated people viewed minibus taxis favourably as compared with more highly educated people.

Furthermore, the generalised linear regression showed age, education and income as statistically significant in this model at 5% level since their p-values were all less than 0.05 in influencing the overall service quality provided by the bus. Similarly age, education and occupation were all significant at the 5% level since their p-values were all less than 0.05 in influencing the overall service quality provided by the minibus taxis. The findings enabled the researcher to conclude that age, education and income were all significant in influencing the overall service quality provided by the bus, while age, education, and occupation (not income) were all significant in influencing the overall service quality provided by the minibus taxis.

Furthermore, the SEM analysis showed that the fitted model had a chi-square test statistic of 0.032 with a p-value of 0.876, which is non-significant at the 5% level, thus implying that the conceptual model fitted to the research data was indeed appropriate (Byrne, 2010: 76 & Bollen, 1989: 263). The conclusion drawn from the findings showed that reliability, comfort, service and safety were influential to the overall service quality that the public buses provided, while reliability, affordability and service all were influential to the overall service quality that the minibus taxis provided since their p-values were less than 0.05.

The exploratory factor analysis showed the cumulative variance that three factors (punctuality, timetables, and timeous arrival at destination) were explaining 78.943%.

Furthermore all of these three factors have eigenvalues over 1. The scree plot also confirms the existence of the 3 factors. The first factor (punctuality) accounts for 70.528% of the variation. The rotated matrix revealed that four factors were accounting for the data, that is, punctuality, timetables, timely arrival at destination, and reasons for failure to arrive at destination on time for minibus taxis. From this analysis, a conclusion was drawn that punctuality, timetables, and timeous arrival at destination were influential to the bus service, and punctuality was more influential on the overall bus service; while punctuality, timetables, timely arrival at destination, and reasons for failure to arrive at destination on time were influential to the minibus taxi service.

7.2.1.1 Service Quality Dimensions

The following discussion provides conclusions drawn from the study findings about the reliability of service, comfort, extent, safety, and affordability of service:

(a) The Reliability of Service

As stated in the preceding discussion, the reliability of service includes punctuality, timetables, timely arrival at destination and adherence to routes. The study findings showed punctuality to be an important factor that is significant on the overall service quality, which means that punctuality played a role in the utilisation of public transport. Passengers consider punctuality of service in their mode selection process. Another important factor that may result in the perception of the quality of bus transport exceeding that of minibus taxis is the availability of timetables in the bus industry. The factor analysis confirmed the availability of timetables as an explaining factor one for both bus and minibus taxi service. This means that passengers consider the availability of timetables in their mode selection process as a variable that influences their perception of service.

As regards the timely arrival at destination, the study findings showed that timely arrival at destination is an important factor influencing the perception of service. A total of 74,79% of the variation in the data may be explained by the first three principal components, which includes timely arrival at destination of the bus service. The study findings showed that time taken to arrive at destination is important to explaining factor one for minibus taxi service and factor two for the bus service, meaning that timely arrival at destination is a factor influencing service for both buses and minibus taxis. It would appear from the study findings that adherence to the routes for both bus and minibus taxi commuters is not necessarily a factor in public transport, therefore is not likely to have a substantial impact on the selection of the mode process.

(b) The Comfort of Service

As stated in the preceding discussion, the comfort of service involves the availability of service aesthetics - the availability of seats and space (often referred to as passenger density), smooth journeys, the availability of air-conditioners/coolers, and the condition of the shelters – is discussed. The study findings showed seat availability is an important factor to both buses and minibus taxis. A conclusion drawn from the study findings is that lack of seat availability is likely to attract negative perception of service, which could lead to the reduction of the utilisation of the service.

As regards the shelters at ranks, the study findings showed that the condition of the bus shelters was somewhat less a factor for the bus commuters than for the minibus taxi commuters. Furthermore, the factor analysis showed bus shelters as poorly rated as a factor for bus commuters compared to minibus taxi commuters. This means that minibus taxi commuters consider shelters at ranks a factor influencing service quality that needs to be taken into account, while the bus commuters do not consider shelters as an important factor. This could be due to historical reasons, that is, bus shelters being maintained and in better condition as compared with minibus taxi shelters at ranks, discussed in the literature review.

As regards the smoothness of the service, the study findings showed smoothness of the service as a more significant factor for minibus taxi commuters than for bus commuters. Regarding air-conditioners/ air-coolers, the study findings showed air-conditioners as being a factor more for minibus taxi commuters than for bus commuters. A conclusion drawn from the study findings is that smoothness of the service and air-conditioners is a factor passengers perceive as being important to the selection of the public transport mode.

(c) The Extent of Service

As stated in the preceding discussion, the extent of service includes the extent to which a public transport mode take commuters to their exact destinations, service availability, and the friendliness of the frontline staff. The study findings showed that taking passengers to their exact destination is an important factor to passengers. This means that the passengers perceive the extent to which a public transport mode take commuters to their exact destinations as an important factor influencing the passengers' perceptions of service.

As regards the availability of service, the study findings revealed the availability of service in the evenings and on public holidays as being relevant factors that influence passengers' perceptions of the minibus taxi service, while the availability of services on weekdays was

considered an important factor that influences passengers' perceptions of the bus service. As regards the driver friendliness, the study findings showed that driver friendliness is one of the important factors correlating highly with the perception of service of the bus and minibus taxi commuters. Passengers' perception of service is influenced by the availability (and frequency) of service and driver friendliness, since these factors were perceived as being important to public transport. Unimproved availability of service (and frequency) and unfriendliness or the friendliness level of staff could lead to a reduction in the utilisation of public transport, especially when other competing modes of transport are taken into account.

(d) The Safety of Service

As stated in the preceding discussion, safety of service involves the number of accidents related to a transport mode, particularly the passengers' fears that they are more likely to be involved in an accident as a result of using a particular transportation mode; the condition of vehicles; driving behaviour; and obeying the rules of the road. The study findings showed the rate of accidents as being less of a factor for public transport, while obeying the rules of the road, driving skills of drivers and fear of sustaining injuries were all factors perceived as being important to both bus and minibus taxi users. Therefore, a conclusion drawn from the study findings is that passengers' perceptions of both bus and minibus taxi service is influenced by the safety of service with regards to fear of sustaining injuries, condition of vehicles, driving behaviour (and skills), and obeying the rules of the road.

(e) The Affordability of Service

Service affordability involves value for money and the fares charged by the public transport modes. The study findings showed the value for money and the fares charged by bus and minibus taxi organisations as important factors influencing users; perceptions of service, thus affecting the selection of the mode of transport. Therefore, it is likely that commuters will use the mode of transport that is being perceived as offering value for money in terms of fares.

Taking into account the aforementioned discussion, the study findings enabled the researcher to reach the conclusions discussed above related to the passengers' perceptions of the bus and minibus taxi services in terms of the service quality dimensions of McKnight *et al.* (1986), namely, reliability, comfort, extent of service, safety and affordability. Additionally, the study objective related to passengers' perception of service has been met and research question resolved.

7.2.2 Future Utilisation of Service and Demand

As regards the research objective and the research question related to ascertaining the extent to which the service quality dimensions may influence the future demand for public transport, the study findings showed Spearman's rank correlation coefficient for each individual scale (RECSA) and mode of transport (buses and minibus taxis). Spearman's rank correlation coefficient was also used to measure the association between each of the individual scales, and the self-stated intention of the respondents regarding whether they would continue to use that method of transport in the future. The study findings showed that for each individual scale and mode of transport, the perceived quality of the mode of transport is strongly associated with the intention to continue using that mode of transport. Therefore, a conclusion drawn from the study findings is that the perceived quality of the mode of transport is strongly associated with the intention to continue using that mode of transport in the future, thus impacting the demand for public transport.

Furthermore, the factor analysis showed service quality dimensions (affordability, safety, availability, and comfort) as factors to using public bus transport in the future, while safety and comfort may be essential to using minibus taxis in the future. The conclusion drawn from the study findings is that affordability, safety, availability, and comfort are important factors to using public bus transport in the future, while safety and comfort may be essential factors to using the minibus taxis in the future.

The study findings and conclusions drawn from the preceding discussion met the objectives of the study and resolved the research questions related to ascertaining the extent to which the service quality dimensions may influence the future demand for public transport.

7.2.3 Importance of Service Quality Dimensions

As regards the research objective and the research question related to determining the importance of each service quality dimension in choosing a public transport mode, the study findings showed the summary statistics in respect of the importance attached to each of the five dimensions of quality of service, on a scale of 1 (less important) to 5 (very important). All five service quality dimensions, namely, reliability, extent, comfort, safety, and the affordability of service were considered as important service quality dimensions to public buses and minibus taxis. Both the factor analysis and structural equation modelling confirmed this; the factor analysis showed the service quality dimensions (reliability, extent, comfort, safety, and affordability) as being important factors to the bus and minibus taxi services. This necessitates the drawing of the conclusion that the reliability, extent, comfort,

safety, and the affordability of service are considered as important services quality dimensions to public buses and minibus taxis. Furthermore, these important service quality dimensions will play a role in the passengers' choice of either using public transport or using a particular mode of public transport, in this instances buses and minibus taxis.

Taking into account the conclusions drawn from the abovementioned discussion, it is evident that the inquiry met the objectives of the study and resolved the research questions related to commuters' perceptions of the bus and minibus taxi services in terms of the service quality dimensions; the extent to which the service quality dimensions may influence the future demand for public transport; and the importance of each service quality dimension in choosing a public transport mode. Passengers will choose the mode of public transport based on their perceptions of the service quality dimensions. The recommendations of the study will be discussed next, drawing from the findings and the conclusions of this study. However, prior to discussing the recommendations of the study, a discussion of the implications of the study findings for both practitioners and academics will be presented below.

7.2.4 Implications of the Study

The study provides practitioners and academics with solutions to important public transportation challenges. The findings of this study make a contribution to knowledge that will benefit practioners and academics of service quality and public transport, as discussed below.

The rationale of the study outlined how passenger transport makes a vital contribution to the economic and social development of the country, and therefore why access to sustainable, affordable and quality public transport is critical. Public transport integration is important as it provides the rest of society access to the broader economy; as a provider of commuter services, public transport has, and continues to provide mobility to millions of people who are dependent on passenger transport (Crous & Price, 1993; Godard & Fatonzoun, 2002; South African Bus Operators Association, 2006; 2010; Sohail, 2005a & Arrive Alive, 2011a).

Furthermore, commuters have to use buses and minibus taxis, despite their inefficiencies in terms of inadequate service – poorly arranged schedules; the absence of facilities, including bus stops and shelters; the infrequency of services, particularly at off peak times; the inconvenience of these services; unreliable and low levels of comfort due to inefficient

scheduling; high costs; overcrowding leading to severe discomfort; high rates of minibus taxi accidents; unroadworthy vehicles; poor service; and unsavoury business management principles (Thomas, *et al*. 2010; Mashiri, *et al* 2010).

Prior research recognises that there are no viable answers and solutions that have been found with which to address the public transport problems in South Africa (Chakwizira, Mathetha, Mokonyana, Mashiri, & Marrian, 2009). Despite the attempts of the transport authorities to remedy the state of public transport, public transport solutions are falling extremely short of expectations (Thomas, *et al*. 2010). Improving service quality in the public transport has remained an elusive and a much neglected area of study. Service quality remains a challenge for the majority of public transport organisations and academics alike, partly as a result of the challenges inherent in measuring service quality. Therefore, improving and encouraging the use of public transport should be one of the cornerstones of the policies of the national Department of Transport (Mashiri, *et al*. 2010).

Taking the aforementioned discussion into account, the findings of this study have made important contribution to knowledge that will benefit practitioners and academics. In general, the study findings have shown the importance of service quality dimensions in influencing passengers' perceptions of service. It seems that the implementation of the vital service quality dimensions in public transport by practitioners is likely to increase the functionality of the public transport system for the urban population – an item that was categorised in the aforementioned discussion as being stranded. Furthermore, the functionality of the public transport system is likely to improve commuters' participation in the broader economy. For example, the functionality of the public transport system will meet the goal of Rea Vaya, which is to improve the quality of life of Johannesburg citizens through the provision of a high-quality and affordable public transport system (City of Johannesburg, 2012).

In addition, the study findings showed the availability of public transport service as an important factor that influences passengers' perceptions of service. Therefore, passengers will use the public transport service that meets their needs in terms of, amongst others, the availability of service. As a result, practioners needs increase the availability of service. The availability of service contributes towards providing access to facilities that communities require. In a research study that was conducted on the availability of service, it was found that the frequency of service was related to positive satisfaction with the availability of public transport having a positive effect on the demand. In other words,

commuters would be likely to increase their utilisation of the service as a result of its increased availability (Hensher, *et al*. 2003).

The findings of this study suggest the affordability of bus and minibus taxi services as an important factor to the passengers' perceptions of service and modal choices. Therefore, practitioners need to take into account the affordability of service if public transport is to attract users and retain the existing users. The income/fares ratio, as discussed in the study, needs to conform to the norm, depicted as less than 10% of monthly income (South Africa, 1996c; Mashiri, *et al*. 2010; Institute for Democracy in Africa, 2011; McCaul, 2012; Arrive Alive, 2012a & Rea Vaya, 2012). However, such a ratio will arise from the true understanding of the public transport service costs by the practitioners. As a result, practitioners should utilise the economic models of fares determination in public transportation to determine the fares structure that attracts users and retains existing users, while improving the efficiency of the service. The economic pricing model, as discussed in this study, is simply a matter of operator's choice. Acquiring knowledge of all demands, analysing them, and setting up different classes of fares is both time-consuming and expensive while an awareness of all the cost characteristics and applying them to each demand segment requires considerable analytical ability and much effort.

As regards the demand for public transport, the findings of this study suggest that future utilisation of public transport will depend on such important factors such as adequate service, properly arranged schedules, the availability of facilities, including bus stops and shelters; the frequency of services, particularly at off peak times; improved reliability and comfort-ability of service through efficient scheduling; low rates of minibus taxi accidents; roadworthy vehicles, and the presence of facilities at ranks. Therefore, practitioners need to apply important service quality dimensions in order to improve service and increase the demand for public transport. A public transport marketing campaign promoting the important service quality dimensions should be at the centre of communication.

As regards the implications for academics, the evidence from this study suggests that RECSA as a valid and credible model for assessing service quality provides an alternative model to RATER, which is more appropriate for public transport studies, thus supporting other researchers, who showed that the RECSA is an appropriate model for public transport. Therefore, failure to utilise RATER as a measure of service quality does not invalidate the research (McKnight, *et al.* 1986). It is suggested that academics should utilise RECSA model for public transportation research. The study's contributing to knowledge in this regard cannot be overemphasised. Furthermore, RECSA as a model of service quality in

public transportation studies should be utilised by practitioners in order to develop appropriate measures to attract users and retain existing users.

Taken together, the study suggests that there is evidence that policy makers and commuters at large expect that public transport will play a more decisive role in shaping the socio-economic landscape of Johannesburg, and South Africa, since public transport has become a central focus area in recent times (McCaul, 2012). The study makes a contribution to knowledge, and contributes towards improving the quality of public road transport service in order to attract new users and retain existing users.

7.3 Recommendations

The following section discusses the recommendations of the study, taking into account the aforementioned discussion of the study findings and the conclusions drawn from the study as related to the study objectives and research questions. The discussion, henceforth, will focus on the recommendations with regards to passengers' perceptions of service in terms of service quality dimensions, RECSA; future utilisation and demand; and the importance of service quality dimensions.

7. 3.1 The Reliability of Service

The reliability of service is a factor that influences passengers' perceptions of service. The following discussion will focus on specific reliability of service variables arising from the study findings and the conclusions drawn from the study.

- Punctuality of service

  Since, according to the study findings, the passengers' perception of service is influenced by the punctuality public transport organisations and policy makers should place more emphasis on the punctuality of service as an important factor to the overall service quality. Accordingly, public transport organisations should implement business processes and TDM systems that improve the punctuality of service; for example, these organisations should focus on service planning software, such as, amongst others, MICROBUS and Mentor Streets Schedule Software Suites, successfully implemented in other countries, and should discontinue the current outdated, paper-based systems. The service planning systems need to enable the efficient planning of service routes, trips, vehicles, drivers and shifts. Furthermore, these systems need to take into account both

internal and external factors likely to negatively affect the punctuality of the service, as a result of delays on route. The service planning systems should be obligatory for any public transport organisation serious about improving public transport and operational efficiencies. The service planning system should, further, simplify the much needed integration of public transport. However, focusing on the systems alone may not necessarily be the only solution to improving the punctuality of service. Accordingly, a combination of tools and related processes should be considered, for example, skilled operators of service planning systems will be required to analyse service data, make the necessary adjustments to service, draw conclusions, and make recommendations to improve the service.

As regards the minibus taxis, there are no efficient service planning systems that are being utilised by the industry. The minibus taxi industry, should, therefore, invest in service planning software in order to maximise the economic and operational efficiencies of the service. Furthermore, service planning systems will provide a mechanism not only to plan routes, trips, shifts, and driver's rosters but will also adequately address unexpected service interruptions and facilitate the integration of the minibus taxi service with other modes of public transport, such as the Gautrain and BRT service. Service planning systems, at the very least, should enable the minibus taxi associations to achieve operational efficiencies and maintain electronic records of routes, drivers, vehicles on each trip, vehicles on routes, and other service information, all of which will be important to the efficient future integration and optimisation of service.

As regards the communication with passengers, the study findings showed communication as being not a highly relevant factor influencing passengers' perceptions of service, however communication is important to the overall service quality. Communication systems are an integral aspect of an efficient and effective public transport system; therefore they should be included in the service mix. In order to enhance the overall service quality, the public transport organisations should implement communication systems, such as, amongst others time-tables, internet messaging, smart messaging systems, terminal electronic displays, on-board passenger communication systems, mobile communication units, and call centres. Furthermore, public transport organisations should integrate the service planning systems with website-based communication systems, such as the PublicTransport@SG system implemented

in Singapore. The website offers an interactive map that covers bus and rail trips and the site also features a simple calculator to compute fares. The transport department should launch and market MyTransport.SG, a portal that consolidates information and e-services for all land transport users, including motorists and cyclists. MyTransport.SG Mobile can give commuters this information on mobile devices, including real-time bus arrival information that is also shown on display panels at all bus stops across Johannesburg.

- Availability of timetables

  Timetables, as a factor that influences passengers' perceptions of service, should be implemented as a norm for public transport. Furthermore, timetables, as used by passengers as a point of reference, are important and relevant to the overall service. As a result timetables should be taken into account by the public transport organisations in the scheduling process because the dissemination of information to passengers is critical to the successful operation of public transport services and in maintaining and stimulating demand. Timetables are part of the service offering. A lack of access to both timetables and general service information regarding the fares, trips, routes, route maps, times, and customer care numbers, therefore may lead to commuters choosing another mode of transport, such as private motor vehicles, thereby hastening the demise of public transport in South Africa. Lack of timetables may be construed as a breaking of trust between operator and passengers. Implementing timetables is important because passengers interpret them as a form of contract or as a declaration of commitment on the part of the transport organisation to provide them, as the passengers, with certain travel services.

  In addition, timetables may be utilised as a marketing tool as they should, at least, reflect the frequency of the service on each route as well as the fare being charged for the service. As regards the minibus taxi service, word of mouth has been shown in this study to be more important to the minibus taxi industry as regards the dissemination of information to passengers regarding routes and service than the issuing of timetables, which are often seen as a cost to the minibus taxi operations. Therefore, the minibus taxi industry should not make changes that have not been thoroughly researched with regards to timetables. However, going forward, it is likely that timetables will become an important tool to the integration of the public transport services. Therefore, there is a need to start introducing timetables to the service to facilitate the integration with the

other modes of public transport. Alternatively, the minibus taxi service should be restructured and be absorbed into a metred-taxi service.

- Timely arrival at destinations

  The study findings showed that timely arrival at destination is an important factor influencing passengers' perceptions of service. Therefore, passengers will utilise the service provided it provides a perceived satisfactorily timely arrival at destination. As a result, public transport organisations should take into account timely arrival of vehicles at destination. Accordingly, public transport should pay attention to seeking methods on an on-going basis to improve the timely arrival at destination. Increasing the frequency of the service on each route may improve the arrival times. In addition, easy and convenient access to the timetable would enable passengers to plan trips and to estimate the time it would take to arrive at destination. There may be serious consequences to the failure to arrive at destination on time because the majority of commuters travel not merely for the pleasure of commuting, but to realise their personal and professional objectives, hence the derived nature of the public transport demand. It is, thus, important to minimise the route disturbances which may result from factors both within and outside the control of the public transport operator.

  Failure to arrive at destinations on time may also be caused by the journey length and, thus, if the length of the journey is too long, this may lead to perceived passenger dissatisfaction. The journey length affects both the health and the productivity of passengers. Other research, discussed in chapter three, has shown that long journeys tend to have a negative effect on the health and productivity of passengers. Therefore, if it is not possible to reduce the length of the journey because of the public transport system design, then comfort of service should be improved. Improved service comfort is likely to minimise the passengers' fatigue and improve productivity. Furthermore, improved aesthetics of the service may lead to the future utilisation of public transport service because comfort is an important variable that correlates positively with passengers' perceptions of service, as discussed below.

  As regards journey length, the study findings showed that time taken to arrive at destination is important to explaining factor one for minibus taxi service and factor two for the bus service, meaning that timely arrival at destination is a

factor influencing service for both bus and minibus taxis. Therefore, passengers' perception of service is influenced by journey length. Long journeys are not conducive to a productive labour force, as discussed in the foregoing section, due to some medical conditions somewhat associated with long journeys, travelling to and from work. Journey length should be reduced where possible, and such a reduction could be achieved through a government policy that encourages commuters (through incentives such as a reduction in property registration tax for home buyers or subsidised rentals) to live as close as possible to their places of work. A large number of commuters (predominantly African) live in townships which are some distance from the cities and their places of work and, thus, in turn, creates further stress to an already stressed community. Unfortunately, the poor are more affected in this way than the rich and a high percentage of the disposable income of the poor is therefore spent on public transport.

7.3.2 The Comfort of Service

The study findings showed that, with regards to the perceived service comfort, buses were perceived as more comfortable than minibus taxis. Furthermore, the comfort of service was perceived as being influential and significant on the overall service quality of public buses.

As stated in the aforementioned discussion, service comfort may mitigate the negative experience of long transport journeys while also improving the health and productivity of passengers. However, the opposite is equally true in that the lack of comfortable service is likely to have a negative effect on the health and productivity of passengers.

It is, thus, important that the bus and minibus taxi industries focus on improving the comfort of service since the lack of comfortable service may result in the negative perception of the service and adversely affect the future utilisation of both bus and minibus taxi service. Accordingly, in order either to maintain or to improve passengers' perceptions of the comfort of service, the following variables should be considered:

- Availability of seats

  The study findings showed seat availability is an important factor to both bus and minibus taxis. As a result, the lack of seat availability is likely to attract negative perception of service, which could lead to the reduction of the future utilisation of service.

If the passengers are not able to find seats in public transport most of the time, long and uncomfortable journeys are likely to cause a negative perception of service. As discussed in the previous section, communication is vitally important and, thus, information about the availability of seats should be displayed on vehicles and on electronic boards at bus and minibus taxi terminals as well as at other key points along the route, including the designated public transport stops. Seat availability also reflects the demand for the service and, thus, if vehicles are always full to capacity, this could means that the demand is exceeding the supply, as a result, more vehicles should be placed on the route instead of increasing the fares in an attempt to manage the demand, as it often happens in public transport.

Furthermore, a load factor for each public transport vehicle should be established, similar to the BRT system. In the aforementioned discussion, a load factor of 80% was recommended for the Rea Vaya service. However, it emerged in the same discussion that this target has not been adhered to, and the vehicles are often full in excess of 90% capacity. The mandatory introduction and subsequent enforcement of the load factor should provide a deterrent to the overloading phenomenon. The enforcement of a load factor in public transport should further assist in reducing the number of accidents caused by overloading.

- Availability of air-conditioners

  The study findings showed the availability of coolers (or air-conditioners) as an important factor to the overall bus and minibus taxi service. This means that the passengers' perception of service is influenced by the availability of air-conditioners. Since the air-conditioners form part of the aesthetics of the service, the public buses and minibus taxis should be fitted with the necessary aesthetics in order to improve the comfort of the service, in this instance, the public transport vehicles should be fitted, at the very least, with the air-conditioners. The aesthetics of the vehicles will, in turn, further assist the public transport organisations to compete more effectively with the private motor car, which has the comfort sought by the commuters. A comfort rating for both buses and minibus taxis should be established, enforced, and be communicated to the current users and the future users of the service. Those public transport vehicles with a high comfort rating are likely to be preferred

over those with a low comfort rating, however further research is required in this regard as this falls outside the scope of this study.

- Condition of shelters

  As regards the condition of shelters at ranks, the study findings showed that the condition of the bus shelters was somewhat less a factor for the bus commuters than for the minibus taxi commuters. Furthermore, the study showed bus shelters as not being highly perceived as a factor to bus commuters compared to minibus taxi commuters. This means that minibus taxi commuters consider shelters at ranks a factor influencing service quality that needs to be taken into account, while the bus commuters do not consider shelters as an important factor. Therefore, there should be visible improvements to the minibus taxi shelters in Johannesburg. Some work seems to be done in terms of upgrading the various minibus taxi ranks in Johannesburg; however more could be done to reduce the backlog of the dilapidated shelters at ranks.

  Furthermore, there is a need for an on-going effort to improve the conditions of the public transport shelters (for both buses and minibus taxis) on the part of the City of Johannesburg as failure to do so will create a negative perception of service on the part of both bus and minibus taxi commuters. Historical reasons have led to the dilapidated state of shelters, particularly, that of the minibus taxi ranks, however there is evidence that more is being done by the City of Johannesburg to improve the minibus taxi ranks in Johannesburg. It is the responsibility of the government, supported by the private sector, to improve the public transport infrastructure in the same way in which the City of Johannesburg has the responsibility to create an enabling environment for the efficient provision of the public transport service. The disintegration of the public transport infrastructure is likely to be extremely costly in the long run for Johannesburg and for the country at large. There is, also a need to integrate the public transport infrastructure to the benefit of both commuters and operators.

  It is, thus, essential that an integrated public transport infrastructure programme be developed. In addition, the minibus taxis should be allowed to use the BRT dedicated lanes, bus shelters and bus terminuses as part of the integrated public transport system to effectively enhance transport services across the board. It would appear that the name BRT is problematic for some sections of the public

transport sector, including the minibus taxi industry, and, as a result, it should be revised to Public Transport Rapid Transit (PTRT).

7.3.3 The Extent of the service

As regards the extent of service, the study findings showed no significant differences in the passengers' perception of overall service for buses and minibus taxis. Furthermore, the perceived quality of the bus service did not exceed that of the minibus taxi service with regards to the variables such as the availability of the service.

After conducting the factor analysis, the extent of service was perceived as being influential and highly correlated to the service quality that the public buses and minibus taxis provided. In addition, the extent of service was found to be one of the top five important factors that correlate positively with the perception of service on the part of both bus and minibus taxis. The following extent of service variables should be considered in order to enhance the passengers' perception of service:

- Taking passengers to their destination

  Taking passengers to their exact destination was perceived as being more important than the availability of the service for bus commuters. As stated in the aforementioned discussion, taking passengers to their exact destination means minimising passenger transfers common in public transport. However, such a strategy would require the proper integration of the road (public bus and minibus taxi) service and with the other modes of public transport, including rail (both Metrorail and Gautrain). Together, the elimination of transfers and the proper integration of the public transport services should be the focus of the public transport policy makers, henceforth, because it is believed that such a strategy would completely overhaul the public transport service and, as a consequence, increase the utilisation and the demand for public transport. Shopping and meeting facilities should be integrated with the public transport network; such a strategy is similar to that found in Paris, France, and other first world countries who have also implemented the BRT systems. The BRT Rea Vaya methodology or network for Johannesburg does not incorporate shopping and meeting facilities, thus, Rea Vaya is not likely to overhaul the public transport system in Johannesburg and in other part of the country where BRT system has been implemented. Furthermore, the BRT system has not been able to adequately address both passenger transfers and proper integration

conundrum with the existing public bus and minibus taxi service. Instead, BRT is a mere extension of the SPTN and the ICDS models intended to address the integration and the optimisation problem but has not been able to do so adequately, as was indicated in the aforementioned discussion.

- Availability of service

  As regards the availability of service, the study findings revealed the availability of service in the evenings and on public holidays as being relevant factors that influence passengers' perceptions of the minibus taxi service, while the availability of service on weekdays was perceived as being important to influencing the passengers' perceptions of the bus service. The availability of service affects passengers' perception of service for both bus and minibus taxis. Accordingly, one approach to increase the availability of service is to increase the frequency of the services, especially on weekdays when the demand is high during peak periods.

  Service planning systems, discussed in the previous section, are important to ensuring the availability of the service. The shift structure that is likely to improve the availability of service should include service on weekdays (start at 04:00 and end at 23:00), weekends (start at 04:00 and end at 02:00 the following day), and public holidays (start at 05:00 and end at 22:00). The Rea Vaya service, for example, starts at 04:50 and ends at 22:00 during the week; and starts at 05:00 and ends at 22:00 over weekends (McCaul, 2012 & Rea Vaya, 2012).

- Friendliness of drivers

  The study findings showed driver friendliness as an important factor to both bus and minibus taxi services. Furthermore, the friendliness of drivers influenced passengers' perception of both buses and minibus taxis. The friendliness of the minibus taxi and bus drivers is likely to be observed mostly during communication encounters with commuters.

  In order to improve the service, public transport drivers should be compelled to attend customer service training, and quarterly assessments on the impact of the training on customer service should be conducted.

In addition, public transport drivers should be thoroughly screened prior to being employed as drivers. A qualification in customer service, experience in driving, a clean criminal record, a clean record of traffic offences, and knowledge of the rules of the road should be introduced as the minimum requirements for a professional driver's permit. In addition, training programmes, similar to the NSW programme, should be implemented. The driver who has either not attended or passed this training should be refused the renewal of his/her PrDP. Drivers should also be compelled to sign a code of conduct; any deviation to the code should be punishable. It should also be made mandatory for public transport drivers to attend behaviour-correction courses as well as to participate in community projects from time-to-time. The driver's recognition awards introduced by the Department of Transport constitute one of the positive initiatives implemented by the department; however, commuters should be involved in the selection of the deserving drivers being awarded.

7.3.4 The Safety of Service

The study findings showed safety as influential and significance on the overall service quality. In particular, buses were perceived as being safer than minibus taxis. The safety of public transport remains an important factor in South Africa. Despite the decline in fatal road crashes, albeit at a slow rate, it is essential to focus on safety of public transport. Safety shortfalls have the potential to negatively affect the passengers' perception of service if left unattended by the public transport policy makers.

It has been established that the human factor is the single, biggest contributor to fatal road accidents and, therefore, future road safety strategies and activities should focus on the human factor. The minibus taxi drivers, in particular, speed from one point to the next in order to maximise revenue and in the process cause accidents. As indicated in the preceding discussion, the integration of the minibus taxi transport with the other modes of public transport should minimise speeding from one point to the next in order to maximise revenue.

A National Task Team (NTT) on public transport safety should be established to focus on improving public transport safety; and provincial structures, reporting to the NTT, should also be established to implement safety programmes throughout the calendar year, instead of only focussing on the busy seasons of the year.

In addition, the regularisation/ governing of the speed limit to 120km per hour for private motor cars and 60km per hour for public transport vehicles should be introduced. Furthermore, motor vehicle manufacturers should face heavy penalties for failure to comply with the policy. The following additional safety variables should be considered to improve the passengers' perception of safety in public transport.

- Vehicle condition

  The condition of vehicles contributes to the safety of service. A smart and safe vehicle is more likely to attract passengers than an unsafe and poorly maintained one. The Minibus Taxi Recap programme, discussed in the literature reviewed, is facing challenges as a result of the uproar from the minibus taxi industry, accusing the transport departments of favouring the bus industry at the expense of the minibus taxi industry. The programme is important to the recapitalisation of the minibus taxi industry, and therefore should be enforced. However, proper consultation should continue in order to address concerns of the industry.

- Driving skills

  In order to improve the driving behaviour and the skills of the public transport drivers, rigorous training on customer service should be implemented. In addition, the TaxiCare Plus Silver Level training course for drivers should be implemented in order to improve the safety of service. Furthermore, public transport organisations should implement driver and vehicle monitoring systems in order to monitor both driving behaviour and vehicle performance to improve safety.

7.3.5 The Affordability of Service

The study findings showed the value for money and the fares charged by bus and minibus taxi organisations as important factors influencing passengers' perception of service. Therefore, it is likely that commuters will use the mode of transport that is being perceived as offering value for money in terms of the fares. Furthermore, buses were perceived as being more affordable than minibus taxis.

It is evident that affordability of service is an important factor. In addition, since the affordability of service affects the income/fares ratio, there is a need to pay attention to pricing, especially fares determination in order to improve the affordability of service.

Therefore, market forces of demand and supply should determine the equilibrium fare and service. To extend the equilibrium model discussed in chapter three of this study, it is recommended that fares should be based on the service offering in terms of the reliability, comfort, availability, and safety of service and the class of service, as shown in Table 7-2:

Table 7-2: Public Transport Service Rating Model

Mode of transport	Service Rating (reliability, comfort, availability, affordability)	Classification	Fares
Buses	PT1,2,3	A,B,C	R100, R200, R300
Minibus taxis	PT1,2,3	A,B,C	R100, R200, R300

Therefore, a superior service (to be referred to as Class 1) should attract a higher fare, and an inferior service (to be referred to as Class 3) should attract a lower fares. This means that a public transport service rating should be established. Furthermore, to determine the classification of service, service quality dimensions should be taken into account. All public transport modes should be classified according to the established service rating, as per the example shown in Table 7-2. However, enforcing the classification of service could be a challenge. It requires the cooperation of both the bus and minibus taxi industry.

7.3.6 Future Utilisation of Service and Demand

As regards the future utilisation and demand for public transport, the perceived reliability, comfort, safety, extent, and affordability of both bus and minibus taxi service are all important factors strongly associated with the intention to use the modes of public transport in question in the future. Both the factor analysis and structural equation modelling confirmed this; the factor analysis showed the service quality dimensions (reliability, extent, comfort, safety, and affordability) as being important factors to the bus service and the minibus taxi service. Therefore, in order to increase the utilisation of the buses and minibus taxis in the future, and reduce the use of private motor cars, it is essential that the reliability, comfort, extent of service, safety, and affordability of the public transport modes, in particular, buses and minibus taxis, be improved.

A public transportation model that will be based on the perceived important service quality dimensions, in question, is likely to increase the demand for public bus and minibus taxi transport. In addition, public transport organisations should develop appropriate strategies

(including inter alia, utilising service planning systems) in order to improve service, thus retaining current users and attracting new users. Furthermore, public transport organisations should cooperate in order to influence public transport policy and find long term solutions to complex, public transportation problems. In addition, public transport operators need to focus their attention on the delivery of the service they provide, while taking into account the RECSA as important service quality dimensions if they are to improve passengers' perception of service. Thus, the public transport operators should ensure that they communicate often, accurately and objectively about their service offering as well as about what passengers may expect from the service they are offering.

As regards the public transport policy, government should create an enabling environment that promotes public transport. Competition on routes should be encouraged in order to promote innovation and improve the quality of and demand for service. Competition on routes is likely to lead to a more reliable, responsive, available, comfortable, safe, and affordable service. In addition, public transport organisations should be free to expand or contract their service offerings, make alterations where necessary, or find new uses for existing service offerings depending on the supply and demand.

Furthermore, public transport should be deregulated (instead of increased regulation) in order to promote competition, particularly where such regulation is having a harmful effect on the industry. Deregulation is likely to encourage innovation and a competitive pricing policy, both of which would benefit the passengers. Furthermore, self-regulation of the industry is likely to improve the quality of service and create a positive passenger perception of service. Public transport should also not be required to operate on unprofitable routes without proper compensation for losses in profit.

The public transport networks should be efficient. However, on-going research and proper consultation with both the commuters and other stakeholders should be prioritised before the network is expanded in order to ensure that the needs of the commuters are matched with the needs of the providers of the public transport services. A balance should be found between the public transport infrastructure needs and the short-term, socio-economic needs of the citizens. Infrastructure investments should not be an unreasonable burden on the commuters and the citizens at large and, thus, various infrastructure financing models should be investigated in an attempt to lessen this burden.

Consideration should be given to the fact that South Africa is a third world country, therefore if preferred, the western public transport system should be adjusted to the environment and

conditions of the third word, developing country, such as South Africa. Other third word or emerging economies with an improved public transport system should be considered rather than showing reliance on Western public transport models, such as those from France. In addition, South Africa's public transport service is dominated by minibus taxis, therefore the public transport model that intentionally or unintentionally is perceived to exclude the minibus taxi industry is not likely to be sustainable in the long-term in achieving public transport integration and optimisation – never mind considering the attraction of new users and private motor car users.

7.4 Limitations of the Study

The study data was collected mainly in Johannesburg, as a result the study did not extend to the other eight provinces due to mainly the high costs of data collection. Although data collection can be costly, it is often even more costly to make erroneous decisions or arrive at study findings based upon inadequate information, weak data, insufficient data (sample too small for use in extrapolation), which could result in the research losing credibility, as supported by the other researchers (Korostoff, 2013).

Based on the research design and sampling method for this study, the researcher followed geographical sampling, which enabled the collection of the data that was representative of the public transport population, that is, all the commuters in the City of Johannesburg comprised the population of interest. The sample was valid – and could be extrapolated to the other eight provinces as discussed in chapter four of this study – meaning that the sample represented the characteristics of the population it purported to represent through the selection of bus and minibus taxi terminals using a map and choosing a sample from the list of terminals concerned. This process was deemed to be a realistic and acceptable solution to overcoming the challenge arising from the complexities involved in the process of sampling in the public transport context, where the choice of a probability sample is always a challenge (McKnight, *et al.* 1986 & Cooper & Schindler, 2001).

Thus, sampling bus and minibus taxi terminals provided a sample of commuters using public bus and mini-bus taxi transport services. The research conducted by the Burbidge City Bus Company applied non-probability sampling techniques in order to select the sample required. Area sampling technique, a form of cluster sampling, is often used in studies in which there are obvious problems of the unavailability of a practical sampling frame for the individual elements (Cooper, *et al*. 2001).

It is important to take into account the following challenges that were experienced during the interviewing process, namely, the arrival of buses and minibus taxis before the interviews had been completed, thus resulting in incomplete questionnaires that eventually had to be excluded from the sample. Unwillingness on the part of some passengers in answering certain questions was another factor that resulted in some questions being left unanswered. However, other researchers have experienced similar challenges which did not invalidate the results of the study (Barnes, 1989). In view of the lack of records on bus and minibus taxi trips, routes, and ranks in the public transport department, a geographic sampling technique was utilised to select the participants instead of a random sampling technique. However, this challenge is common in public transport research (McKnight, *et al*. 1986).

Finally, the commonly used service quality dimensions (RATER) developed by Parasuraman *et al.* (1986) were not utilised for the study but, instead, the service quality dimensions (RECSA) developed by McKnight *et al*. (1986) specifically for the public transport sector, were utilised, as per the foregoing discussion. Failure to utilise RATER as a measure of service quality do not invalidate the research because an alternative, more appropriate measure of service quality for public transport, was utilised. McKnight *et al*. (1986) maintain that one of the challenges confronting public transport organisations in measuring service quality is that service quality, in particular, is a complex area of study. Furthermore, measuring service quality, particularly in public transport, is made difficult by the subjective nature of service, unlike other services industries. Therefore, an alternative, more appropriate methodology developed and tested by McKnight *et al*. (1986) to measure service quality in the specific context of public road transport was used in this study to measure service quality of bus and minibus taxi service, to overcome the difficulties mentioned above.

7.5 Further Research

The study findings showed that time taken to arrive at destination is important to explaining factor one for minibus taxi service and factor two for the bus service, meaning that timely arrival at destination is a factor influencing service for both buses and minibus taxis. In a study, which was conducted in order to calculate a service quality index for bus transport, it was established that journey length is often the leading cause of dissatisfaction on the part of the commuters. In other words, the majority of passengers are often dissatisfied with the time taken by public transport to arrive at destination (Hensher, *et al*. 2003). Journey length is important because it impacts on the well-being, health and productivity of the passengers. According to Lovelock *et al.* (1987), there is a need to publicise research studies that have

linked the stress of commuting for hours to a range of health problems and productivity in the workplace. Therefore, it is suggested that further research be undertaken to examine the impact of the journey length to the health and productivity in the workplace.

In addition, the Phase 1 of the BRT Rea Vaya in Johannesburg has been completed as discussed in the literature reviewed in chapter two of this study, therefore, it will add value to academic literature to conduct a study examining the service quality dimensions (RECSA), as developed by McKnight *et al.* (1986), and commuter satisfaction in Johannesburg. This research should ascertain satisfaction with the service quality dimensions (including comfort rating) post the implementation of the BRT system specifically in Johannesburg, and generally in South Africa.

7.6 Concluding Remarks

The study addressed the following research objectives and provided answers to the research questions:

- to explore the commuters' perceptions of bus and minibus taxi services in terms of the service quality dimensions of McKnight *et al*. (1986), namely, reliability, comfort, extent of service (service), safety, and affordability.

- to ascertain the extent to which service quality dimensions influence the demand for public transport.

- to determine the importance of each service quality dimension as regards choosing a public transport mode.

As regards the research objectives and the research questions, the study findings showed that the reliability, comfort, extent of service, and safety all were influential on the overall service quality that the public buses provided while reliability, affordability and service all were influential on the overall service quality that the minibus taxis provided. Buses were perceived by the commuters more positively than minibus taxis in terms of reliability, comfort, safety, and affordability of the service. Those commuters who used buses more than minibus taxis, on the one hand, often tended to have a high opinion of the quality of bus transport. However, this is not actually surprising since, presumably, they would not use buses if they had a negative opinion of this mode of transport. On the other hand, those

commuters who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience.

Age, education and income were all significant in the overall service quality provided by the bus and the minibus taxis, and should be taken into account. The important factors that were significance on the overall service quality were punctuality, timetables, and timeous arrival at destination for public buses; and punctuality, timetables, timely arrival at destination, and reasons for failure to arrive at destination on time for minibus taxis.

The utilisation of the buses and minibus taxis will increase in the future, thus reducing the use of private motor cars, when reliability, comfort, extent of service, safety, and affordability of the public transport modes, in particular, buses and minibus taxis, are considered as important service quality dimensions. A public transportation model that will be based on the perceived important service quality dimensions, in question, is likely to increase the demand for public bus and minibus taxi transport.

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APPENDIX 1

The Measurement Instrument

UNIVERSITY OF KWAZULU-NATAL

Graduate School of Business

Dear Respondent,

DBA Research Project

Researcher: Ayanda Menzi Vilakazi (0833869120)

Research Supervisor: Prof. Will Akande (031-2607629)

Research Office: Ms P Ximba 031-2603587

EVALUATING SERVICE QUALITY IN THE SOUTH AFRICAN ROAD PUBLIC TRANSPORTATION INDUSTRY: A CASE STUDY OF JOHANNESBURG

The purpose of this survey is to solicit information from you regarding your perception of service quality in the bus and mini-bus taxi industries in Johannesburg. The information and ratings you provide will go a long way in helping us to identify the service quality levels in the South African bus and mini-bus taxi industries. The questionnaire/interview should take 15 minutes only to complete. In this questionnaire/interview, you are asked to indicate what is true for you, so there are no "right" or "wrong" answers to any question. Work as quickly as you are able to. If you wish to make a comment, please write it directly on the booklet itself. Make sure not to skip any questions. Thank you for participating!

SECTION 1: SCREENING QUESTIONS

A. Do you use public transport in commuting to work?

1. Yes	2. No

If no, please indicate why you do nott use public transport. Probe fully then close interview.

_____

_____

_____

B. Please indicate the mode of transport used most often (minimum 3 times per week).

1. Public Bus	2. Minibus Taxi	3. Metro Rail Trains

If selected (3), why do you use rail the most often? Probe fully then close interview.

_____

_____

If selected (1), ask question c below.

C. Name public buses used:

_____

SECTION 2: QUOTAS

A. Area

1. Durban	2. Johannesburg	3. Other

B. Age

1) Under 19	2) 20 – 24	3) 25 – 34	4) 35 – 50	5) 51 and above

C. Gender

1. Male	2. Female

SECTION 3: DEMOGRAPHICS

A. What is your current occupation?

1. Full-time employment	2. Part-time employment	3. Student	4. Scholar	5. Self-employed	6. Unemployed

B. Please indicate your highest level of education completed

1. Less than Matric	2. Matric	3. Matric + tertiary qualification	4. Bachelor's degree	5. Postgraduate degree

6. Other, please specify,_____

C. In which nett income bracket per month do you fall under?

1) 0 – R1000	2) R1001 – R2000	3) R2001 – R3000	4) R3001 – R4000	5) R4001 – R5000	6) R5001 – R6000

7) Above R6000

D. How often do you use public buses?

1. Daily	2. Every second day	3. Twice a week	4. Once a week	5. Other

_____

_____

E. How often do you use mini-bus taxis

1. Daily	2. Every second day	3. Twice a week	4. Once a week	5. Other

If other, please specify

_____

_____

SECTION 4: TESTING

A. <u>RELIABILITY</u>

Please tick the appropriate answer:

a) How would you rate public buses in terms of punctuality?

Always on time _____ _____ _____ _____ _____Always late

5 4 3 2 1

How would you rate minibus taxis in terms of punctuality?

Always on time _____ _____ _____ _____ _____Always late

5 4 3 2 1

b) Do you have easy access to public bus timetables?

Strongly Agree_____ _____ _____ _____ _____ Strongly Disagree

5 4 3 2 1

Do you have easy access to minibus timetables?

Strongly Agree_____ _____ _____ _____ _____ Strongly Disagree

5 4 3 2 1

c) Do you always arrive at your destination on time when using public buses?

Strongly Agree _____ _____ _____ _____ _____Strongly Disagree

5 4 3 2 1

Do you always arrive at your destination on time when using minibus taxis?

Strongly Agree _____ _____ _____ _____ _____Strongly Disagree

5 4 3 2 1

d) Are you always informed of the reasons why public buses are not operating on time?

Always _____ _____ _____ _____ _____ Never Informed

5 4 3 2 1

Are you always informed of the reasons why minibus taxis are not operating on time?

Always _____ _____ _____ _____ _____ Never Informed

5 4 3 2 1

e) How satisfied are you with the time it takes for the public buses to arrive at your destination?

Very Satisfied _____ _____ _____ _____ _____ Very Dissatisfied

5 4 3 2 1

How satisfied are you with the time it takes for minibus taxis to arrive at your destination?

Very Satisfied _____ _____ _____ _____ _____ Very Dissatisfied

5 4 3 2 1

f) Do public buses adhere to scheduled routes? (follow one route everyday)

Always _____ _____ _____ _____ _____ Never

5 4 3 2 1

Do mini-us taxis adhere to scheduled routes? (follow one route everyday)

Always _____ _____ _____ _____ _____ Never

5 4 3 2 1

g) Based on your answers to a to f above, are you likely to use buses and minibus taxis more or less often public in the future?

Public buses: more_____ _____ _____ _____ _____ less

5 4 3 2 1

Minibus taxis: more_____ _____ _____ _____ _____less

5 4 3 2 1

B. COMFORT

a) Is it easy to find a place to sit on public buses?

Always _____ _____ _____ _____ _____ Never

5 4 3 2 1

Is it easy to find a place to sit on minibus taxis?

Always _____ _____ _____ _____ _____ Never

5 4 3 2 1

b) How would you rate the smoothness of the journey on public buses?

Very Smooth _____ _____ _____ _____ _____Very Rough

5 4 3 2 1

How would you rate the smoothness of the journey on minibus taxis?

Very Smooth _____ _____ _____ _____ _____Very Rough

5 4 3 2 1

c) Do the public buses which you use have coolers or air conditioners on board?

Strongly Agree _____ _____ _____ _____ _____ Strongly Disagree

5 4 3 2 1

If NOT, how do you feel about the lack of coolers or air conditioners?

Satisfied _____ _____ _____ _____ _____Not Satisfied

5 4 3 2 1

Do the minibus taxis which you use have coolers or air conditioners on board?

Strongly Agree _____ _____ _____ _____ _____ Strongly Disagree

5 4 3 2 1

If NOT, how do you feel about the lack of coolers or air conditioners?

Satisfied _____ _____ _____ _____ _____Not Satisfied

5 4 3 2 1

d) What is the condition of the public bus shelters?

Very good _____ _____ _____ _____ _____ Very Bad
5 4 3 2 1

What is the condition of the shelters at the minibus taxi ranks?

Very good _____ _____ _____ _____ _____ Very Bad
5 4 3 2 1

e) Based on your answers to a) to d) above, are you likely to use public buses and minibus taxis more often or less often in the future?

Public buses: more_____ _____ _____ _____ _____ less
5 4 3 2 1

Minibus taxis: more_____ _____ _____ _____ _____less
5 4 3 2 1

C. <u>SERVICE</u>

a) How often do public buses take you to your exact location?

Always _____ _____ _____ _____ _____ Never
5 4 3 2 1

How often do minibus taxis take you to your exact location?

Always _____ _____ _____ _____ _____ Never
5 4 3 2 1

b) Is there enough public transport available in the area in which you live?, Please answer both sections

<u>Public buses</u>

On weekdays?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

Over weekends?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

On public holidays?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

In the evenings?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

<u>Minibus taxis</u>

On weekdays?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

Over weekends?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagee
5 4 3 2 1

On public holidays?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

In the evenings?

Strongly Agree ___ ___ ___ ___ ___ Strongly Disagree
5 4 3 2 1

d) How would you rate the friendliness of the public bus drivers towards commuters

Very friendly _____ _____ _____ _____ _____ Very unfriendly
5 4 3 2 1

How would you rate the friendliness of minibus taxi drivers towards commuters

Very friendly _____ _____ _____ _____ _____ Very unfriendly
5 4 3 2 1

e) Based on your answers to a) to d) above, are you likely to use public buses and mini-us taxis more often or less often in the future?

Public buses: more_____ _____ _____ _____ _____ less
5 4 3 2 1

Minibus taxis: more_____ _____ _____ _____ _____less
5 4 3 2 1

D. <u>SAFETY</u>

a) What is your opinion of the rate of accidents of public buses?

Very High ___ ___ _____ ___ _____ Very Low
5 4 3 2 1

What is your opinion of the rate of accidents of mini-bus taxis?

Very High _____ _____ ____ _____ _____ Very Low
5 4 3 2 1

b) While on board, do you feel that you may be injured on a public bus as a result of an accident?

Never _____ _____ _____ _____ _____ Always
5 4 3 2 1

While on board, do you feel that you may be injured on a minibus taxi as a result of an accident?
Never _____ _____ _____ _____ _____ Always
5 4 3 2 1

c) How would you rate the overall condition of the public buses used?
Excellent condition _____ _____ _____ _____ _____ Very Poor Condition
5 4 3 2 1

How would you rate the overall condition of the minibus taxis used?
Excellent condition _____ _____ _____ _____ _____ Very Poor Condition
5 4 3 2 1

d) How satisfied are you with the driving skills of public bus drivers?
Very Satisfied _____ _____ _____ _____ _____ Very Dissatisfied
5 4 3 2 1

How satisfied are you with the driving skills of minibus taxi drivers?
Very Satisfied _____ _____ _____ _____ _____ Very Dissatisfied
5 4 3 2 1

e) In your opinion, how often do public bus drivers obey the rules of the road?
All the time _____ _____ _____ _____ _____ Never
5 4 3 2 1

In your opinion, how often do minibus taxi drivers obey the rules of the road?
All the time _____ _____ _____ _____ _____ Never
5 4 3 2 1

f) Based on your answers to a) to e) above, are you likely to use public buses and minibus taxis more often or less often in the future?
Public buses: more_____ _____ _____ _____ _____ less
5 4 3 2 1
Minibus taxis: more_____ _____ _____ _____ _____less
5 4 3 2 1

E. <u>Affordability</u>

a) Does the public bus service offer value for money?
Strongly agree _____ _____ _____ _____ _____ Strongly Disagree
5 4 3 2 1

If disagree or strongly disagree, why?
_____
_____
_____

Do minibus taxis offer value for money?
Strongly agree _____ _____ _____ _____ _____ Strongly Disagree
5 4 3 2 1

If disagree or strongly disagree, why?
_____
_____
_____

b) What would you say about the public transport fares you pay in relation to the service you are receiving?

<u>Public Buses</u>
Expensive___ ___ ___ ___ __ Not Expensive
5 4 3 2 1
Worth it ___ ___ ___ ___ ___ Not worth it
5 4 3 2 1
Fair ___ ___ ___ ___ ___ Not Fair
5 4 3 2 1
Affordable__ __ __ __ __ Not affordable
5 4 3 2 1

<u>Minibus Taxis</u>
Expensive___ ___ ___ ___ __ Not Expensive
5 4 3 2 1
Worth it ___ ___ ___ ___ ___ Not worth it
5 4 3 2 1
Fair ___ ___ ___ ___ ___ Not Fair
5 4 3 2 1
Affordable__ __ __ __ __ Not affordable
5 4 3 2 1

f) Based on your answers to a) to b) above, are you likely to use public buses and minibus taxis more often or less often in the future?
Public buses: more_____ _____ _____ _____ _____ less
5 4 3 2 1
Minibus taxis: more_____ _____ _____ _____ _____less
5 4 3 2 1

F. <u>GENERAL</u>
a) Based on the service quality dimensions, please indicate whether you would use public transport more often or less often in the future? Please complete both sections

Public buses

Reliability:
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Comfort
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Service
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Safety
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Affordability
Use More _____ _____ ____ ____ ____Use Less
5 4 3 2 1

Minibus taxis

Reliability:
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Comfort
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Service
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Safety
Use More _____ _____ ____ ____ ____ Use Less
5 4 3 2 1

Affordability
Use More _____ _____ ____ ____ ____Use Less
5 4 3 2 1

b) How important is each service quality dimension as regards choosing public transport?

Public buses

Reliability:
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Comfort
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Service
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Safety
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Affordability
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Minibus taxis

Reliability:
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Comfort
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Service
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Safety
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

Affordability
Very Important ___ ___ __ ___ ___ Less important
5 4 3 2 1

- - - **END** - -