INVESTIGATION OF COMMUTERS' PERCEPTIONS TOWARDS THE IMPLEMENTATION OF THE BUS RAPID TRANSIT (BRT) SYSTEM: A CASE STUDY OF THE BRT SYSTEM IN POLOKWANE MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

BY

MALULEKE RIVONINGO GETRUDE

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DISSERTATION TITTLE:

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BY

MALULEKE RIVONINGO GETRUDE

STUDENT NO: 11594875

SUPERVISOR: DR JAMES CHAKWIZIRA

CO-SUPERVISOR: PROF PETER BIKAM

THIS DISSERTATION IS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTERS IN URBAN AND REGIONAL PLANNING DEGREE TO THE DEPARTMENT OF URBAN AND REGIONAL PLANNING, SCHOOL OF ENVIRONMENTAL SCIENCES, UNIVERSITY OF VENDA, THOHOYANDOU, SOUTH AFRICA

2018

DECLARATIONS

I, Maluleke Rivoningo Getrude, hereby declare that this dissertation for Masters in Urban and Regional Planning Degree at the University of Venda, submitted by me, has not previously been submitted for a Masters Degree qualification at this or any other University, and that it is my own original work in design and content, and that all reference materials contained herein have been duly acknowledged.

Student's signature…… Date…….

Rivoningo Getrude Maluleke

Supervisor's signature…….. Date…….

Dr. James Chakwizira

Co-supervisor…… Date…….

Prof. Peter Bikam

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DEDICATION

My father, my mother and siblings, your unconditional love and infinite support gave me strength and hope throughout my studies. I thank God for you.

ABSTRACT

The study investigated commuters' perceptions towards the implementation of bus rapid transport (BRT) system in Polokwane Local Municipality. This was achieved through determining the commuters' perceptions of the implementation phases of Polokwane BRT. The assessment considered whether the implementation of the Polokwane BRT meets commuters' travel needs and preferences with respect to the operational characteristics. The study used the stated preference and checklist technique to collect data. Questionnaires were spatially distributed per settlement cluster, targeting the general commuters. Data was also collected through interviews with the company implementing the system and the Polokwane municipal officials. The study was based on a comparison of two scenarios, which are: "protraction of public transport system without BRT and a combination of both public transport and the BRT system". The collected data was analysed using Scenario-Based Analytical Approach (SBAA), with the aid of Statistical Package for Social Sciences (SPSS) and Microsoft Excel software. The collected data was represented and interpreted using both quantitative and qualitative data presentations formats. The study noted that commuters' travel needs were limited to comfort, time, fare (affordability), safety and security. The results revealed that the methods used to introduce the implementation of BRT system influenced the perceptions of commuters towards the system. Most of survey respondents (55%) were not aware of BRT system implementation, while (56%) indicated that the methods used were extremely ineffective. Furthermore 43% of the survey respondents were not willing to shift from the public transport to use the BRT system. Therefore, many of the survey respondents (52%) negatively perceived and associated the system with negative transport changes within the Municipality. However, it was also established that the operation of the system within the municipality would attract (77%) commuters towards public transportation such as BRT system, only if the system incorporates commuters' preferred operational characteristics. On the other hand, the scenarios revealed that without the intervention of BRT system, the municipality is likely to continue experiencing transport problems, although there are also challenges associated with the implementation of BRT system. The use of effective and familiar methods of communication, integrating the system with existing modes of transport, development densification, provision of mixed land use and transit oriented development along BRT corridors and BRT routes extensions to residential and socio-economic areas, are some of the recommendations in support of the BRT system.

Key words: *Commuters perceptions, Level of service, Bus Rapid Transit, Public Transport, Quality of Service and Travel Time.*

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ACRONYMS

A-S-I	Avoid Shift Improve
A-S-1-S	Avoid Shift Improve Strategy
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed Circuit Television
CITP	Comprehensive Integrated Transport Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DOT	Department of Transport
ECAS	Export Credit Agencies
ICT	Information Communication Technology
IDP	Integrated Development Plan
IRPTN	Integrated Rapid Public Transport Network
IRPTS	Integrated Rapid Public Transport System
ITP	Integrated Transport Plan
ITS	Intelligent Transport System
KII	Key Informant Interview
LOS	Level of Service
LDRT	Limpopo Department of Roads and Transport
MRT	Mass Rapid Transit
NDOT	National Department of Transport
NDP	National Development Plan
NPC	National Planning Commission
NMT	Non-Motorised Transportation
NO_X	Nitrogen Oxide
PLK	Polokwane
PLTF	Provincial Land Transport Framework
PTS and AP	Public Transport Strategy and Action Plan
PTSAP	public transport strategy and action plan
PTSAP	Public Transport Strategy and Action Plan
RAL	Road Agency Limited
RECSA	Reliable, Efficient, Comfort Service Safety and Affordability
RIT	Rapid Integrated Transport

RP	Revealed Preferences
SACO	South Africa Community Organizations
SANRAL	South African National Road Agency Limited
SBAA	Scenario-Based Analytical Approach
SDF	Spatial Development Framework
SO_X	Sulfur Oxide
SPTP	Strategic Public Transport Planning
SP	Stated Preferences
SPP	Seshego Precinct Plan
SPSS	Statistical Packages for Social Sciences
TSP	Traditional Scenario Planning
TOD	Transit Oriented Development
TPB	Theory of Planned Behaviour
TRCP	Transit Cooperative Research Program
UDPD	Urban Densification Policy Draft
UNEP	United Nation Environmental Programme
UN-HABITANT	United Nation Habitant
WPTNP	White Paper in Transport National Police

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1. General introduction

This chapter introduces the need to carry out the study in Polokwane. This is a general introduction of the study, the detailed background of the study and the statement of research problem. It further discusses the scope of the study, followed by the significance of the study and the definition of key terms. Figure 1.1 shows the conceptual structure of this chapter.

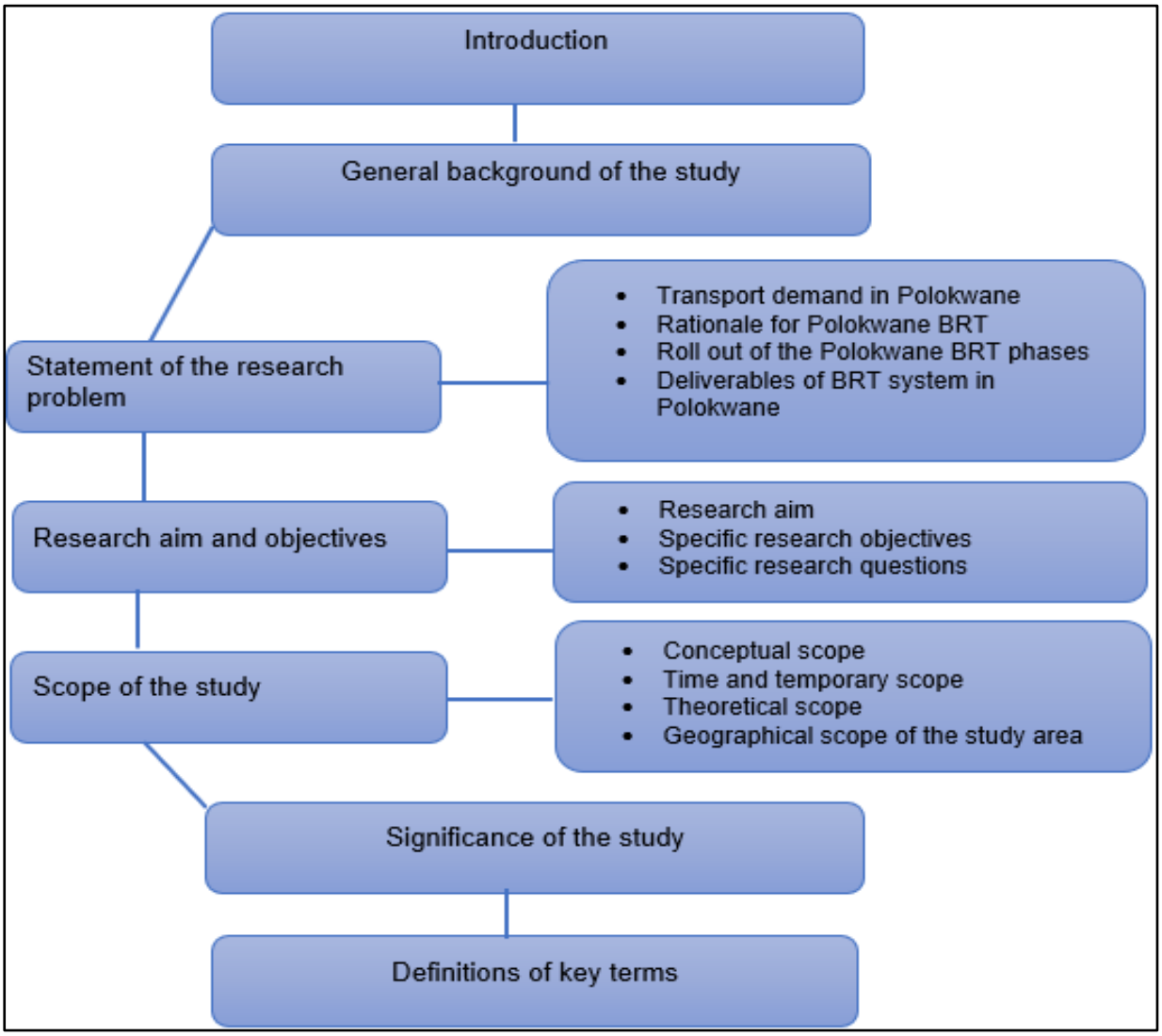

Figure 1.1. Conceptual structure of chapter one.
Source: Authors construct (2017)

Figure 1.1 shows that the chapter is organised into seven components; namely introduction of the study, general background, statement of research problem, research aim and objectives, scope of the study, significance of the study and the definition of key terms.

1.1.1. Introduction of the study

According to Basorun and Rotowa (2012:82), transport systems also determine regional patterns of development, economic viability and social acceptable levels of quality of life. Consequently, transport is a fundamental component of urban life. It contributes and enables the society to access different socio-economic development or activities offered by cities. Pojani and Stead (2015:7789) further indicate that transport is central to the economic growth of developing cities. For example, transport facilitates trade between countries, regions or municipal areas, while it also attracts major economic developments.

However, according to Chakwizira *et al.* (2014:564), Basorun and Rotowa (2012:82) and Cervero (2013:7), rapid urbanization, rapid motorization, urban sprawl, rapid unplanned and uncoordinated growth of cities, and spatial mismatches result in major transportation challenges, particularly in developing countries. This has prompted cities across the globe to search for alternative sustainable mode(s) of transport. Studies conducted by Pojani and Stead (2015:7785), Satiennam *et al*. (2006:60) and Chakwizira *et al*. (2014:564), reflect on urban transportation problems, such as traffic congestion, environmental degradation, air pollution and urban sprawl. This explains why Deng and Nelson (2013:109) indicated that the Chinese decision makers enacted public transport such as Bus Rapid Transport (BRT) schemes as practicable and affordable strategies of addressing transport related challenges which include, congestion, air pollution, and conserve energy. Cervero (2013:20) and Wright and Hook (2007:26), indicated that poor public transport services in both developed and developing worlds, push commuters to private vehicles. Consequently, encouraging and improving public transport system in developing and developed countries have become a central issue in transport planning (Laffel, 2006:53).

According to Wright and Hook (2007:1), public transport is a critical means by which the society can effectively access goods and services. The study further indicated that public transport is the only practical means to access socio-economic activities particularly in developing cities (Wright and Hook, 2007:10). The Polokwane Comprehensive Integrated Transport Plan (CITP) (2013:93), pointed out that public transport was one of the most sustainable long-term strategy to address transport-related challenges, such as traffic congestion and other negative effects of high transport demand. Public transport can refer to any mode of transport that is available to the public (White, 2016:19-20). Various modes of public transport, such as human and animal powered vehicles, cycling and walking, are encouraged. However, they cannot transport as many passengers as road-based modes, street tramway and BRT systems (Roux, 2013:36; Pojani and Stead, 2015:7790; Wright and

Hook, 2007). Among these modes, the BRT is acknowledged for its high quality, customer-oriented service and cost-effective transit solution (Moylan *et al*., 2013:3; Wright and Hook, 2007:11; Wirasinghe *et al*., 2013:1).

In a recent study conducted on BRT system by Cervero (2013:14), BRT is perceived as a sustainable mode of transport that can play a significant role in the global campaign to achieve more sustainable mobility futures. Deng and Nelson (2013:26). These researchers also indicated that commuters perceive BRT system as a reliable system that addresses mobility problems for disadvantaged groups. The disadvantaged people include pregnant women, handicapped and the elderly. Laffel (2006:5) and Deng and Nelson (2013:108), also noted that traffic congestion and environmental pollution are among the major problems faced by commuters. By implication, BRT adds value to the commuting experience in terms of affordability, efficiency and quality of the services through cheap modes. It is from this background that the study sought to investigate commuters' perceptions towards the implementation of the Bus Rapid Transit system in Polokwane. The study further investigated commuters' perceptions towards the choice of existing modes of transport, such as taxis, public buses, and private vehicles, in a bid to illuminate commuters' perceptions regarding to travel time, travel fare and travel comfort to socio-economic and spatial location differences in Polokwane municipal area.

1.2. General Background of the Study Area

The Polokwane Municipality covers a total area of +/-377578, 99 hectares in the central part of Limpopo province, within the Jurisdiction of Capricorn District Municipality (Polokwane, IDP, 2016:1). The Polokwane Integrated Development Plan (IDP) (2015:71 and 2016:71 and 95), has indicated that the municipality has population of approximately 628 999 and 178 001 households. According to Polokwane IDP (2015:117), the municipality is currently experiencing an annual population growth rate of 1.6% (Polokwane IDP, 2016:98). Much of this growth is ascribed to an influx of migration from rural areas into Polokwane (Polokwane IDP, 2016:117). 71% of its population lives in rural areas and 23% in urban areas (Polokwane Spatial Development Framework (SDF) (2016:101).

The Polokwane IDP (2016:103), report showed that approximately 40% of the Polokwane population has no income at all. Consequently, public transport is one of the most common mode of transport used by the majority within the municipal jurisdiction. According to the Polokwane Integrated Rapid Public Transport Service (IRPTS) (2014:16), public transport is the most dominant mode of transport within the municipality, where mini-bus taxis provide

67% of the public transport services (Polokwane Integrated Rapid Public Transport Service (IRPTS), 2014:16). Like many rapidly growing cities in South Africa, Polokwane is not an exception from the impacts of poor public transport services. Currently, the Polokwane Municipality relies on inefficient and unpredictable minibus and microbus services (Polokwane Comprehensive Integrated Transport Plan (CITP), 2013:46-47).

It is from this background that the Polokwane Local Municipality decided to implement a Bus Rapid Transit (BRT) system. The full implementation of the BRT system is defined as parts brought by a combination of elements such as main trunk, feeders, bus stops and operational characteristics (Wright and Hook, 2007; Wirasinghe *et al*., 2013:1; Cervero, 2013:2). Deng and Nelson (2011:70) mentioned that BRT is an emerging form of Mass Rapid Transit, which has its own specific fixed track, or has exclusive use of urban street network. This type of system was implemented by the Polokwane Local Municipality (Polokwane IRTPS, 2014:67), and is jointly managed with the company responsible for the implementation of the Polokwane BRT system. It advocates that the ultimate objective was to swiftly, efficiently and cost effectively commute people with the BRT system. According to Wright and Hook (2007:1-11) and Cervero (2013:11), the BRT concept is becoming increasingly utilized by cities looking for cost-effective transit solutions. BRT has a couple of main characteristics which distinguish it from a 'general' bus line. The characteristics include segregated bus ways, rapid boarding and alighting, clean vehicle technology, secure and comfortable stations and terminals, efficient pre-board fare collection, effective licensing and regulatory regimes for bus operators, clear and prominent signage and real-time information displays, transit prioritization of intersections, modal integration at stations and terminals (Wirasinghe *et al*., 2013:6 and Pojani and Stead (2015:7790).

1.3. Statement of research problem

According to the Polokwane IDP (2015:70), the City/Seshego, Mankweng/Sebayeng/Dikgale, Molepo/ Maja/ Chuene and Moletjie are the four main clusters of Polokwane settlements. These four clusters of Polokwane settlements are connected by the transportation systems that operate along the Seshego/Moletji, Polokwane central, Polokwane East and Polokwane West (Mankweng), as shown in Table 1.1. Apart from the existing transport corridors within the municipality; the Polokwane IDP (2016:114) indicated that the municipality has identified Seshego/Moletji and Mankweng as the dominant public transport corridors serving transport services to Polokwane residents. These dominant public transport corridors would be highly affected by the implementation of the BRT system. Moreover, according to the Polokwane IDP (2015:186), these dominant public transport corridors have high population concentrations

and a high demand forpublic transport. However, the BRT project has correctly identified the clusters. What has not been researched on is the influence and relevance of commuters' perceptions towards the implementation of BRT in those identified clusters, especially from the project conception to implementation. This study therefore seeks to unpack the commuter preferences and travel needs regarding affordability (travel fare), comfort, travel time, safety and security.

According to the Polokwane SDF (2016:77), the Polokwane municipal area is excessively serviced s by taxis, with 149 taxi routes but only 108 subsidized bus routes. However, the existing modes of transport in the municipal area include private vehicles, taxis, buses and Non-Motorized Transport (NMTs). The Polokwane CITP (2013:43), has revealed that the modal split for work trips varies in accordance with the socio-economic profile of an area, as shown in Figure 1.2. After alighting from motorized transport, commuters rely on non-motorized transport (NMTs), such as walking, as the main mode of transport. This accounts for 29, 8% of the trips, followed by private vehicles with 27, 7%; taxis with 27, 3% and buses with the least percentage of 13, 3% as shown in Table 1.1.

Table 1.1. Modal split for work trips in Polokwane

Home area	Nr of trips	Bus	Taxi	Car	Walk	Other	Total
Sehsego/Moletji	23 064	14,7%	55,1%	16,6%	12,9%	0,8%	100%
Polokwane central	14 605		6,3%	82,9%	7,9%	3.0%	100%
Polokwane east	24 890	19,5%	14,1%	11,6%	52,3%	2,4%	100%
Polokwane west	19 024	13.6%	26,7%	20,2%	37,7%	1,9%	100%
Total Polokwane LM	81 583	13,3%	27,3%	27,7%	29,8%	1,9%	100%

Source: Polokwane Comprehensive Integrated Transport Plan (2013:43)

Table 1.1 shows that the modal split for work trips within the Polokwane municipal jurisdiction tilted towards the use of private cars. The table further indicates that the majority of Seshego/Moletji home-area is highly depend on taxis, accounting for 55% of overall work trips, while 82, 9% of the Polokwane central home-area relies on private vehicles. On the other hand, the Polokwane east and west home-areas, representing a population of about 52,3% and 37, 7%, a respectively are highly dependent on walking as the major mode of transport.

Figure 1.2 provides a graphical illustration of the dominant modal split for trips in the Polokwane Municipality.

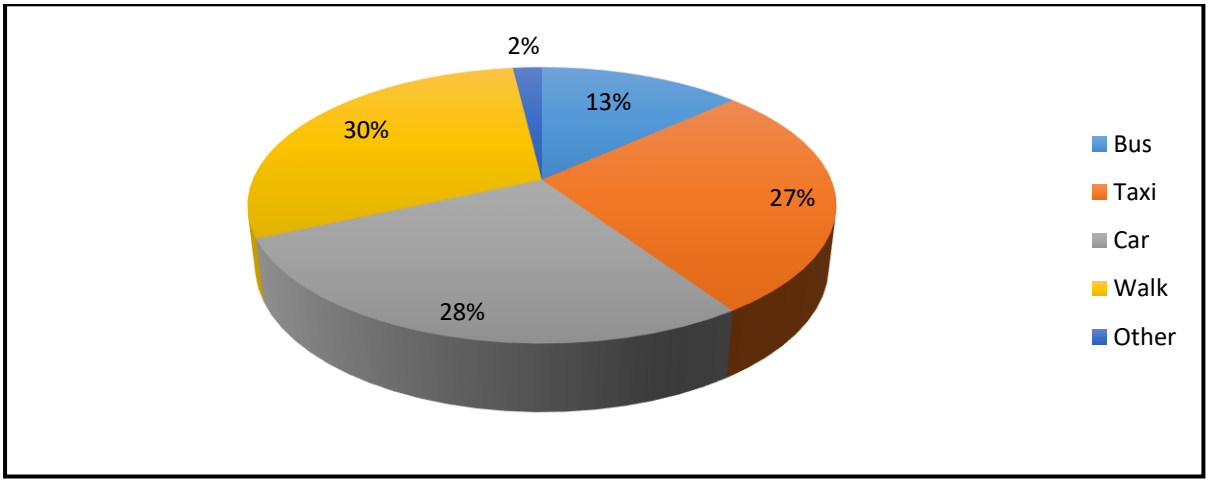

Figure 1.2. Dominant modal split for trips in Polokwane municipality

Source: Polokwane CITP (2013:44)

Figure 1.2 shows that (30%) of the population are pedestrians, accounting for most dominant mode of transport to work, followed by private vehicles (28%), taxis (27%) and buses at 13%. As a result, the implementation of the BRT system can be a challenge forPolokwane commuters, because of the initiatives aimed at transecting and changing travel plans and patterns from their current modes of transport. This is because the bus system is the least preferred mode of transport in the study area. It is, therefore, necessary to conduct an investigation of commuters' perceptions towards the implementation of BRT system in the Polokwane municipality, in order come up with strategies and recommendations to ensure project efficacy, given the above mentioned contextual realities.

1.3.1. Transport demand in Polokwane

According to the Polokwane IRPTS (2014:45), the Polokwane demographic profiles shows high densities along the Seshego, Moletji corridor and North West of the CBD. The Polokwane IRPTS (2014:16), has further shown that Seshego and Mankweng corridors are dominated by high dependency on public transport, where minibus taxis are the dominant mode of transport. The Seshego/Moletji corridor is supplied by approximately 79% of minibus taxis. Unlike Seshego/Moletji corridor, the Mankweng high transport demand, shows that buses are the most preferred mode of transport, with 63% of public transport passenger trips (CITP, 2013:64). The National Household Transport Survey (2010), indicated that the split between public and private transport ratio is 3:1, in favour of public transport and 90% of Mankweng households do not have cars.

1.3.2. Rationale for Polokwane BRT

The Polokwane BRT system is driven by a set of policies, strategies and plans; which aim to provide sustainable transport for South African citizens. Figure 1.3 presents a schematic illustration of policies, strategies and plans guiding the study.

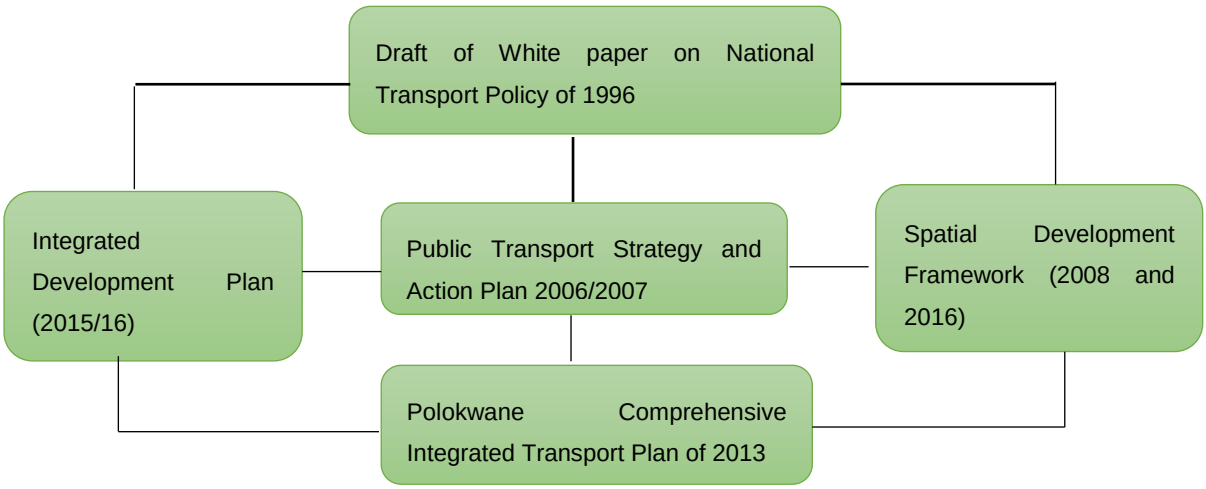

Figure 1. 3. Policies, Strategies and Plans guiding the study

Source: Authors construct (2017)

Figure 1.3 presents a graphical illustration of the set of policies guiding the study. The main vision of the White Paper on National Transport Policy (WPNTP) of 1996 advocates for safe, reliable, efficient and fully integrated transport (Tenza, 2017:4). According to Pillay and Seedat (2007:398), the Department of Transport has mandated the Polokwane municipality to implement high-quality integrated public transport services to achieve public transport strategy and action plan of 2006/2007. The Polokwane IDP (2016:75) and SDF (2010:16), indicated that transport matters within the municipal jurisdiction require future planning that will enable the transport system to respond to the commuters' travel needs. Furthermore, the Polokwane Comprehensive Integrated Transport Plan (2013:35), aim to provide public transport that is accessible and benefits the community at large, in order to stimulate economic growth and development. Therefore, the aims of the afore-mentioned policy, plan and framework can also be achieved by implementing BRT system, which appropriately considers commuters' perceptions and travel needs.

1.3.3. Roll out of the Polokwane BRT phases

According to the Polokwane IRPTS (2014:43, 44 and 45), the Polokwane BRT is divided into three physical phases. Phase 1 is divided into two phases namely, phase 1A and 1B. Phase 1 connects the CBD and Seshego settlement. The second phase connects Seshego and Moletjie settlements. Phase 3 connects the CBD and Mankweng settlements. These phases are precisely shown in Figure 1.4, whereas Figure 1.5 shows the implementation time frame of the BRT system. Table 1.2 shows the implementation phases of BRT system.

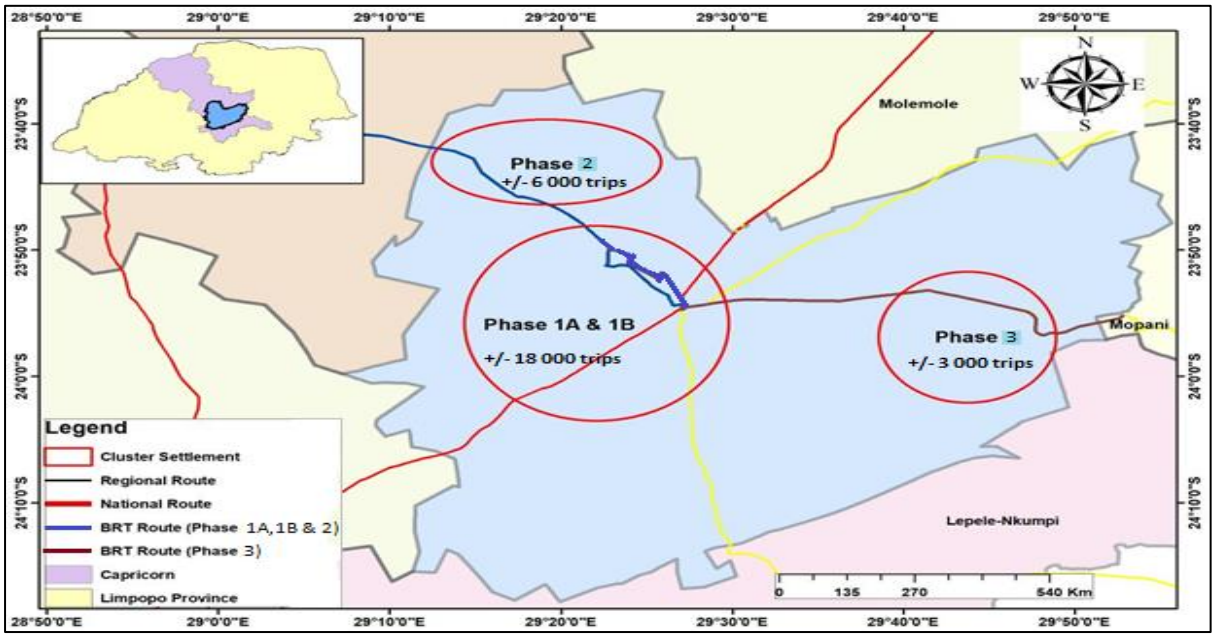

Figure 1. 4. Physical phases of Polokwane BRT and trips to the Polokwane CBD

Source: Polokwane IRPTS (2014:45)

Figure 1.4 shows the four phases of Polokwane BRT and number of desired peak trips to the CBD per day. Phases 1A and 1B accommodate +/-18 000 commuters per peak trips to the CBD. Phase 2 carries approximately +/- 6000 commuters per peak trips to the CBD. The last phase (phase 3), which connects the Mankweng and the Polokwane CBD has been designed to carry +/- 3000 commuters per peak trips to the Polokwane CBD. Figure 1.5 is an illustration of the implementation timeframe of the Polokwane BRT.

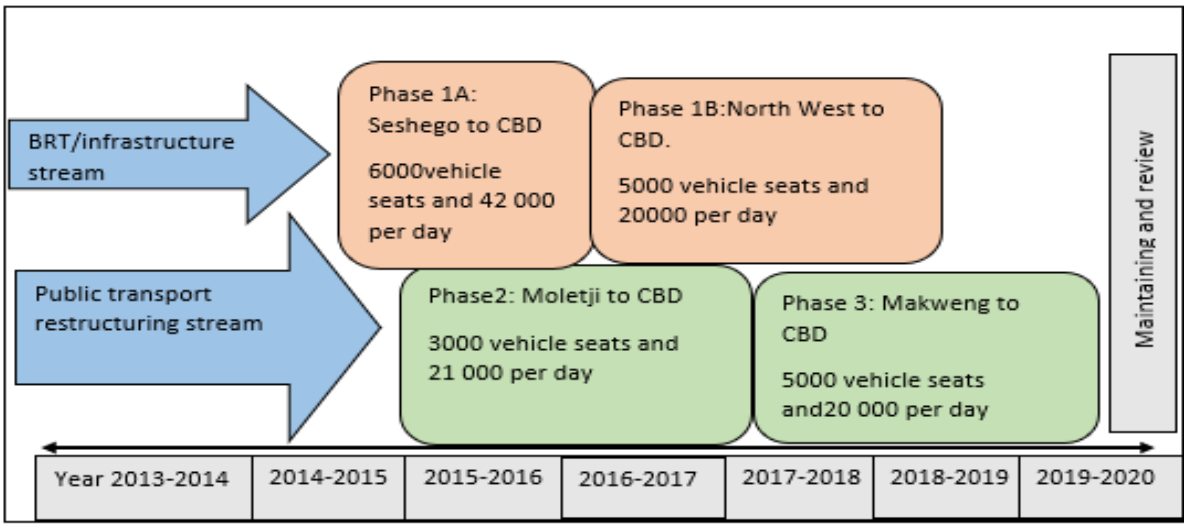

Figure 1.5. Illustration of the implementation timeframe of the Polokwane BRT

Source: Polokwane CITP (2016:13)

Figure 1.4 depicts that the implementation timeline of the Polokwane BRT started in 2013. Phase 1 was expected to be completed in year 2016, according to the implementation time frame. The Figure shows that the implementation of phase 1B, 2 and 3 will be finalized between year 2013 and 2020.

1.3.4. Deliverables to be achieved during each phase of BRT systems implementation

According to Polokwane CITP (2013:17), each phase of the BRT systems implementation is associated with different levels of stakeholder engagement. The phases of BRT system aim to achieve the following principles:

- Provide sufficient information to enable informed participation;
- Minimize or avoid social mobilization that represent structured resistance;
- Implement a robust and fair process;
- Be transparent;
- Use consistent methodologies;
- Ensure realistic outcomes; and
- Build trust between the stakeholders and team project.

Table 1.2 below presents the implementation phase of the BRT in tabular format.

Table 1.2. Implementation phases of the BRT system

	Phase A Status quo analysis	Phase B Pre-negotiations	Phase C Contract negotiations	Phase D Pre-operations	Phase E Start operations
Tasks	-Approach refinement -Critical issues -Identification of 3 political champions -Stakeholder analysis -Literature review -Identification of affected operators and associations -Develop a negotiations strategy -Consult and engage public transport industry	-Report on the impact of the transition on the industry -Analysis of options for issues to be negotiated -Development of MoU and MoA -Establishment of BRT and Technical committees -Vetting of affected operators -Development of compensation framework and model -Agreement of who is affected -Development of Q and A on BRT -Development of negotiation programme -Development of database of affected operators including drivers, marshals etc.	-Business impact management -Negotiate compensation and developed compensation agreement -Develop procedures on how to become a shareholder -Financial agreement -Employment framework agreement -Value-chain agreement -Agreement on fee per km -Agreement on a process of becoming a shareholder	-Agreement on the BCC -Bus operating company agreement for 12 years -Employment of BOC staff for interim BOC -Develop shareholders agreement -Development of transitional plan -Confirmation of bus and taxi industry representation in the BOC -Training and orientation of prospective shareholders -Re-skilling employees who wish to apply for positions in the BC	-Removal of vehicles from routes and cancelation of operating license /permits -Commence operations for the inception company -Negotiation closure agreement -Draft inception phase agreement –IPBOCA -Asses company's readiness for operations -Establish a task force to oversee operations during inception phase
Outputs	-Status quo report -Negotiation strategy -lesson learnt report	-Signed MoU and MoA -Compensation model -Agreement on who is affected -Protocol of engagement	-All the agreements endorsed and signed	-BOC agreement -BOC setup and the SP set up -Transition strategy	-Go live
Continuous consultation engagement with the affected stakeholders					

Source: Polokwane CITP (2016:16)

Table 1.2 precisely shows that there is a need for continuous consultations with the affected and interested stakeholders, throughout the implementation of BRT system. The study therefore focused on phase A and Phase D of the implementation phases, as phase E is yet to be rolled out.

In brief, the problem statement can be summarised as follows:

- A preliminary investigation revealed that Polokwane municipality did not sufficiently consider commuters' interests and perceptions during the implementation phases of the BRT project.
- As a result, the majority of Polokwane municipality stakeholders, including commuters might not be aware of the travel needs and envisaged impacts associated with and considered in the implementation of BRT system.

- The implementation phases of BRT system require constant and continuous consultations with the relevant stakeholders, which include commuters (Polokwane CITP, 2013:16). The study assessed the adequacy or inadequacy of the used consultations, marketing and communication systems linked to the BRT project in Polokwane.
- The literature also shows that failure to comply with commuter perceptions and requirements during the implementation phases of BRT system had resulted in various post-project implementation challenges. For example, the implementation of BRT Rea Vaya in Johannesburg, was resisted by primary beneficiaries, who were not willing to change and use the system because they had not been continuously consulted during the implementation of the system (Heather, 2013:18). It is in this light that the study seeks to confirm, verify and identify the challenges arising from failure to comply with BRT implementation in Polokwane.
- Overall, preliminary investigations further revealed the following problems that require further investigation:
- The impact of delay on the implementations of the BRT system on commuter perceptions and travel needs;
- Evidence of continuous consultations with the commuters during each phase of BRT system implementation. Investigating "*who, when, how and why"* commuter participation and involvement was structured in a given manner
- The Polokwane IRTPS (2014) showed little evidence of considering commuters'' travel needs. Therefore, the question is, how do commuters' perceptions and needs patterns manifest in BRT project implementations, as an extension of a deep-seated structural transport engagement model?

1.4. Research aim and objectives

To address the problem statement of the study, the research aim and objectives are:

1.4.1. Research aim

The main aim of the study was to investigate commuters' perceptions towards the implementation of the BRT system in Polokwane Municipality.

1.4.2. Specific research objectives

1. To determine the perceptions of commuters on the implementation phases of Polokwane BRT
2. To assess if the implementation of the Polokwane BRT would meet the stated preferences of commuter travel need
3. To assess if the Polokwane BRT operational characteristics would respond to commuters' preferences
4. To recommend a framework for BRT implementation guidelines incorporating commuters' perceptions and travel needs.

1.4.3. Specific research questions

1. What influences the perceptions of commuters with respect to the implementation phases of Polokwane BRT?
2. What are the stated and revealed preferences of commuters' travel needs in the study area?
3. What are the operational characteristics of Polokwane BRT, and why?
4. What aspects should be included in commuters' perceptions and travel needs guidelines for BRT implementation

1.5. Scope of the Study

The delimitation of the study was described in terms of the conceptual, time and temporary scope, theoretical and the geographical scopes, as written in the following sections:

1.5.1. Conceptual scope

The study focused on the commuters' perceptions towards the implementation of the Bus Rapid Transit within Polokwane Municipality, in Limpopo Province of South Africa.

1.5.2. Time and temporary scope

The study focused on the implementation of Polokwane BRT system from inception (2013), to implementation (Between 2016 and2020).

1.5.3. Theoretical scope

This study was based on three main commuter perceptions and needs transport theories; namely, the cognitive dissonance *"transport"* theory, theory of planned *"travel"* behaviour and operational theory of *BRT* implementation.

1.5.4. Geographical scope of the study area

Polokwane Municipality is located at the heart of Limpopo Province, within Capricorn District Municipality (Polokwane IDP, 2015). Figure 1.6 presents a map showing the location of the study area.

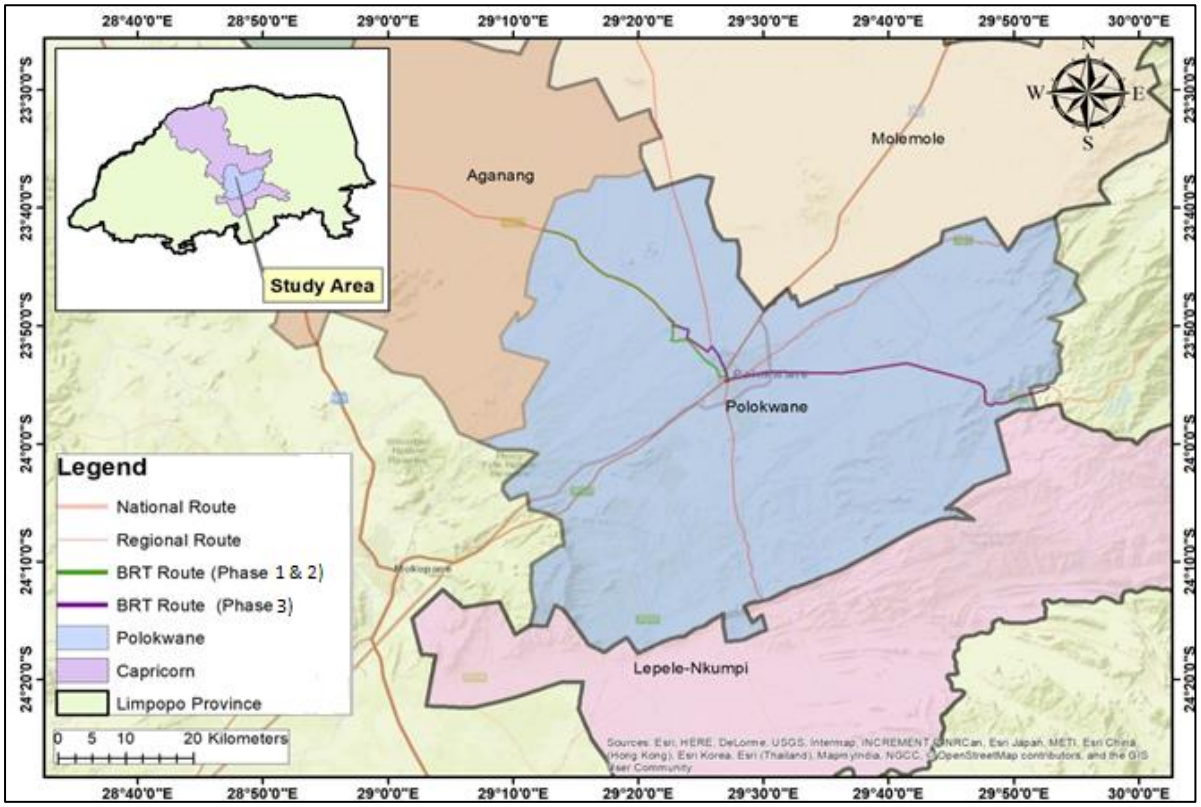

Figure 1. 6. Maps of the study area

Source: Polokwane IRPTS (2014:65)

Figure 1.6 depicts the study area, which is located in South Africa, Limpopo Province, Capricorn District, under Polokwane Municipality. The specific study routes are coded in purple and green colours.

1.6. Significance of the study

The implementation of the Bus Rapid Transit in Polokwane Municipality was recommended by the Department of Transport. The purpose of BRT is to promote sustainable public transport, and address transport challenges faced by South African citizens (Pillay and Seadat, 2007:53; and Polokwane IRPTS, 2014:1). It is significant to investigate commuters' perceptions towards the proposed system. Wirasinghen *et al*. (2013:1), emphasized that the success of sustainable urban transportation was based on selecting the optimal design and service aspects of a transit system that best meet and balance the needs of both operators and commuters. Consequently, the study recommended an implementation guideline framework that considers commuters' perceptions and travel needs. The travel needs include, travel time, safety and security, comfort and affordability in terms of travel fare. The system will also encourage a shift from private to public transit.

The study noted new ways of addressing commuters' perceptions towards the implementation of the BRT system. The findings can be applied to to the other cities or municipalities, in order to successfully implement BRT systems. The study also addressed the scarcity of academic literature on commuters' perceptions towards the implementation of BRT systems. The study has contributed new aspects to the body of knowledge in South Africa. These include:

- The development of effective awareness strategies on spatial distribution, strength and weakness of the BRT system in Polokwane.
- The study generated new and essential ideas on how to develop and improve the system from commuters.
- The study identified and addressed commuter travel needs that can possibly hinder the efficacy of Polokwane BRT system.
- The study will influence transport planners to consider the importance of commuters' perceptions before implementing any mode of transport, in order to effectively solve the complex transport problems.
- The study has also opened new avenues for future research projects in BRT systems by outlining possible areas of study.

1.7. Definitions of Key Terms

The defined terms are frequently used words mostly relating to the study. These terms are outlined and defined in the Table 1.3 below.
Table 1.3 presents the definition of key terms in a tabular format.

Table 1.3. The definition of key terms

Key terms	Definitions
Commuters Perceptions'	The view from which commuters see, understand or interpret a particular mode of transport (Deng and Nelson, 2012:18).
Level of service	Quality measure describing operational conditions within a traffic stream, generally in terms of service measures such as speed and travel time, capacity to manoeuvre, traffic interruptions, comfort and conveniences (Beirao and Cabral, 2007:483).
Service quality	Commuters perceptions towards a particular transport services meets or surpass their expectations (Nandan & Geetika (2010:97–112).
Mass Rapid Transit	Mode of urban transport that carry large volumes of commuters quickly, using exclusive routes that connect different land uses (Deng and Nelson, 2012:18).
Bus Rapid Transit	High-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, as well as excellence in marketing and customers service (Wright and Hook, 2007:11)
Public Transport	All modes of transport that are available to the public, irrespective of ownership. Such include taxis, and buses, trains (White, 2016:19-20).
Quality of Service	Quality of service may be defined by a wide range of attributes which can be influenced by planning authorities and transport operators (Paulley *et al.,* 2006:300).
Travel fare	The sum charged for riding in a public conveyance (Elefteriadou and Cui, 2005:3)
Travel time	The time it takes a typical commuter to move from the beginning to the end of a corridor (Elefteriadou and Cui, 2005:3).
Green Economy	Economy that results in improved human well-being and social equality while reducing environmental risks and ecological scarcity (UNEP:2011)
Green Transport Economy	It is a new economic paradigm in transport sector that promote and support environmental sustainability. i.e. global climate, ecosystem, public health and natural resources (UNEP:2011)
Affordability	The extent to which financial costs of travelling put an individual or household in the position of making sacrifices to travel or the extent to which they can afford to travel when they want to (Carruthers *et al.*,2005:1)

Source: Authors construct (2017)

Table 1.3 presents the key terms for public transport, such as BRT system that needs to be understood and considered in order to provide for a public transport that incorporates commuters' perceptions and travel needs.

1.8. Chapter one summary

This section introduced the study, research background, research problem statement, aim and objectives, significance of the study and definition of key terms. The following chapter presents the adopted research methodology.

CHAPTER TWO: RESEARCH METHODOLOGY

2.1. Introduction

This chapter discusses methods that were used for data collection, analysis and interpretation. It includes a conceptual framework that underpins the methodology gives a proper orientation to the study. There are a number of sections covering a couple of key concepts on perceptions towards the implementation of the Mass Rapid Transit (MRT), such as Bus Rapid Transit (BRT), relating to the context of the study. The stated and revealed preference surveys were discussed as instruments used to determine the required data for the study. The stated and revealed surveys were the appropriate methods for the study because they are widely applied in the public transport marketing and travel demand modelling surveys. A Scenario-Based Analytical Approach (SBAA) was also used because it is a tool generally used to unpack public transport implementation possibilities for research. Snowball sampling and random sampling techniques were adopted to achieve the objectives of the study. Figure 2.1 overleaf presents a graphical illustration of the conceptual structure of the chapter.

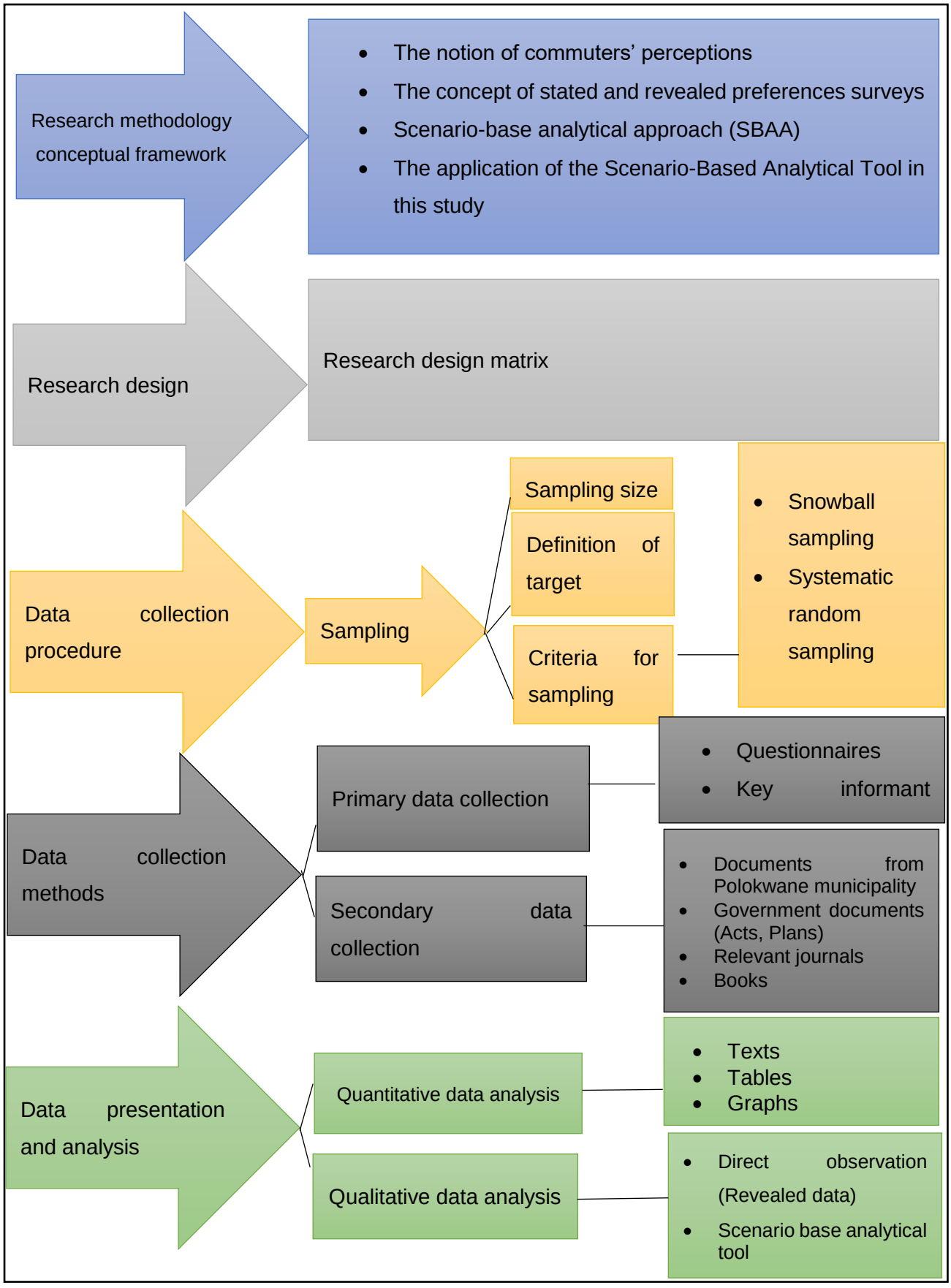

Figure 2.1. Graphical illustration of the conceptual structure of the chapter

Source: Author's construct (2018)

Figure 2.1 shows that chapter two is organised in five six major thematics of research methodology; namely, research methodology conceptual framework, research design, data collection procedure, data collection methods and data presentation and analysis.

2.2 Research methodology conceptual framework

A research conceptual framework is an analytical system employed to unpack both substantive and procedural matters necessary for investigation. The framework highlights the importance of understanding the linkages between theory, methods and practice in tackling a research topic. Both primary and secondary data collection methods, including the use of the snowball sampling and systematic random sampling, were also considered. The data and information collected was analysed using the Scenario-based analytical approach because it clearly brings out the concept of scenario approach. Ways in which data was obtained, and analysed using both qualitative and quantitative tools, such as texts, graphs and maps are outlined. Figure 2.2 is an illustration of the step by step approach used for the study.

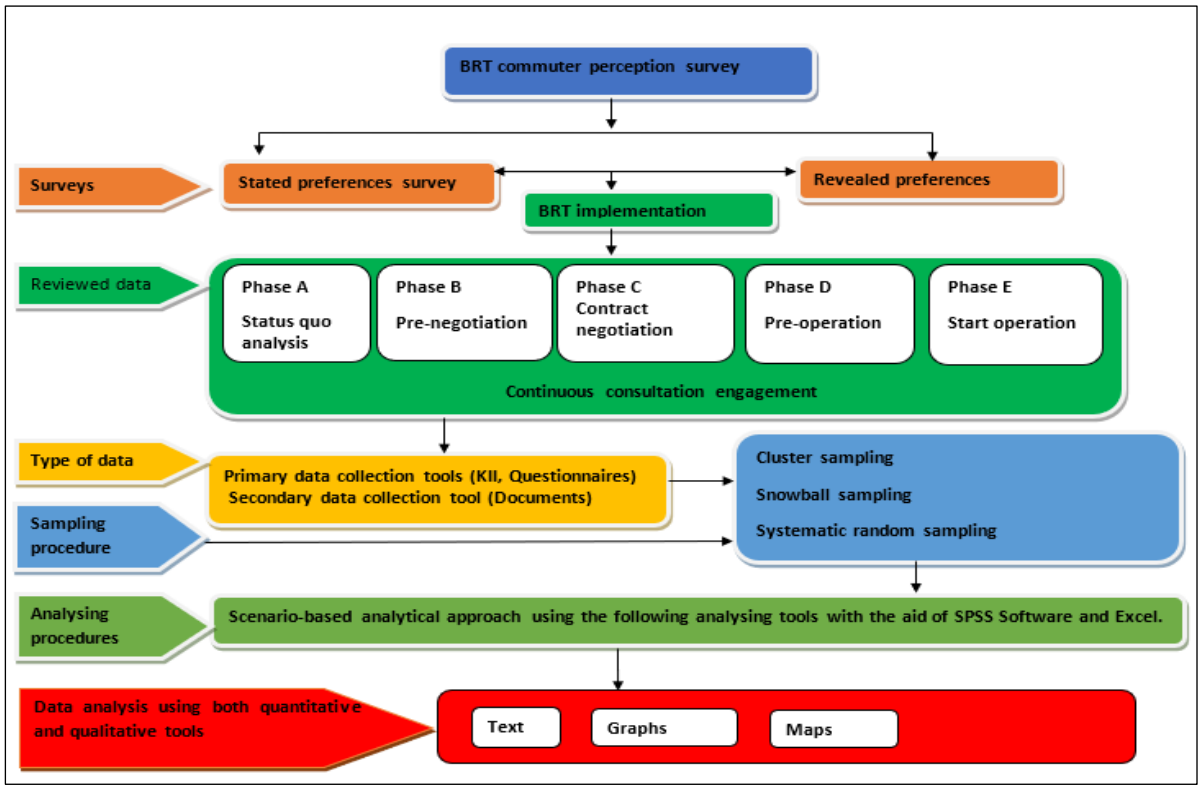

Figure 2.2 Conceptual overview of the reserch methodology

Source: Authors construct (2017)

Figure 2.2 illustrates the logic that was used to undertake commuters' preferences perception survey. The key to the approach are the six stratified steps; namely, survey, reviewed data, sampling procedure, analysing procedure, as well as data analysis with the aid of quantitative

and qualitative analysis tools, such as texts, graphs, maps and photographs. Therefore, appropriate survey tools were employed. Furthermore, relevant data and information was collected and analysed. The next section reviews key notions that informed the study.

2.2.1 The notion of commuters' perceptions

Commuters' perceptions play a major role in determining the success and, or failure of any transportation project. The same applies to the implementation of BRT systems. Wright and Hook (2007:9), indicated that, commuters' opinion and perceptions are important in measuring the success or failure of BRT systems. Consequently, it is crucial to effectively involve commuters to participate in the implementation process of BRT systems. According to Wright and Hook (2007:33), an effectivepromotional strategy of BRT system is crucial in influencing public perceptions to accept and have clear understanding of the new system. Satiennam *et al*. (2006:64), indicated that marketing strategies, such as advertisements, distribution of brochures and websites, can be used to influence, access and manage commuters' perceptions, information and attitudes.

According to Levinson *et al.* (2003:26), successful implementation of a BRT system is dependent on community willingness to support the system. Wright and Hook (2007:27), also indicated that ineffective participation of the public, can be a significant barrier towards the successful implementation of BRT systems. Consequently, Levinson *et al*. (2003:26), emphasised that extensive and efficient public participation in the decision-making of implementations BRT systems is crucial in all phases of implementation. Commuters' perceptions of the Lagos BRT, for instance, was obtained through different communication strategies (Amiegbebhor *et al.,* 2007:8). The majority of the commuters perceived BRT as the safest, comfortable mode of transport with improved travelling time.

Beirao and Cabral (2007:478), and Langer (2014:7), outlined the type of journey, system performances, reliability (travel time and travel variability), safety and security, affordability (travel cost) and comfort, as the main factors determining the choice of mode of transport. Attitudinal factors can also possibly affect commuters' preferences. However, Deng and Nelson (2013:83) and Wright (2005:24), highlighted that BRT is associated with improved travel time, fares, safety and comfort attributes. For example, after the implementation of TransMilenio in Bogota, Columbia, traffic congestions, road accidents and road accidents death rate decreased drastically. Figure 2.3 shows the main concepts of the study. It also illustrates the notion of perceptions of commuters towards a hypothetical BRT system.

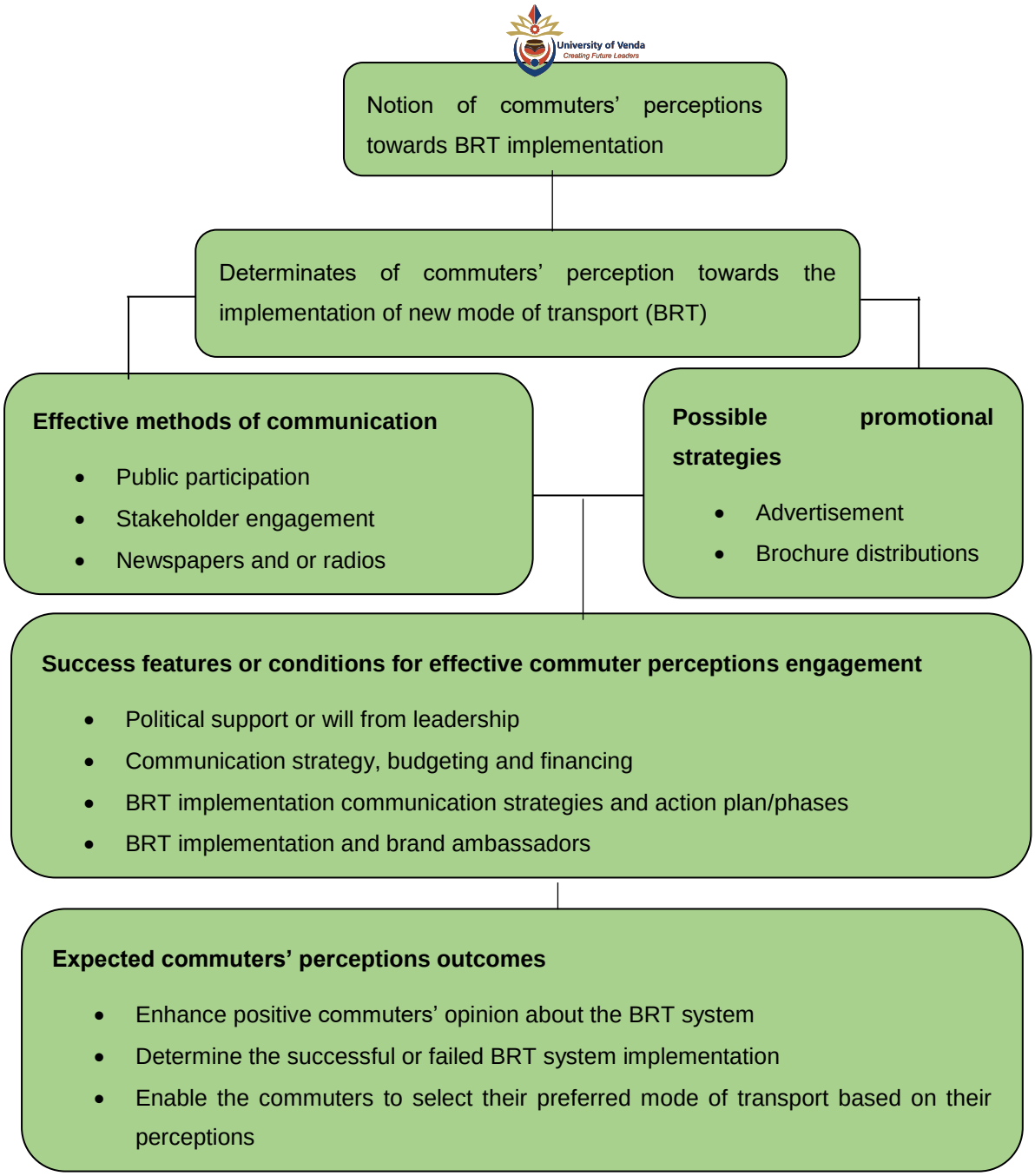

Figure 2.3. Diagramatical illustration of the notion of commuter perceptions of BRT system

Source: Authors construct (2017)

Figure 2.3 illustrates the notion of commuter perceptions plan, to achieve a successful implementation of the BRT systems. It indicates that commuters' perceptions are likely to be influenced by the method or strategies of communication used to inform them about the new transport system to be implemented. It further indicates that communication methods and strategies, influence the success features or conditions for effective commuters' perception engagement, which results in commuters' expectations. Thus, commuters' opinions also determine the success or failure of BRT projects. The processes enable commuters to select the mode of their choice based on perceptions.

2.2.2. The concept of Stated and Revealed preference surveys

The literature impliesa that the concepts of Stated Preference and Revealed Preferences surveys are most appropriate for the study. According to Yang *et al.* (2009:4), a Stated Preference survey is referred to as the self-stated preferences for public transport market service offering. It is an important tool that assists in forecasting public transport decisions and situations yet to exist, using scenarios (Petrik, 2016:13). It has been widely applied in the areas of public transport marketingand travel behaviour research, to identify behaviour responses to choose situations where the attribute levels offered by existing public transport choices are modified (Hensher, 1994, 107). Adamowicz *et al*., (1994:244), further stated that the Stated Preference survey involves the elicitation of responses to predefined public transport travelling alternatives, in the form of ratings, ranking or choice. The Stated Preferences (SP) survey specifies situations based on individuals' perceptions, while Revealed Preferences (RP) survey describes the realiable observed data.

Sanko (2001:7), indicated that Stated Preferences are different from Revealed Preferences in the sense that, Revealed Preferences involve obtaining reliable data from retrospective questionnaires, while Stated Preferences survey obtains data using questionnaires and interviews. Yang *et al*., (2009:5) also indicated that Stated Preference survey is an effective method to analyse commuters' evaluation of multi-attributed products and services, especially where there are new attributes or choice. A pro-active approach was used in this study to determine the preferences of commuters. Thus, in some cases the study used stated preferences survey while in others the Revealed Preferences survey was used where necessary.

2.2.3. Scenario-base analytical approach (SBAA)

A study that involves investigating the perceptions of commuters in the implementation of BRT systems requires a Scenario-Based Analytical Approach (SBAA), to enable the possibilities and eventuality components to be addressed in a feasible manner. According to Amer *et al*. (2013:23), scenarios are regarded as crucial tools for assisting organizations to prepare for possibilities, eventualities as well as to build flexibility and innovation in public transport systems. Ryse and Glinz, (1999:1), indicated that Scenario-Based Analytical Approach describes the functionality and behaviour of a system from a user-centred perspective. Wulf *et al.* (2010:1), however, indicated that the Scenario-Based Analytical Approach to Strategic

Public Transport Planning (SPTP), serves as a management innovation in the field and it builds on the strengths of Traditional Scenario Planning (TSP).

Wulf *et al*. (2010:13), further indicated the benefits associated with Scenario-Based Analytical Approach. These include, reducing the complexity of scenario planning project, quicker implementation of the project. This is because it decreases the time needed to carry out the planning process by between four to six weeks. The Scenario-Based Analytical Approach is based on six different steps, which consider traditional planning process. Figure 2.4 shows the six steps of the Polokwane BRT scenario-based approach, according to Wulf *et al*. (2010:14).

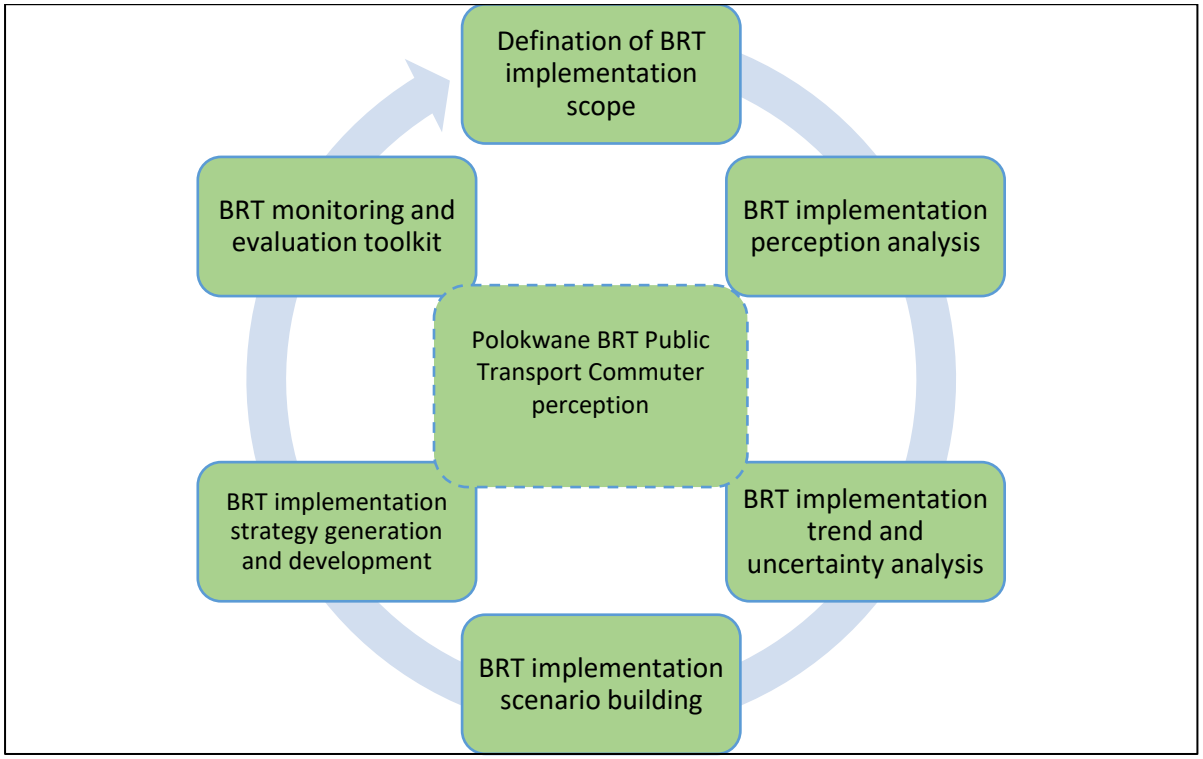

Figure 2.4. Six steps of the Polokwane BRT Scenario-Based Analytical Approach.

Source: Adopted from Wulf *et al*. (2010:14)

Figure 2.4 shows the relevance of adopting the six steps from the SBAA, in analysing the data obtained from BRT implementation project in Polokwane during the fieldwork. According to Wulf *et al*. (2010:14), omission of either or any one of these six steps can result in poor analysis of BRT implementation scenario data, rendering to unreliable, incomplete and invalid results.

2.2.3.1. The application of the Scenario-Based Analytical Tool in this study

The following considerations were made when employing the Scenario-based analytical approach for the present study. Adopting the Scenario-based analytical approach was

determined by the data collection instruments that were used. These are: questionnaires and key informant interviews. The approach was based on two scenarios, which are:

- Public transport system (as is or without BRT scenario); that is, the do-nothing approach (business as usual).
- Polokwane public transport system (with BRT scenario); that is thedo something approach (unusual business).

Table 2.1 presents a tabular representation of how the scenario-based approach was applied to the BRT implementation study in Polokwane.

Table 2.1. The six stages of scenerios applied in the study

Stage	Description	Application to BRT implementation in Polokwane
Definition of BRT implementation scope	This related to the geographic scope of the BRT implementation project phases in Polokwane municipality as well as the identified study area investigation focus areas.	The scope of the study was limited to the three phases of Polokwane implementation project phases within the Polokwane municipality boundaries, in the four main cluster settlements. These cluster settlements include Cluster 1, Cluster 2, Cluster 3 and Cluster 4. The scope is defined and illustrated in chapter 1, 4 and chapter 6 with aid of maps.
BRT implementation perception analysis	Perception analysis was described in chapter 5 and 6, and the commuters travel needs factors was considered.	The perceptions were based on four commuter travel needs, which included the affordability (travel fare), travel time, comfort; and safety and security.
BRT implementation trend and uncertainty analysis	The study managed to draw the trend and uncertainty of introducing the BRT system in the Polokwane municipality.	The BRT implementation trend and analysis was achieved by bench-marking the Polokwane BRT system with the similar projects across the globe, particularly, BRT implementation projects that focuses on commuters perceptions towards the system.
BRT implementation scenario building	Different scenarios were formulated from the data collected in the study, to propose strategies for addressing these scenarios	The scenarios were based on two major scenarios on the Polokwane public transport “one with the BRT system and one without the BRT system”. Various scenarios were formulated when analysing the scenarios in detail.
BRT implementation strategy generation and development	The scenarios built from the data collected, was addressed by different strategy formulation, in which some formed part of the recommendations.	New strategies were generated and developed. These strategies were obtained from the reviewed literatures and data obtained from the respondents and key informants.
BRT monitoring and evaluation toolkit	Advice on how the strategies must be monitored was addressed.	To continually sustain the success of Polokwane BRT system requires ongoing monitoring and evaluation to address the generated and developed strategies.

Source: Authors construct (2017)

Table 2.1 shows describe and how the six stages of scenario based analytical tools were applied in the study.

2.3. Research design

The research design used for this study was meant to determine commuters' perceptions on the implementation phases of the Polokwane BRT. This made it possible to assess the implementation of the Polokwane BRT; evaluating whether it would meet the stated preferences and revealed preferences of the commuters' travel needs. It further facilitated the assessment of Polokwane BRT operational characteristics in terms of the project capacity and ability to respond to the commuters' preferences. This enabled the development of an approach to BRT implementation guideline framework, which considers commuters' travel perceptions and needs.

2.3.1. Research design matrix

The research design matrix shows a summary of the research objectives, research questions, and data collection tools, sampling methods, data analysis tools and expected outcomes as illustrated in Table 2.2 in the form of a goal achievement matrix.

Table 2.2. Goal achivemenent matrix

Research objectives	Corresponding Research questions	Data collection tools		Sampling methods	Data analysis and presentation tools	Outcome
		Primary data sources	**Secondary Data sources**			
To determine the perceptions of commuters on the implementation phases of Polokwane BRT.	What influences the perceptions of commuters on the implementation phase of Polokwane BRT?	Questionnaires KII	Books Journals IDP IPT CITP	Purposive Random Cluster	Texts Maps Tables Graphs SBAA EXCEL SPSS	-Assessment of perceptions in every implementation phases of BRT system. -Detailed different communication methods used in every implementation phase of Polokwane BRT.
To assess if the implementation of the Polokwane BRT would meet the stated preferences of commuters' travel needs.	What are the stated and revealed preferences of commuters' travel needs?	Questionnaire KII Observation	Books Journals Newspapers	Random Purposive Cluster	Texts Maps Tables Graphs SBAA EXCEL SPSS	Identified stated and revealed travel needs and envisaged impacts of the Polokwane BRT on commuters.
To assess if the Polokwane BRT operational characteristics would respond to commuters' preferences.	What are the operational characteristics of the Polokwane BRT system?	Questionnaire KII Observation	Books Journals Newspapers ITP CITP	Random Purposive Cluster	Texts Maps Tables Graphs SBAA EXCEL SPSS	Detailed different operational characteristics of Polokwane BRT.
To recommend a BRT implementation guidelines framework incorporating commuters' perception and travel needs.	What aspects should be included in BRT implementations guidelines framework that consider commuters' travel needs?	Questionnaires KII	Books Journals	Random Purposive Cluster	Texts Tables Graphs SBAA EXCEL SPSS	Detailed the Implementation guideline framework for commuters' travel needs.

Source: Authors construct (2016)

Table 2.2 shows a repertoire of methods and techniques designed to answer the research aim, objectives and research questions.

2.4. Data Collection Procedure

This section highlights different techniques and tools, which were used to achieve the objectives. These are, sampling, primary data collection tools, secondary data collection tools, data analysis and presentation tools.

2.4.1. Sampling procedure

Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population, to determine parameters or characteristics of the whole population (Mugo, 2001:1). It is the number of respondents selected from a large number of people or population for survey purposes. The sampling procedure of this study was discussed in detail in the sections below.

2.4.1.1. Definition of the target population

The research targeted three different respondents or stakeholders/participants groups. These include, **internal stakeholders** within Polokwane municipality, **specialist stakeholders** from the company responsible for implementing the Polokwane BRT system and the **external stakeholders** which include general commuters. Different questionnaires, key informants interviews and a checklist were administered to the three identified respondent groups.

2.4.1.2. Sampling size

According to the Polokwane IDP (2015:71-73), the municipality has a population size of 629 609 and household population of 178 001. This population is well distributed within four major cluster settlements. Each has 9 wards, and there are 38 wards within the municipal jurisdiction (Polokwane IDP, 2015:71). Table 2.3 shows the population of Polokwane by cluster.

Table 2.3. Population of Polokwane by clusters

Cluster number	Cluster	Number of household population per cluster	Total number of population per cluster
Cluster 1	Seshego (ward 1 up until ward 9)	63 125	222 831
Cluster 2	Mankweng/Sebayeng/Dikgale (ward 10 to ward 18)	52 735	186 154
Cluster 3	Molepo/ Maja/ Chuene (ward 19 to ward 27)	34 285	121 026
Cluster 4	Moletjie (ward 28 to ward 38)	28 215	99 598
Total number of households		178 001	629 609

Source: Polokwane IDP (2015: 71-73 and 2016:71)

Table 2.3 shows the population of the Polokwane Municipality by a cluster. Cluster 1 consists mainly of urban areas with higher population than other clusters, followed by cluster 2, which accommodates the University of Limpopo and the Zion Christian Church. Cluster 3 and 4, are said to be more rural and the population are smaller thancluster 1 and 2.

2.4.1.3. Criteria for sampling

Fowler (2003:1), indicated that, when the sampling size is greater than 10 000 or more than 100 000, the sampling size of the population is equal to 384, at 95% level certainty. However, given time constraints, limited resources and the fact that the sample was too big for the study, a formula for developing a realistic sample was devised. Considering the fact that acquiring reasonable opinions from a sample of residents was key, the sample size was reduced to 250 for all intents and purposes.

2.4.1.4. The sampling technique used

To reach the desired sample of the target respondents, the study used both snowball sampling and cluster sampling techniques.

2.4.1.4.1. Snowball sampling technique

Gilbert (2001:2), indicated that Snowball Sampling is most frequently used to conduct qualitative research, primarily through interviews. In this study, Snowball Sampling was used

to identify the key informants from Polokwane municipality, and the company responsible for Polokwane BRT implementation; for follow up interviews.

2.4.1.4.2. Systematic random sampling

According to the Polokwane IDP (2015:71), the municipality has four cluster settlements. To reach the desired sample from the commuters per cluster, the study used Systematic Random Sampling method to administer questionnaires to commuters. Systematic random sampling was applied in the following mathematical equation:

$$s = \frac{dy}{dx} \times c = n$$

Table 2.4. Mathematical equation representation

S=sample size
dy=total population per cluster
dx=total population in the municipality
c=sample percentage
N=percentage of questionnaires to be distributed/ number of questionnaires to be distributed

Source: Derived from Fowler (2003)

Table 2.4 shows the mathematical equation used by this study to calculate the percentage of the questionnaires to distributed per Polokwane cluster settlements.

$$Sample\ size\ of\ ward\ level$$
$$= \frac{Total\ population\ per\ cluster}{Total\ population\ in\ the\ muncipality} \times cluster\ sample\ percetage$$
$$= percetage\ of\ questionnaires\ to\ be\ distributed$$

For example, $Seshego\ cluster = \frac{222\ 831}{629\ 609} \times 100 = 35\%$

The number of questionnaires distributed per cluster is determined as follows:

$$Sample\ size\ of\ cluster = \frac{Total\ number\ of\ questionnaires}{Total\ population\ percetage} \times cluster\ percetage$$
$$= Number\ of\ questionnaires\ to\ be\ distributed$$

For example, the number of questionnaires administered at Seshego cluster/ cluster one is determined as follows:

$$Seshego\ cluster\ settlement = \frac{250}{100} \times 35\% = 87\ questionnares$$

Table 2.5 shows the number of questionnaires administer per cluster, while considering the total number of questionnaires distributed (which is equal to 250).

Table 2.5. Number of questionnaires administered per cluster

Cluster number	Cluster name and number of ward	Number of household	Total population per cluster	Percentage of total population per cluster	Number of questionnaires distributed (NQD)	Number of questionnaires returned (NQR)	Percentage of questionnaires returned (% NQR)
Cluster no:1	Seshego (ward 1 up until ward 9)	63 125	222 831	35%	87	79	31%
Cluster no:2	Mankweng/Sebayeng/Dikgale (ward 10 to ward 18)	52 735	186 154	30%	75	65	27%
Cluster no:3	Molepo/ Maja/ Chuene (ward 19 to ward 27)	34 285	121 026	19%	48	42	17%
Cluster no:4	Moletjie (ward 28 to ward 38)	28 215	99 598	16%	40	38	15%
Total number		178 001	**629 609**	**100%**	**250**	**224**	**90%**

Source: Authors construct (2017) and Polokwane IDP (2015:71-73)

Table 2.5 shows how 250 questionnaires were distributed in the four cluster settlements, within the Polokwane Municipality. From Table 2.5 a total number of 250 questionnaires were distributed to the population and household sizes. Out of a total of NQD (250), only NQR (224) were returned. This represents 100% in total, and about 90% of the total was distributed. The questionnaires were distributed per cluster, to ensure a fair geographical coverage of the area. The questionnaires were distributed in four clusters of the Polokwane Municipality, particularly at the existing taxi ranks, bus rank, car parking and along bus routes.

The sample from each selected cluster was proportional to the population size of a cluster. The proportional sample size was derived from the following formula:

$$s = \frac{dy}{dx} \times \Delta = \aleph$$

$$Sample = \frac{Total\ population\ per\ cluster}{Total\ population\ in\ the\ municipality} \times sample\ size$$

$$= Number\ of\ questionares\ to\ be\ distributed$$

For example, cluster 1 has a total of 222 831population.

Therefore, $Sample\ size\ of\ cluster\ 1 = \frac{222\ 831}{629\ 609} \times 250 = 87\ questionnares$

2.4.2. Data collection methods

Data was collected using both primary and secondary data collection methods. Each method assisted the researcher to achieve the main objectives of the study.

2.4.2.1. Primary data collection

The researcher collected primary data directly from the residents of the Polokwane Municipality, who were the targeted population for the study. The following paragraphs discuss the data required for the study.

2.4.2.1.1. Questionnaires administered to the respondents

A total of 250 questionnaires were administered using the systematic sampling technique, within the four main cluster settlements in the Polokwane Municipality, particularly to the potential BRT commuters. Figure 2.5 displays the spatial locations of clusters where the questionnaires were distributed. Both open and close-ended questions were systematically administered to the commuters.

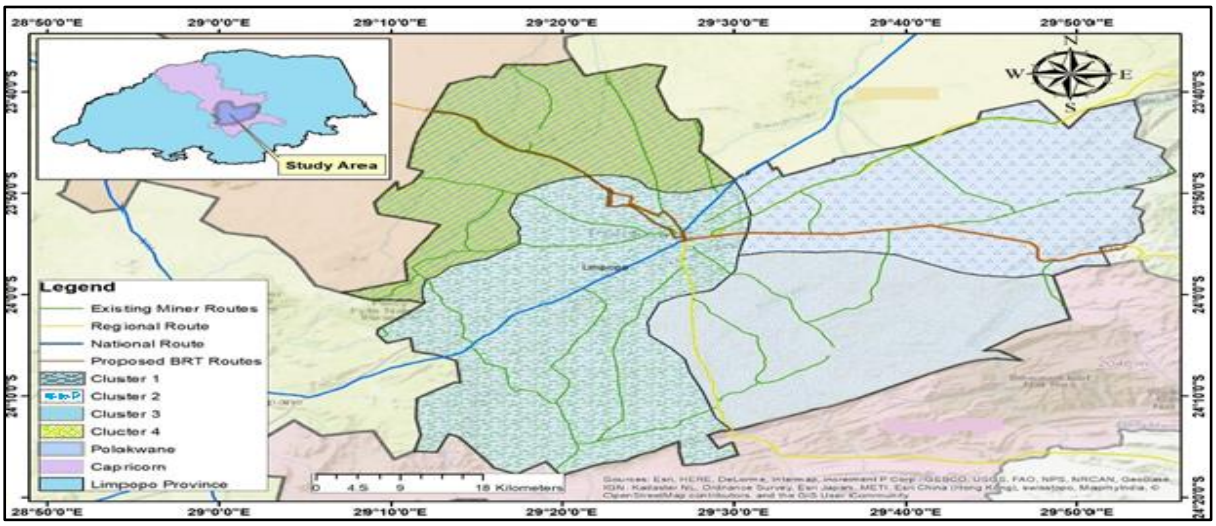

Figure 2.5. Spatial locations where questionnaires were distributed

Source: Polokwane CITP (2013)

Figure 2.5 shows the spatial locations where questionnaires was distributed. It also indicates that that the questionnaires were distributed in the four existing cluster settlements of the Polokwane Municipality, which are highlighted in different colours.

2.4.2.1.1.1. Criteria for selecting the study clusters

According to the Polokwane IDP (2015:70), the Polokwane municipality has four main settlement clusters, which are connected to the Polokwane CBD by transport systems. These clusters form part of the implementation of BRT system in Polokwane. The questionnaires were distributed per cluster as follows:

2.4.1.1.1.1. Cluster 1 (Seshego and Polokwane CBD)

According to the Polokwane IDP (2015:70), cluster 1 is located west of Polokwane CBD. It has some major economic activities. The cluster is serviced by Seshego/Moletji corridor. There are two major areas with a high concentration of socio-economic zones, which are: Seshego shopping centre and Polokwane CBD. Therefore, in order to cover the household population from this cluster, questionnaires were distributed at Seshego Shopping Complex, commonlyknown as the Seshego Circle Centre and in the Polokwane CBD at Pick n Pay Mall, where there are most of the public transport operators are located and where commuters board from taxis and buses. In this cluster, questionnaires were also distributed at the bus stops and taxis linking Seshego and Polokwane CBD.

2.4.2.1.1.1.2. Cluster 2 (Mankweng/Sebayeng/Dikgale)

This cluster is serviced by the Mankweng major transport corridor. The corridor connects the University of Limpopo, Moria, Mankweng and the CBD. The corridor has many taxis ranks and bus stops that leads to Polokwane CBD. According to the Polokwane IDP (2015:70), the Mankweng cluster settlement is located 30km to the east of the city. The Turfloop Shopping Centre is the most active socio-economic zone in cluster 2. Questionnaires were distributed at Mankweng/Turfloop shopping centre and Pick and Pay Mall in the CBD, specifically at parking lots, taxi and bus stops that lead to the CBD.

2.4.2.1.1.1.3. Cluster 3 (Molepo/ Maja/ Chuene)

The Polokwane IDP (2015:71), indicated that cluster 3 is located far from the Polokwane CBD and comprised of informal settlements. Many people within this cluster rely on the Polokwane CBD for socio-economic activities. Therefore, questionnaires were administered at the Pick and Pay Mall, in the CBD, specifically at the taxi rank and bus stops within the CBD.

2.4.2.1.1.1.5. Cluster 4 (Moletji)

Cluster 3 is located on the western part of the Polokwane CBD. Questionnaires for general commuters were administered at the Indian Centre in the Polokwane CBD, and some were distributed at taxi and bus stops along the Moletji corridor, leading to the CBD.

2.4.2.1.2. Key informant interviews

The Key Informant Interviews were conducted with the municipal officials and the Company responsible for implementing the BRT system within Polokwane Municipal area. The Key-Informant' Interviews were conducted using open and close-ended questionnaires. However, the interviews were conducted with the officials responsible for the management and implementation of the Polokwane BRT system. The officials involved in the implementation of the Polokwane BRT system are the following:

- Transport Planner: manager from Polokwane Municipality;
- Engineering Services: manager from Polokwane Municipality;
- Communication Officer from Polokwane Municipality;
- Transport Technical Advisor from the company responsible for the Polokwane BRT implementation; and
- Project Manager for the company implementing the Polokwane BRT system.

2.4.2.2.2.1. Transportation Planner Manager

The Polokwane Transport Planner was selected for the interview, to provide data related to the involvement of commuters in all the phases of implementing the Polokwane BRT system. At the same time, the Transport Planner provided insights on the incorporation of commuters' travel needs when implementing the Polokwane BRT and detailed descriptions and

explanations of the operational characteristics of the BRT system. The collected data and information provided insight into the Polokwane BRT implementation issues, gaps and thereby making it easier for the study to propose possible recommendations.

2.4.2.2.2.2. Engineering Services Manager

The Engineering Service Manager was one of the key informants, because he was responsible for the operational characteristics of the system. The Engineering Service Manager provided information on the route alignment of the system, envisaged BRT model to be purchased, carrying capacity, travel time, travel fare, safety and comfort operational measures to be incorporated into the system. This made it possible for the current researcher to draw recommendations and conclusion and on the efficacy of Polokwane BRT system on commuters' travel needs and operational preferences when it is fully operational.

2.4.2.2.2.3. Communication Manager

The Polokwane Municipality's Communication Manager was also interviewed, in order to assess the effectiveness of the communication methods used to reach out to commuters. This data provided insight into how communication methods played a role incommuters' perception towards BRT system.

2.4.2.2.2.4. Transport Technical Advisor to BRT implementing agent

The Transport Technical Advisor for the company responsible for implementing the Polokwane BRT system was interviewed, to acquire information on whether the implementation of Polokwane BRT system was well articulated to the commuters. The interview also accounted to the incorporation of commuters' preferences, opinions and inputs regarding BRT implementation modalities and logistics. Furthermore, it explored the envisaged impact of BRT on commuters and their travel needs.

2.4.2.2.2.5. Project Manager for BRT implementing company

Data collected from the Project Manager was related to the phases of BRT implementation and accounting for the implementation timelines and impacts of commuters' perceptions towards the BRT system implementation.

2.4.2.2. Secondary data collection methods

Secondary data was acquired from reliable and adequate sources. The secondary data and information sources included, books, journals, government and Polokwane municipality documents. The following methods were used to collect secondary data:

2.4.2.2.1. Official documents from the Polokwane Local Municipality

Information was gathered from several documents, such as the Polokwane SDF (2010), Polokwane IDP (2015 and 2017), Polokwane CITP (2013) and the Polokwane IRTP (2014). These documents were used to obtain policies, strategies, plans and actions used in implementing the Polokwane BRT. These aspects included, proposed corridors for BRT implementation, land use maps, the municipal demographics statistics and the spatial location of different clusters within the municipality. This data played a part in drawing conclusions on commuters' perceptions towards the implementation of Polokwane BRT system. For example, commuters located in cluster 3 and 4, who are spatially located at a distance from the CBD, were hypothesized to have more negative perceptions of the BRT system than commuters from cluster 1 and 2 who are spatially located near the CBD.

2.4.2.2.2. Government documents (Relevant Acts, legislations and policies)

Relevant Acts, legislations and policies supporting the implementation of the BRT system include; Draft White paper on National Transport Policy of 2017, National Development Plan Vision 2030 of 2012, Public Transport Strategy of 2007. These legislations promote the implementation of safer, affordable, comfortable, reliable, accessible and sustainable integrated public transport such as BRT system. Data obtained from these documents assisted the researcher to analyse whether the Polokwane BRT system was fully responding to the legislative and policy stipulations as notarised in national, provincial and municipal government documents.

2.4.2.2.3. Relevant journals

The main journals reviewed for the study include "*The perception of Bus Rapid Transit: A passenger survey from Beijing Southern Axis BRT lite1"* by Denga and Nelson (2012), and

"*Bus Rapid Transit: An efficient and competitive mode of public transport" by* Cervero (2013). These two journals noted the perceptions of the commuters towards their travel needs, and what influences the choice of their mode of transport. Furthermore, these journals emphasized that BRT system is perceived as the most sustainable public transport; safer, reliable, frequent, affordable, comfortable and able to address transport challenges such as traffic congestion and environmental pollution. The journals have shown that a that BRT system can help reduce car dependency by attracting car user to use the BRT system as their main mode of transport. Emphasis is also made on the ground move to green transport economy.

2.4.2.2.4. Books

Major books reviewed for this study include "*Bus Rapid Transit Planning Guide"*, by Wright and Hook (2007), and "*Low carbon land transport"* by Bongaradt D *et al.* (2013). These two books provided the researcher with the operational characteristics of the BRT system, methods used to communicate the implementation of the BRT system and how they influence commuters' perceptions and decisions.

2.5. Validity and reliability of data

The questionnaires were designed in a logical way and a pilot study with few respondents was carried out prior to the actual fieldwork. Questionnaires were designed to accommodate all respondents, with the use of open and close-ended questionnaires, were used. An interview guide was also used through the acquisition of data from various sources, and ethical clearance was acquired. This improved the reliability of data and enhanced the quality of the research findings.

2.6. Data presentation and analysis

Data was gathered and analyzed using both qualitative and quantitative data analysis. These were done to present and analyze data collected from both primary and secondary data sources. The data was first processed, edited, coded, where necessary and presented in the form of tables, graphs, cross-tabulation, maps and pictures.

2.6.1. Quantitative data analysis

Quantitative data analysis was facilitated by the use of SPSS (Statically Packages for Social Sciences, version 20). The SPSS software was used to manage data; that is, data entry and editing. It was further used to present the study findings in the form of tables and graphs, such as bar graphs and pie-charts, to draw conclusions from the field data. This method of analysis was chosen because it is reliable and increases the objectivity in data presentation and interpretation.

2.6.1.1. Quantitative direct observation (revealed data)

The researcher undertook a direct observation of the current transport situation within the Polokwane Municipality. Assessing whether the Polokwane BRT can ease the current transport situation, and the assessment of the current transport situation, to determine if the implementation of the Polokwane BRT system will address the transport challenges faced by commuters in their daily commuting experiences. These were some of the aims addressed by the study. The observation checklist targeted 20 people per mode of transport in each cluster settlement, assessing, travelling time, weather, gender, mode of transport used, commuter travel information availability, safety measures and current transport problems. Table 2.6 shows the observation checklist form used to assess commuters' travel information, safety measures, comfort measures and transport problems.

Table 2.6. The observation checklist formant to check commuters' pereptions based on the observed transport situation

Clusters	Day	Time	Weather	Gender 20 people		Mode of transport 20 modes			Commuters travel information	Safety measures	Comfort measures	Transport problems
				Male	Female	Car	Taxi	Bus				
Cluster 1												
Cluster 2												
Cluster 3												
Cluster 4												
Overall findings												

Source: Authors construction (2018)

Table 2.6 shows the checklist format adopted to access the commuters' perceptions from the observed transport situation. The data collected included travel time, gender, mode of

transport, commuters travel information, safety measures, comfort measures and transport problems. The obtained data from the checklist was used to undertake the analysis in chapter five.

2.6.2. Qualitative data analysis

Quantitative data cannot completely convey the study findings without the help of qualitative data analysis. The quantitative data analysis was derived, deduced, analysed and interpreted using qualitative analysis, such as textual inferences, in order to discover the patterns and attach meaning to the data and re-cycled information. For example, the current popular modes of transport used in the study area were provided and meaning was attached.

2.6.3. Data presentation tools

Different data presentation tools were adopted to present both quantitative and qualitative data. The presentation data tools used for the study are as follows:

2.6.3.1. Textual deduction

Texts were used to explain field data. It was also used to describe the data presented in the form of graphs, maps, tables and photographs.

2.6.3.2. Tables

The data collected from the field was orderly classified, systematically analysed and presented in the form of tables. Cross-tabulation from SPSS analysis software was also used to analyse the data with common relationships. For example, the current mode of transport per cluster was analysed. The table presentation tool was adopted because it incorporates the capacity to easily assemble massive data gathered and summarise it into a small, clear and simplified manner.

2.6.3.3. Relevant maps

Relevant maps were used to illustrate the study area, BRT routes, land use maps and population density in the study area. The maps were also pillars of the study because they assisted with the bus routes, land use and different densities within the proposed BRT project in Polokwane. These maps were mostly used in chapter four spatially depicting the transport corridors and the major road network particularly in the Polokwane CBD.

2.6.3.4. Graphs

The data collected on the perceptions of the respondents was presented using different types of graphs. These graphs assisted in providing the graphical and summarized forms of the statistical expression of commuters' perceptions, measured in the form of percentages.

2.7. Chapter summary

This chapter provides detailed data collection methods which were used to collect the data. The chapter also described the research design and research design matrix, which discussed ithe goal achievement matrix. Sampling procedures, data analysis and presentations were also discussed in this chapter. The following chapter presents the literature review.

CHAPTER THREE: LITERATURE REVIEW: THEORETICAL FRAMEWORK

3.1. Introduction

This chapter presents literature review of, from both published and unpublished documents regarding the commuters' perceptions on implementation of BRT systems. It detailed the conceptual framework of the BRT system and the notion of commuters' perceptions towards public transports. The chapter takes on approach which details service provision concepts and the relevant theories for commuters' perceptions towards the implementation of BRT systems. This enables one to conceptualize commuters' perceptions following a Scenario-based analytical approach; particularly for BRT project implementation that is yet to be completed. The emerging model from theories of commuter's perceptions of BRT system is also reviewed in this chapter. Figure 3.1 shows the structural settings for chapter three.

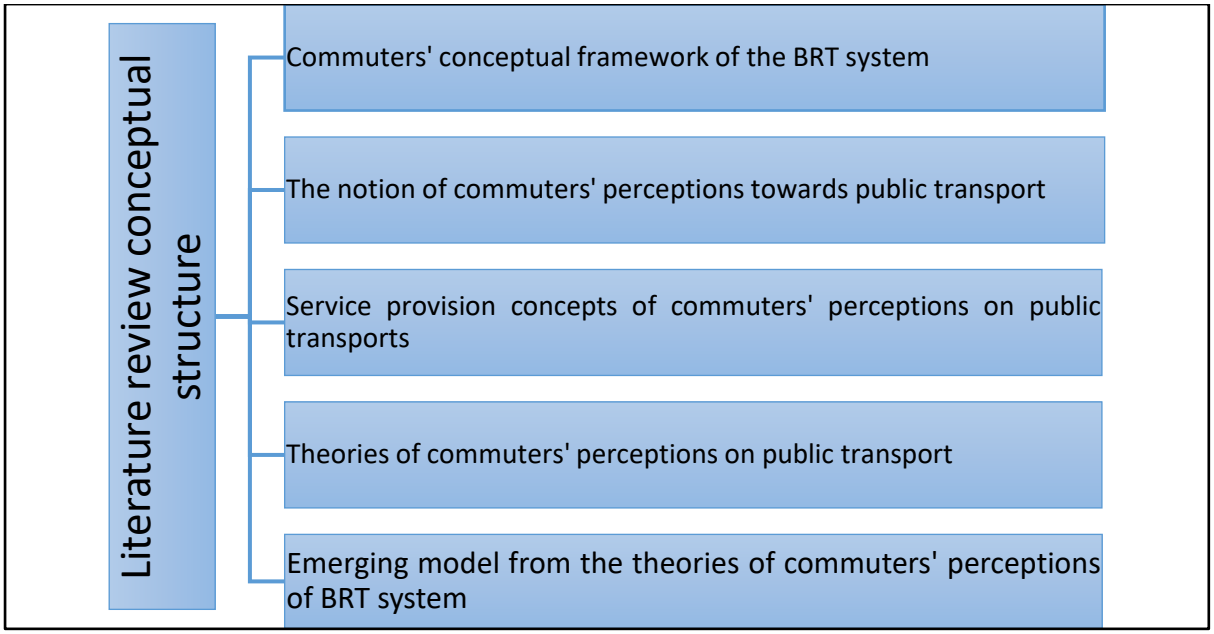

Figure 3.1. Structural setting for chapter three

Source: Authors construct (2017)

Figure 3.1 shows that chapter three is composed of five components. These components include the commuters' conceptual framework of the BRT system, the notion of commuters' perceptions towards public transport, the concepts of service provision, theories of commuters' perceptions on public transports and the emerging model from the theories of commuters' perceptions of the BRT system.

3.2. Commuters' conceptual framework of the BRT system

The conceptual framework outlines the reviewed notion, service provision concepts and theories of commuters' perceptions on public transports while paying attention to the implementation of the BRT system. It further detailed the emerging models from the theories of commuter perceptions of BRT system. The conceptual framework is depicted in Figure 3.2.

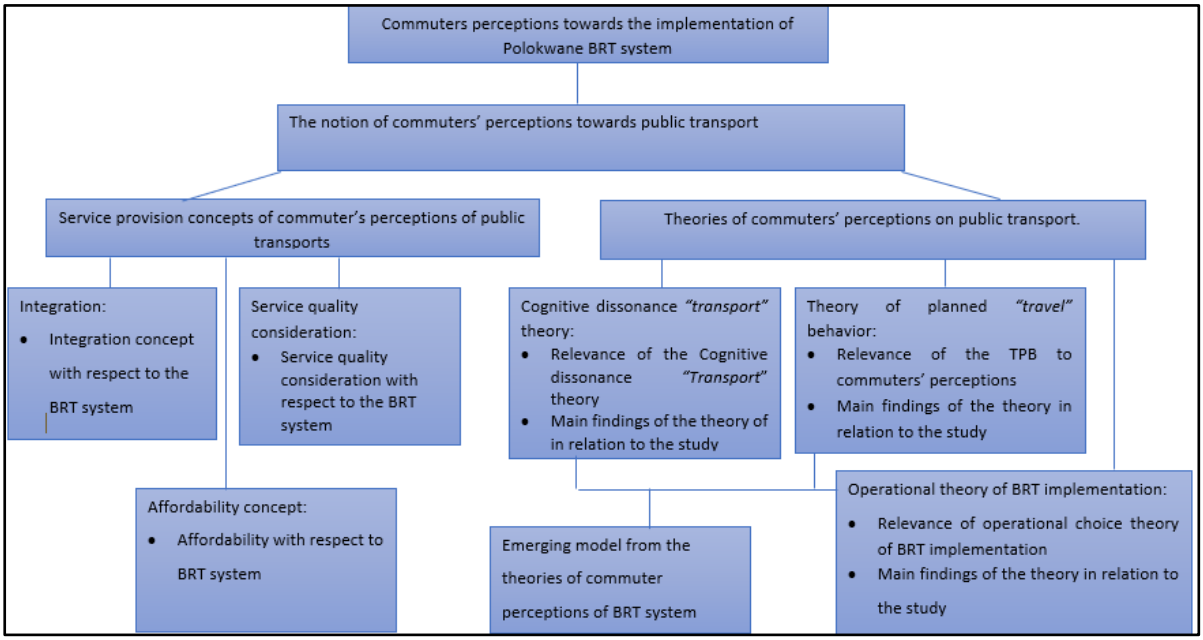

Figure 3.2. Conceptual framework

Source: Authors construct (2017)

Figure 3.2 shows that the notion of commuters towards public transport has been reviewed in conjunction with the concepts regarding service provision for commuters' travel needs, which include, integration, service quality considerations and affordability. The cognitive dissonance *"transport"* theory, theory of planned *"travel"* behaviour and operational theory of *BRT* implementation, are the three theories analysed for the study and from which the emerging model derived.

3.3. The notion of commuters' perceptions towards public transport

There are various factors that influence the choice of mode of transport. However, the choice towards mode of transport is based on the physiological state of mind of an individual. The way commuters perceive a mode of transport is dependent from either their previous experiences or influenced by observation. Beira and Cabral (2007:478), mentioned various factors that influence the choice of mode of transport as follows: "individual characteristics and lifestyle, the type of a journey, the perceived services performance of each mode and

situational variables". However, Gray (1992:625), Vilakazi and Govender (2014:260) and Mouwen (2015:1), indicated that public transport commuters consider on-time performances, travel speed, service frequency, personnel/driver behaviour and vehicle tidiness as the major factors behind their choice of transport.

Regardless of the factors influencing the choice of mode of transport, resistance towards change also has an impact on choosing and perception a particular mode of transport Consequently, Vilakazi and Govender (2014:258 and 267), indicated that the majority of commuters perceive a mini-bus taxi as an inadequate mode of transport, utilised more than the other modes of public transport. Scholars such as Belwal and Belwal (2010:17), Noor and Foo (2014:395), and Ugo (2014:5), indicated that the majority of commuters have unpleasant experiences with public transport such as buses, as they are also associated with socio-cultural barriers, always overcrowded, in-effective and risky to travel at night.

Belwal and Belwal (2010:17) showed that the minority of public transport commuters perceive public transport as most effective mode transport because, it is cost effective when when compared to the other modes of transport. The arguments precisely show that commuters' perceptions towards the mode of transport vary. Consequently, it is essential to conduct a study on commuters' perceptions and needs before implementing any mode of transport, BRT included. By doing so, decision –makers and policy makers would be able to approve and provide sustainable modes of transport that reflects commuters' travel attributes and needs.

3.4. Service provision concepts of commuters' perceptions of public transport

Concepts regarding service provision for commuters' travel needs, which include, integration, service quality considerations and affordability, are discussed below. Aspects on how these attributes are incorporated in the implementation of BRT system are also outlined.

3.4.1. Integration

According to the Strategies for Public Transport in Cities (SPUTNIC) (2009:1)), public transport integration refers to the incorporation of transport modes, tariffs, fares, schedules and ticket systems to function as one. On the one hand, Fang and Zimmerman (2015:1), indicated that public transport is customer-oriented and extremely efficient when it is planned and operated as an integrated system. On the other hand, Saliara (2014:537-538) and Fang and Zimmerman (2015:1), assert three arch-types of integrating public transport. These arch-

types are the institutional, operational and physical integration typologies. However, SPUNIC (2009:2), indicated that public transport integration means much more than mere provision of a more attractive public transport system that is reliable to the public. It also means the provision of complete public transport system with an anchoring vision of how a network or systems of public transport is developed and managed; how they are integrated with respect to timetables for various transport modes; how the principle of a single or one ticket operates under such circumstances; the rolling out of an agreed fare structure system in the network as well as how the service seeks to develop public transport close to “a door to door” service.

Integration of public transport enhances both sustainable accessibility and efficiency towards socio-economic activities. Wright and Hook (2007:8), highlighted that a well-integrated public transport system must be accessible and efficient. However, to achieve an accessible and efficient public transportation, the following public transport attributes must be considered:

- Providing a walkable urban structure that promotes walking, so as to discourage high dependence on private vehicles;
- Ensuring that public transport services, facilities are designed to suit all individual needs within the society; that is, the disabled, youths, aged and pregnant women;
- Facilitating development that supports the efficiency of public transport systems based on principles of promoting safe and direct access; and
- Providing a variety of plot sizes and housing types to cater for the diverse housing needs of urban dwellers at densities that can support the provision of viable public transport.

3.4.1.1. Integration concept with respect to the BRT system

According to Wright and Hook (2007:453), BRT systems should not be designed and implemented in isolation. Consequently, the system works best when they are part of an integrated network of transport options that allow safe and convenient access to all parts of the city. Unlike other public modes of transport, BRT system is planned and designed in such a way that the system is well integrated with the other modes of transport. BRT operating systems must be linked and connected to other public transport modes of travel, as a way of promoting the desired levels of services. This mode of public transport can attract a large number of commuters and thereby result in a change of commuter perceptions to a positive attitude towards bus use and travel. Furthermore, Wright and Hook (2007:463), noted that an efficient and integrated BRT system must be built on the premises of a viable corridor,

existence of facilities to allow easy access of corridor and terminals for pedestrians and cyclists. On the same note, a BRT infrastructure should be attuned to optimising existing public transport systems using taxis and feeder services through a “park and ride” or “park and kiss” integrated systems. An appropriately planned, designed, constructed and implemented BRT system will result in high dependence of BRT system and is confirmed through visible changes in societies’ perceptions towards public transport, particularly the use and popularity of BRT systems. As indicated by Deng and Nelson (2012:23), a well-integrated BRT system promotes an efficient, convenient and accessible mode of transport. Wright and Hook (2007:263-264), further indicated that accessible public transport such as BRT should consider the elements described in Table 3.1, in order to attract commuters and change their negative perceptions towards public transport such as buses.

Table 3.1. Elements to be consider when implementing a sustainable public transport

Element	Description
Accessibility	“Accessibility” refers to the viability of individuals with physical disabilities in using the system and reaching destinations.
Affordability	The “affordability” in providing public transport access is greatly affected by the need for pedestrian bridges, underpasses, and other significant infrastructure.
Aesthetic	The “aesthetics” of the pedestrian access area encompasses the attractiveness of the walkway, the street furniture, and the congruence between street design and local architecture.
Directness	“Directness” involves a pedestrian path that minimizes the distance travelled to access the public transport station. “Connectivity” refers to the ability of pedestrians to readily access a broader network of destinations.
Ease access	“Ease of access” refers to the pedestrian’s comfort level in walking along a corridor; this issue encompasses steepness of inclines, weather protection, condition of the walking surface, and protection from noise and air pollution.
Legibility	The “legibility” of an area refers to the ease in understanding the street environment. The availability of maps and signage can help legibility.
Safety	A “safe” pedestrian pathway implies that pedestrians are well protected from road hazards such as vehicles.
Security	“Security” refers to providing an environment where pedestrians are not susceptible to robberies or other crimes.

Source: Wright and Hook (2007:264)

Table 3.1 depicts and explains different elements to be considered when implementing a sustainable public transport. These elements include accessibility, affordability, aesthetic, directness, ease access, legibility, safety and security.

3.4.2. Service quality considerations

Service quality comprises of various elements of commuter travel needs. Commuters tend to prefer and have a good perception of any mode of transport which exhibits delivery on all quality service attributes. A mode of transport with high and good quality service tends to attract large numbers of commuters. According to Nandan and Geetika (2010:97–112), quality service in public transport can be defined as a commuters' perception towards a transport service that meets or surpass commuters' expectations. However, service quality remains as the critical challenge for public transport originations. Vilakazi and Govender (2014:259), assert that public transport organizations have difficulties in measuring the quality service, and commuters perceive quality as a multi-dimensional concept that apply to all services.

According to Currie (2005:41–53), quality service is composed of different attributes, which include comfort, travel time and the existence of appropriate infrastructural support systems. Vilakazi and Govender (2014:260) mentioned reliability, comfort, service, safety and affordability, commonly referred to by the acronym RECSA (reliability, comfort, service, safety and affordability) as the five key elements of quality for public transport. These key elements have specific elements linked to them as shown in the figure 3.3 below.

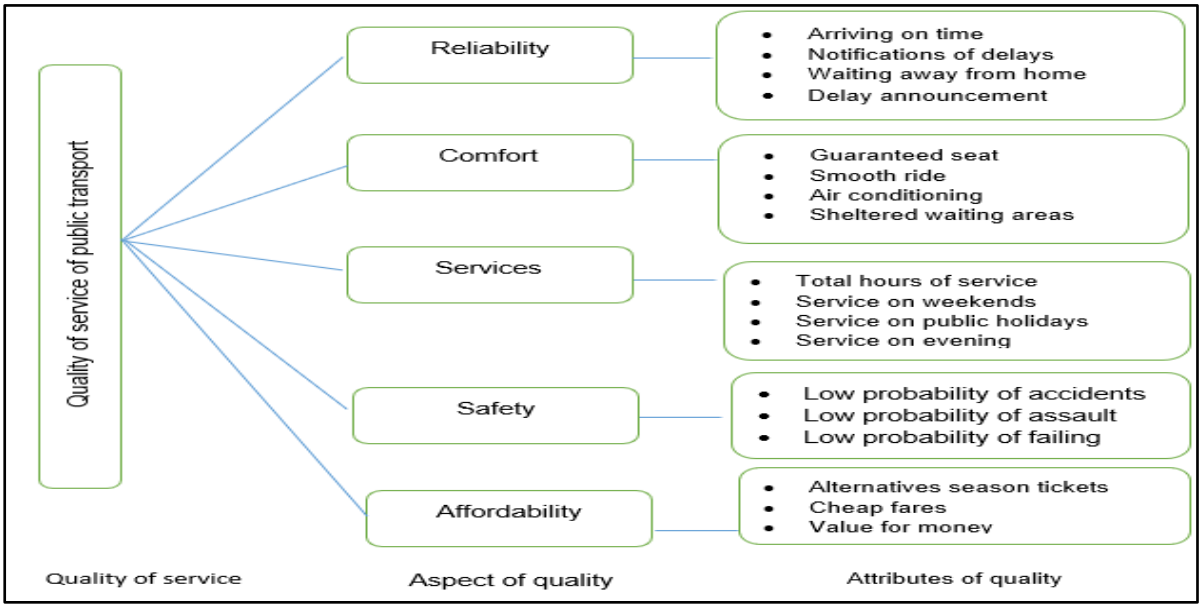

Figure 3.3. Cluster of service quality
Source: Adopted from Vilakazi and Govender (2014:260)

Figure 3.3 above shows key components of quality service and various attributes that determine the perceptions of commuters' perceptions towards various modes of public transport.

3.4.2.1. Service quality with respect to the BRT system

The distinct elements of BRT system ensure that the key elements of quality service in public transport are achieved. According to Deng and Nelson (2011:70), BRT elements are effectively integrated and work together, to ensure that a BRT achieves the required service and quality of public transport. Satiennam *et al*. (2006:69), further emphasized that BRT has many comfortable and luxurious facilities with high technology functions for faster and safer travel, including exclusive busways/dedicated lanes, convenient stations, comfortable articulated buses, and Intelligent Transportation Systems. For example, Diaz *et al*. (2004:2), indicated that dedicated busway enhances the system speed and reliability.

Wright (2005:11), further poited out that BRT systems are designed around the customer-based needs for speed, comfort, convenience, cost, and safety, rather than around a specific technology. Wirasinghe *et al.* (2013:15), also emphasised that the technological advancement on the vehicle and stations, as well as the use of dedicated right of way play a major role in ensuring safety and security. Wright (2005:450), indicated that BRT fares are on average relatively cheaper and affordable to all people within the society.

3.4.3. Affordability concept

Affordability is one of the critical concepts in public transport provision and services. This is because it is one of the foremost attributes that influences commuters' travel decisions (Nyarirangwe and Mbara, 2007:26). The cheaper or affordable the mode of transport, the higher the chances of being preferred by the commuters. However, Venter (2012:1), noted that dispersed spatial location between transportation system and other land use tends to increase high transport expenditure, while it creates affordability problems difficulties. For example, Piek (2017: ii), indicated that Cape Town spatial mismatch between residential areas and socio-economic activities influenced the high commuting costs and high travel times. Adewumi (2013:1), emphasised that cost is an important factor that influences the demand for public transport. Consequently, improving public transport travel fares is likely to attract a large number of commuters (Buehler and Pucher, 2011:126).

3.4.3.1. Affordability with respect to the BRT system

Wiresighe *et al.* (2013:11), indicated that affordability is one of the most crucial aspects of the BRT systems because it also affects system ridership. Different scholars indicated that BRT

is accommodating to all people in a society. However, (Ugo, 2014:9) asserts that the affordability of travel fares, indicates that the system is not affordable to the low-income people. Nevertheless, Vaz, and Venter (2012:627), attest that BRT is associated with major improvement in travel fares that areaffordable to low-income earners. For example, BRT Rea Vaya in Johannesburg costs R10.20 per trip while for other modes are at R11.70 , making BRT travel fares more affordable.

3.5. Theories of commuters' perceptions on public transport

Theories are the most vital tools in scientific research, particularly those related to human behaviour. Theories play a major role in both theory driven field and empirically-focused work. Commuters' perceptions towards the different modes of transport are influenced by various theories, most of which focus on the influence of human behaviour towards mode of transport. This study therefore reviewed the cognitive theory of "transport", theory of planned behaviour and operational choice theory of BRT implementation" . These theories are reviewed below, in order to illuminate how commuters' perceptions towards the implementation of BRT system play out in practice.

3.5.1. Cognitive dissonance "transport" theory

According to Juvan and Dolnicar (2014:3), the cognitive dissonance "transport" theory was propounded by Leon Festinger in 1957 in a bid to prove that "transport" actions could affect "commuter" preferences through cognitive dissonance. Various studies conducted (Culluta, 2013:1 and David, 2015:2), indicate that this theory effectively applies to decision-making and problem-solving situations where one must choose between two incompatible beliefs or actions. In addition, the theory is said to be extremely effective, especially when choosing between similar and positive alternatives. McLeod (2014:1), defined the cognitive dissonance "transport" theory as a situation that involve conflicting attitudes, beliefs or behaviours towards a transport object or service provision. He further indicated that this produces a feeling of transport commuting (dis)comfort leading to an alteration in one of the attitudes, beliefs or behaviours to reduce the (dis)comfort and restore balance. Archaya *et al*. (2015:3), indicated that in order to minimize or avoid this discomfort, there is a need to change transport commuter preferences to be more closely aligned with travel actions. Adjei and Behrens (2012:58) argued that, the use of information, particularly new information has impact on the transport

commuter dissonances. Figure 3.4 shows the schematic diagram of cognitive dissonance theory.

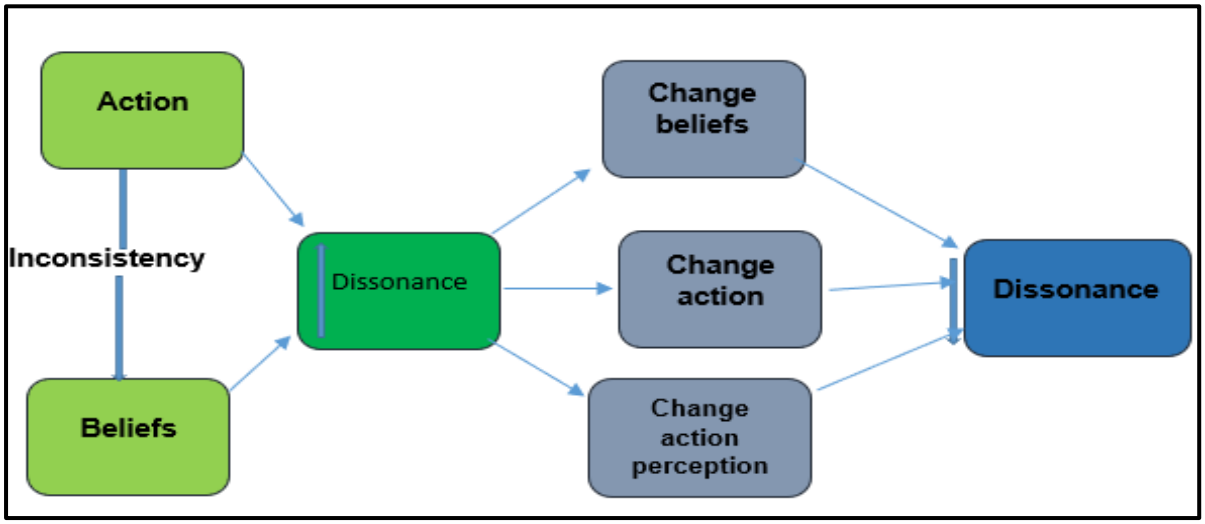

Figure 3.4. Schematic diagram of cognitive dissonance

Source: Festinger (2003:3)

Figure 3.4 depicts the schematic diagram of cognitive "transport" dissonance theory, which occurs due to inconsistencies between action and beliefs, resulting in dissonances. This obliges one to solve the dissonances by changing transport commuter action, change beliefs and change action perceptions. These changes result in what is termed "transport commuter" dissonances.

3.5.1.1. Relevance of cognitive dissonance to commuters' perceptions

Choosing the mode of transport for commuting can result in cognitive dissonance (Domarchi *et al.,* 2008:592). This would be particularly so in instances in which commuters have to choose the mode of transport for commuting after the implementation of the system. Under such circumstances, transport commuter cognitive dissonance would occur, dependent on the impact that new information can have on ones' attitudes towards the new transport system (Kah and Lee, 2016:373; Bamberg *et al.,*2003:177 and Adjei and Behrens 2012:61). Effective communication with regards to newly introduced modes of transport should show benefits around issues such as comfort, affordable travel fare, safety and security of transport and secure stations and routes.

The way in which such benefits are packaged will result in commuters having to change their change of perception towards their current mode of transport and the BRT system. The change in commuter perception can be in favour of a traditional mode of transport or in-favour of BRT system, depending on how the introduction of the implementation of BRT was

communicated to the Polokwane community. For example, having and knowing the full benefits of a BRT system can assist in making a habitual car user desist from using the car or seek contrary information about the BRT system (in) adequate benefits to come to terms with using the car. Adjei and Behrens (2012:60) and David (2015:1), indicated that people tend to change their actions and perceptions of action than changing behaviour, since one cannot easily undo deeply entrenched behaviour. Therefore, communicating the new information of the new BRT system might influence Polokwane commuters to change their perception and response actions regarding BRT as a public transport choice, thereby shifting from private vehicles to the use of BRT system.

3.5.1.2. The main findings of the theory in relation to the study

The main findings of the theory review are summarized as follows:

- New information can affect the transport dissonances resolution, depending on how it was communicated;
- People tend to choose to change their transport commuter perceptions and actions about an object, rather than transport commuting behaviour since the past cannot be easily undone;
- Festinger pointed out that, even though people pursue the reduction of transport commuting dissonance in the long run, it may persist because of the difficulties which may be encountered while changing either the behaviour, or the knowledge about the behaviour (Adjei and Behrens; 2012:60).

3.5.2. Theory on planned travel behaviour (TPB)

According to Adjei and Behrens (2012:59) and Armitage and Conner (2001:472), the Theory of Planned Travel Behaviour (TPB) was introduced by Ajzen in 1991, to predict the non-volitional transport commuting behaviour induced by factors such as time, money and skills. Consequently, this theory explains and predicts factors that affect mode of transport choice. These which include, behavioural beliefs, normative beliefs and non-controlled beliefs and value system considerations. Ajzen (2002:1), indicated that these three factors respectively aggregate, behavioural beliefs producing favourable and unfordable attitude towards commuter behaviour. Normative beliefs result in perceived social pressure or subjective norm and control beliefs give rise to Perceived Behaviour Control (PBC) in which in combination they result in (mis)information of Behavioural intention.

According to Ajzen (2002:1), various transport considerations (which constitutes variables) are linked together to predict one's travel behavioural intentions. However, Armitage and Conner (2001:472), indicated that from the three antecedents of intentions, PBC is the only antecedent that influences both the commuter intention and commuter behaviour change. Therefore, the theory can be best defined as the theory that predicts an individual's commuter intention to be engaged in a transport changing behaviour in space and time. Figure 3.5 shows a schematic diagram of the Theory of Planned Behaviour.

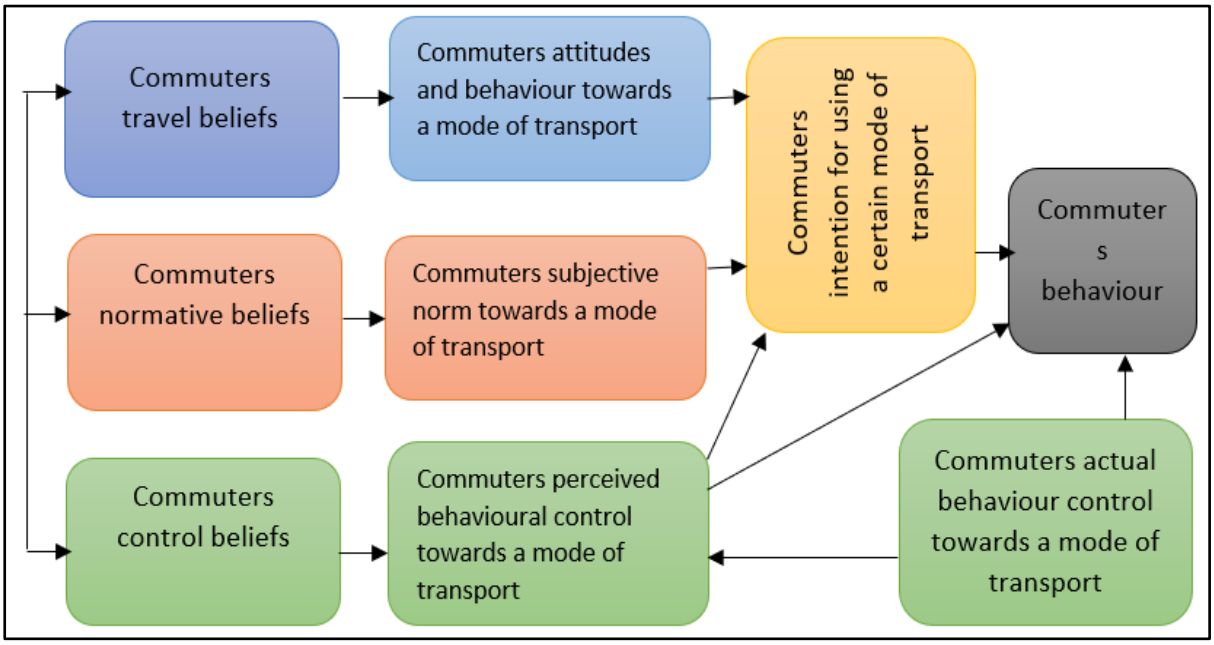

Figure 3.5. Schematic diagram of the theory of planned travel behavior

Source: Authors construct (2017)

Figure 3.5 depicts the schematic diagram of TPB. The diagram shows three steering commuter perception factors, such as behavioural beliefs, normative beliefs and control beliefs, that influence one's intentions to perform the commuting behaviour in question. These factors respectively aggregate and cascade in both directions, with behavioural beliefs spiralling to commuting attitudinal behaviour, normative beliefs cascading to commuting subjective norms, while controlling cultural beliefs results in Perceived Behavioural Control in the way in which the factors combine to result in commuter behavioural intention and shifts. However, PBC influences both the behavioural intentions and behaviour.

3.5.2.1. Relevance of the TPB to commuters' perceptions

Bohte *et al*. (2009:394), indicated that TPB defines factors that influences travel behaviour. Travel behaviour may include the categories of behavioural intentions towards a decision to travel, mode of choice for commuting, time for catching a mode. The study conducted by Bamberg *et al.* (2003:175), proved that the Theory of Planned Behaviour plays a major role in making a choice on mode of transport. The study concluded that the commuter's choice of mode of transport is a largely reasoned decision, that can be affected by the new intervention that bring changes in attitude, subjective norms and perception of behavioural control. The study further pointed out that the past commuting or travel choice contributes to the prediction of late behaviour, however only circumstances remain relatively stable.

In support of the TPB theory towards BRT implementation, the studies carried out by Levinson *et al*. (2003:4-5) and; Deng and Nelson (2011:70) showed that the system infrastructure, operational and service unique and innovative characteristics such as segregated right of way, the use of Intelligent Technological systems, service (frequency, span or travel time , reliability, affordable travel fares) and comfortable, safe and secured station, buses satisfy commuters' travel needs and result in higher system ridership and less use of private vehicles. Consequently, the implementation of the BRT in Polokwane might result in commuters undergoing changes of behavioural intentions towards public transport, particularly, the BRT system, thereby resulting in the shift of the commuters' current mode of transport to the use of BRT system.

3.5.2.2. Main findings of the theory in relation to the study

The main findings of the theory and its applicability to the study are summarised as follows:

- TPB plays a major role towards the choice of mode of transport;
- The three fundamental factors influencing commuter perceptions and intentions include attitude, subjective norms and perceived behaviour. These factors also play a further role of controlling and determining the behavioural intention of commuters towards the preferred mode of transport;
- The TPB theory defines the factors influencing travel behaviour, resulting in shaping commuters' behavioural intentions towards the choice of mode of transport;

- The implementation of BRT system is likely to change the perceptive foundation of commuter travel intention and behaviour towards existing and new modes of transport; and
- Change of perception towards BRT system results in having higher behavioural intentions and that can become more inclined to the use of public transport or BRT systems.

3.5.3. Operational choice theory of BRT implementation

According to Schneider (2013:129), the operational theory of BRT implementation is described as the individual choice towards the available mode of transport for routine travel purpose. This theory emphasises that people travel for a purpose, and that determines the type of mode of transport they prefer for commuting. The theory suggests that there are five steps in the choice of decision making process. These processes are best summarized and defined in Figure 3.6 below.

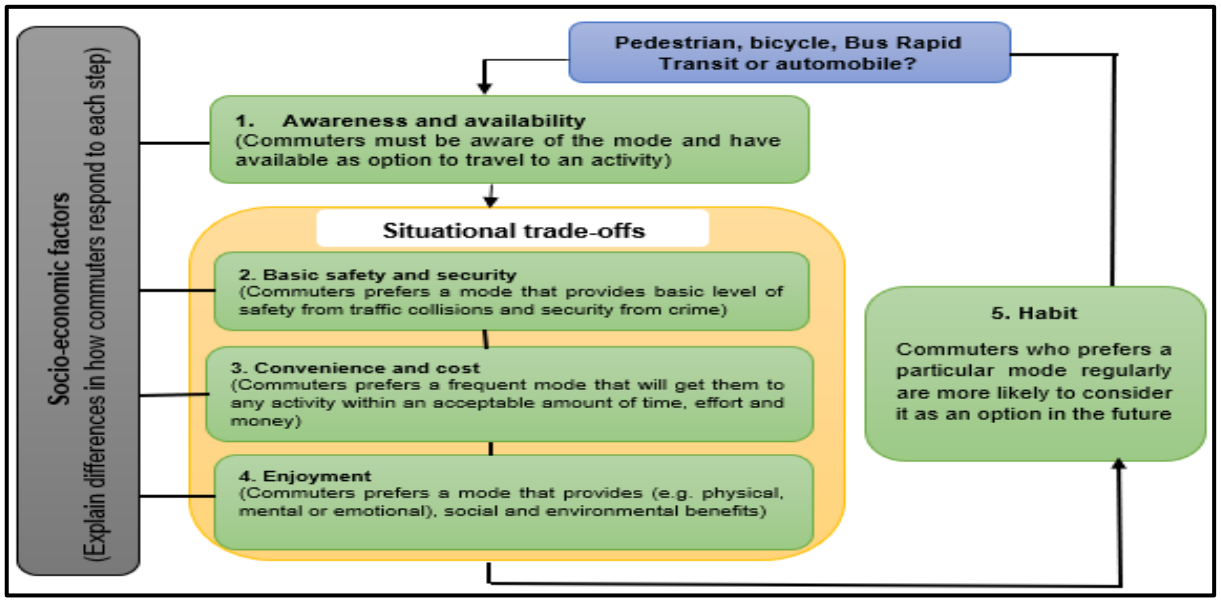

Figure 3.6. Schematic diagram of operational choice theory of BRT implementation

Source: Schneider (2013:130)

Figure 3.6 precisely indicates the five steps of the theory of operational choice theory of BRT implementation. The first part, (1) awareness and availability, determines which modes are viewed as possible choices for routine travel. The next three elements, (2) basic safety and security, (3) convenience and cost, and (4) enjoyment, assesses situational trade-offs between modes in the choice set. These middle three steps may be considered

simultaneously or in various sequences. The final part, (5) habit, reinforces previous choices and closes the decision process loop. Socio-economic characteristics explain differences in how individuals view each part of the process.

3.5.4. Relevance of operational choice theory to BRT implementation

According to the Polokwane CITP (2013:16), Polokwane residents commute for various reasons, including, educational, leisure, work purposes. Ugo (2014:3) indicated that the purpose of commuting also has an influence on the type and mode of transport used. The socio-economic factors also play a major role towards using a specific mode of transport. This was supported by Tiwari and Jain (2012:87), who emphasized that distances travelled and choice of mode for travel is influenced by socio-economic profile of the users and availability of mode choice. For example, high-income earners tend to use private vehicles, while low-income earners use public transport such as buses and taxis for commuting. Therefore, the routine and purpose of commuting is likely to determine whether the Polokwane residents will shift to use the BRT system.

3.5.4.1. Main findings of the theory in relation to the study

According to this theory, commuters choose the mode of transport depending on the following factors:

- Awareness of the availability of a mode of transport;
- Safety and security;
- Convenience and affordability;
- Provision of entertainment and enjoyment; and
- Based on their habit (that is, if they have been using a mode of transport regularly).

3.6 Emerging model from the theories of commuters' perceptions towards the BRT system

According to the reviewed theories of commuters' perceptions, such including cognitive dissonance "*transport*", theory of planned "*travel*" behaviour and operational choice of BRT implementation, the psychological state of mind influences the mode of transport to be chosen, travel behaviour and the reason for commuting. However, a commuters' state of mind is dependent on the system's service quality or and the commuters travel needs. Currie (2005:41-53), highlighted that quality of service is composed of different commuters' travel needs or attributes, such as comfort, safety, reliability and affordability of the system. Satienam *et al.* (2006:69) and Wright (2005:1), indicated that BRT systems designs, elements and

technology associated with the system enable the system to offer most of these commuters' travel needs in a cost-effective manner. This results in many commuters shifting from their current mode of transport to the BRT system.

3.7. Chapter summary

The chapter showed that the implementation of the BRT system is influenced by various factors, which include the notion of commuters' perceptions towards the system, which is linked to the service provision concepts of public transports, such as integration, service quality consideration and the affordability of the mode transports. Furthermore, the reviewed theories disclosed a magnitude influence exerted by various theories such as the cognitive dissonance *"transport"* theory, theory of planned *"travel"* behaviour and operational theory of *BRT* implementation on commuters' perceptions on the implementation of the BRT system. The following chapter focuses on the policies, legal and institutional framework of implementing BRT system.

CHAPTER FOUR: POLICIES, LEGAL AND INSTITUTIONAL FRAMEWORK FOR IMPLEMENTING THE BRT SYSTEM.

4.1. Introduction

The implementation of BRT system is guided by various policies and legal framework that must be adopted by distinctive institutions that are responsible for implementing any BRT system. This section discusses the general policies that are used across the globe to guide the implementation of the BRT system. At the same time, the legal framework in South Africa and the institutional framework that inform BRT implementation are also outlined. Figure 4.1. highlights the structural settings of this chapter.

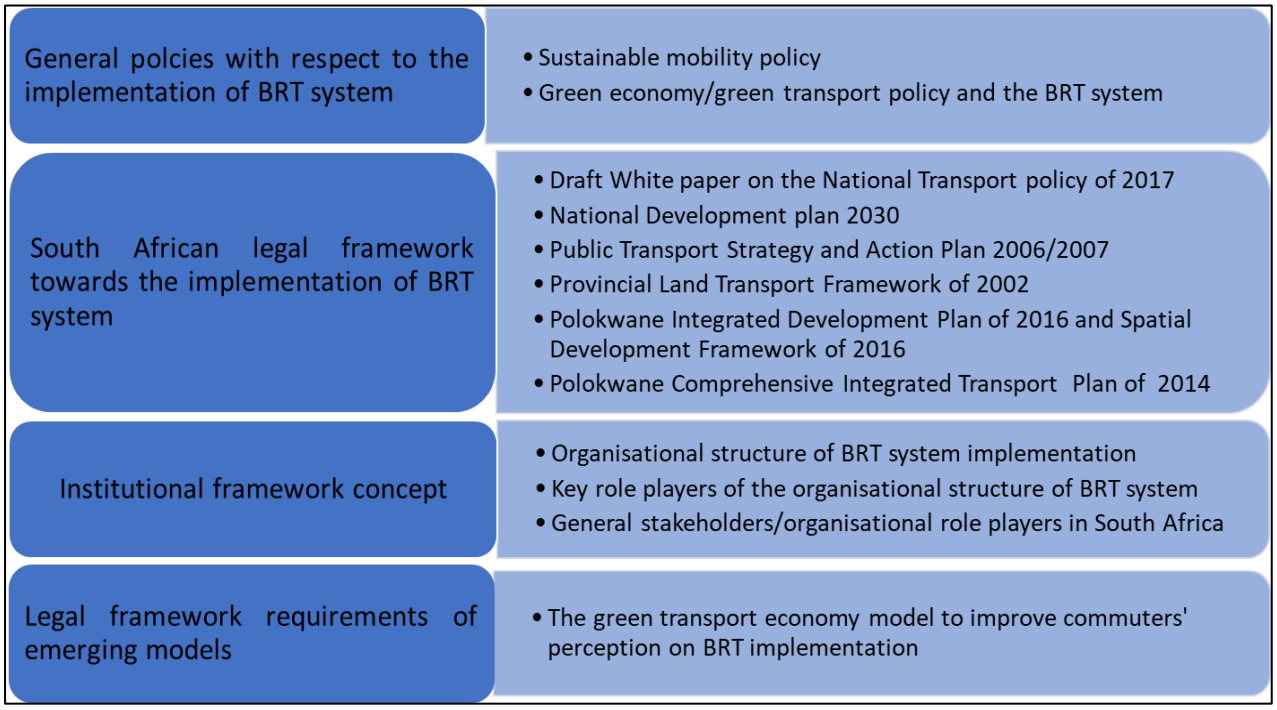

Figure 4.1. Structural settings for chapter four
Source: Authors construct (2018)

Figure 4.1. shows that chapter four is structured into four sections, which include the general policies with respect to the implementation of the BRT system, South African legal framework towards the implementation of BRT system, the Institutional framework concept that inform implementation of BRT system and the legal requirements of emerging models.

4.2. General policies with respect to the implementation of the BRT system

The entire globe has been facing major transport problems, such as including traffic congestion, unreliable public transport, high consumption of non-renewable energies, and high emission of greenhouse gases. However, at the same time, there has been the (r) evolution of new policies that seek to address such transportation problems. Below are general policies that deal with the implementation of BRT systems. These policies specifically promote the use of public transport and Non-Motorised Transport (NMT), as they are perceived as sustainable modes of transport that can address challenges faced by global cities.

4.2.1. Sustainable mobility policy

According to UN-HABITANT (2013:60), the sustainable mobility policy advocates for adopting a new paradigm shift in addressing urban mobility. This policy strives to achieve the sustainable transportation development goals by ensuring that transport systems are sustainable. Nykvist and Whitmarsh (2008:1373) and Bannister (2008:74-75), indicated that this policy can be achieved through four possible actions such as technological change, reduced travel demand, land use policy measures and transport policy that promote modal shift. According to Bannister (2008:75), by adopting the four-mentioned actions, the sustainable mobility policy will be able to achieve its goal of minimizing travel need, encouraging modal shift and encouraging greater efficiency of transport system. However, for the policy to be extremely effective, there must be a strong support base from the society. Consequently, Banister (2008:80), emphasised that sustainable mobility is reliant on the understanding and acceptability of the system by the commuters. Nykvist and Whitmarsh (2008:1374), grouped the dimensions of sustainable mobility under the social, economic and environmental pillars of sustainability. These dimensions are depicted by table 4.1. below.

Table 4.1. Dimensions of sustainable mobility

Economic outcomes	Environmental	Social outcomes
Accessibility Transport operation cost Productivity/efficiency Coasts to economy Benefits to economy	Resources use Direct ecological intrusion Emissions to air Emissions to soil and water Nose Waste	Accessibility and affordability Safety and security Fitness and health Liveability and amenity Equity Social cohesion Working conditions in transport sectors

Source: Nykvist and Whitmarsh (2008:1374)

Table 4.1 depicts the three dimensions of sustainable mobility, which are economic, environmental and social outcomes.

Bannister (2008:79-80) also mentioned different principles of the sustainable mobility policy. These principles are linked together with the four actions of the policy. The principles are showed and described in Table 4.2.

Table 4.2. The principles of sustainable mobility policy

Principle	How it will be achieved
1. Promote the use of the best technology	The policy aims to make use of best technologies such as best technological engines, the use of alternative fuels (for example hybrid fuel vehicles), and the use of renewable energy sources.
2. Regulation and pricing means	By increasing parking fees for private vehicle in prime nodes and central places.
3. Integrating land use development and the policies.	Promote transit-oriented development, compact cities, new urbanism and mixed land uses that enhance the use of public transport and non-motorized transport.
4. Clearly targeted personnel information	Precisely speak and engage with society about the policy

Source: Bannister (2008:79-80)

Table 4.2 shows the four principles of sustainable mobility policy which are meant to promote the use of best technology, regulation and pricing means, integrating land use development and transport policies and clearly target personal information. The table also reveals further shows how the sustainability mobility policy has been crafted with the intention to achieve such principles.

4.2.1.1. Relevance of Sustainable mobility polices in terms of implementing BRT system

According to UN-HABITANT (2008:13), public transport systems offers solutions for improving urban mobility, quality of life and the environment in both developed and developing countries while providing a competitive alternative to private cars. Among public transport, BRT is perceived to be the most sustainable mode of public transport that can assist in achieving sustainable urban mobility in a cost-effective manner (Deng and Nelson, 2011) and Cervero (2013:4). According to Pojani and Stead (2015:7791) and Mganda (2017:5), cities across the globe have been implementing the BRT system, in order to enhance commuters' mobility and

reduce the transport related challenges such as traffic congestions, time saving, unreliability and high energy consumption.

The UN-HABITAT (2013;40), further indicated that BRT supports the sustainable mobility policy by ensuring that the implementation of a BRT system transforms cities to be more sustainable, live-able with cleaner environment from reduced air and noise pollution. The unique characteristics of the BRT systems serve the main goals of promoting sustainable transport mobility in different ways. For example, scholars such as Saitiennam *et al.* (2006:61) and Pojani (2015:7791), indicated that the systems use environmentally friendly fuels, such as natural gas, electricity and bio-fuels, reduces energy consumption and pollution, while ensuring that commuters are provided with frequent services on an exclusive right of a way. The UN-HABITAT (2013:13 and 41), further indicated that the systems flexibility, combined stations, segregated right of way and the use of intelligent technological systems, ensures that the system operates in a frequent manner. The BRT systems provides high quality services while accommodating a large number of commuters in a reliable, affordable, comfortable and safe manner.

4.2.2. Green economy/ green transport policy and the BRT systems linkages

Green transport policy emerged from the concept of Green economy. Bushehri (2012:2), defined Green economy as the process of decoupling of unsustainable resource use and socio-environmental impacts from economic growth. According to Bongardt and Schalternberberg (2O11:1), UNEP in 2011, it is indicated that green transport is one of the main sectors targeted as instrumental in achieving the main goal of a green economy. The main role of a green transport policy is to ensure that the transport sector transect from the current unstainable mode of transport that are associated with increase of greenhouse emissions, immobility within cities, unaffordable, environmental hazardous and high consumption of non-renewable energies Bushehri (2012:2) and UNEP,2011).

According to UNEP (2011:382), green transport is any mode of transport that is environmentally, social and economic friendly. The mode of transport considered to be a green transport, must pose less impact on the environment, while using renewable resources and accessible by all person of different income level within a society. The BRT system fits in the conceptual and operational definition of a green transport system. Table 4.3 describes the the sustainability parts of the green transport system being applied to the BRT system.

Table 4.3. Sustainability parts of green transport

Pillars of sustainability	Explanation	Application to BRT system
Environmental	• Low greenhouse gases • Mitigate against global climate change, • Reduces public unhealthy issues, • Based on and uses renewable resources	BRT systems buses use renewable energy and green fuels that reduce the energy consumption and emission of pollutants (Pojani, 2015:7791)
Economic	• Are affordable, fair, efficient and balance regional development and the creation of decent jobs	BRT systems are efficient, cost effective, safer and attracts Transit Oriented Development that improves commuters' accessibility to various socio-economic activities (Mganda, 2017:6 and Cervero, 2013:31)
Social	• Allowing the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health • Promoting poverty reduction and equity within and between successive generations	BRT enable all individuals within the society to equally access different socio-economic activities while also creating job opportunities by attracting investors (Deng and Nelson,2011:75)

Source: (UNEP, 2011:382) and Authors construct (2018)

Table 4.3 shows sustainable parts of the green transport, with clear explanations on the application to the BRT system being provided. These parts are based on the three pillars of sustainability which are environmental, economic and social factors.

4.2.2.1. Relevance and applicability of green transport policy in implementing BRT system

The green transport policy is relevant and applicable when in implementing the BRT system in various ways. For example, according to Bongardt and Schaltenberg (2011:2), green transport polices encourage the switch from in-efficient private vehicles to the efficient public transport systems. This is because structured BRT systems provide high quality and efficient services to the commuters. In addition, high order public transport customer services are well integrated with other public transport and Non-Motorised Transportation, such as pedestrian walkways and cycling lanes, making BRT system a superior transport commuting service, compared to using private cars and taxis.

The implementation of a BRT system is associated with a reduction in greenhouse gases from road transport, reduction of non-renewable energy, improvement in urban air quality and health benefits. This is due to less travel times for commuters, a reduction in traffic congestion, stimulation of modal shift, from private vehicles to clean, safe, affordable, financially viable and socially acceptable and environmentally-sound public transport system in the form of BRT (DOT, 2007:12). Bongardt and Schaltenberg (2011:4), indicated that efficient and sustainable transport can be achieved through by adopting the holistic Avoid-Shift-Improve Strategy

(ASIS). This strategy aims to promote a shift from cars to sustainable public transport. Figure 4.2 shows the relevance and relationship between the green transport policy and the implementation of BRT system.

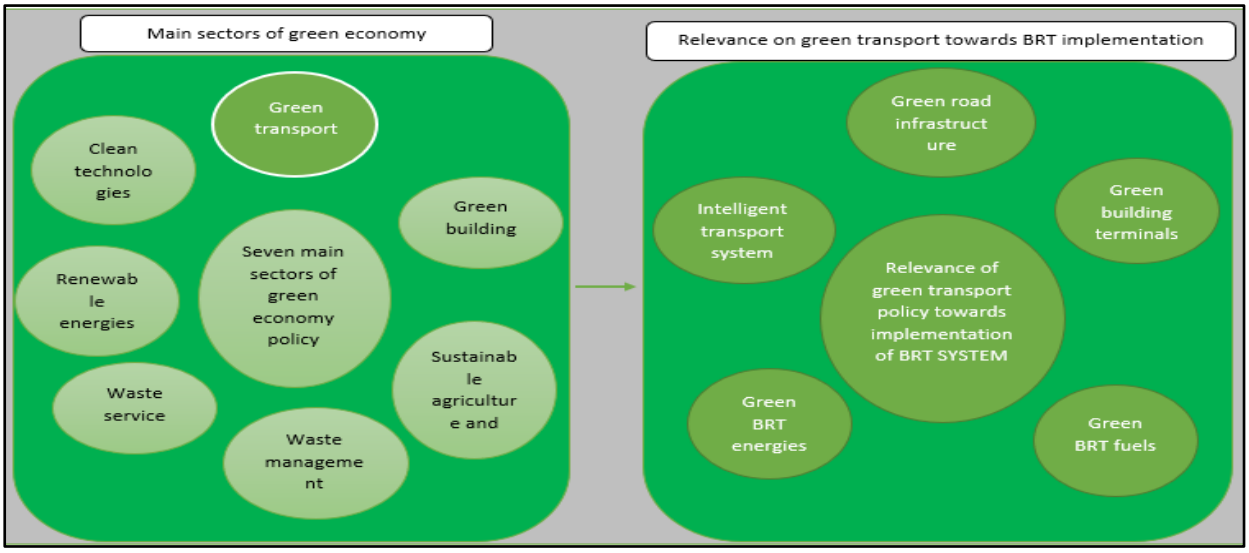

Figure 4.2. Relevance of green transport policy towards BRT implementation

Source: Adopted from Bongardt and Schalternberg (2011:1)

Figure 4.2 shows the relevance and the relationship between the green economy policy and the green transport towards the implementation of a BRT system. It clearly shows that the implementation of a BRT system will assist in achieving the main goals espoused in the green transport policy. This is because BRT systems, uses green transport infrastructure, green transport terminals, clean technologies such as intelligent transport system and the use of green transport fuels and energies such as natural gas, electricity or biofuels and as well as the use of clean diesel (Cervero,2013:23 and Pojani and Stead,2015:7791)

4.3. South African Legal Framework towards the implementation of BRT system

South Africa has various legislative mandates that support the implementation of a BRT system. These legislative mandates are derived from different legal framework such as the White Paper on National Transport Policy (1996 – under revision), National Development Plan, Public transport strategy and action plan, Provincial land transport framework, Polokwane IDP and SDF and Polokwane Comprehensive Integrated Transport system. These policies support the general policies of sustainable mobility and green transport policies. Table 4.4 indicates all the legal framework that should be reviewed in informing the deployment of a successful BRT project.

Table 4.4. Legal framework towards the implementation of the BRT system

Legislative framework	Sphere of government
White Paper on the National Transport Policy (WPNTP), 2006 (Draft revision underway)	National legislation that provides cue to national, regional, provincial, district and local transport plans in South Africa.
National Development Plan 2030 of 2012.	National Development Plan that guides development thrust with a chapter 8 dedicated to transforming human settlements. A key lever for this chapter is the implementation of integrated public transport networks and systems anchored on BRT systems as one of the key pillars.
Public Transport Strategy and Implementation Plan of 2006/2007	National Public Transport Strategy that identifies priority urban areas in South Africa in which IPTN and BRT systems should be implemented, Polokwane included.
Provincial land transport framework 0f 2002	Provincial Framework that indicates the major transport issues in Limpopo province with targeted public transport interventions for nodal points in Limpopo, Polokwane included.
Polokwane IDP (2016) and SDF (2016)	Local Plan and Framework with specific transport actions and measures to address existing commuting challenges in Polokwane.
Polokwane CITP of 2013	Local plan that indicates clearly the need for integrated commuting solutions in solving commuting problems in Polokwane with particular emphasis placed on the role that the BRT will play in resolving issues.

Source: authors construct (2017)

Table 4.4 above shows the legal framework reviewed that supports the implementation of the BRT system. It further shows that all spheres of government have different but complementary roles associated with the implementation and operationalization of each legislation, plan, framework or policy and how this plays out in the context of rolling out a BRT system.

4.3.1. Draft White Paper on the National Transport Policy (WPNTP) of 2017

The study also benefits immensely from insights provided by the draft Revised White Paper on National Transport Policy of 2017. This is an umbrella policy for the transport sector. According to Tenza (2017:11), the main aim of the policy towards public transport is to “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 rural and urban passengers”. The White Paper on National Transport Policy of 1996 also features the Land Passenger Transport, in which, one of its key strategic objective is to promote customer-based systems. This strategic objective aims to ensure that passenger transport services address commuters’ needs, promote affordable public transport, while promoting safe and secure, reliable and sustainable passenger transport (DOT, 2008:35).

4.3.2. National Development Plan 2030

The National Development Plan 2030, chapter four (Economic infrastructure) stipulates a vision of South African transport system in 2030. The key goal of this chapter from a transport perspective, is to maintain and expand transport infrastructure to support economic growth and social development goals. The plan various issues that relates to the implementation of the BRT system. For example, according to the National Planning Commission (NPC) (2012:183), in 2030, the transport sector will promote a low-carbon economy by offering transport alternatives that minimise environmental harm. The plan further emphasised that in 2030, the transport systems will strive to serve the interest of the society by meeting commuters travel needs. It will do so by ensuring that all South Africans are provided with suitable means for safe, affordable and efficacy transport services that meet their needs (NPC, 2012:184). The NPC (2012:185) also indicated that it must be a key policy and planning priorities that by 2030, the South African transport system creates a workable urban transit solution that includes public transport such as BRT system.

4.3.3. Public Transport Strategy and Action Plan 2006/2007

According to DOT (2017; 1), The Public Transport Strategy is a key driver of the other strategies developed within the transport sector. Polokwane IRPTS (2014:x), indicated that the PTS of 2007 has two main thrusts. These include, Accelerating Modal Upgrading and Integrated Rapid Public Transport Network (IRPTN), their aim is to provide equitable and sustainable public transport that is car competitive in order to attract commuters and to reduce public transport related problems.

Pillay and Seadat (2007:398), precisely indicated that Public Transport Strategy was then followed up by the Action Plan, whereby six metropolitan cities and other six minor cities, including Polokwane were selected to put the strategic plan in action. Pillay and Seadat (2007:399), further indicated that current private car commuters are not pleased with the current public transport service quality. Consequently, this requires transport planners and implementers to have a precise understanding and perceptions of commuters towards the proposed integrated rapid public transport, such as BRT systems, so they can effectively integrate commuters' travel needs on the final product of the BRT system. This would contribute towards the success of the Public Transport Strategy and Action Plan of 2006/2007.

4.3.4. Provincial land transport framework of 2002

The National land transport act requires each province to prepare a provincial land transport framework for a five-year period. The provincial land transport framework (PLTF), must serve to guide land transport in provinces including intra provincial, inter provincial and cross-border transport. Over time, subsequent provincial land transport frameworks must also include summaries of local plans within the province. This entails that each province should have their own policies which guide the implementation of BRT systems that consider theirunique commuters' travel needs. s. The Polokwane CITP (2013:12), also highlighted that the Limpopo provincial land transport framework borrowed its vision from the White Paper on National Transport Policy (1996). This vision supports the implementation of integrated, safe and secure mode of transport which includes the implementation of BRT system.

4.3.5. Polokwane Integrated Development Plan of 2016 and Spatial Development Framework of 2016

The Integrated Development Plan (IDP) and Spatial Development Framework (SDF) can be argued to be the most fundamental tools for the South African local municipal governance system. The Polokwane IDP (2016:75), clearly pointed out that public transport is one of the major challenges faced by the Polokwane municipality. The Polokwane Comprehensive Integrated Transport Plan (2013:46) and Polokwane SDF of 2016 (2006:18), mentioned traffic congestion, poorly integrated public infrastructure and long travel distances as chronic transport problems in the area. These problems have a combined net effect of having transport services that are focused on the profitable peak periods only, with limited to no services during off-peak periods. At the same time, existing public transport systems provide no advance time-tabled passenger information for commuters', compounding the public transport challenges faced by the municipality. As instructed by the Department of Transport, the municipality introduced the implementation of the Integrated Rapid Public Transport in form of BRT system so as to address the aforementioned transport challenges faced by the municipality (Polokwane IDP, 2016:119). According to the PKL IDP (2016:126), the implementation of the BRT system within the municipal jurisdiction is expected to result in the transformation of the municipal public transport sector through the provision of high quality and affordable transport systems whilst reducing commuting travel time.

4.3.6. Polokwane Comprehensive Integrated Transport Plan (Polokwane CITP) of 2014

The main vision of Polokwane Comprehensive Integrated Transport Plan (CITP) of 2014 is "to provide a safe, reliable, efficient, effective and integrated transport system for both passengers and freight that will enhance the quality of life for all" (CITP, 2014:13). Polokwane CITP (2014:35) also highlighted that it aims to provide public transport that are accessible and benefit large community to stimulate economic growth and development. The CITP (2014:13), further outlined objectives that support, consider and incorporates commuters travel needs when implementing integrated transport systems, such objectives include:

- Providing for and manage future transport demand;
- Providing a more balanced transport system;
- Promotion of public transport integrated with other modes of transport;
- Relating to and complimenting the spatial development plan; and
- Supporting economic development strategies and long term Environmental management strategies.

4.4. Institutional framework, organizational structure and operational characteristics of the BRT system

To have a clear understanding of the implementation of a BRT system, it is crucial to have a clear understanding of the institutional framework, the organization responsible for operating and managing the system and its main operational characteristics. The incorporation of the literature obtained, and the collected data will give directions as to how the Polokwane BRT was implemented. At the same time, the BRT institutional framework and organization structure provides benchmarks in understanding the degree of whether BRT implementation was well articulated to the commuters or not. In any case the review of the BRT operational characteristics will provide lenses for assessing whether the BRT system responded to commuter's travel needs. In this way, this analysis will assist the researcher to propose a BRT implementation guideline that is able to consider all the gaps as evidenced by the Polokwane BRT implementation experience.

4.4.1. Institutional framework concept

An institutional framework provides the incentives that dictate the kinds of skills and knowledge perceived to have the maximum payoff. According to Wright (2002,149), the supporting institutional structure can either create an efficient and transparent environment or lead to

corruption. Studies conducted by Turner *et al* (2012:15), and Wright (2003:150), revealed that the institutional framework of the BRT system consists of both public and private sector, whereby public sectors plan and implement, and private sectors are responsible for the operation of the system. For example, according Feye *et al*. (2014:13), the Transmilineio BRT is planned by the public sector and operated by the private sectors.

Wright and Hook (2007:561), indicated that the institutional oversight of the BRT system can be implemented through existing agency or through a newly created organisation. He further outlined the following as some of the responsibilities for the transport institution: Policy-making and setting standards; Regulation; Planning and design; Project implementation; Operational management; Financial management; Contracting and concessions; Regulation; Administration; and Marketing. The institutional framework of BRT system varies from one country to the other. However, Wright and Hook (2007:159), indicated that there is a general institutional framework for the BRT system, which is depicted in the Table 2.8 below. Hook (2006:2), further outlined different institutional frameworks of BRT system from different cities. Table 4.5 below depicts the general optional institutional framework of BRT system, while table 4.6 depicts the institutions managing BRT systems in selected cities.

Table 4.5. General optional institutional framework of the BRT system

Institution	Description
Transport department	Large entity with a wide range of regulatory and management responsibilities; typically reports directly to city political officials
Transport authority	Organisation with wide oversight on all public transport activities; frequently given autonomous status through a board of directors
Public company	A specially created company that is owned and managed by the local government
Specialised transport agency	Smaller organisation with a focused mandate; typically reports directly to city political officials
Non-profitable organization	Independent outside organisation that is given the responsibility of managing the public transport system

Source: Wright and Hook (2007:561) and Wright (2002:150)

Table 4.5 Shows the general framework of the BRT system, which is made up of the transport department, transport authority, public company, specialized transport agency and non-governmental organizations. Table 4.6 depicts the institutions managing BRT systems in selected cities.

Table 4.6. Institutions managing BRT systems in selected cities

Institutions Managing BRT Systems, Select Cities										
	Bus Authority	BRT Authority	Transport Department Contracted BRT	Public Bus Company	Metro Company	Authority (excluding Metro rail)	Transport Authority (All transport)	Transit Authority	Contracted Transit Service Provider	Transport Department In House
Lower-Income Countries										
TransMilenio, Bogota		X								
Medellin, Colombia					X					
GBRT, Guangzhou		X								
Guadalajara, Mexico		X								
Lima (Protransporte)		X								
Rio de Janeiro (Transoeste)			X							
Curitiba (URBS)	X									
Belo Horizonte (BHTrans)						X				
Pereira, Colombia (Megabus)		X								
Guayaquil, Ecuador (Metrovia)		X								
Cali, Colombia (Mio)		X								
Sao Paulo, Brazil (SP Trans)	X									
Ahmedabad (Jan Marg SPV)		X								
Johannesburg (Rea Vaya)			X							
Monterrey, MX			X							
Mexico City (Metrobus)		X								
Estado de Mexico (Mexibus)		X								
Jakarta, ID (TransJakarta)		X								
Leon, MX (rating pending)		X								
Caracas, VZ					X					
Lanzhou, BRT				X						
Beijing, China				X						
Jinan, China				X						
Puebla, MX		X								
Cape Town BRT			X							
Lagos busway (Not BRT)							X			
Delhi HCBS (basic BRT)				X						
Dar es Salaam (2016)		X								
Higher-Income Countries										
Rouen, France (TransDev)									X	
Paris Mobilien, Ile de France (RATP)									X	
Brisbane, Australia (TransitLink)								X		
Amsterdam R-Net (rating pending)									X	
Nagoya busway (rating pending)										X
HealthLine, Cleveland (RTC)								X		
Cambridgeshire , England									X	
Nantes, France (Semitans)									X	
LA Metro (Orange Line)								X		
Las Vegas (RTCSV)								X	X	
Ottawa, Canada (OC Transpo)										X
Pittsburgh MLK (Port Authority)								X		
London (busways only)							X			
San Francisco (no BRT yet)							X			

	Gold Standard BRT
	Silver Standard BRT
	Bronze Standard BRT
	Basic BRT, not yet rated BRT, not BRT, not yet implemented, as specified

Source: Hook (2006:2)

Table 4.6 shows how different BRT systems across the selected cities manage their BRT systems. It further reveals that the majority of the BRT system are managed by the BRT authority, as compared to the other managing authorities. It also highlights the three different types of BRT systems, with Silver standard BRT dominating, following by Bronze and Gold BRT system being the least implemented system.

4.4.2. Organisational structure of BRT system implementation

According to Tunner et al (2012:19), an organisational structure is an important component in the successful delivery and operation of a BRT system. The organisational structure of the BRT system shows the key role players and their main responsibilities either in managing or

operating the BRT system. Dimitriou et al (2011:446) and Hook (2006:13), indicated that BRT systems are managed and operated differently by different role players in different countries. For example, Hook (2006:13), indicated that Lower and Higher-income economies have different organisational structure.

Most of the Lower-income economies BRT systems are managed by the public authorities, while Higher-income economies have invested the operational part of the systems to private transport authorities or public transport services. Wright (2005:547), further indicated that the mixed system of public regulation and private operation is increasingly seen as the optimal approach to achieving a competitive and transparent system responsive to user needs of BRT systems. Finn (2010:17), further indicated that organisational structure of BRT system precisely indicates the relationship among stakeholders, including the contractors and their responsibilities. Figure 4.3 depict the general organisational structure of a BRT system.

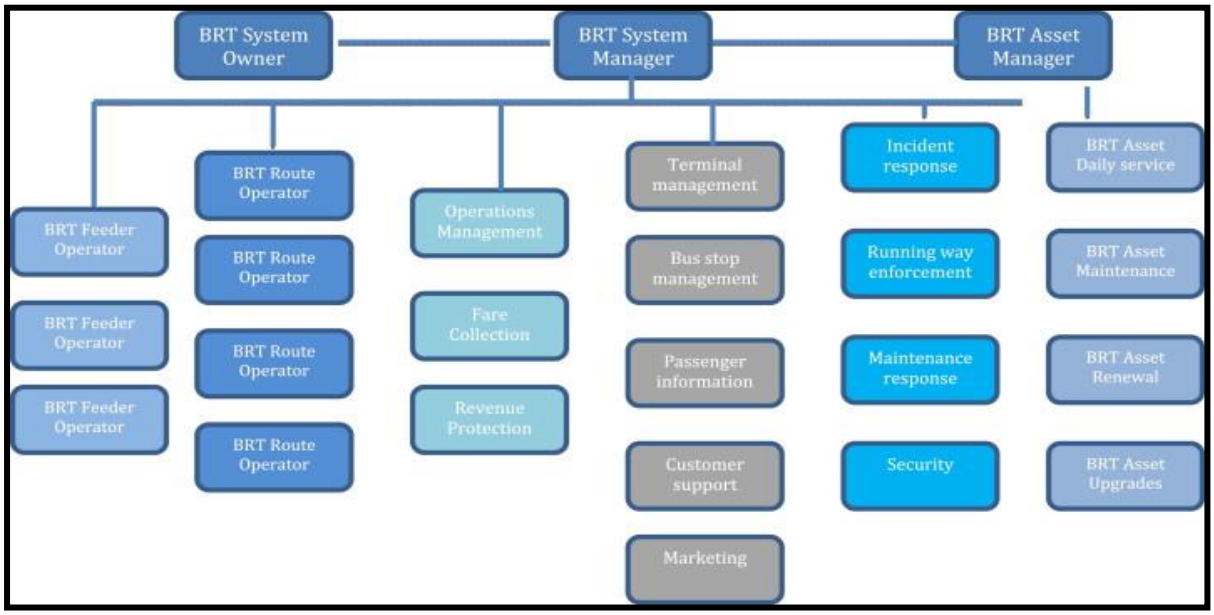

Figure 4.3. Organisational structure of a BRT system

Source: Finn (2010:8)

Figure 4.3 depicts the organizational structure of a BRT system, which is connected to the key organisational role players and the main operational service of the BRT system. Finn (2011), indicated the following as the main operation services of a BRT system: BRT Route Operations, Feeder Route Operations, BRT Operational Systems, BRT Customer-facing services, BRT Operations Support and Response and BRT Asset Management. Table 2.8 shows the different operational systems delivered through a BRT system.

4.4.3. Key role players of the organizational structure of BRT system

According to Finn (2013:143), there are three key institutional roles for BRT systems. These include BRT system owners, BRT system managers and BRT asset managers. These role players ensure that a BRT is well-implemented, well-managed and responds to the commuters' travel needs, while ensuring that the BRT system assets or infrastructures are monitored and kept in good condition. Table 4.7 shows the role players and their responsibilities with regards to the major role players.

Table 4.7. BRT role players and their responsibilities

Key role players	Options of ownership	Functions and option for the nature of BRT system.	Description	Roles/responsibilities
BRT system owners	**Transport authorities** such as: • Municipality • Municipality/ies only • Municipality/ies plus other public-sector stakeholders • Municipality/ies plus operator stakeholders • Municipality/ies investor and operator stakeholders.	**Functions of BRT system owners** is of Public domain **Nature of BRT system owners include:** • The Transport Authority • Special purpose entity for the specific BRT corridor or lines (routes) • Special purpose entity for all BRT corridors.	The owner of the BRT scheme	the primary roles are strategic decision-taking, selection of main operational actors, and governance of system.
BRT system managers	Option for BRT management is for private sector such as: • The BRT System Owner • The bus Operators stakeholders • An experienced BRT or transport service operator • A joint venture between Transport Authority, bus operators and experienced BRT operator/service Company.	**Functions of BRT system managers** is of Private domain. **Nature of BRT system managers include:** • Special purpose division of the Transport Authority • Special purpose entity to provide BRT Management Services • Existing transport operator or service company	Manages the BRT on behalf of the BRT System Owner.	It is accountable to BRT system owner for performance. It provides all of the day-to-day services, either directly or through contracted services, but is in any case responsible for delivery of: • Management and supervision of the bus operation • Management of the terminals and bus stations • Management, supervision and enforcement of the running way • Management of the customer-facing services • Quality control and corrective/mitigation actions • Marketing, passenger information and BRT system promotion
BRT asset managers	Options for BRT asset managers sometimes involves **both private and public operators**. These include: • The Municipality/ies • BRT System Owner • BRT System Owner plus other public stakeholders (e.g. Ministries) • Public- private partnership, in case of private investment in assets	**Functions of BRT asset managers** is of both public and Private domain **Nature of BRT system asset managers include:** • Transport Authority • Special purpose entity for the specific BRT corridor • Special purpose entity for all BRT corridors in the city/region • Existing entity that holds public assets (e.g. roads, public buildings).	BRT asset managers normally outsource the maintenance, upkeep and renewal works, either to the private sector or to a works division within the public sector	The BRT Asset Managers is responsible for maintenance and upkeep of the assets, and for renewal/upgrade investments. The role of the BRT Asset Manager(s) is to hold the non-private assets utilised by the BRT such as Running way, Terminals and bus stops, Depots, CCTV, ITS, fare collection, passenger information and other systems vehicles, if purchased by the BRT system. **Responsibilities of public domain** as a BRT asset manager include, relocation of utilities, installation of services and systems arrangement of traffic management and measures of signage. **Responsibilities of private domain** as in managing BRT asset include, procurement and installation of assets.

Source: Finn (2013:146-147)

Table 4.7 shows the main role players and their responsibilities during the implementation process of the BRT system. These role players are from both the public and private institution, working together to achieve the successful BRT system.

4.4.4. General stakeholders/organisational role players in South Africa

Role players during and after implementation of the BRT system vary from one country to the other. These general stakeholders play a major role towards the success of the BRT implementation. According to Wright and Hook (2007), commuters are the most critical stakeholders that must be fully incorporated throughout the implementation of the system. Table 4.8 below, show general stakeholders considered in South African before and after the implementation of the BRT system. The decentralization of the BRT responsibilities enables the key role players to successfully execute their responsibilities without any delays and complications.

Table 4.8. General stakeholders for implementing BRT in South Africa

Role player	Description
Government **Departments**	• Political parties and individual politicians at national provincial and local level • Departments at national level, particularly the department of transport • Departments or dividends at local level, particularly those responsible for transport, roads, planning, police and traffic, environment, finance and legal matters • Agencies at national, provincial and local level, particular the South African National Roads Agency Limited (SANRAL), Gautrain Management, RAL • Individual officials at national, provincial and local levels.
Public and private transport operators	• Individual minibus-taxi owners and owner-operators at local level; • Minibus-taxi associations at national, regional and local level; • Existing subsidised bus operators, both privately and publicity owned • Small previously disadvantaged bus operators • Special interest operators, particularly women and scholar transport operators • Bus industry organisations • South African operators who want to enter the public transport market; and • International operators who want to enter the South African market, particularly those with BRT experience in developing countries.
Community stakeholders	• Organised passenger groups, particularly the South African Commuters Organisation (SACO) and its general and local branches: • Current potential passengers: • Other community groups, e.g. youth, religious and women: • Disability alliance: • Heritage and environmental groups: and • The general public.
Business stakeholders	• Chambers of commerce and major employers • Specific business coalitions; • Developers of both existing and new major commercial, retail and industrial developments along BRT routes • Consultants • Contractors
Financers	• Development agencies; • Banks; and • Export credit agencies (ECA's)
Suppliers	• Vehicle manufactures • Vehicle body-builders • Vehicle service industry • Fuel industry • Suppliers of fare and ticketing equipment • Suppliers of Intelligent Transport (ITS) • Facility managers; and • Service suppliers, e.g. security, cleaning
Media	Communicating the operation of BRT system
Transport advocacy groups and associates	Private and public entities responsible for advocating transport systems.

Source: Finn (2013:18)

Table 4.8 shows the general stakeholders involved in implementing the BRT system in South Africa. The identified general stakeholders include the government departments, public transport operators, community stakeholders, business stakeholders, financers, suppliers, media and transport advocacy groups and associates.

4.5. Legal framework requirements of emerging models

The reviewed policies and legal framework indicate that the whole globe is on a paradigm shift towards sustainable public transport. For example, Banister (2008:80), indicated that sustainable mobility policy strives to promote provision of sustainable mobility that meet commuters travel needs such as safety, affordability and pose less environmental impacts. The UN-HABITAT (2013:13), indicated that BRT system is viewed as a green public transport that offers efficient, safe, comfortable and accessible transportation to all socio-economic classes. However, the success of BRT system depends on the institutional structure, concept of BRT integration with other modes of transport and safe interchange and reduction of conflicts between modes of transport (Tiwara and Jain, 2010:367). The South African legal frameworks, such as PTS and AP of 2007, proposed the implementation of BRT system, to resolve transport problems and to respond to commuters' travel needs. The NPC (2012, 164), further outlined that in 2030, South Africa will have achieved provision accessible, affordable and efficient public transport system which also include the BRT system.

4.5.1. The green transport economy model to improve commuters' perception on BRT implementation.

The green transport economy model seeks to improve commuters' perception on the implementation of the BRT system by promoting the use of Avoid-Shift-Strategy. Bos and Temme (2014:2). The green transport economy model promotes the use of green transport through by adopting the use of A-S-I strategy to improve the commuters' perceptions towards the implementation of the BRT system. UNEP (2011:382), defined green transport as any mode of transport that is environmentally, social and economic friendly. BRT system is recommended as one of the green transport, becaouse it uses renewable energies and clean fuels while frequently transporting large number of commuters. Bos and Temme (2014:2), further indicated that the A-S-I strategy promotes a reduction or avoidance of trips, while encouraging the shift from car to the use of green transport such as BRT systems that use improved renewable energies and clean

fuels to improve the vehicle efficiency. Figure 4.4. shows the applicability of the green transport economy model, to improve the commuters' perception on BRT implementation.

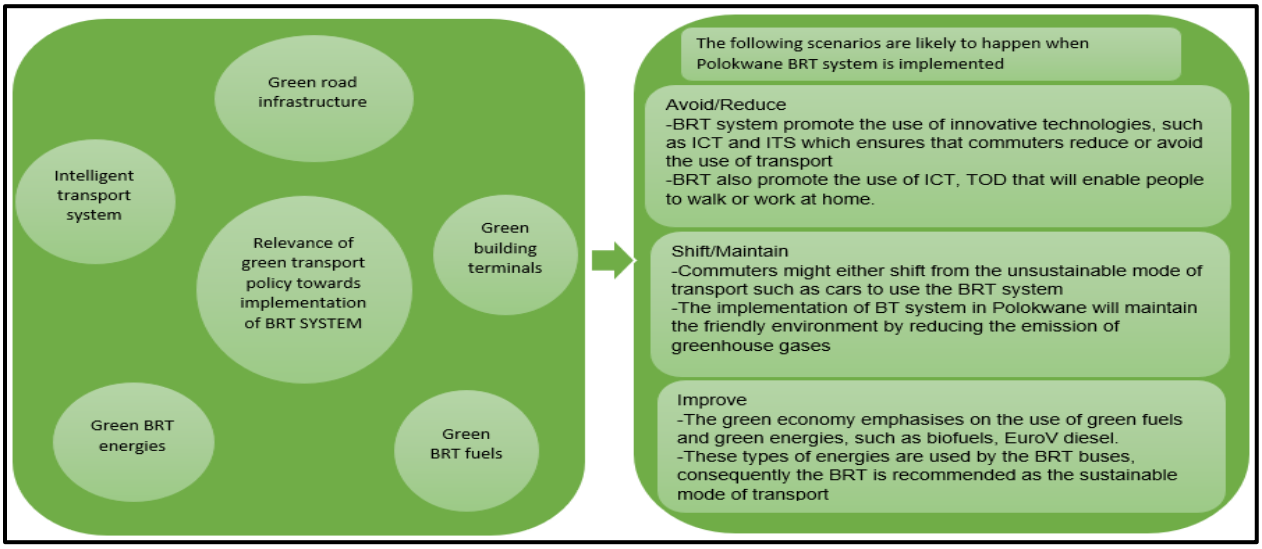

Figure 4.4. Applicability of green transport economy model to improve the commuters' perception on BRT implementation

Adopted from Bongardt and Schalternberg (2O15:1)

Figure 4.4 shows the applicability of the green transport economy model to improve the commuter perceptions on the implementation of BRT system. It further shows how the main pillars of green transport can apply the A-S-I, to improve the commuters' perception towards the implementation of BRT system.

4.6. Chapter summary

This chapter reviewed the general policies that addresses the sustainability issues, while underpinning green transport economy, which is central to the BRT transport intervention philosophy of planning. These general policies guided the South African legal framework that support the implementation of the BRT system in South Africa. The chapter further reviewed the best possible institutional framework concept adopted by various cities to implement the BRT system. The legal framework requirements of emerging models were also explained in this chapter. The following chapter focuses on the global overview of the implementation of BRT system.

CHAPTER FIVE: GLOBAL OVERVIEW OF THE IMPLEMENTATION OF THE BRT SYSTEM

5.1. Introduction

This chapter presents the global overview of the implementation of BRT system. it reviewed the most critical issues such as elements and different types of BRT systems, possible methods of communication, BRT system operational characteristics and the dynamic benefits associated with the system's operation. The chapter reviewed the best and worse case studies in relation to BRT implementation. The study further reviewed the applicable public transport strategies adopted worldwide when implementing the system. These is followed by the different emerging models from the reviewed data. Figure 5.1 shows the conceptual structure of chapter five.

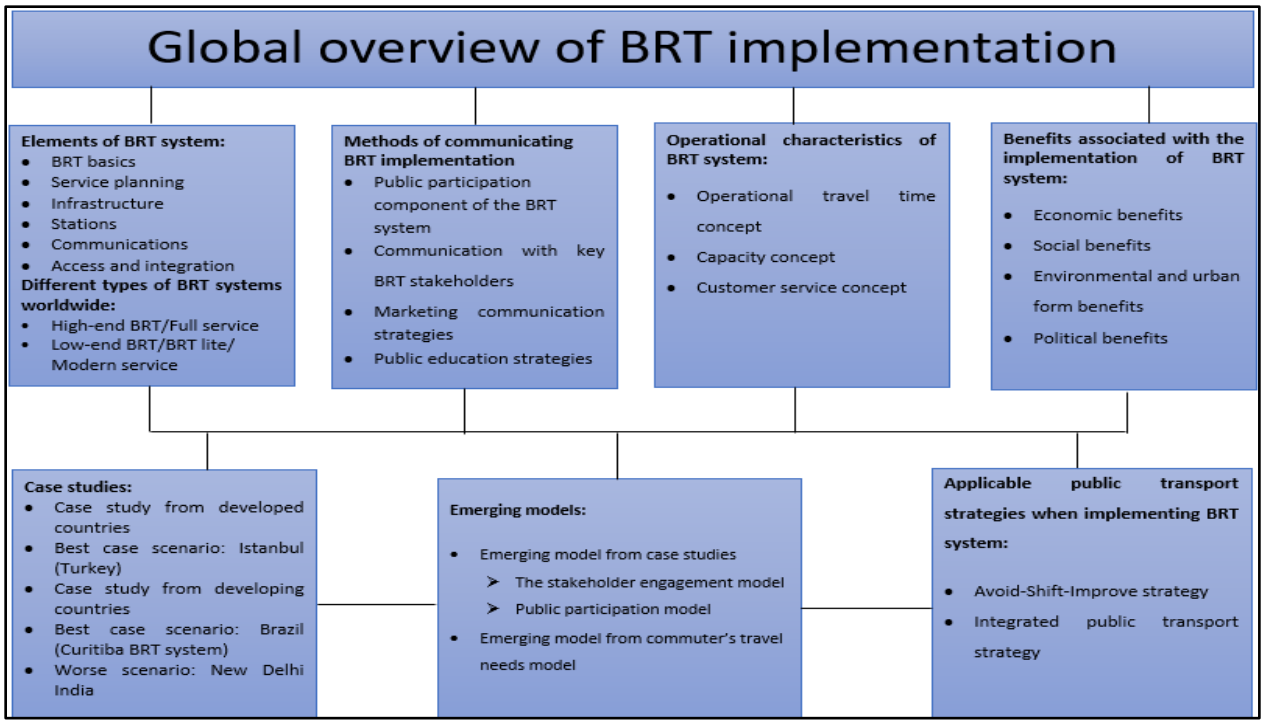

Figure 5.1. Conceptual structure of chapter five

Source: Authors construct (2018)

Figure 5.1 indicates that chapter five is composed of five integrated sections of the global overview of BRT implementation. These include the elements and types of BRT sytems, the methods used to communicate the implementation of BRT, the operational characteristics that consider the commuters travel needs and the benefits associated with BRT implementation. Moreover, the figure showed the reviewed case studies from both developed and developing countries,as well

as the and the public transport strategies adopted worldwide when implementing BRT system. These are followed by the emerging models from the case studies, methods of communicating BRT implementation and the overall commuters travel needs model.

5.2. Global overview of the implementation of the BRT system

Levinson *et al* (2002:1) defined BRT as a permanently integrated system of facilities, services, and amenities that collectively improve the speed, reliability, and identity of bus transit. According to Henser (2008:501), the BRT system has been shown to be an effective catalyst to help transform cities into more liveable and human-friendly environments. According to Nikitas and Karlson (2015:12), in 2015, there were 186 cities in 41 countries with BRT systems or corridors, serving almost 32 million passengers every day as indicated in table 5.1 below.

Table 5.1. Number of BRT's per continent

Region	Passengers /Day	No of cities	Length
Africa	242, 000(0, 76%)	3 (1.61 %)	80(1, 68%) %
Asia	6, 8,529,322(26, 93%)	38% (20, 43%)	1,317(27, 6%)
Europe	1,804,829(6%)	53(28, 49%)	822(16, 27%)
Latin America	19,769,380(62, 42%)	60(32,29%	1.646(34, 6%)
North America	894,821(2, 82%)	26(13, 97%)	798(16, 77%)
Oceania	430,041(1, 35%)	6(3, 22%)	94(1, 97%)

Nikitas and Karlson (2015:12)

Table 5.1 indicates the number of BRT systems per continent. The total number of BRT systems that were operating in the entire globe in 2015 were 186, with the African continent having the least BRT systems operating at 3 and Latin American continent having the highest number of 60 BRT systems operating.

5.2.1. Elements and types of the BRT systems

Nikitas and Karlson (2015:6), Wirasinghe *et al,* (2013:5-15), and Wright and Hook (2007:5-6), mentioned, BRT basics, service planning, infrastructure, stations, communications and access and integration as the major and the latest BRT elements that distinguish BRT system from the other public mode of transport. The elements precisely distinguish the full BRT and the BRT lite. According to Cervero (2013:1-2), full BRT offers metro-quality services, while BRT lite offers some form of priority but not full-segregated busways and shelters instead of stations. BRT lite exists

where elements deviate from the five elements needed to keep in the bus transit to achieve the golden standard of BRT buses. Table 5.2 shows different elements of the BRT system.

Table 5.2. Different elements of the BRT systems

Element	Explanation
BRT basics	Dedicated right-of-way, busway alignment, off-board fare collection, intersection treatment, platform-level boarding
Service planning	Multiple routes, express/limited/local services, control center, located in top 10 corridors, demand profile, hours of operations, multi-corridor network
Infrastructure	Passing lanes, bus emissions minimization, stations set back from intersections, center stations, pavement quality
Stations	Distance between stations, safe and comfortable stations, number of doors on bus, docking bays and sub-stops, sliding doors in BRT stations
Communications	Branding, passenger information
Access and integration	Universal access, integration with other public transport, pedestrian access, secure bicycle parking, bicycle lanes, bicycle-sharing integration

Source: Nikitas and Karlson (2015:6), Wirasinghe *et al*, (2013:5-15), and Wright and Hook (2007:5-6)

Table 5.2 shows the six different elements of BRT systems, including the accompanying explanations thereof. The elements include BRT basics, service planning, infrastructure, stations, communications and access and integration. Table 5.3 shws the different types of BRT systems worldwide.

Table 5.3. Types of the BRT systems worldwide

Elements of BRT system	High-End BRT/ Full- service	Low-end BRT/ BRT "Lite"/ Moderate-Service
Running ways	Exclusive"TransitAways;" Dedicated"Bus"Lanes;"Some" grade"separation	Mixed"Traffic
Stations/stops	Enhance"Shelters"to"large"temperatureAcontrolled" transit"centers	Stops,"sometimes"with" shelter,"seating,"lighting,"and" passenger"information
Service Design	Frequent"services;"integrated" local"and"express"services;" timed"transfers	More"traditional"service" designs
Fare collection	OffAvehicle"collection;"smart" cards;"multiAdoor"loading	More"traditional"fare"media
Technology	Automated"Vehicle"Location"(AVL);"passenger"information" systems;"traffic"signal"preferences;"vehicle" docking/guidance"systems	More"limited"technological" applications

Source: Cervero (2013:2)

Table 5.3 above shows the different types of BRT systems, their elements and descriptions that differentiate the High end and Low-end BRT systems.

5.3. Communicating the implementation of BRT system to the targeted stakeholders

Wright (2002:10) indicated that a sustainable and effective transport planning system should not be conducted in isolation; it must include all key actors. Consequently, transit implementers must effectively communicate the characteristics of a new proposed public transport to the commuters using different communication methods. Communication strategies such as public participation, public education strategies and marketing plans are encouraged, to reach out to the public. Wright (2002:13), indicated that communicating public transport such as BRT project before its actual implementation, enables the key parties to give inputs that can be incorporated during the design stage, expression of critical commuters' travel needs and customer service features requiring incorporation in terms of a BRT system. These inputs help to ensure that the system will be fully accepted and utilized by the commuters, thereby increasing number of BRT ridership. Therefore, below are various communication methods used to affectively involve commuters in the planning and implementation of public transport of BRT system are as follows:

5.3.1. Public participation component of the BRT system

The level of involving the general public or commuters can determine the success or failure of the implementation of public transport. Consequently, Wright (2005:99), argued that lack of communication and participation from key actors ultimately undermines a project's success. The Marine Department of Transportation (2015:4), further outlined that public participation with key actors is a fundamental part of transportation processes which helps to ensure that decisions are made in consideration of and to the benefit of commuters needs and preferences. Public participation enlightens the implementers to achieve commuters' independent and objective viewpoint on design.

5.3.2. Communication with key BRT stakeholders

The commuters and other key stakeholders' perceptions towards the implementation of BRT system is dependent on the way the system was communicated. Consequently, it is crucial for the municipality to effectively communicate the implementation of a BRT system to the key stakeholders, such as including via existing operators and commuters. Moylan *et al*. (2013), indicated that maintaining effective communication strategies during project implementation and

operation can assist to preserve current commuters, attract new commuters' and stimulate political and financial support and win supportfrom the existing transport operators.

Wright (2002:15), indicated that effective communication provides the design insights of commuters' travel needs that must be incorporated during the implementation of the project. Various problems that arisen due to poor communication of the BRT system include, being unable to attract private car users to the system, misunderstanding and inability to differentiate the conventional bus from BRT system, thereby resulting in the failure of the project. For example, Sieatnam *et al*. (2006:62), indicated that Transmilenio BRT commuters had negative perceptions towards the system, as they were poorly informed.

5.3.3. Marketing communication strategies

Public transport, particularly buses, are generally perceived as an inconvenient, unpleasant, unsafe and uncomfortable mode of transport (Moylan *et al*, 2013:1). Consequently, the BRT system requires the right marketing strategies that can win commuters' positive perceptions towards the system. (Wright, 2002, 16). Steinem et al. (2006:64) and Wright (2002:16) mentioned that effective marketing strategy must consider the logo, artistic elements complementing location, stations, vehicle and other components aimed at creating harmony with the local environment. By allowing commuters to effectively participate in generating the logo, making inputs to the artistic elements and collaborating in identifying complementary bus/station locations, main stations location, design and siting, choosing the type of vehicles and other add-on components in harmony with the local environment is essential in building support for a BRT system. Such gestures and overtures will enable the implementers to implement a BRT system that brings a sense of belonging to the commuters and ensures the system responds to commuters' travel needs.

According to Seitnaam *et al*, (2006:64), BRT marketing strategies use various tools such as brochures, websites, flyers and other media in introducing the concept's advantages among other modes, as well as thecontributions of a BRT system. The study conducted by Moylan et al. (2013:2), found out that appropriate infrastructure and good marketing strategies of BRT have the potential to radically increase ridership among both the rider and non-rider populations. Marketing strategies platform such as brochures, websites and advertisements can be adopted to introduce the concepts, advantages among other modes, contributions of BRT system (Satiennam et al,

2006:64 and Moylan *et al*., 2013:13), indicated that these marketing strategies must be presented to commuters in such a way that commuters begin to perceive the BRT system as an effective solution for addressing high travel fare, congestions and emission of greenhouse gases. This createsthe right atmosphere in order to gain positive perception of BRT from the commuters.

5.3.4. Public education strategies

According to Wright and Hook (2007:14), a public educational plan is part of a design plan used to secure support and approval for BRT but also to better prepare the public on how the system will be used. Public educational process begins before the BRT system starts operating to inform and provide baseline information to the commuters or public. Saitenaman *et al.* (2016:61), indicated that design campaigns such as vehicle and station shelter appearances and traffic conference are very crucial since the public can give inputs that can be incorporated before the actual implementation of the system. Moylan *et al.* (2013:13), indicated that these public education campaign must begin with a broad campaign to educate commuters and non-commuters about the *upcoming* service, how it will differ from the existing mode of transport and how it might improve commuting than their alternatives.

5.4. Operational characteristics of the BRT system

According to Wright and Hook (2007:76), public transport such as a BRT system is critical to the transportation system and important to the economic and social quality of life of our cities. Consequently, the operational characteristics of public transport must comply with the travel needs of commuters. Operational characteristics that match commuters travel needs are likely to receive positive perception and to be accepted by the general commuters. Below are various operational characteristics of BRT system.

5.4.1. Operation travel time concept

Bus Rapid Transit is one of the most efficient, convenient and reliable road based MRT system associated with improved travel time. Moylan *et al* (2013:2), indicated that improved or reduction in the travel time leads to increased ridership, which leads to decreases in car use, fuel consumption and greenhouse gas emissions. Moylan et al (2013:3) and Diaz et al. (2004: Es-05),

indicated that exclusive running ways of BRT system plays a major role on improving and saving greatest travel time. Diaz *et al.* (2004:ES-5), also highlighted that Exclusive transit way projects operated at a travel time rate of 2 to 3.5 minutes per mile and this is why transit projects attracts large numbers of commuters.

Astudy conducted by Cervero (2013:67)., indicated that Transmelenio commuters save approximately 223 commuting hours annually. As a result, 9% of Transmelineo commuters have shifted from commuting by private vehicles to the BRT system. Diaz *et al*. (2004:.ES-54), indicated that the operation of travel time of the BRT system is unlike most road-based transport. This is because most BRT systems have websites where the travel time is communicated to the commuters, and such information is also precisely displayed on BRT stations. These interventions improve the convenience and reliability of the system.

5.4.2. Capacity concept

Capacity is one of the most crucial aspects of the operation of the BRT system. Diaz *et al*. (20042), defined capacity as the maximum number of passengers that could be served by a BRT system. Wirasinghe *et al.* (2013:12), indicated that transit capacity is defined in terms of either volume of passengers carried between points and transit vehicle. Passenger capacity refers to the maximum number of seated and standing passengers that a vehicle can safely and comfortably accommodate (Diaz *et al.,* 3-73), while vehicle capacity is defined as the maximum number of transit vehicles (capacity in vehicles per hour per direction) that can be moved past a point by a BRT system (Diaz *et al.*, 73). Therefore, the capacity of BRT system, determines the number of commuters to be accommodated per trip.

5.4.3. Customer service concept

Unlike other road-based mode of transport, the BRT systems consider, and incorporate commuters' travel needs when designing the system. Wright (2005:24), pointed out that customer service must be well-planned and should reflect the commuters' travel needs, to avoid failure of the project in the long run. Wright (2005:25) mentioned five major factors to be considered when designing the operation of the customer's services offerings. The major factors are enlisted and discussed below:

5.4.3.1. Factors for designing the operation of BRT customer service

There are various factors that need special consideration when designing the operational service of the BRT system. These factors have a major impact on the BRT operational system and how people perceive the BRT system. Thesefactors are described as follows:

5.4.3.1.1. Hours of operation/ service span

According to Diaz *et al.* (2004:69), service span represents the period that the service is available for the commuters'. Wright (2005:25), highlighted that BRT systems operating 24 hours experiences security problems such as robberies and assaults, particularly during the late night and morning hours. Seitanam *et al.* (2006:24) have proposed the two options of BRT service span; the first option offers an all-day BRT services, and the second options offers two services; namely, one for the off-peak service and another offered during peak hour only. Wright (2005:24) further indicated that appropriate service span or hours of operation depend on cultural and social practices and based on the schedules of major employment, educational and leisure activities. For example, the TransMilenio operates from 05:00 until 23:00, reflecting the early start time to go to work.

5.4.3.1.2. Customer travelling information

Customer travelling information can be displayed through maps and visually (written) or verbally announced through an audio system. Wright (2005:24), indicated that these customers' travel information must be readable, visible and understandable even for the people who do not understand the local language, including visitors. However, this information must be user-friendly. Consequently, where possible, particularly if there is a need, such information must be supported by signages. Diaz *et al.* (2004:23) ad Wright and Hook (2007:224-26) and Seitanam *et al.* (2006:11) indicated that customer travel information must inform commuters regarding the direction of the system routes, boarding, the next station stops, estimated arrival time at the next vehicle, delay at the next vehicle, new corridors and instructing commuters regarding using fare collection machines.

5.4.3.1.3. Safety and security

According to Finn and Mulley (2011:89– 107), safety and security, comfort and reliability impact on the rate of competition between transport modes. Commuters tend to prefer a mode of transport which is safer, comfortable and reliable. Consequently, safety and security are the most crucial aspects that must be considered and incorporated in the operation of BRT system. Moylan *et al.* (2013:13) indicated that individual choices of mode of transport are determined by the safety level associated with a particular mode of transport. Wright (2005:68), indicated that bus system loses modal share to private vehicles because commuters feel unsafe from drivers' attitude, perceived vehicle road-worthiness and fear of crime at stations and within the buses. However, unlike many public transport, BRT is perceived as the system with the highest safety and security levels. However, Saintnam *et al.* (2006:15) and Diaz *et al.* (2004:2-3 and 2-22), indicated that dedicated right of way, enclosed stations with surveillance cameras, closed-circuit television monitoring, extensive spot illumination, and the use of transparent materials, emergency call box and signal priorities increase the system safety and security. Consequently, most public transport riders perceive BRT system as the safest and secure road based MRT to travel with at any time.

5.4.3.1.4. Service frequency

According to Diaz *et al.* (2004:23,145), service frequency is a key determinant of wait and transfer time. Seitanam *et al.* (2006:24), indicated that BRT systems provide high frequency service, especially in the morning or evening peak hours. Service frequency is determined by the method of schedule timetabling in operation. Diaz *et al.* (2004:68) briefly discussed these methods as follows: Schedule-based control-it dictates that operators must arrive within a certain scheduled time at specific locations along the route. Headway-based control focuses on maintaining headways rather than meeting specific schedules.

5.5. Benefits associated with the implementation of BRT system

The literature reviewed precisely indicates that effective public transport is associated with socio-economic and environmental benefits (Wright, 2002:23, Diaz *et al.*, 2004:74, and Cervero, 2013:108 and Wirasinghe *et al.*, 2013:76). Wirasinghe *et al.* (2013:80), and Diaz *et al.* (2004:68), indicated the major environmental benefits of the Bus Rapid Transit as the reduction of

greenhouse emissions, both noise and air pollutions and the reduction of fuel consumption. Deng and Nelson (2012:), summarised urban form and social benefits of BRT system as it promotes mixed land uses that promote healthy living by walking and cycling, reduces road fatalities, crushes and injuries. Cervero (2011:121) and Diaz *et al.* (2014:76) pointed out that BRT can attract Transit Oriented Development, mixed land uses, high-density development and policy development and play a major role on the local economy and employment rate. Table 5.4 depicts the benefits associated with the BRT system.

Table 5.4. Benefits associated with BRT systems

Category	Benefit area
Economic	• Reduced travel times • More reliable product deliveries • Increased economic productivity • Increased employment • Improved work conditions
Social	• More equitable access throughout the city • Reduced accidents and illness • Increased civic pride and sense of community
Environmental and Urban form	• Reduced emissions of pollutants related to human health (CO, SOx, NOx, particulates, CO2) • Reduced noise levels Urban form • More sustainable urban form, including densification of major corridors • Reduced cost of delivering services such as electricity, sanitation, and water Political • Delivery of mass transit system with
Political	• Delivery of mass transit system within one political term • Delivery of high-quality resource that will produce positive results for virtually all voting groups

Source: Wright and Hook (2007:24)

Table 5.4 indicates different benefit associated with the implementation of Bus Rapid Transit. The benefits include the social, economic, environmental, urban form and political benefits

5.6. Case studies on the implementation of BRT system

The case study reviewed include, three distinctive case studies. These include worse and best-case scenarios in the implementation of the BRT system in both the developed and developing countries.

5.6.1. Case study from developed countries

The study reviewed the Istanbul BRT as the best-case scenario of BRT implementation from a developed country.

5.6.1.1. Best case scenario: Istanbul (Turkey)

Istanbul is a city located in Turkey. According to Nikkitas *et al.* (2015:19), the Istanbul BRT system is considered the most successful BRT system and the only intercontinental the BRT scheme. Babalik-Sutcliffe and Cengiz (2015:797), indicated that the purpose of implementating the BRT system in Istanbul city was to address the excessive high dependence of cars, which increased from 20% in 1990's to 35% in 2010. Unlike Curitiba's BRT system, the Istanbul system was not coordinated in the city's metropolitan development plan, and comprehensive transport plan resulting in the system being associated with poor transport integration and mostly operating on a mixed traffic system model (Babalik-Sutcliffe and Cengiz, 2015:802 -810). However, this did not hinder the success of the system, as Nikitas *et al.* (2015:19) indicated, becaouse that the rapidly increased ridership number from 2000 to 2015, shows the positive acceptance of the system by the commuters.

Babalik-Sutcliffe and Cengiz (2016:804), further pointed out that the systems' location and high service level had resulted in the system to be having the best performance and operational characteristics. As a result, the system is considered a major success becaouse it has high levels of service features and remarkable speed of frequency that operates 24hrs per day (Babalik-Sutcliffe and Cengiz, 2015:809). Table 5.5 shows a comparison of BRT system's operational characteristics in different countries.

Table 5.5. Comparison of the operating characteristics of BRT systems

System	City	Commercial speed	Headway	Hours of operation	Real-time passenger information
RIT	Curitiba	21	90	24hrs per day	No
Transantiago	Santiango	26	20	Data unavailable	No
Beijing BRT	Beijing	26	60	05:00-23:00	Yes
Transmilenio	Bogota	26	13	05:00-23:00	Yes
Metrovia	Guayaquil Janmarg	26	120	06:00-24:00	No
TransJakarta	Jakarta	19	Data unavailable	05:00-23:00	No
Metrobus	Mexico city	20	48	04:30-0:30	No
City Metrobus	Instanbul	38	14	24hrs	Yes

Source: Babalik-Sutcliffe and Cengiz (2015:809)

Table 5.5 above shows the comparison of the operational characteristics of various BRT systems. The Istanbul system is indicated in the red (colour).

5.6.1.1.1. Measures that contributed to the success of the Istanbul BRT system

The success of Istanbul BRT system was attributed to various measures which are as follows:

- The Istanbul BRT system is located in a high-density population where there is high demand for transportation;
- It is associated with a high-level service features, which improved the systems' performance;
- The system operates 24hours a day; and
- Extensive stakeholder engagement.

5.6.2. Case studies from developing countries

The study reviewed Curitiba in Brazil as the best-case study of implementing BRT system in developing countries, and New Delhi as the worst case study of BRT implementation in developing countries.

5.6.2.1. Best case scenario: Brazil (Curitiba BRT system)

Curitiba is the capital city of Parana, located south of Brazil. The city is well-known for its massive success of the implementation of the BRT system. According to Goodman et al (2006:76), Friberg (2000:153), the rapid urbanisation has resulted to major transportation challenges, such including traffic congestions, pollution and emission of greenhouse gases, however, Curitiba managed to address the emerged transportation problems by successfully implementing the BRT system. According to Deng and Nelson (2011:73) and Pienaar *et al.* (2005:362), Curitiba BRT is the first modern and successful system and yet the cost-effective mode of public transport in the entire globe. The magnificent success of Curitiba BRT inspired the development of BRT system across the globe. Lindau *et al.* (2010:274), indicated that the Curitiba's administrators have constantly achieved innovations with the city's bus-based transit system through performance and capacity improvements since 1970s. Friberg (2000:154), indicated that the major success of Curitiba was influenced by the integrated transport systems, development of road network system and land use legislations that preserve the environment, consider the cultural values of the society and meet human needs.

According to Deng and Nelson (2011:75), the Curitiba BRT system is associated with various socio-economic and environmental benefits, such as reduction of greenhouse emission as dependency of private vehicles decreased and massive job creation. TRCP (2012:13) and Pienaar *et al.* (2005:373), indicated that Curitiba BRT system use renewable or clean energies, created sustainable job opportunities, reduced high traffic congestions and high private vehicle dependence. Godman *et al.* (2006:75), indicated that the Curitiba's BRT passes at the station every 90 seconds, resulting in the system being more reliable, frequent and convenient to the commuters. This has motivated approximately 70% of the Curitiba commuters who use the BRT to travel to work, resulting in congestion-free streets and pollution-free air for the 2.2 million inhabitants of greater Curitiba. TRCP (2012:12), further highlighted that the higher ridership from commuters of approximately1.9 million per day in 2000, is a positive indication that the system is positively perceived to be the most effective mode of transport.

5.6.2.1.1. Measures that contributed to the success of the Curitiba BRT system

According to Pinnar *et al.* (2005:363 and 364) and Friberg (2000:156), the following items were the major contributors towards the success of the implementation of the Curitiba BRT system.

- Strong political will and leadership;
- Guidance from the experts (land use and transportation planning unit, Urbanizascoa Curitiba S.A (URBS)-and organisation with total of 1730 staff members;
- Control of urban growth by means of a land use master plan and the development of high density activity corridors;
- Provision of high capacity, dedicated right-of-way bus service combined with circular routes linking the radial routes;
- Effective institutional framework system; and
- A close relationship between the stakeholders.

5.6.2.2. Worst scenario from New Delhi India

Rivzi and Sclar (2014:195) and Kishore (2009:23.4), indicated that New Delhi is the capital city of India, and the very first Indian city to implement the full BRT system. According to Kishore (2009:23.4), the Delhi Transport Cooperative and Infrastructure Development and Finance Company held an international conference with various stakeholders, including commuters to address the transport challenges, such as rapid road accidents and transport pollution faced by the city. It was then recommended that BRT be implemented on all major arterial corridors of Delhi. According to Hildago (2009:2), the Delhi BRT initially came into operation on the 9th April 2008.

The studies carried by Kishore (2009:23.4) and Hildago (2009:3), indicated that the initial perceptions of commuters' and politicians of the Delhi BRT was bad, and it caused political conflicts between the then ruling party and the opposition parties. As a result, the system was given various names, such as "corridor of chaos", "ill-conceived system" and some critics were demanding that it be scrapped. These tensions resulted because commuters were not properly informed during the initial stage of the system, and the problem with the system operational and inexperienced drivers, which caused irresolvable traffic congestions and cars to encroach on the cycling lanes (Hildago, 2009:2).

5.6.2.2.1. Measures that contributed to the failure of New Delhi BRT system

- The New Delhi BRT was half planned, which resulted in increased transport problems such as massive traffic congestion and increase in greenhouse emission within the city (Hildago,2009:3);
- The system was not well-integrated with other modes of transport facilities, such as parking facility and foot over bridges;
- There was insufficient engagement with general stakeholders;
- The method used to communicate the system was not effective, which resulted in the commuters having a bad perception towards the system; and
- There was poor political will (Hildago, 2009:2)

5.7. Applicable public transport strategies when implementing BRT system

The whole globe has been focusing on shifting towards an innovative and sustainable mode of transport. The literature revealed that the globe is currently viewing public transport system as the most sustainable form of public transport. Below are two of the most effective public transport strategies that have been used globally to manage and shift towards sustainable public transport.

5.7.1. Avoid-Shift-Improve strategy

Avoid-Shift-Improved approach is viewed as the major mitigation towards attaining sustainable mobility and green transport. Bongardt and Schalternberberg (2O11:1), mentioned that Avoid-Shift-Improve (A-S-I) strategy seeks to achieve significant greenhouse gas emission reductions, reduced energy consumption, less congestion, with the final objective being to create more live-able cities. According to Bos and Temme (2014:2), the Avoid-Shift-Improve framework, prefers the avoidance of trips above a modal shift towards sustainable transport modes, which is preferred over cleaner fuels and electric vehicles. BRT system is currently viewed as the most sustainable, cleanest mode of public transport that can attract car users, thereby resulting in the reduction of greenhouse gases and traffic congestion. It is advisable that the BRT implementers consider this strategy so as to provide sustainable modes of transport that meet commuters travel needs while ensuring that systems do not pose negative socio-economic and environmental impacts. Figure 5.2 shows the A-S-I strategy.

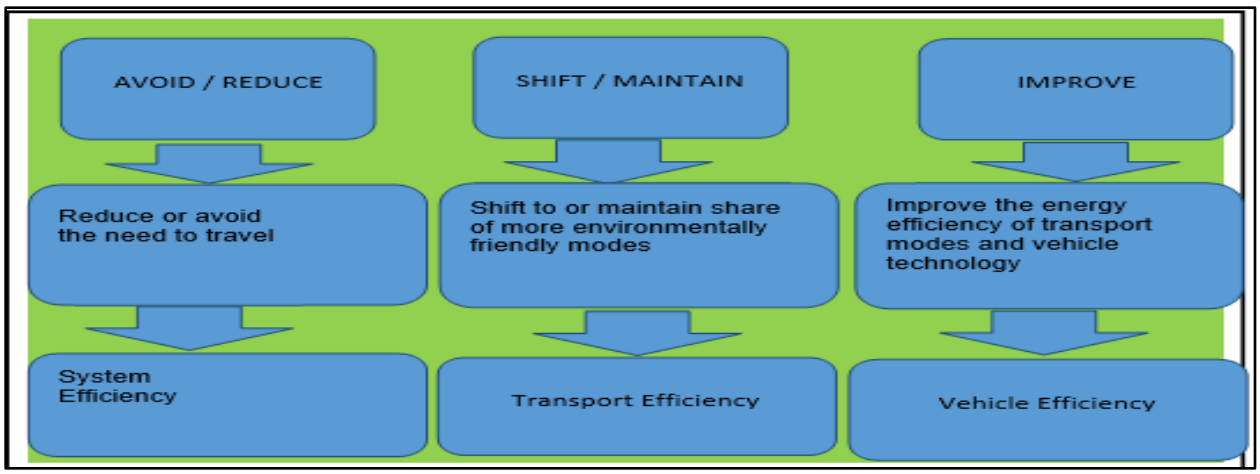

Figure 5.2. A-S-I strategy

Source: Bongardt and Schalternberberg (2O11:1)

Figure 5.2 precisely indicates how the A-S-I strategy aims to reduce transport sector problems. Bakker and Hakel (2016:2), further indicated that following A-S-I approach will assist in the reduction of the greenhouse emission by the transport sectors. According to the sustainable framework by Bannest (2008:16)), A-S-I measures are capable of assisting in contributing towards the success of sustainable mobility and green transport.

5.7.1.1. Applicability of the A-S-I strategy towards to the implementation of BRT systems.

The study conducted by Vincent (2006:221), found out that from among public transport systems, BRT system is considered the good strategy to reduce transport related challenges such as emission of greenhouse gases. BRT system encourages the shift from car dependency to the use of efficient bus. The technological improvement of the BRT system further improves the system, transport and vehicle efficiency and such are the main goals of the A-S-I strategy. Banister (2008:74-76), further highlighted the following measures that must be considered during the implementation of a BRT system:

- Avoid (avoid trips made through substitution by for example ICT);
- Reduce (reduce distance and travel time reduction by infrastructural & land use measures);
- Shift (modal shift towards sustainable transport modes; and
- Improve (increase efficiency by technical innovation).

Inability to incorporate the A-S-I strategy when implementing BRT system, can result infailure to the implement the BRT system. Levinston (2003:18), indicated that the BRT system is considered a rapid transit due to its system efficiency, frequency, accommodation of large number of commuters using technological vehicles and fuels. Wright (2007:168), indicated that specific components of a BRT system makes the system stand out and be more environmentally friendly, as compared to the other road based public systems. However, Wright and Hook (2005:171), indicated that the success of the BRT system is dependent on the commuters' perception. Consequently, it is crucial for BRT implementers to have a clear understanding of the views of the commuters before implementing any mode of transport.

5.7.2. Integrated public transport strategy

According to Matas (2004; 195), integration is a broad concept that includes several issues, such as the coordination of service levels, routes and timetables, and a common fare system. Therefore, integrated public transport refers to the popular public transport strategy for promoting public transport use such as buses, taxis and Non-Motorised Transport (walking and cycling) in the provision of an integrated and high quality public transport system (Matas,2004:195). This strategy has been effective and utilised across the whole globe, including in countries such as South Africa (D, 2007:1), Spain since 1985 (Matas, 2004:195) and Brazil. The main aim of this strategy is to reduce high car dependence, by providing affordable, efficient, accessible and integrated mode of public transport

The Allen (2013:3-4), indicated that Spain government re-organised its institutional setup to promote public transport integration. Its new re-organised organisation features the integrated transport connections and timetabling, bike and car share schemes, carpooling, improving passenger information, removing street parking and promoting park and ride, company employee mobility plans and developing weekly and monthly special ticket rates to mention a few. The South African government approved the Public Transport Strategy and Action Plan in 2007, in which it promotes the integrated public transport, and such also include the BRT systems (Pillay and Seadat 2007:399). According to Allen (2013:4), Nantes offers an excellent example of the highly integrated public transport system. Figure 5.3 illustrateS the Nantes integrated public transport system.

Figure 5.3 Example of an Integrated Public Transport in Nantes, France

Source: Allen (2013:4)

Figure 5.3 shows an excellent example of integration in Nantes; high quality express bus lines and the tramway are within a short walk from a 'park and ride' parking area.

5.7.2.1. Implementation of Integrated Public Transport strategy (BRT)

According to Wright and Hook (2007:463), BRT systems should not be designed and implemented in isolation. The systems work best when integrated with other alternatives of transport that allow safe and convenient access to all parts of the city. Mfinanga & Ochieng (2006:35–52), indicated that BRT system integrates flexibility and low-cost features and continues to exhibit modernity and technology in comparison to the minibus taxi. For example, BRT in Brazil, is well integrated with other systems, hence it is the most successful BRT to have implemented in the entire globe.

5.8. Emerging models of BRT implementation

The emerging models of this chapter is based on the reviewed case studies, methods of communicating BRT implementation and the overall literature which produced the general commuters travel needs model. The models are divided into three sections which are as follows:

- Emerging model from the case studies;
- Emerging models from the methods of communication; and
- General commuters' travel needs mode.

5.8.1. Emerging model from case studies

The purpose of implementating of the BRT systems in various countries across the globe was to address transport challenges such as high dependency of private vehicles that resultant in magnitude transport challenges, such as the rapid urbanization resulted to major transportation challenges, such including traffic congestions, pollution and. emission of greenhouse gases (Goodman *et al.*,2006:76), Friberg (2000:153); and Babalik-Sutcliffe and Cengiz (2015:797). According to TRCP (2012:13) and Pienaar *et al.* (2005:373), the systems' innovative and unique characteristics result in various socio-economic and environmental benefits, such as sustainable job opportunities, reduced high traffic congestions and high private vehicle dependence.

The impressive system's performance and operational characteristics such as speed frequency, operational characteristics (for example, operating the whole day, availability and easy access of commuters' information), attributes such as comfort, reliability, convenience, safety and security, affordable travel fare, result in positive perception and acceptability of the system by the commuters (Babalik-Sutcliffe and Cengiz,2015:809 and Currie (2005:41-53). Some of the major contributing factors to the success of BRT system in Curitiba and Istanbul include, effective institutional framework, closer relationship amongst stakeholders and political will and good leadership (Pinnar et al, 2005:363 and 364).

The case studies further indicated that lack of capacity (skills), poor will-power from the politicians, improper institutional framework, poor introduction of the implementation of the system during the initial stage result in the failure of the BRT systems (Kishore, 2009:23.4 and Hildago,2009:2). Transport problems such as irresolvable traffic congestions and cars that encroach on the cycling lanes, are likely to be experienced (Hildago, 2009:2).

5.8.2. Emerging models from the methods of communication of BRT system

The study managed to come up with two models emerging from the methods used to communicate the implementation of BRT systems. These models are discussed below:

5.8.2.1. The stakeholder engagement model

The emerging model of stakeholder engagement emphasized that there should be transparent stakeholder engagement with the affected and interested stakeholders, to successfully implement a BRT system that responds to commuters' travel needs, such as comfort, affordability, safety and security and travel time. Schalekamp *et al.* (2010:371), indicated that the general public, affected parties (including transport operators), the current and prospective BRT commuters, residents and businesses as well as the major stakeholders, should be engaged to obtain their buy-in into the system. Omission of the stakeholders would negatively impact on the success of the BRT system. For example, the failure of New Delhi was partly attributed to insufficient engagement of general public, which led the public to have negative perception towards the system. Effective stakeholder engagement enables the BRT implementer's to inclusively involve and incorporate the preferred commuters travel need, and as a result, BRT system that responds to preferred commuters travel needs tend to have positive perception and attract commuters as stated by Moylan et (2013).

5.8.2.2. The public participation models

The case studies reviewed revealed that public participation is one of the most critical methods of communicating the implementation of BRT system. For example, according to Pinnar *et al*. (2005:365), the success of Curitiba BRT system was also a result of strong support of the political and public will-power. These stakeholders were involved during the public participation. Wright (2005:99), further indicated that public participation with the key stakeholders improves the success of BRT system. In terms of implementing the BRT system, the public participation model allows the commuters to state out their preferred commuters travel needs. Consequently, this model is the most effective method and ensures that implementers consider and incorporate the commuters travel stated needs.

5.9. General commuters travel needs model

Commuters travel needs model indicates that commuters are likely to positively perceive the BRT system if it is associated with improved travel needs. Consequently, the studies conducted by Moylan *et al.* (2013:2) and Cervero (2013; 63), indicated that the improved travel time and the

system frequency motivated commuters to shift from using private cars to use the system. Diaz *et al.* (2004:2-3 and 2-22), further pointed out that comfort, safety and security, such as enclosed station, surveillance cameras, signal priorities and cleaners in the station, are some of the key commuters' travel needs that attract commuters to use the system. In terms of affordability or travel fare, Vaz and Venter, (2012:627) and Ugo (2014; 9), indicated that most people prefer to use the BRT system because it financially considers all socio-economic classes within the society.

The above discussed dilemmas resulted in commuters having a positive perception towards the BRT system. However, Wright (2002:16), indicated that the best way to win positive perceptions of the commuters towards the BRT system, the implementers must use effective method of communication to reach out to the commuters. Effectively reaching out to the commuters helps the commuters to precisely understand and change their psychological state of mind in terms of bad perception of bus system. This results in commuters having positive perceptions towards the system and a shift from unsustainable modes of transport to the BRT system.

5.10. Chapter three summary

This chapter presented different the types of BRT systems that have been implemented globally. These BRT systems are made up of different elements that are associated with various operational characteristics. The chapter further explored the different communication methods used to reach various stakeholders and commuters. The case studies reviewed showed that proper and improper processes of implementing the BRT system can either result in the failure or success of the system. The public transport adopted worldwide indicated that BRT is the most innovative and sustainable mode of transport. The emerging models from the reviewed case studies and methods of communication, as well as and the general literature were found. The following chapter analyses the study area in detail.

CHAPTER SIX: STUDY AREA ANALYSIS

6.1. Introduction

This chapter discusses the study area, taking into consideration the main factors that contribute to the implementation of BRT systems. Such factors include the demographic profiles, income status, population and development densities, land use characteristics, transport situation, the proposed BRT system in Polokwane Municipality, plans, strategies, implications towards the development and the implementation of the BRT system. Figure 6.1 highlights the structural settings of this chapter.

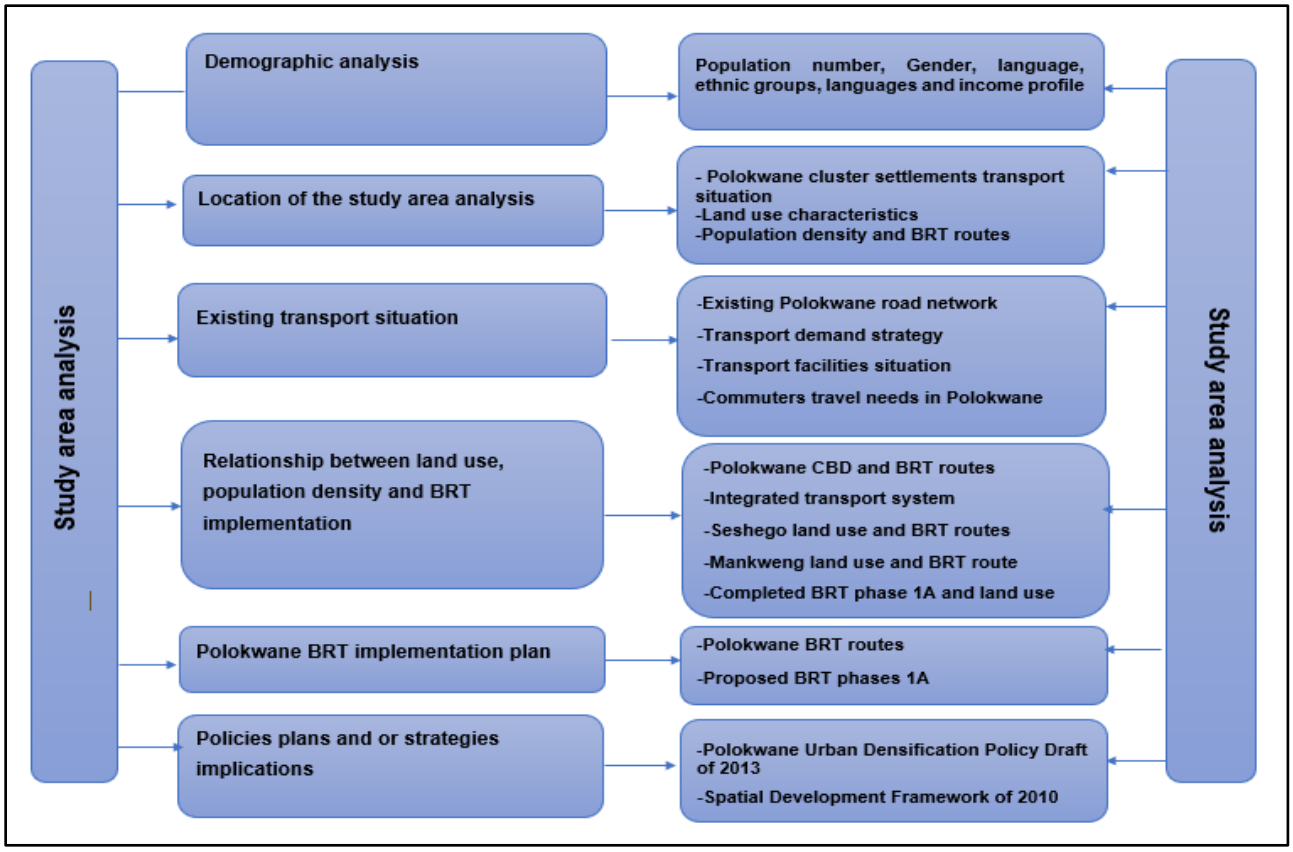

Figure 6.1. Structural settings for the study area analysis

Source: Authors construct (2017)

Figure 6.1 detailed the structural settings of the study analysis, which is composed of six sections. These sections all together explained the demographic status impacted by the BRT implementation, the settings of Polokwane, the current transport situation, the relationship between the implementation of Polokwane BRT and the population density and land use

characteristics. It further demonstrates the Polokwane BRT implementation plan and the adopted policies, plans and strategies to implement the Polokwane BRT system.

6.2. Demographic profile of Polokwane Municipality

According to the Polokwane IDP (2015:71), Polokwane CITP (2013:15) and the Polokwane IDP (2018:89), the municipality has the highest population of 628 999 in the entire Limpopo province; with a growth rate of 2.8%. The Polokwane IDP (2018:89), further shows that the municipality population is predominantly male, at 52% as compared to 48% female. The Polokwane CITP (2013:16), shows that the majority among the four ethnic groups is black, at 92, 9%, followed by whites with 5% and 1, 8% other groups (Coloured, Asian and Indians). Consequently, the most spoken language is Sepedi, comprising of 79%, Afrikaans 5%, English 3% and other spoken languages at 13% (Polokwane CITP, 2013:16). In the Polokwane IDP (2015:75), reported that the majority of the municipal population is predominately uneducated young people, between the ages of 0 to 24. As a result, about 47% of the people have poor income, with 31% middle to higher income and higher income accounting for only 22%. Table 6.1 summarises the demographic profile of the Polokwane Municipality.

Table 6.1. The demographic profile of Polokwane Municipality

Category	Population and or percentage
Total population	628 999
Number of household size	178 001
Population growth rate	2001-2007 (Average Annual %) 1.7
	2001-2011 (Average Annual %) 2.8
Gender	301 920 (48%)
	327 079 (52%)
Ethnic groups	Blacks=92,9%
	Whites=5,2%
	Other =1,8%
Languages	Sepedi=79%
	Afrikaans=5%
	English=3%
	Others=13%
Income profile	Poor income=47%
	Low to middle income=31%
	Middle to higher income=22%

Source: CITP (2013:15 & 16), Polokwane IDP (2015:71&75) and Polokwane IDP (2018:103)

Table 6.1 summarises the demographic profile of the Polokwane Municipality, focusing on the total population, number of household size, population growth rate, gender, ethnic groups, languages and income profile. This population outlook can influence the choice and the

implementation of the Polokwane BRT system. The demographic profile and the Polokwane CBD were expected to be a major determining factor of planning and implementating of the Polokwane BRT system.

6.3. The location of the study area

The Polokwane municipality is located in Limpopo province of South Africa, within Capricon district municipality. It is surrounded by Aganang, Molemela and Lepele-Nkumpi municipalities. The SDF (2010:1), shows that both National and regional routes pass through the municipal area. In the Polokwane IDP (2015:71) report, the proposed BRT is planned to provide efficient, safe and comfortable transport systems to the four main cluster settlements of the municipality.
These four main cluster settlements include:

- Cluster 1 (include Seshego/The Polokwani CBD and most of the urban),
- Cluster 2 (Mankweng, Sebanyane and Dikgale),
- Cluster 3 (Molepo, Maja, Chaune) ; and
- Cluster.4 (Moletji) (Polokwane IDP (2015:70).

These cluster settlements are linked by different road system, which include the minor, regional and national roads and the proposed BRT lanes. Figure 6.2. Illustrate the study location.

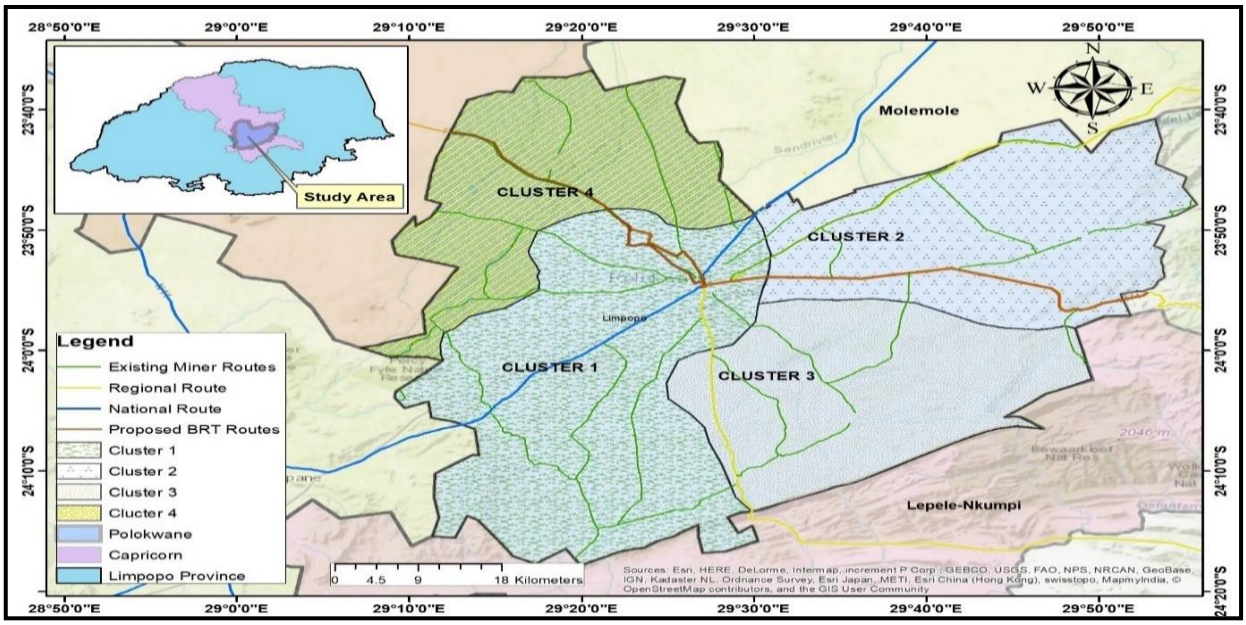

Figure 6.2. The study location

Source: Derived from Polokwane SDF (2010)

Figure 6.2 shows the study area. It also shows the existing transport routes and the proposed BRT routes and showing the existing minor, regional routes and the proposed BRT system and the four cluster settlements.

6.3.1. Polokwane cluster settlements transportation situation

The transport system within Polokwane Local Municipality, provides services to the entire municipal population situated in the four main cluster settlements. According to the Polokwane IDP (2015:70), the four main cluster settlements are: City/Seshego, Mankweng/Sebanyane/Dikgale, Molepo/Maja/Chaune and Moletji. These four major cluster settlements are connected by two major public transport corridors which include the Seshego/Moletji and Mankweng corridor. The Polokwane IRPTS (2014:16), shows that the most dominant mode of public transport within the clusters are minibus taxis, providing 67% of public transport service. The IRPTS (2014;16) reports that commuters residing in Seshego (Cluster 1) and Mankweng (cluster 2) predominately rely on minibus taxis, with Seshogo accounting for 79% and Mankweng 42% (Polokwane IRPTS,20414:16). Table 6.2 shows the four settlement structures of the Polokwane.

Table 6.2. Polokwane settlement clusters

Clusters	Name of cluster	Cluster situation
Cluster 1	Seshego/City	This cluster is located west of the CBD and railway line. It is the nearest to the economic core of all the settlement areas and thus has the best access to the formal economy of Polokwane
Cluster 2	Mankweng / Dikgale / Sebayeng	This cluster is located 10km to the east of the city. It constitutes a large mixed formal and rural area. It accommodates the University of the North and is a long-established settlement area.
Cluster 3	Molepa/ Maja / Chuene	This cluster is located 20 km to the south and comprises a rural settlement area, with purely rural village limited services and infrastructure. The settlement area abutt on the fringe of the rural hinterland and is surrounded by a vast clustering of rural/semi-rural areas.
Cluster 4	Moletje	Is a purely rural cluster and comprising of Moletje settlements that is scattered into the periphery with limited to no services and infrastructure

Source: Polokwane CITP (2013:36)

Table 6.2. Shows the clusters in the study areas, the clusters name and the clusters situation and description.

6.3.2. The land use characteristics

Litman (2017:5), pointed out that transport planning and land use development have impact on each other. For example, active mixed developments tend to attract various modes of transport that promote the use of public transport and non-motorized transport infrastructure. Furthermore, the Polokwane CITP (2013:85), land use management is a central issue to ensure that proper transport services are provided where people live and conduct business activities and that proper land use rights and densities are promoted to make transport more effective and efficient. According to Polokwane SDF (2010:10), 71% of the land within Polokwane municipality is rural, while only 29% is urban.

The Polokwane Local municipality is characterized by different land uses. According to the interview held with the Polokwane transport planner held on the 24 of February 2017, the Polokwane BRT route is located along active and highly densified land uses. Figure 6.3 below show the general land use map within the Polokwane Municipality.

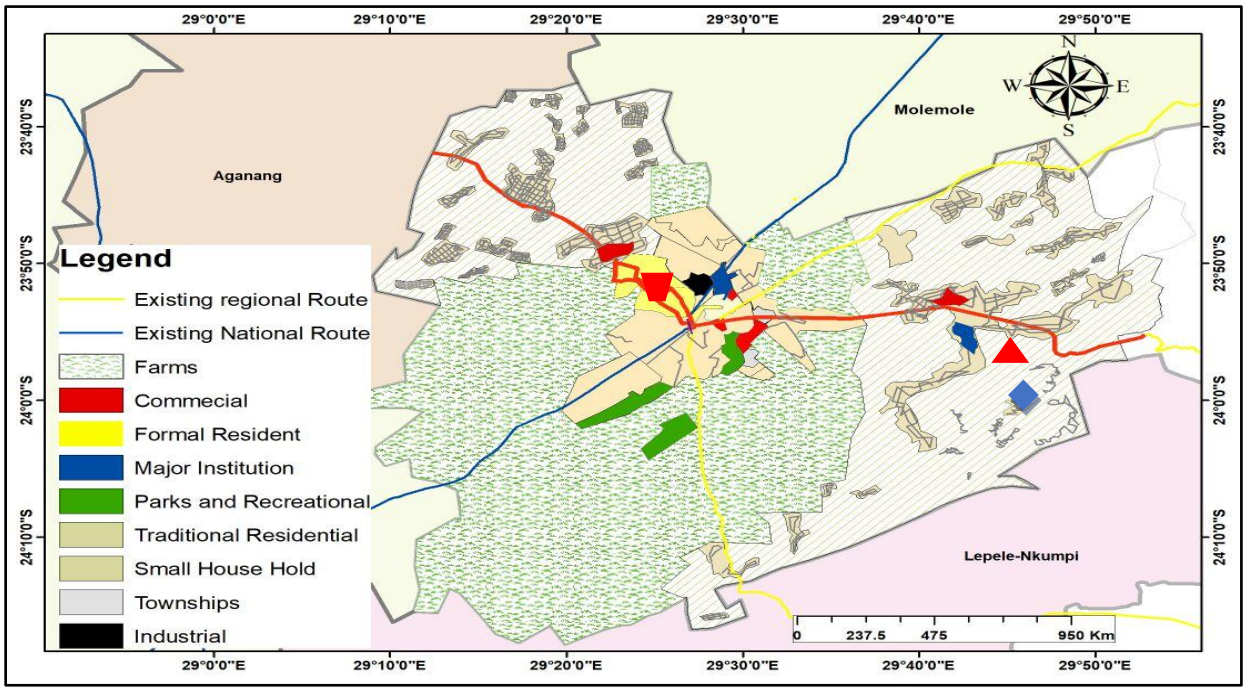

Figure 6.3. Land use and the proposed BRT route

Source: Derived from Polokwane Urban Densification Policy Draft (2013)

Figure 6.3 shows that the majority of the Polokwane Local Municipality in terms of land use practices, is dominated by residential land use. According to the Polokwane SDF (2016), the

majority of Polokwane land is under the custodianship of traditional authority, especially in the outskirt of the Polokwane CBD. This might result in misunderstanding and disapproval of the system, if the system implementation was not well articulated to the traditional authorities. The map also shows two major institutions within the municipality. These include the University of Limpopo and Tshwane University of Technology. It shows that the BRT route passes through the major economic activities such as commercial land uses within the CBD, Seshego township and Mankweng.

6.3.3. The population density and the BRT routes

The Curitiba BRT system in Brazil shows that there is a relationship between the urban density and the land value. According to Bocarejo *et al.* (2013:78), the Curitiba BRT system attracted higher density along the system's corridors and high land values. The Polokwane Municipality considered the same strategy when planning its BRT corridors. According to the Polokwane CITP (2013:15), the population density of the Polokwane Municipality was 167 per km². However, the major densities of the municipal population are reflected in Mankweng and Seshego areas, which fall under clusters 1 and 2 settlements. The Polokwane Urban Densification Policy Draft (2013:37) and the Polokwane IRTP (2014:32), established that the high population densities and high public transport demands within Seshego/Moletji and Mankweng, particularly along the corridors, made the corridors ideal for implementation of the Polokwane BRT system. Figure 6.4 shows the population densities along the Polokwane transport corridors.

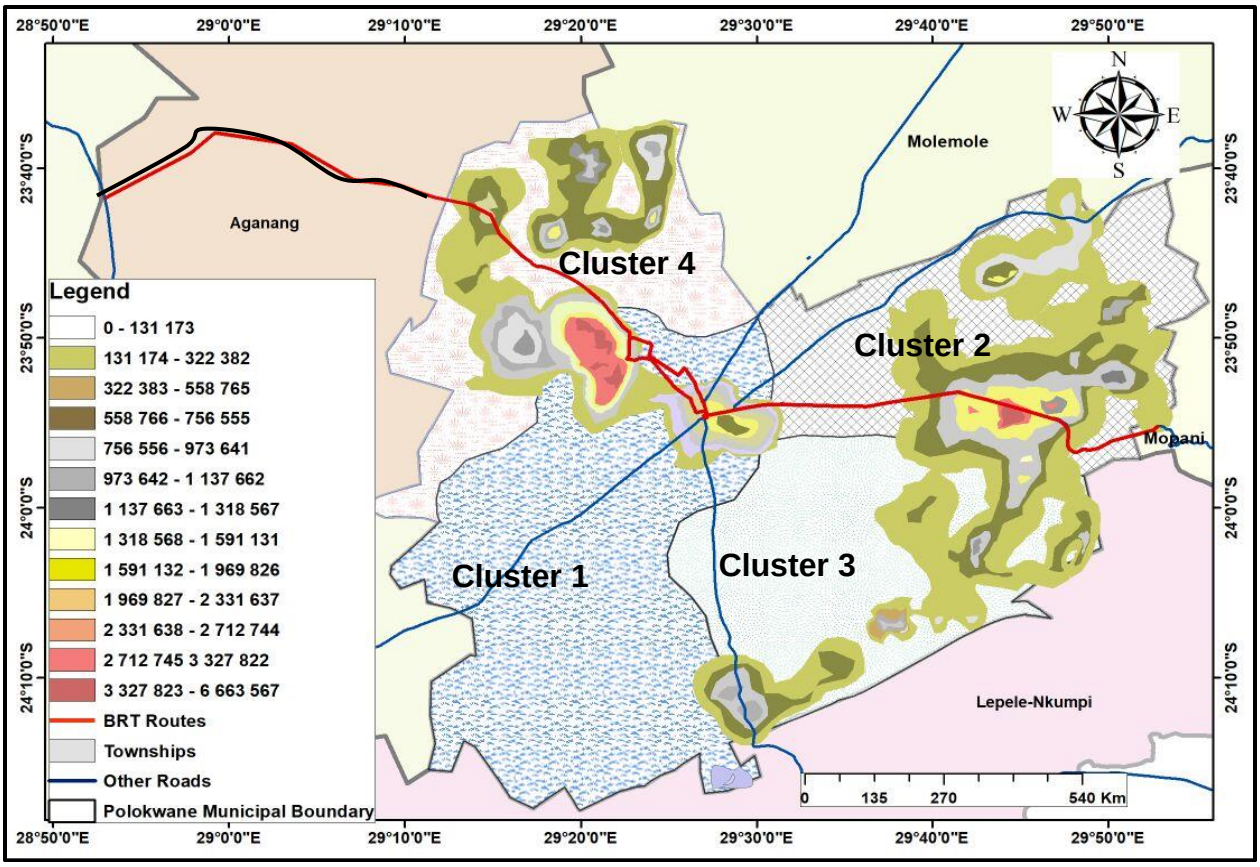

Figure 6.4. Population densities along Polokwane transport corridors

Source: Derived from Polokwane UDPD (2013)

Figure 6.4 shows the population densities within the Polokwane Municipality. The map shows higher densities within cluster 1 and cluster 2 of the municipal settlements. This shows that the Polokwane Municipality has considered and incorporated the population density as a major planning factor for the implementation of the Polokwane BRT system.

6.4. Existing transport situation

The current transport situation plays a major role in determining the location of the BRT routes, extensions and feeders. This study assessed the transport situation within the municipality, taking into consideration the transport demand and the transport facilities within the municipality.

6.4.1. Existing Polokwane road network

The Polokwane road network is characterized by different road network corridors. These include a National road, regional roads, main roads and internal roads. These road networks are mainly used by the Polokwane commuters. Figure 6.5 shows the road network map within Polokwane central core.

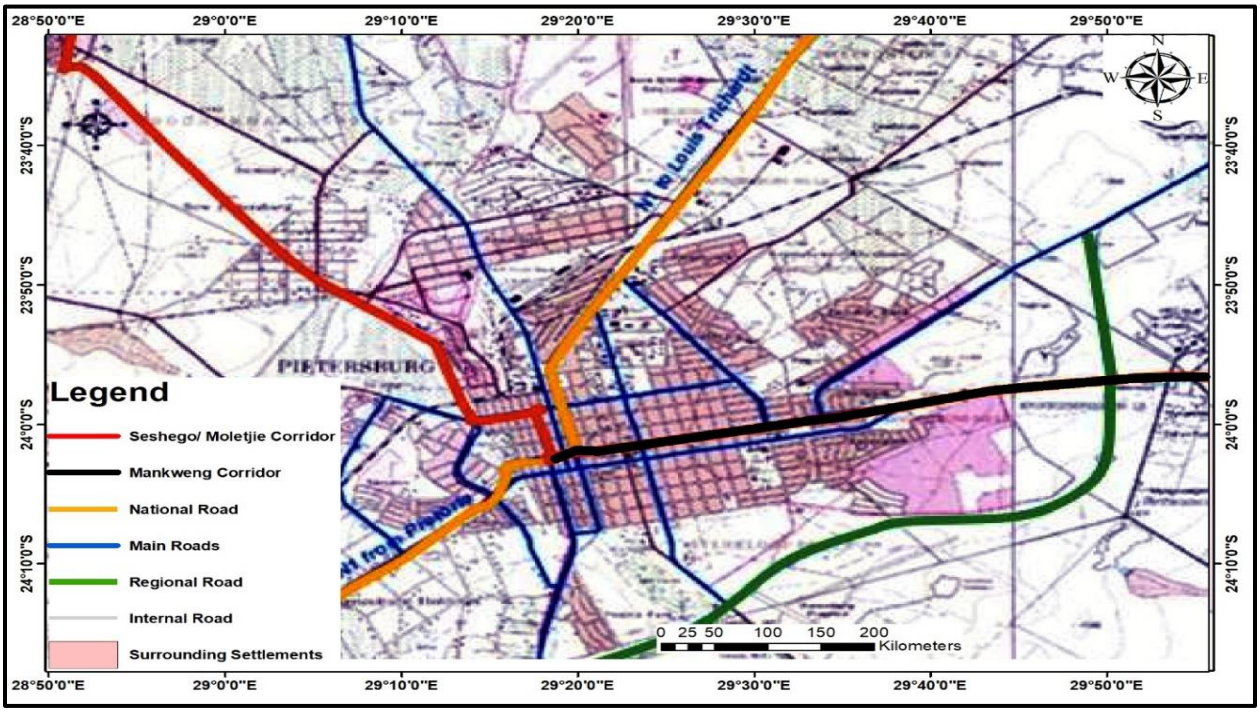

Figure 6.5. Road network map within Polokwane central core

Source: Derived from Polokwane SDF (2010)

Figure 6.5 shows the road network within Polokwane central. The main existing roads include the two major public transport corridors, which are the Seshego/Moletji and Mankweng corridors. The map also shows the National road, regional road and the internal roads. These roads navigate the urban area of Polokwane in and out. Thus, the completion of the implementation of the Polokwane BRT is likely to improve the transport situations that are currently experienced by commuters. The proposed BRT routes are located on the two major public transport corridors. These include the Seshego/Moletji and Mankweng corridors. The BRT route passes through the National, regional and internal roads. Figure 6.6 shows the Polokwane CBD road network and BRT routes.

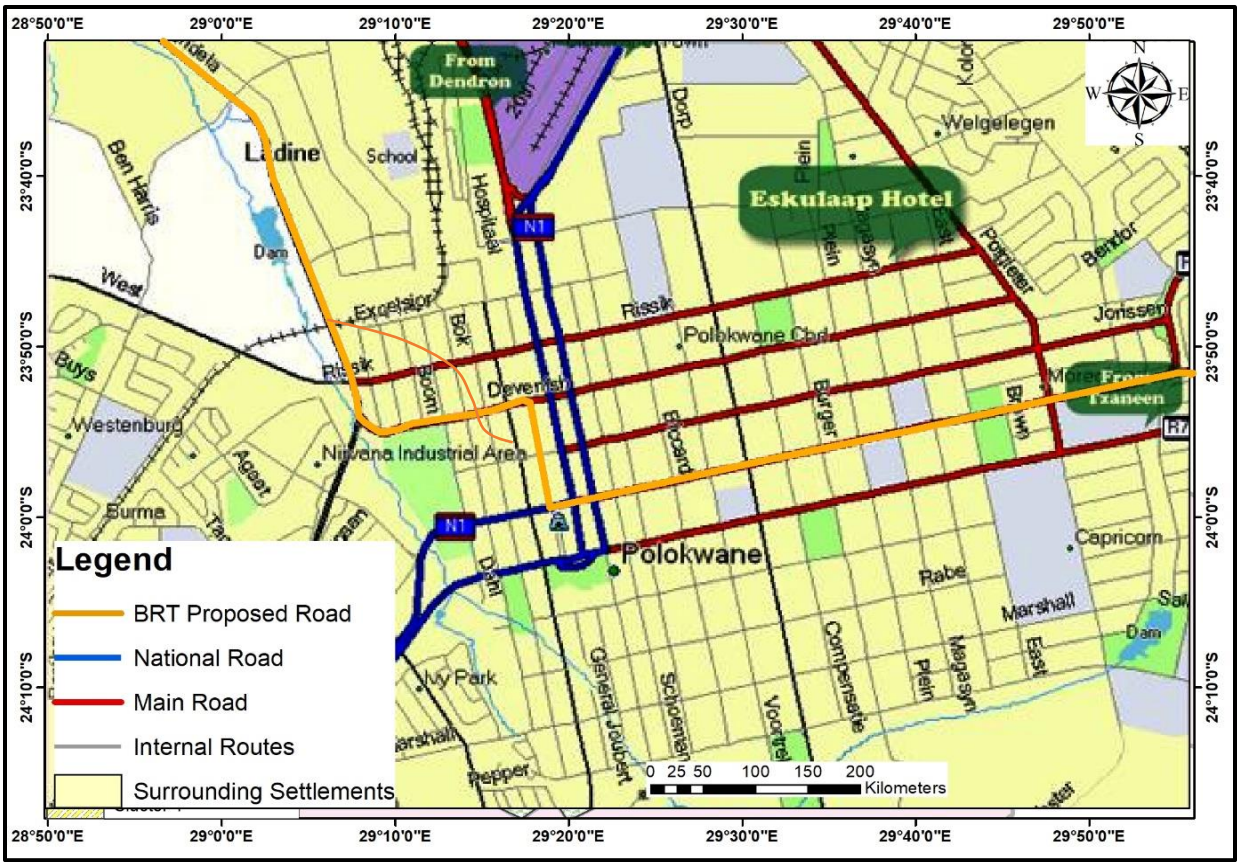

Figure 6.6 Polokwane CBD road network and BRT routes

Source: Derived from the Polokwane SDF (2010)

Figure 6.6 shows the relationship between the existing road network within the CBD and the proposed BRT routes. The BRT network was the route network chosen to integrate the BRT system with the movement of transport, such as non-motorised transport systems connecting active existing roads, particularly where there is a concentration of commercial activities. The study revealed that the NMT's promote healthy living and reduce travel fare because it integrates walking and cycling in dedicated NMT infrastructures.

6.4.2. Transport demand situation

The Seshego/Moletji and Mankweng public transport corridors provide transport system to the four cluster settlements of the Polokwane municipality. The Polokwane Municipality decided to implement the BRT system along these corridors because of its high demand for public transport and its high population density (Polokwane IRPTS, 2014:21 and Polokwane Urban Densification Policy draft, 2013:36). The Seshego/Moletji corridors service both Seshego/City Polokwane and

Moletji clusters, while the Mankweng corridors provide transport services to the Mankweng and Maja/Molepo/Chaune clusters.

According to the Polokwane IDP (2018:112), the Seshego/Moletji corridor provides transport services to most urban areas. The Mankweng corridor mostly provides transport services to rural settlements. However, certain areas have vibrant economic modes, which include the University of Limpopo, Mankweng Hospital and Turf loop shopping centre (Polokwane IDP, 2018:114).

6.4.3. Transport facilities situation

The Polokwane IRTPS (2014; 25), provided different modes of transport facilities to the Seshego/Moletji corridor, the Mankweng corridor and the Polokwane CBD. This is summed up by Table 6.3

Table 6.3. Existing transport facilities on road corridors

Mode of transport	Seshego/Moletji facilities:	Mankweng facilities	Polokwane CBD facilities: For
Public transport facilities	bus/taxi stops and lay-bys on some arterial roads	Rely on taxis departing from the Turf loop Plaza Rank and the Hospital Rank to take them to town or the surrounding villages.	bus and taxi commuters are dropped-off at various bus and taxi stops throughout the CBD
Taxi and bus ranks	there are no formal ranks in the residential areas	Taxi and bus ranks are used at low intensity throughout the day because nurses and students	There are taxi and bus ranks within the Polokwane CBD
Transport problems resulting from poor transport facilities	Commuters are picked-up along the routes in the morning by both taxis and buses. In the afternoon, commuters are also dropped off along the route	They are not reliable as they operate at low intensity throughout the day	lack of lay-bys or formalized drop-off points in the CBD forces taxis and buses to stop in the roadway to off-load commuters

Source: Polokwane IRTPS (2014:25)

From Table 6.3, it is clear that the existing transport facilities are along the Seshego, Moletjie, and Mankweng and Polokwane CBD corridors. It further shows the current operating modes of

transport and types of transport problems occurring due to poor transport facilities within Polokwane Municipality.

6.4.4. Commuters' travel needs situation in the Polokwane Municipality

Commuter travel needs are based on four major themes in the study. These themes include safety and security, travel fare (affordability), travel time and comfort. Safety /security and comfort are discussed under the same heading because they are similar or related issues. Travel fare and travel time are based on the current fare of the mode of transport.

6.4.4.1. Safety, security and comfort

Transport safety and security have become a major problem within Polokwane Municipality jurisdiction. According to the Polokwane IDP (2015:175), the high demand for different modes of transport does not correspond with the low supply of commuter transport, which often lack safety, security and conformity because of the limited number of transport within the Polokwane municipality. Some of the concerns include increased traffic congestion, poor transport and road safety which has increased road accidents in all clusters of the Polokwane Municipality (2018:131 and 2015:175). According to the Polokwane SDF (2010) and Polokwane IDP (2015), the poor road and transport safety and security result to constraint mobility and an increase in the number of road accidents whichincreased by 3.6% from 2010 to 2017, particularly during holidays.

According to the Polokwane CITP (2013:242), some of the transport facilities do not have essential safety and comfort measures such as surveillance videos, lights and security, thereby rendering commuters vulnerable. The Polokwane Central Business District Plan and Urban Renewal Strategy Final Report (2016:46), indicated pick-pocketing as one of the most dominant crimes faced by the commuters, particularly the elderly, students and foreign citizens. Such crimes regularly occur in the morning and afternoon peak hours. As a result, Polokwane commuters feel unsafe and uncomfortable when travelling in the morning and afternoon peak hours. However, the IRPTS (2014:17), pointed out that the provision of the BRT system will provide the critical safety, security and comfort needs. Some of the measures include installation of CCTV's in the bus system, and along the routes, to ensure that all commuters are safe and comfortable to use this mode of public transport.

6.4.4.2. Travel fare (affordability)

The Polokwane Municipality is characterized by different modes of public transport. Such as minibus taxis, minibus buses, metered taxis, long distance taxis and long-distance buses (Polokwane IDP,2018:113). These modes of transport are associated with different travel fares. According to Paulley (2006:3), travel fares are fundamental to the operation of public transport because they form a major source of income for operators. In general, if fares are increased, patronage will decrease. Consequently, it is crucial for the municipality to ensure that the BRT system financially accommodates all citizens. Table 6.4 shows the current travel fares in the four cluster settlements of Polokwane Municipality for minibus taxis, minibus buses and meter taxis for local trips.

Table 6.4. Travel fare of different modes of transport in Polokwane

Mode of transport	Cluster	Origin	Destination	Distance (km)	Fare
Minibus taxis	Cluster 1	Polokwane CBD	Westernburg	Between 6.3 and 12.6	R5.00
	Cluster 1		Seshego	Between 6.5 and 16	R8.00
	Cluster 1		Perskebult	17	R11.00
	Cluster 2		Turfloop	31	R15.00
	Cluster 3		Ga-Mathapo	35	R18.00
	Cluster 4		Ga-Modikana	43	R20.00
Minibus bus	Cluster 1	Polokwane CBD	Seshego	Between 17 and 32	R7.00
	Cluster 1		Perskebult	22	R7.50
	Cluster 2		Mokgokong	30	R9.00
	Cluster 2		Mankweng	32	R11.70
	Cluster 3		Lebowakgomo	Between 44 and 60	R18.50
	Cluster 4		Mentz/Boyne	Between 47 and 56	R21.20
	Cluster 4		Bochum	91	R37.50
Metre taxi	Cluster 1	Polokwane CBD	Westernburg	Between 6.3 and 12.6	+/-R50.00
	Cluster 1		Bendor, Flora Park,Ivydale	Between 5 and 7	+/-R60.00
	Cluster 1		Seshego	Between 6.5 and 16	+/-R100.00
	Cluster 1		Blood river	15	+/-R150.00
	Cluster 2		Mankweng	31	+/-R280.00
	Cluster 2		Boyne	44	+/-R350.00
	Cluster 3		Bochum	91	+/-R570.0

Source: Derived from Polokwane IRPTS (2014:19 and 20)

Table 6.4 shows the three-dominant mode of public transport and their associated travel fares. The table shows that meter taxis are very expensive and might be unaffordable to the low-income people. Therefore, meter taxis mostly operate within cluster 1, that is, urban areas, where the majority is employed, and they mostly within the middle-income group. Minibus buses are affordable, and they also operate in rural areas, but in a cost-effective manner. However, minibus taxis, the most dominant mode of public transport, consisting of 67% (IRPTS, 2014:16), this mode of transport operates in both urban and rural areas, unlike meter taxis. Minibus buses were the cheapest mode of transport, with affordable travel fare, as compared to the other public transport modes. These modes of transport are affordable to the majority of Polokwane residents and accommodate almost all people within the municipal area.

6.4.4.3. Travel time

According to Biliyamin and Absode (2012:19), traffic congestion increases travel time and delays. The Polokwane CITP (2013:16), indicated that congestion within the municipal area occurs during peak hours, particularly on the roads used by public transport vehicles. Lack of pick and drop off facilities are the main contributors of the traffic congestion in the Polokwane Municipality. Biliyamin and Absode (2012:19), further indicated that traffic congestion varies one day to the other, in as much as time frames. Accordingly, observed data from the study area revealed that poor travel time is between early hours in the morning, and between late hours in the afternoon.

The study on Polokwane IRPTS (2014:25), further reveal that Polokwane municipality is characterised by poor transport facilities that affect transport frequency. It further indicated that the implementation of the BRT system to the road network will influence the possible reduction in traffic flow caused by private vehicles and local public transport (Polokwane, IRPTS, and 2013:76). Therefore, the implementation of BRT will reduce wasted traveling time, and this might have impact to the commuters' perception towards the system.

6.5. Relationship between land use, population densities and the BRT system

The implementation of a BRT system is dependent on population densities aas well as development densities. The reviewed studies indicated that the BRT systems are located where there is a high demand for transportation. The higher the population and development densities,

the likely the system will successfully operate. The same applies to the implementation of the Polokwane BRT system. However, since there is no land use map in the villages, the study did not manage to analyse the land use, density and BRT implementation in cluster 3 and 4. This relationship is explained by the following maps.

6.5.1. Polokwane CBD land uses and the BRT route

Polokwane CDB is the major economic centre in the Limpopo Province (SDF, 2010:2). It is located in cluster 1, together with the Seshego Township. The CDB is surrounded by residential urban land use, industries, educational and institutional uses. Figure 6.7 shows the Land Use Map of Polokwane, development density, proposed BRT and the road network within the Polokwane CBD.

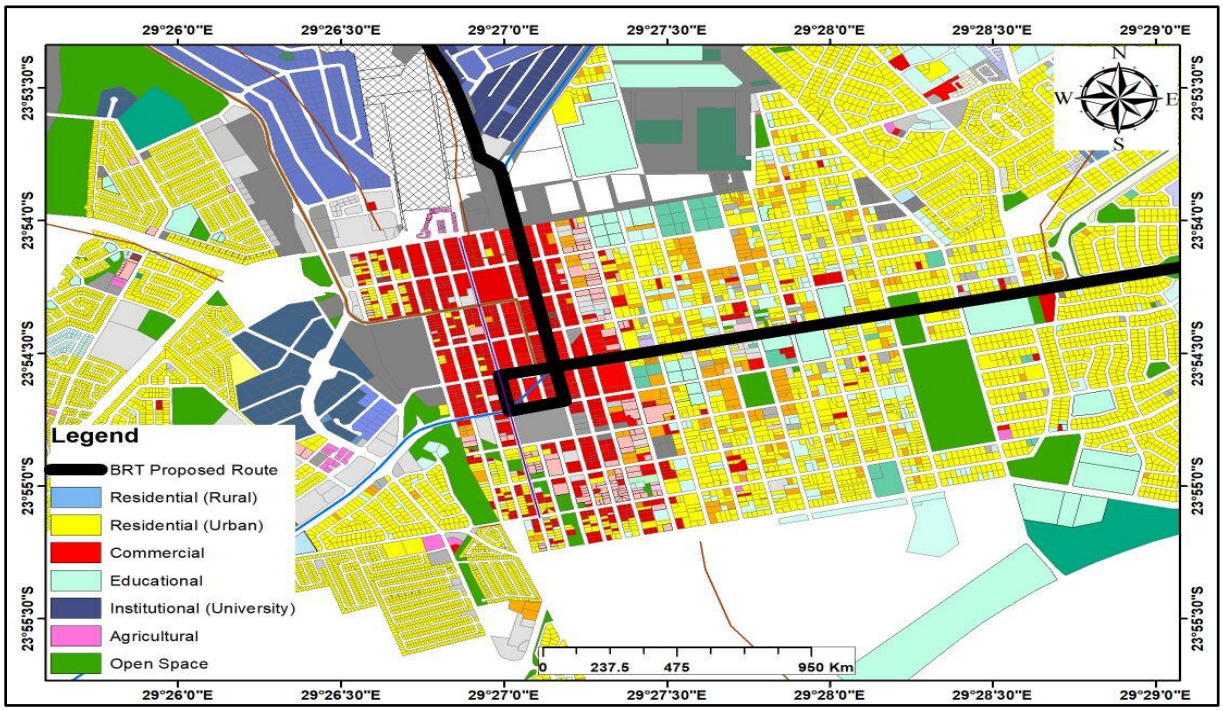

Figure 6.7. Polokwane CBD land use map

Source: Derived from Polokwane SDF (2010)

Figure 6.7 shows the land use map of Polokwane CBD. This map depicts the major economic activities which are interconnected by different transport routes. It alsoshows the Proposed BRT route which passes through a densified and active land use activities. This shows a forward

thinking that was applied during the planning of the implementation of the system, and it further implies that the system may succeed based on that criterion.

6.5.2. Integrated transport system from the Polokwane CBD to Seshego neighbourhood

Seshego residential neighbourhood is the closest area to the Polokwane CBD. According to the Polokwane IDP (2015:75), Seshego has the highest percentage of population relying to the public transport. Consequently, Figure 6.8 shows the integrated transport corridor, connecting the Polokwane CBD and the Seshego residential neighbourhood.

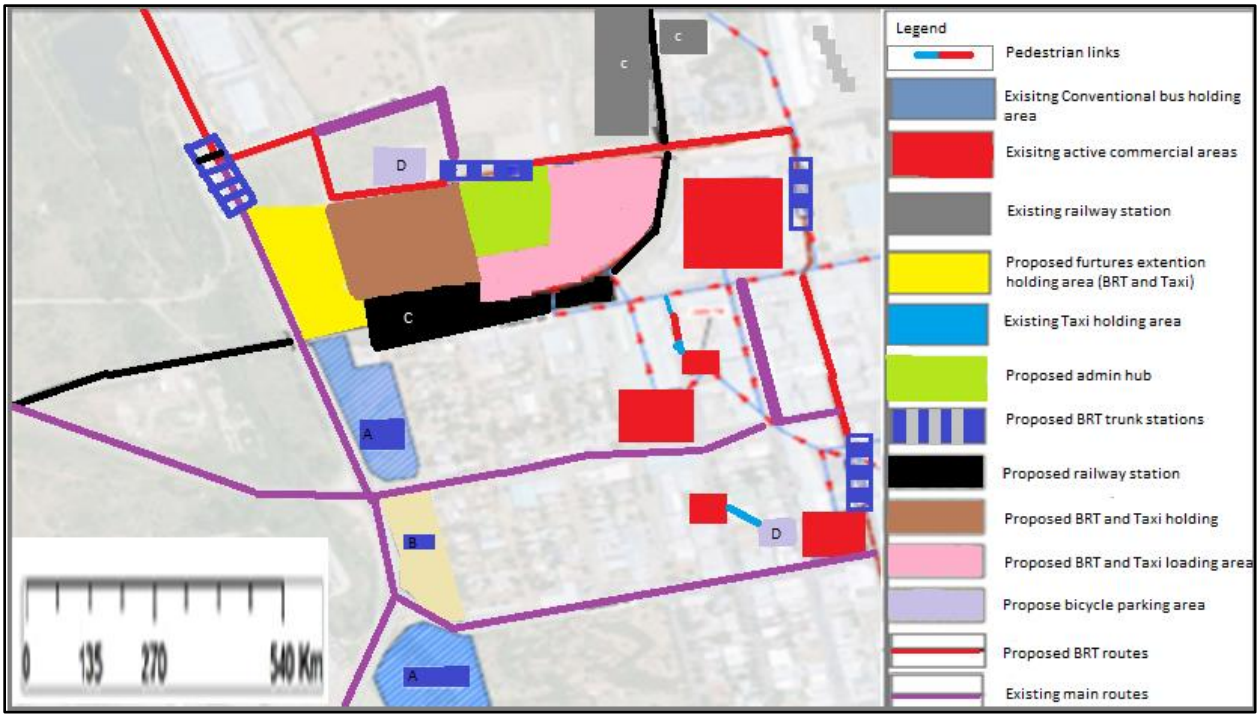

Figure 6.8. BRT facilitates and integration with major road corridors

Source: Derived from Polokwane CITP (2013:86)

Figure 6.8 shows the integrated transport corridor that connects the Polokwane CBD and the Seshego residential neighbourhood. It further shows how the BRT is integrated with the existing modes of transport infrastructure, such including the railway, taxi and bus stations. It also shows the existing active commercial areas closed to the system, proposed bicycle parking area and three pedestrian linkage to the corridors and the stations.

6.5.3. Seshego land use and the BRT route

According to the Polokwane CITP (2013:36), Seshego Township is under cluster 1, together with the CBD. Seshego Township is currently serviced by the existing transport system through the Seshego/Moletji corridor. These corridors currently experience high transport demands. Consequently, the BRT route was proposed along the Seshego/Moletji major public transport corridor. The Seshego Township is characterized by people from different socio-economic classes. Figure 6.9 shows the Seshego land use and the BRT route.

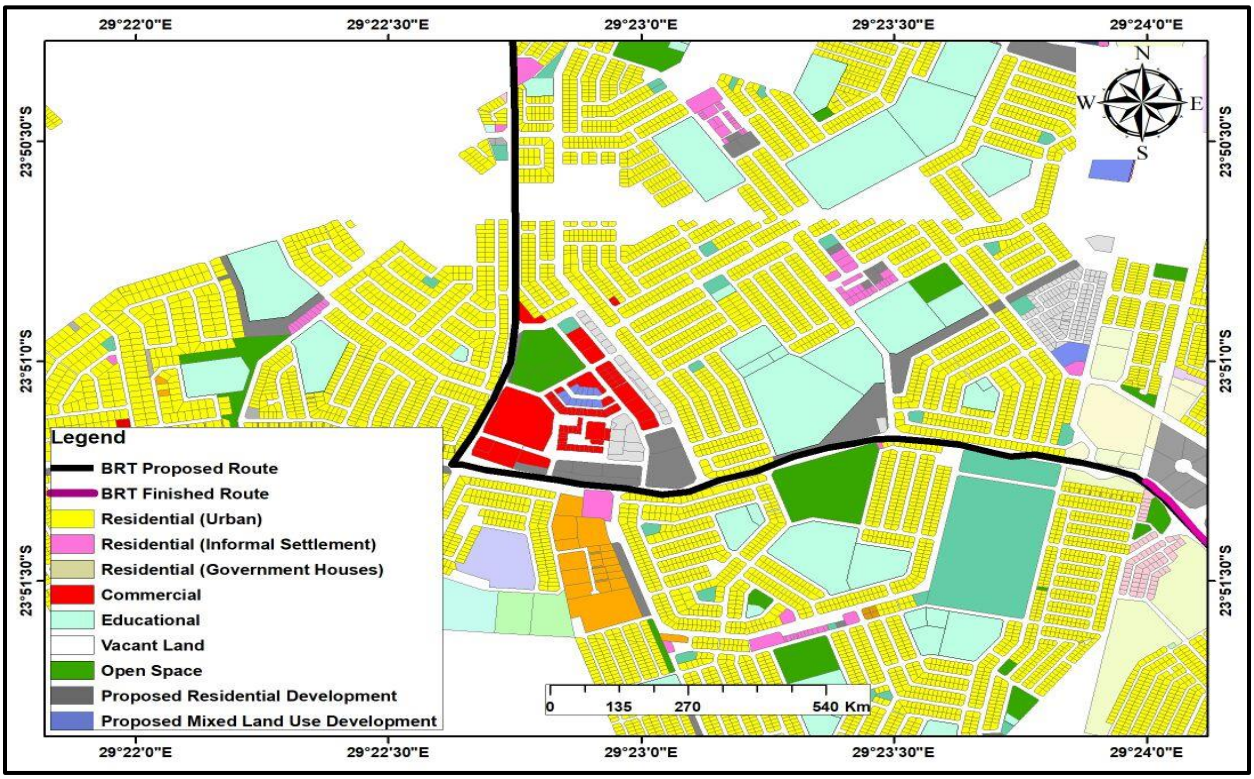

Figure 6.9. Seshego land use map

Source: Derived from Polokwane SDF (2010)

Figure 6.9 displays the land use map of Seshego Township. It further shows the development densities along the proposed BRT route and the finished BRT route. The existing developments were densified enough to support the BRT system. However, there are large portions closer to the BRT which are undeveloped and may affect the progress of the BRT system in the future. The analysis also depicts the need for non-motorized transport along the BRT route and within the residential settlements to improve the transport problems.

6.5.4. Mankweng land use and BRT route

Mankweng is located east of the Polokwane CBD and 30 kilometres from the town centre. The area falls within cluster 2 settlement, much closer to cluster 3. The Mankweng major corridor provides transport services to Mankweng residents and the neighbouring villages within cluster 2 and cluster 3 settlements. The area is dominated by educational and institutional land uses, which include the University of Limpopo and the Zion Christian Church (Z.C.C). Figure 6.10 shows the land use map of the Mankweng.

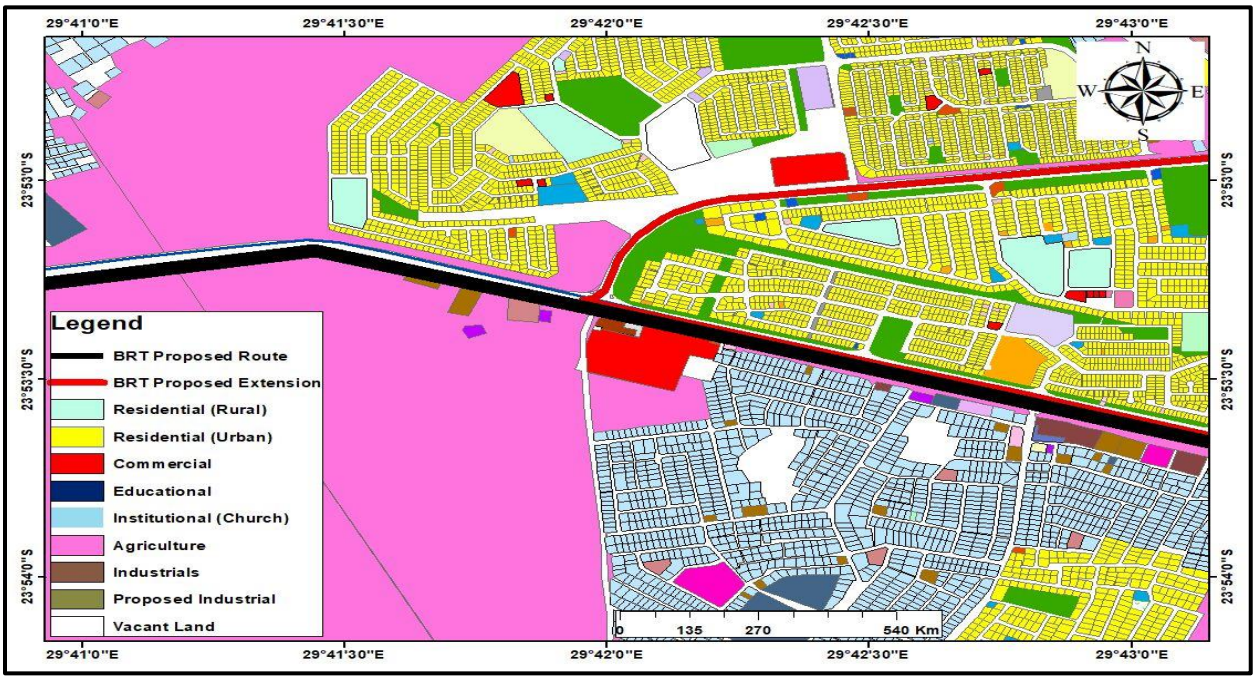

Figure 6.10. Mankweng land uses and BRT route

Source: Derived from Polokwane SDF (2010)

Figure 6.10 shows the land use and BRT route of Mankweng an analysis of this route revealed large portions of agricultural land, rural residential, Urban residential, educational, institutional and as well as commercial land uses. The analysis revealed that there is undeveloped agricultural land adjacent to the proposed BRT, which might negatively impact the system in the long run. However, the proposed BRT route shows some positive and critical planning integrated between the urban core and rural areas. These include providing social cohesion and equal distribution of transport system for both rural and urban areas as the BRT route passes Polokwane CBD through the settlements along the route to Mankweng (Nyquist and Whit marsh, 2008:1374).

6.5.5. The relationship between the completed BRT route and land use

According to the key informant's interview and field data, the Polokwane Municipality is lagging behind in its actual planed timeline for completing the BRT system. Phase 1A, which is between Seshego and the Polokwane CBD, is completed, with the construction of route alignment. The Key informants from the municipality indicated that they have not started with the other routes and the stations. The timeline indicated that the municipality should have finished this phase in 2016. The study assumes that the delay in the completion of the BRT also plays a role in how commuters perceive the system. Figure 6.11 shows the land uses adjacent to the completed BRT route of phase 1A.

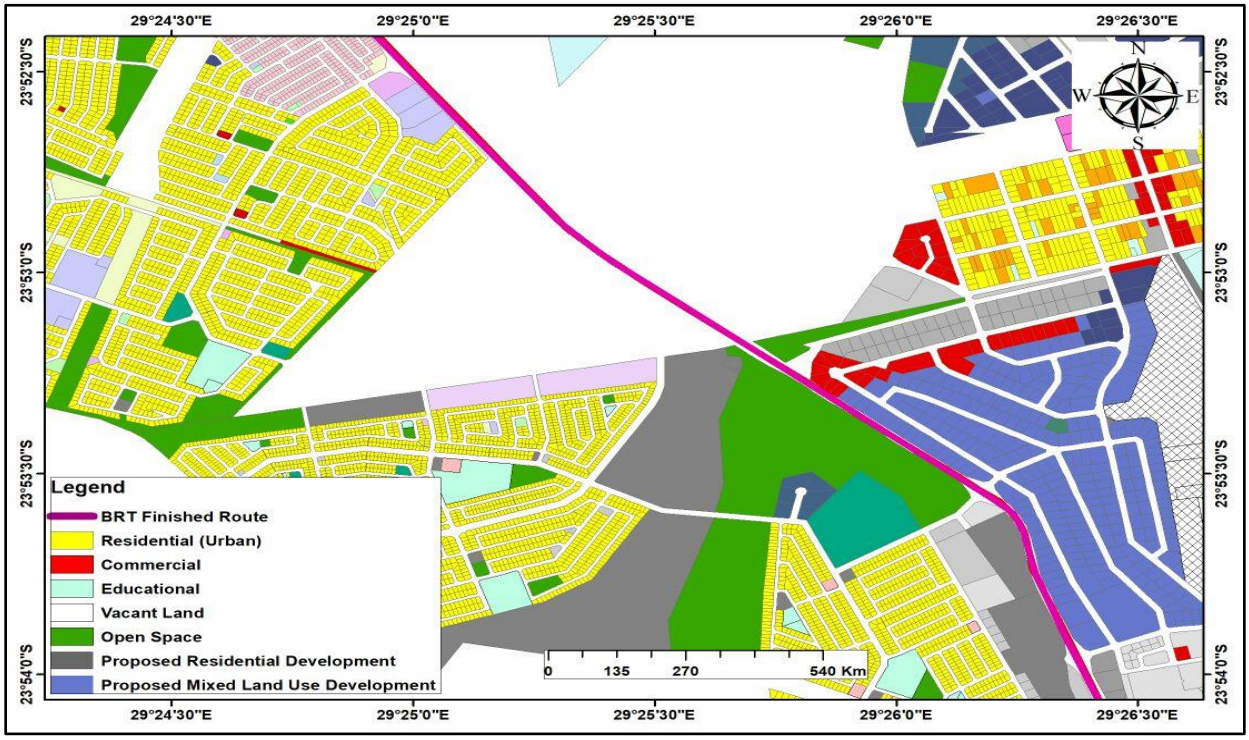

Figure 6.11 The land use closer to the completed BRT route of the Phase 1A

Source: Derived from Polokwane SDF (2010)

Figure 6.11 shows the land uses closer to the completed route of Phase1A.The route passes through open space, land earmarked for future residential and mixed land used developments. The map also shows a large vacant land adjacent to the completed road. According to Deng and Nelson (2012), in order for BRT to be successful, there is a need to densify settlements along the

system to promote the use of NMTs. Densified development or settlements promote active commuting and the use of NMTs.

6.6. Polokwane BRT implementation plan

As instructed by the Department of Transport in 2007, the Polokwane Municipality drafted plans to implement the BRT system, to achieve the goals of the Public Transport Strategy and Action Plan of 2007. This section presented the detailed implementation plan for the Polokwane BRT system.

6.6.1. Polokwane BRT routes

The Polokwane CITP (2013: BRT routes consist of the main trunk, which connects the feeders and extensions. These extensions run on the residential street to minimize the walking distances. Figure 6.12 shows the propose BRT routes with feeders and extensions of the Polokwane municipality.

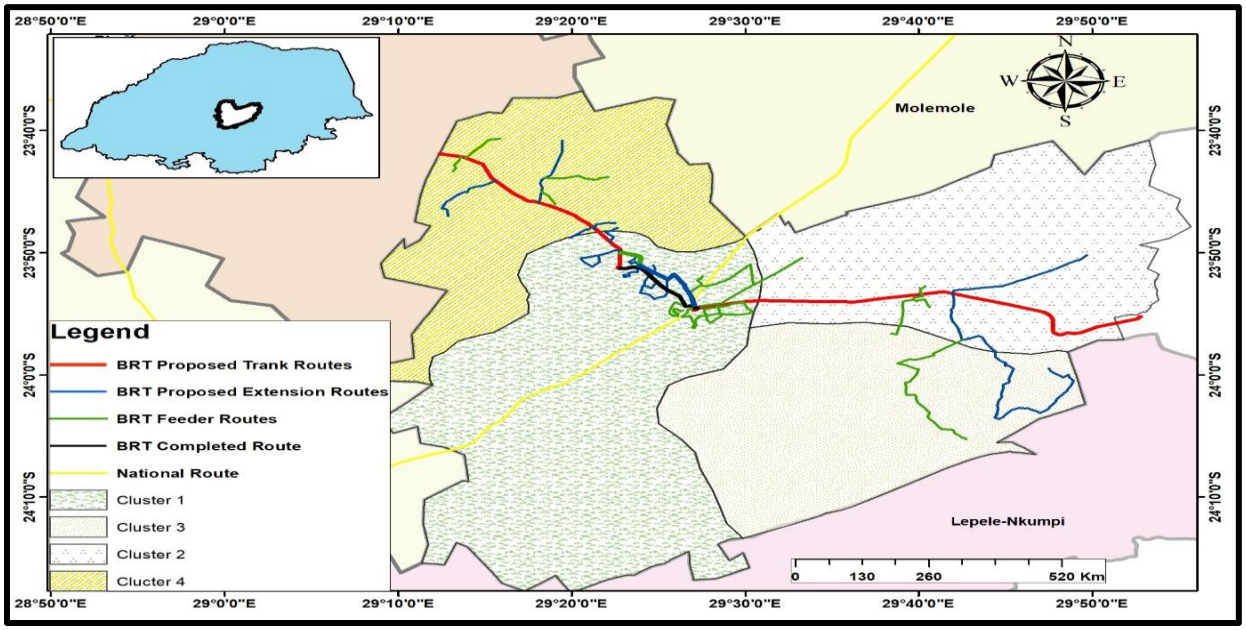

Figure 6.12. Proposed BRT routes with extensions and feeders of Polokwane municipality
Source: Derived from Polokwane IRPTS (2014)

Figure 6.12 shows the proposed BRT routes of the Polokwane Municipality, with its extensions and feeders. These feeders and extensions provide accessible and safe modes of transport. However, the key informants interview held with the municipal officials. The municipality does

have enough finance for the feeder's infrastructures and BRT vehicles. These might affect the accessibility and safety of the system. Consequently, the municipality must come up with less cost but most effective strategy of addressing the issue to avoid negative perceptions of the system from commuters.

6.6.2. Proposed Polokwane BRT phases

According to the Polokwane IRPT (2014:45), the Polokwane BRT system is comprised of three physical phases. The Polokwane BRT system phases include phase 1, which contains phase 1A and 1B, phase 2 and phase 3. Figure 6.13 shows the physical implementation phases of Polokwane BRT system.

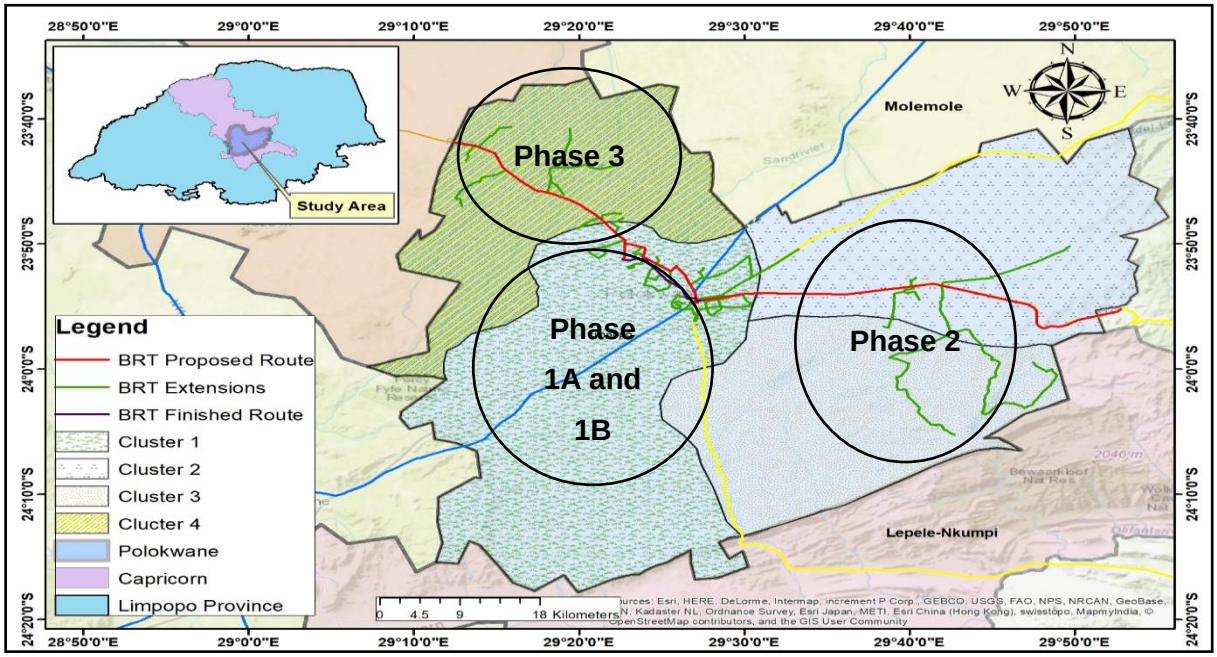

Figure 6.13. Physical implementation phases of Polokwane BRT system

Source: Derived from Polokwane SDF (2010)

Figure 6.13 shows the physical implementation phases of the Polokwane BRT system. The proposed physical phases of the BRT system were planned to provide transport services to all the four main cluster settlements. However, the proposed BRT route shows that cluster 3 settlements will provide services by using BRT extensions from cluster 2. The detailed information of each phase is described in Table 6.5.

Table 6.5. Details of phases of the Polokwane BRT implementation

Characteristics	Phase 1A and 1B	Phase 2	Phase 3
1. Cluster	Cluster 1	Cluster 1 and 4	Cluster 2 and 3
2. Areas covered	Seshego, Polokwane CBD and surrounding urban areas	Seshego and Molejti	Mankweng Maja, Molepa and all areas within ward 10 to 30
3. Wards covered	Ward 1-9	Ward 28-38	Ward 10-27
4. Urban or rural	Urban areas	Partially urban, but mostly rural	Partially urban, but mostly rural
5. Breakeven fares	R15,06 for trunk routes R9,04 for feeders	R15,06 for trunk routes and R9,04 for feeders	R18,24 for truck route and R9,04 for feeders
6. Breakeven fares excluding the fleet	R12, 89 and R6, 63 respectively.	R10,45 and R6,63	R12,89 andR6,63 respectively
7. Estimated date of completion and operational	June 2016	After completion of phase 1B	Not specified

Source: CITP (2013:39, 60), Polokwane IRTP (2014: IX, 43) and Polokwane BRT specification framework draft (2014:7)

Table 6.5 shows that the Polokwane BRT system is comprised of 3 phases. Phase 1A and 1B covers cluster 1, while phase 2 covers cluster 1 and 4 and phase 4 covers cluster 2 and 4. It further reveals the number of wards covered by each phase and whether the phase will be covering the urban or rural settings. The table further highlights the breakeven fares and the estimated date of completion and operation.

6.6.3. Proposed BRT phase 1A

According to the observed data and the key informants interview with the Polokwane municipal officials. Phase 1A was supposed to be completed in 2016 and Phase 1B in 2018. However, the municipal financial muscle did not allow the implementers and municipal officials to reach their goals. However, Phase 1A, BRT route is currently completed, and the municipality is in the process of finalizing the BRT vehicle procurement. One of the key informant indicated that these vehicles must be environmental friendly, as they are targeting BRT vehicles that use renewable energies and technological fuel, such as biofuels and electricity. Figure 6.14 below shows the proposed BRT routes and extensions for phase 1.

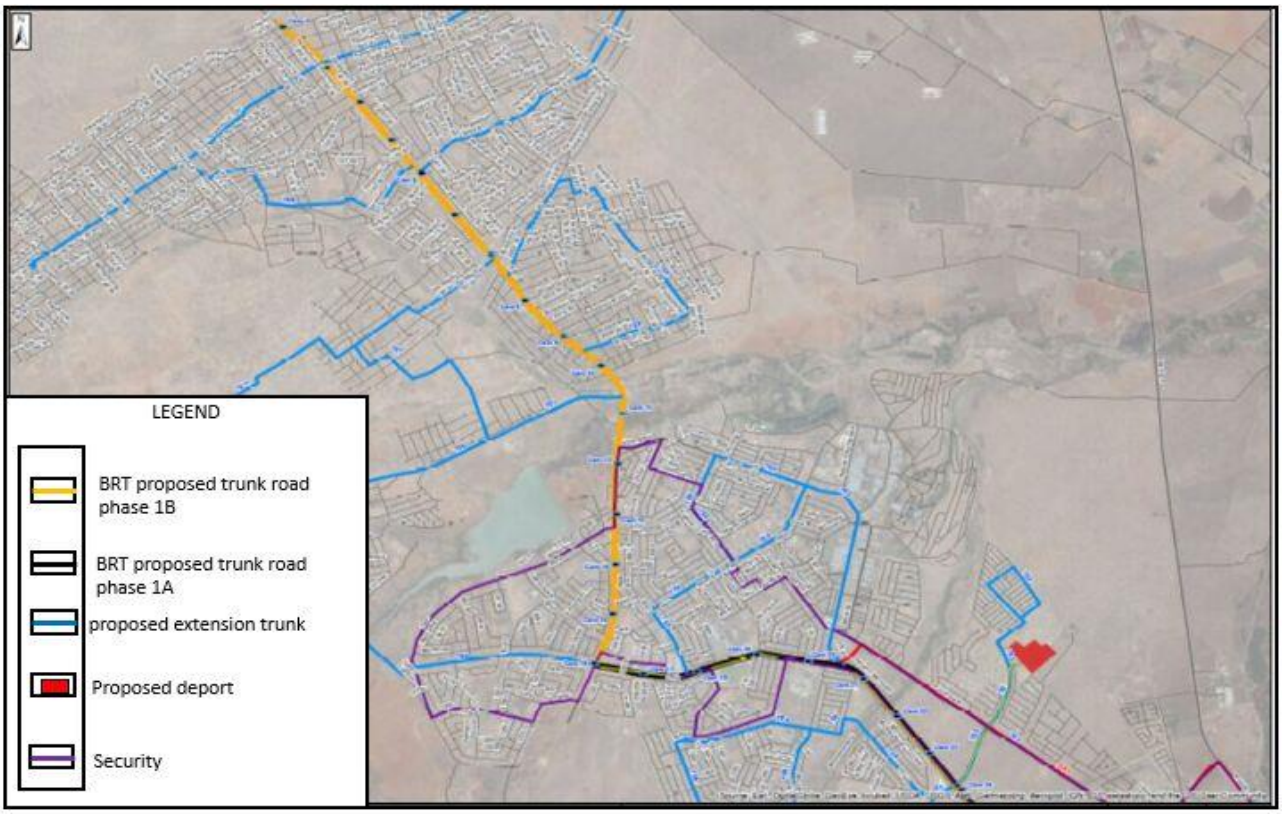

Figure 6.14. Proposed BRT routes and extensions

Source: Polokwane CITP (2013)

Figure 6.14 shows the detailed proposed BRT of the Polokwane system, Phase 1(A and B). It further shows the proposed depot, BRT extensions and both proposed Phase 1A and B Polokwane BRT routes.

6.6.4. Management and responsible authority of the Polokwane BRT system

According to the Polokwane IRTPS (2014:71), the operation of the Polokwane BRT system will be handed over to the BRT Operation Teams, which include the Control Room functions and systems. This operation team will manage the BRT operations through contracts with other companies. These companies will include a Fare Collection Agent, a Bus Operating Company (will also manage the Depot) a BRT Operations Contractor (will also manage the Maintenance contractor) and a BRT Station Management Company. However, the following line departments and Polokwane local municipality sections will be directly active to assist with operating the system: Electrical Services, Department Energy (Traffic Signals), Polokwane Municipal Traffic;

Disaster Management and Emergency Services. The tasks of the operations team of Polokwane BRT will include the following:

- Bus scheduling and monitoring
- Incident monitoring route
- Station monitoring
- Provide information to passengers
- Monitor mobile inspection staff and;
- Monitor bus operating company, BRT Operations contractor, station management Company and the fare collection agent. Figure 6.15 shows the Polokwane proposed BRT management structure

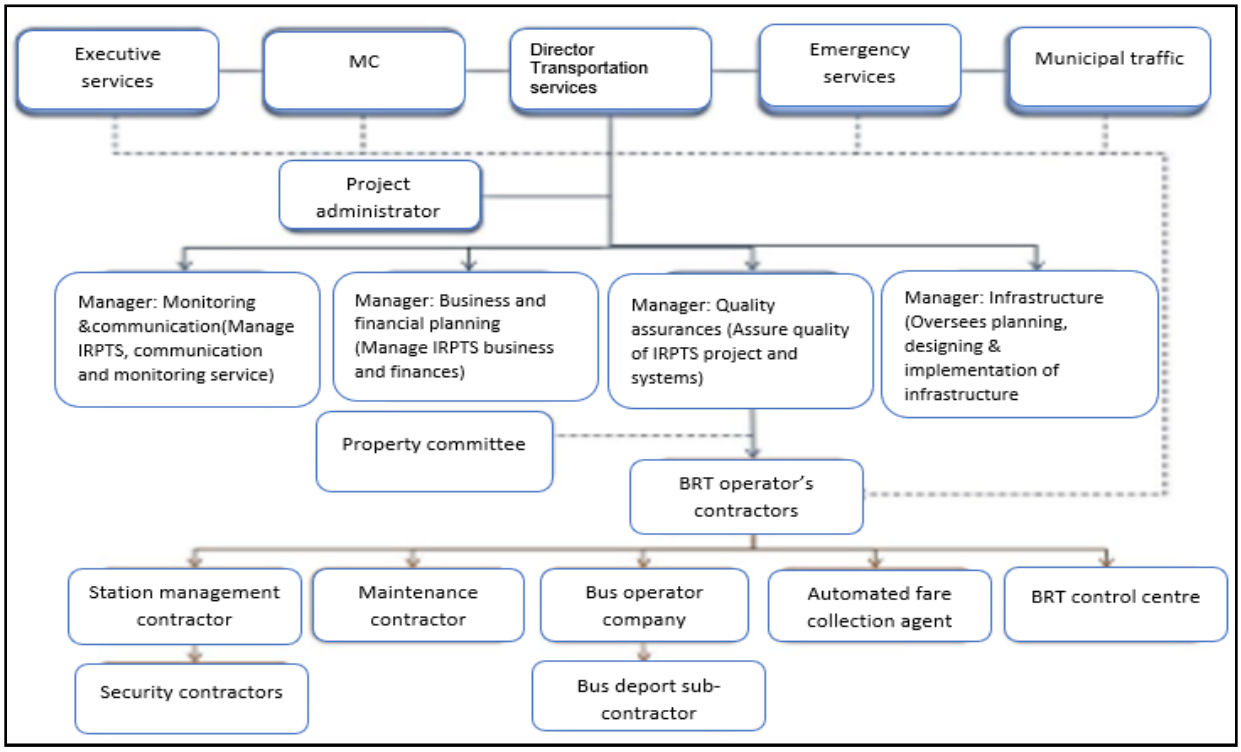

Figure 6.15. Proposed BRT management strutucure

Source: Polokwane IRTPS (2014:73)

Figure 6.15 shows the proposed BRT system management structure, the team role players and their designated responsibilities.

6.7. Policy and strategy implications towards public transport system

Polokwane Municipality has different policies, plans and strategies that contradict and support the implementation of the Bus Rapid Transit systems. Few of these governing tools are discussed below.

6.7.1. Polokwane Urban densification policy draft of 2013

The Polokwane Urban Densification Policy Draft (2013:120), indicated that commuters that use the Seshego corridor face lack of opportunities for alternative modes of travel such as walking, cycling and public transport. The Mankweng corridor is predominately characterized by dispersed rural settlement, with a poor transport system. Much of the land within Mankweng cluster are under traditional council. As such, the municipality would have to negotiate for the land to allocate the BRT system. The Seshego/Moletji corridors are said to have a high demand for public transport and high population growth (Polokwane IRPTS: 2004: x). As a result, the Polokwane urban Densification Policy Draft (2013:8), identified Seshego/Moletji and Mankweng corridors as the ideal corridors for the implementation of Integrated Transport System such as Bus Rapid Transit. However, according to Wright and Hook (2007:106), the sustainable BRT system should be implemented in highly densified developed settlements. Consequently, the Polokwane Urban Densification Policy Draft (2013:24) proposed to densify areas near the Seshego/Moletji and Mankweng corridors and areas closer to Sebayeng to support the implementation of the Polokwane BRT system so to ensure that the system is sustainable and respond to transport implications faced by the commuters.

6.7.2. Spatial Development Framework (SDF) of 2010

In the Polokwane SDF (2010:161) report, it was indicated that it is important “to promote sustainable human settlements by integrating developments through improved public transportation and roads networks particularly for BRT in a spatial manner”, as one of its objectives. It further adopted the Integrated Transport Plan (ITP) as its sector plan of the IDP. The ITP view the development of BRT system in the municipality as the economic catalyst that must be taken advantaged of to provide sustainable public transport system to the Polokwane residents (SDF, 2010:209). It further indicates that a BRT would bring an opportunity to provide equitable,

safe and attractive transport and encourages socio-economic development within the municipal jurisdiction. The Polokwane CITP (2013, 40), further pointed out the transport implication of SDF as follows:

- High migration from rural to urban areas, requiring a high demand of public transport;
- The current public transport is unable to accommodate the large number of commuters;
- Adopted ITP emphasizes on promoting urban and transport linkage through b encouraging the following:
- Concentrating residential development at stations along public transport corridors;
- creating a high density of trip-attracting activities in central areas well served by public transport; and
- Issuing guidelines, which try to ensure that new development is accessible to public transport.

6.8. Chapter four summary

This chapter detailed an analysis of the study area, the demographic profile of the study and the study location analysis in relation to the BRT implementation. It features the land use, population and development densities. The chapter also describes the existing transport situation, pointing out the current road network and the implications of BRT implementation. The study also analysed the Polokwane Municipality plans for implementing the BRT system, as well as the policy and strategy implications towards the implementation of the Polokwane BRT system. The study has also presented the relationship between the urban form or spatial planning and the need for integrated transportation. The next chapter presents, analyses and interprets the data collected from the study area.

CHAPTER SEVEN: PRESENTATION OF DATA AND ANALYSIS

7.1. Introduction

This chapter presents the findings of the data collected from the responses of the targeted participants. Among them aregeneral commuters, municipal officials, and the company responsible for implementing the Polokwane BRT system. The analysis was done based on the study objectives mentioned in chapter one. Figure 7.1 illustrates the conceptual structure of data analysis and presentation chapter.

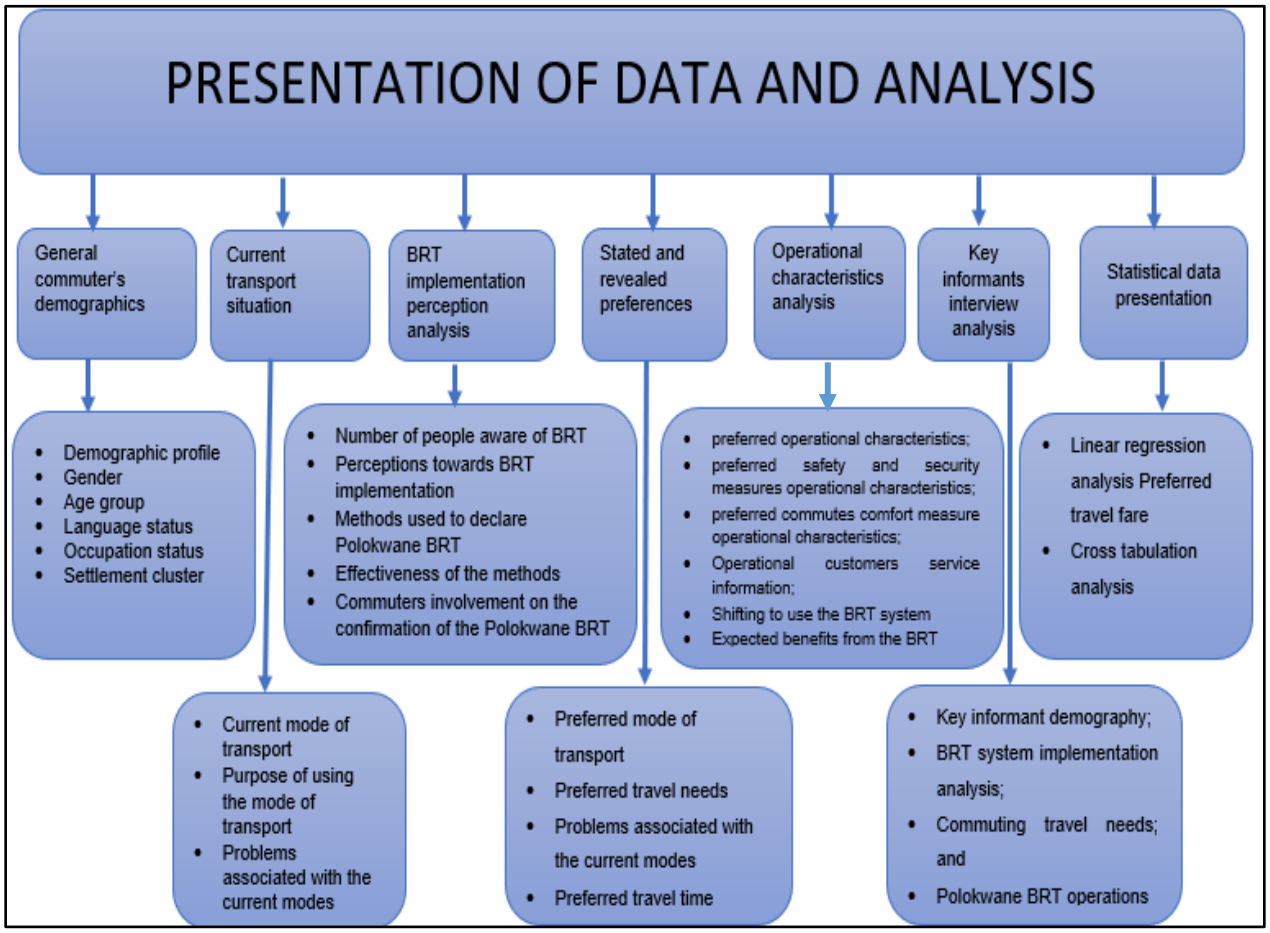

Figure 7.1. Conceptual illustration of the structure of presentation of data and analysis

Source: Authors construct (2018)

From Figure 7.1 shows that chapter seven is organised into seven major thematic data presentation and analysis areas; namely, general commuter demographics; current transport situation; implementation phases; stated and revealed preferences; operational characteristics preferences; key informant interviews and scenario-based tool analysis.

7.2. Demographic profile of the respondents

This section presents the socio-economic profile of the commuters who participated in the study. The socio-economic profile variables of the commuters to be discussed are as follows:

- Gender;
- Age group;
- Language;
- Occupation status; and
- Type of settlement where commuters reside.

7.2.1. Gender

The majority of respondents (54, 8 %) are male, where female respondents constitute 39, 6%. Those who were not willing to specify their gender, constituted 5.6%. Figure 7.2 presents the gender of the study respondents.

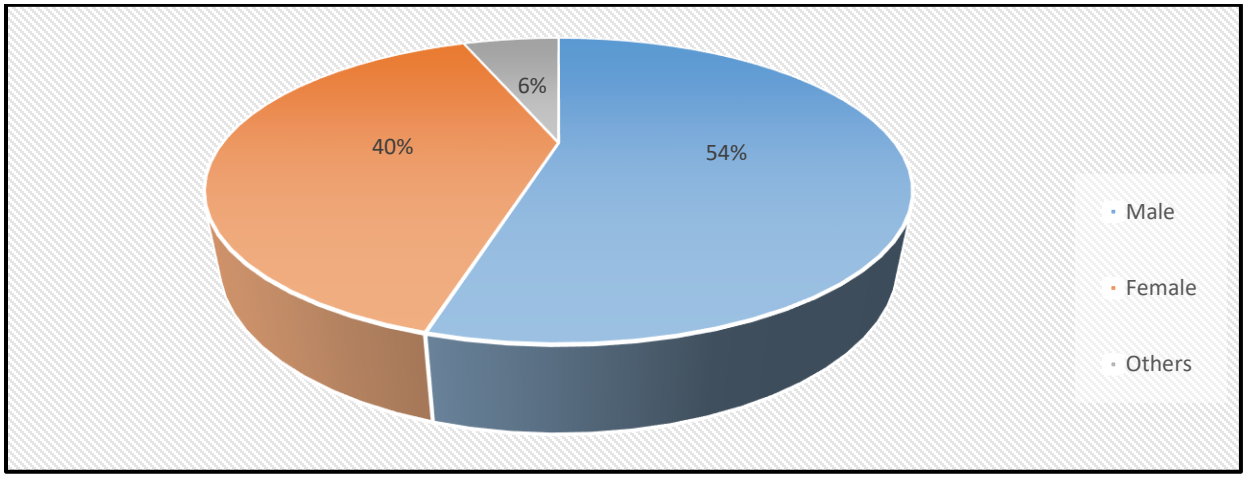

Figure 7.2. Gender of survey respondents

Source: Author's field data (2018)

Sample size: N=250

Figure 7.2 shows a high ratio of male respondents, which corresponds with the information obtained from the Polokwane CITP (2013:15). This indicates that the area has a higher male population than females. This may be attributed to the fact that most males commute to work every day when compared to females in the study area with implications regarding empowerment

constraints and restricted access to work or job opportunities for women (Statistics South Africa, 2011).

7.2.2. Age group

The data regarding the age of the respondents were collected from the survey. The data findings are in Figure 7.3.

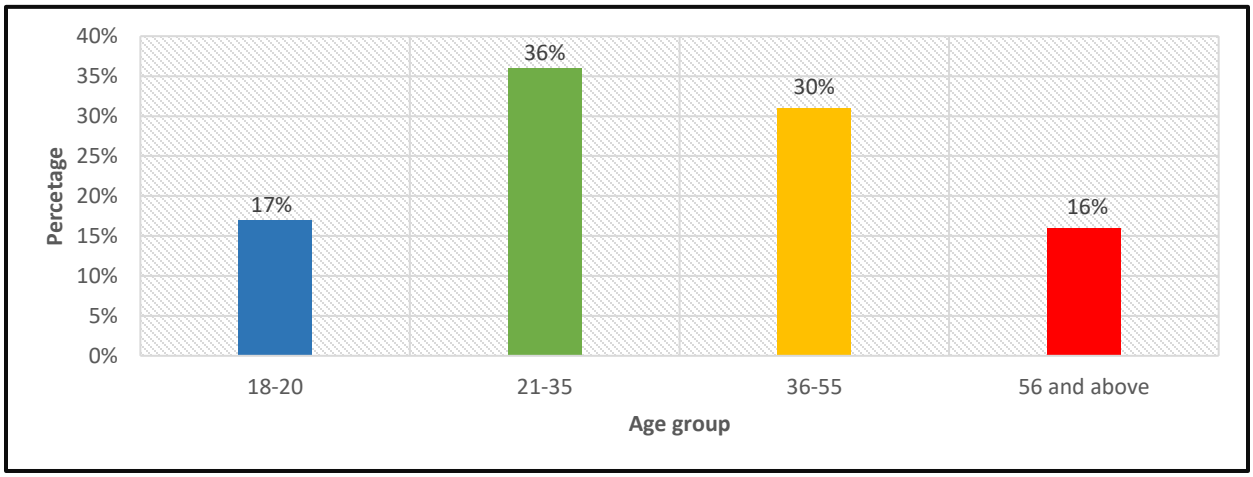

Figure 7.3. Age of the respondents

Source: Author's field data (2018)

Sample size: N=250

Figure 7.3 shows that the majority of the respondents (36%) are between the ages of 21-35 years, while a small proportion (16%) is between the age of 56 and above. The age group between 18-20 years constitutes (17%) of the survey respondents, while the age group of between 30 - 55 constituted (31%). The respondents' age group in the current studyresults, slightly correspond with the age groups stated in the Polokwane IDP (2015:75), which indicates that the Municipality has an economically active population of between 20-29 years. This age group uses different modes of transport to access job opportunities. The results are evenly spread, suggesting that the survey's findings are representative of different travel groups; namely, the young, the working and the old, which offer a good base to draw inferences and recommendations from.

7.2.3. Language status

Respondents were asked to indicate their home language. Data relating to the language status was essential because this provided a cultural understanding to the context in which the BRT was implemented. Understanding the language groups in the study area, helps evaluate and assess the appropriateness of marketing and communication methods during BRT implementation in Polokwane. This data was also essential in order to ascertain whether the name of the system reflect the cultural orientation of the people residing within the Polokwane municipal jurisdiction. As a result, data reflecting the language groups in Polokwane was collected from the survey respondents. Figure 7.4 depict the respondents' language profile.

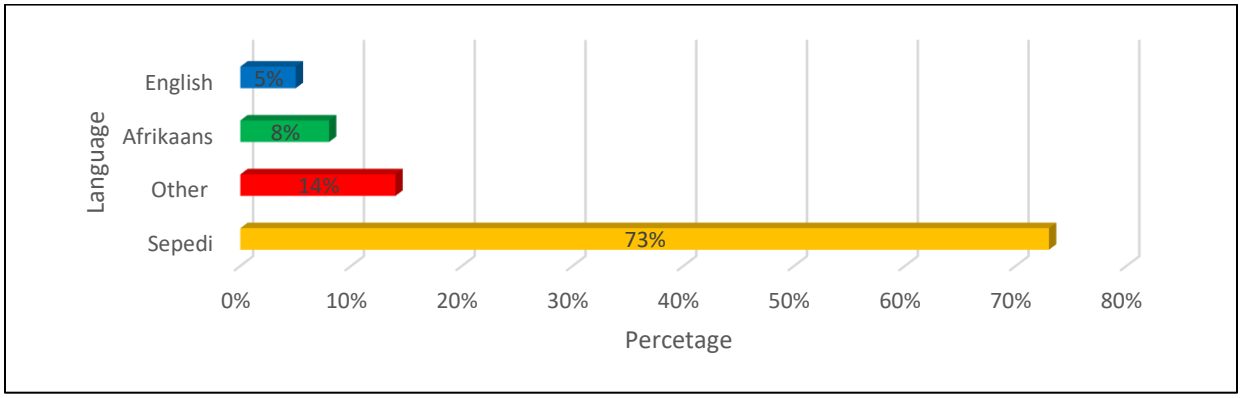

Figure 7.4. Respondents Language status

Source: Author's field data (2018)

Sample size: N=250

Figure 7.4 shows that the majority of respondents (73%) speaks Sepedi, while the minority respondents speaks English (5%). The remaining respondents of (14%), speaks other languages while (8%) of the respondents speak Afrikaans. This partially corresponds with data outlined in Polokwane CITP (2013:16), which indicated that the main languages spoken in Polokwane is Sepedi consisting of 79%, Afrikaans, 5.0%, English, 3.0% and others, 13% of overall Municipal population. Consequently, the branding of Polokwane BRT and communication on BRT implementation required the provision of brochures and material in various languages in the spirit of delivering inclusive transport solutions.

7.2.4. Occupational status

The employment status of an area has an impact on the main modes of transport that people use for commuting. Consequently, it was crucial for the current researcher to gather data concerning the commuters' occupational status. Figure 7.5 shows the survey respondents occupational status.

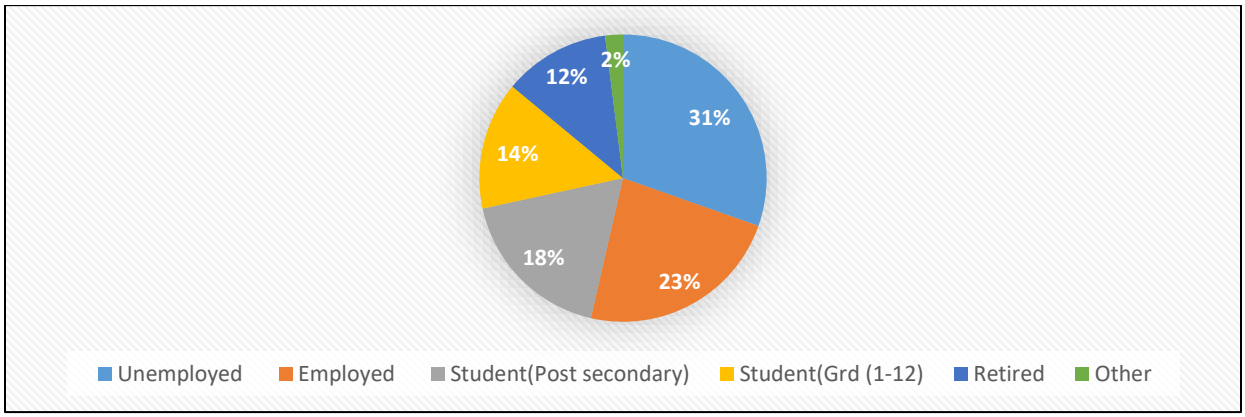

Figure 7.5. Occupational status of respondents.

Source: Author's field data (2018)

Sample size: N=250

Figure 7.5 shows that the majority of the respondents (31%) are employed, followed by (23%) who are students, while a minority of the respondents (2%) indicated other occupation, such as being self-employed. This correspond with the information from the Polokwane IDP (2015:102), which stated that the majority is unemployed. This finding has implications on the affordability and fare structure to be adopted in the BRT implementation. There is a need to strike a balance in setting appropriate fares that are viable for BRT success but also consider the economic affordability issues in the study area. This is to avoid the BRT project being branded elitist, exclusive and risk becoming a "white elephant", with buses running trips with low load factors.

7.2.5. Types of settlements where commuters reside

The study data was collected from the four-main cluster settlements in the Polokwane Municipality. These clusters have different corridors and place making functions attached to them in relation to the Polokwane CBD, which is the central focus in transporting commuters from the

immediate environments to the CBD region and industrial environments. The spatial relationship of clusters to the CBD of Polokwane has implications regarding perceptions towards BRT implementation. Therefore, figure 7.6 depict the respondents who participated in the survey from each cluster.

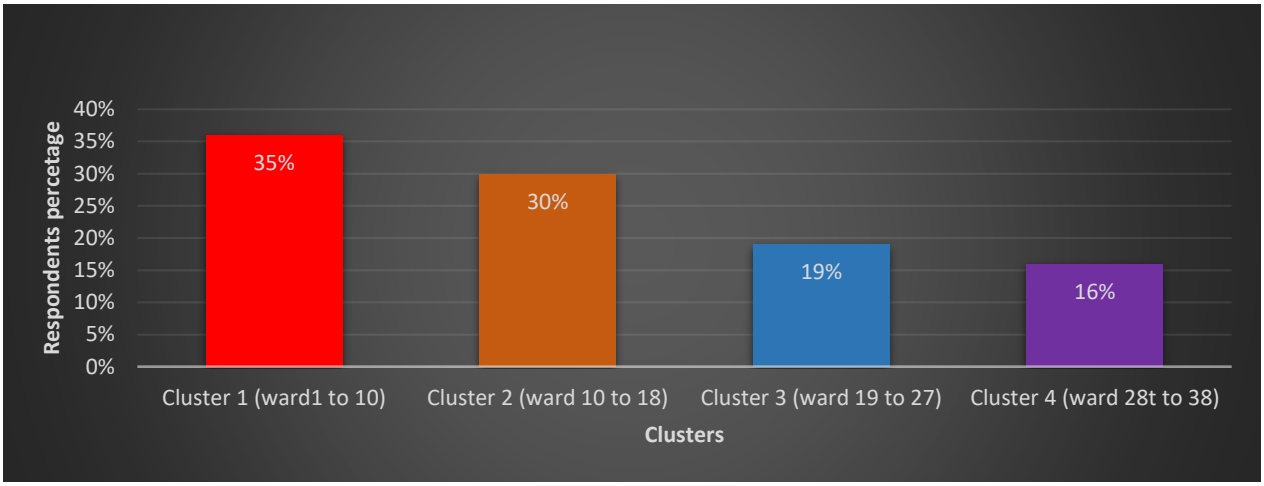

Figure 7.6. Respondents' per cluster settlement

Source: Author's field data (2018)

Sample size: N=250

Figure 7.6 shows that the majority of the survey respondents were from cluster 1 (35%), followed by cluster 2 (30%), cluster 3 (19%) and cluster 4 had the least respondents, consisting of (16%). The almost even spread suggests a representative collection of views and opinions from all cluster settlements in the Polokwane Municipality.

7.3. Current transport situation in Polokwane municipality

To have a clear understanding of the current situation of Polokwane public transport, the targeted respondents were asked several questions which covered the following factors:

- Current mode of transport;
- Purpose of using the mode of transport; and
- Problems associated with the current modes.

The following sections present detailed analysis regarding each of the afore-mentioned factors.

7.3.1. Current mode of transport in the entire municipal area

Data relating to the current mode of transport was collected to determine the most used mode of transport in the municipality and per cluster. Table 7.1 shows the survey's respondent's current mode of transport used.

Table 7.1. Respondents current modes of transport

	Mode of transport						
Clusters	**Car**	**Taxi**	**Walking**	**Conventional bus**	**Bicycle**	**Other**	**Total**
Cluster 1	26	28	11	14	3	5	87
Cluster 2	9	24	0	32	2	8	75
Cluster 3	4	24	0	18	0	2	48
Cluster 4	5	17	0	16	0	2	40
Total count in the municipality	**44**	**93**	**11**	**80**	**5**	**17**	**250**
Percentage within the municipality	17.6%	37.2%	4.4%	32.0%	2.0%	6.8%	100.0%

Source: Author's field data (2018)

Sample size. N=250

From Table 7.1 we can deduce that the data collected revealed that the majority of respondents use taxis (37%) as their mode of transport, followed by convectional buses with (32%) and only (2%) of respondents indicated that they use bicycles. Cars were found to be the third commonly used mode of transport at (18%). Interestingly, other modes of transport such as carts, motorcycles and skate boards were identified under "other mode of transport", constituting of (7%). Bicycles were the lowest used mode of transport by commuters in Polokwane at (2%). This can be appreciated in the context of the fragmented spatial nature of settlements in the study area, necessitating the use of motorised transport systems to satisfy transport demand.

These findings on the currently used mode of transport are contradict to the findings contained in the Polokwane CITP (2013:44). This is because the CITP illustrated walking as the most dominant mode of transport. This is true of short-trips and local travel, however for long trips/journeys walking becomes practically impossible. This is the context that the study sought to address, as

the BRT in Polokwane is not developed to only cater for short trips but also cover long trips. The survey tool however,r focused on inter-cluster and connections between the cluster and the CBD areas but not intra-cluster travel. hence the disparity. In this regard, this study focused on the movement of people from areas that required a vehicular mode of transport as they are not located within walkable distance to Polokwane town. However, the findings completely correlate with the public transport situation within the municipality. As indicated in the Polokwane IRPTS (2014:79), taxis were found to be the most dominant mode of public transport constituting 67% of overall public transport services within the Polokwane municipality.

7.3.2. Purpose ofthe trip/journey

The purpose of the trip to a certain area plays a vital role on selecting or using mode of transport. At the same time, the spatial location and arrangement of land uses in any area can also determine the type of mode of transport commuters' use for specific commuting trips/journeys. Figure 7.7 below displays the survey respondents' purpose for commuting in the study area.

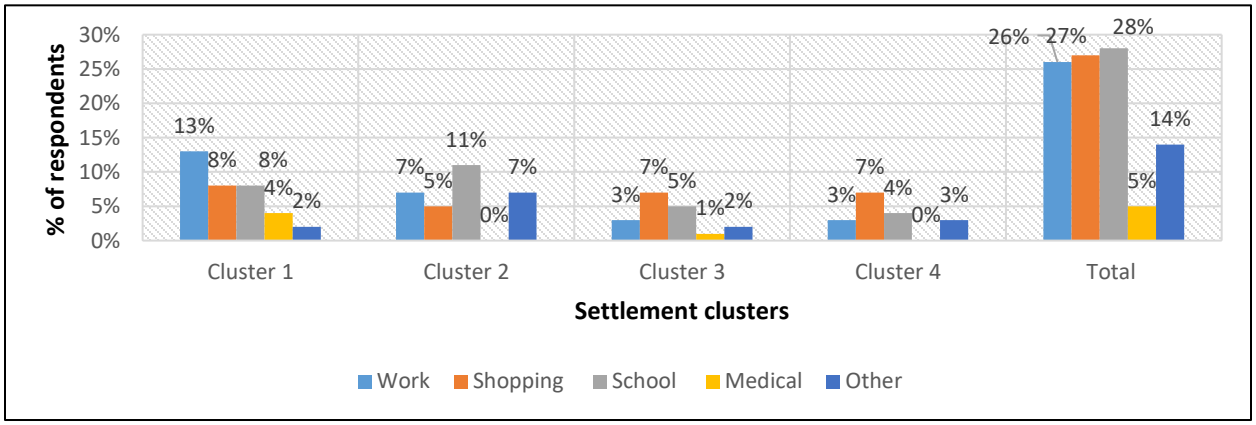

Figure 7.7. Respondents' purpose for commuting.

Source: Authors construct (2018)

Sample size: N=250

Figure 7.7. revealed that the majority of respondents (28%) in the entire municipality travel for schooling/learning purposes. This group is constituted of the majority of respondents emanating from cluster 2, contributing (11%) of the survey respondents commuting for schooling/learning purposes. This corresponds with what is stated in the Polokwane CITP (2013:36), which indicated that cluster 2 major trip/journey generator is the University of Limpopo. A significant flow and

volume of staff and student population travels from various sub-places of Polokwane to the University for schooling/learning purposes within cluster 2.

It was further revealed that (27%) of the overall survey respondents travel for shopping purposes, while (26%) of the respondents travel for work purposes within the municipal area. The majority of the survey respondents travelling for work purposes was found to be from the settlement cluster 1. These findings confirm the information in the Polokwane IDP (2015:70), which states that settlement cluster 1, which that includes the CBD, is the economic core and hub of the municipality. The CBD and surrounding environment offer a wide range of high order, low order goods. Itervices and is also the area with high job density thereby generating high employment opportunities.

7.3.3. Existing transport challenges faced by the commuters

The research approach noted the importance of gathering data on the existing transport challenges faced by the commuters on a daily basis in the study area. This was essential in order to understand the nature and form of commuting transport constraints in the study area. In this regard, data was collected to assist to draw the futuristic scenario of the transport situation. Figure 7.8 also shows the existing transport challenges.

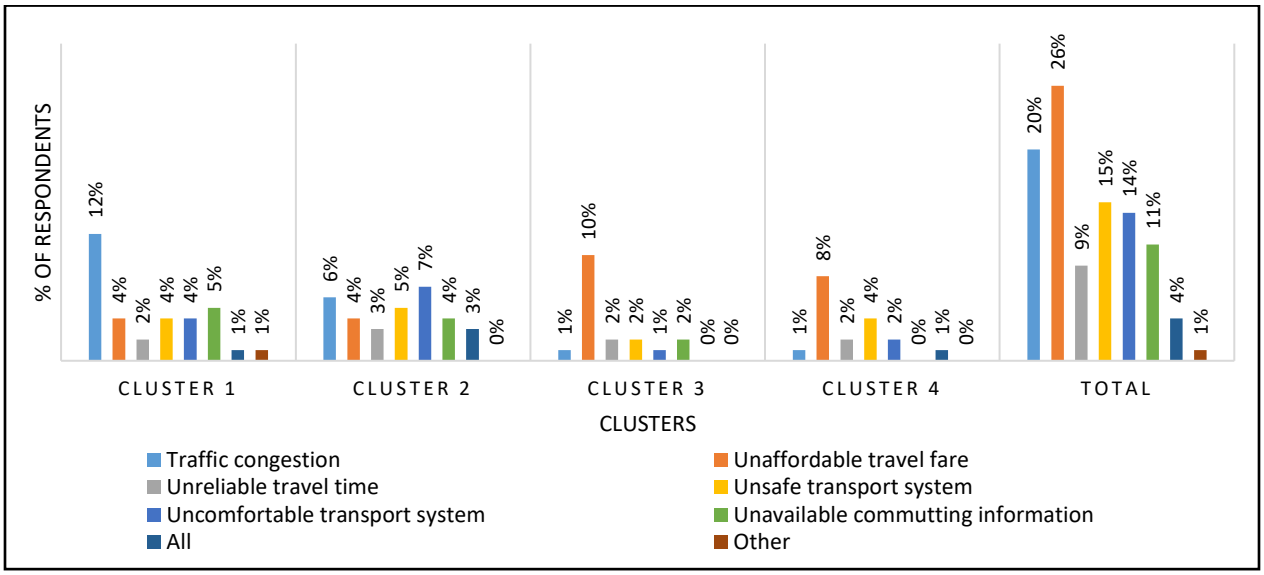

Figure 7.8. Existing transport challenges

Source: Authors construct (2018)
Sample size: N=250

From Figure 7.8 we can deduce that the data collected indicates that the majority of survey respondents (26%) perceived unaffordable travel fare as the main problem that they face when commuting, followed by traffic congestion, constituting (20%) of the survey respondents. The least number of survey respondents (9%) perceived unreliable transport systems as the least transport commuting challenge in the Polokwane Municipality. However, a minority of the survey respondents (1%) indicated “others” such as bad-mannered drivers, high speed and transport delays as the commuting inadequacies in the system that required redress. The majority of the respondents affected by unaffordable transport fare were residents from settlement cluster 3, constituting of (10%) of the survey respondents, while settlement cluster 4 constituted (8%) of the survey respondents. Settlement cluster 3 and 4 are located far apart from the Polokwane CBD as indicated by the Polokwane IDP (2015:70).

Distance-based fare structures in place entail that the longer the distance travelled to the Polokwane CBD from any area, the more that a commuter pays for the journey/trip. However, the majority of survey respondents affected by traffic congestions were residing in settlement cluster 1, which consisted of 12%. This finding might be due to the high car ownership by people residing in settlement cluster 1. Different scholars such as Adewumi (2013:1), Tirachini *et al.,* (2006:36) and to Paulley (2006:3), have indicated that travel fare was one of main commuting problems and has a significant influence on the choice of mode of transport travel by commuters in any spatial setting. Consequently, for the Polokwane BRT system to attract positive perception of the system, the BRT project implementers and managers need clear formulae for considering the issue of spatial allocation implications on travel fare and fare structure and BRT funding fare structure model. Figure 7.9 displays the survey of respondents’ commuting challenges disaggregated by settlement cluster areas in the study area.

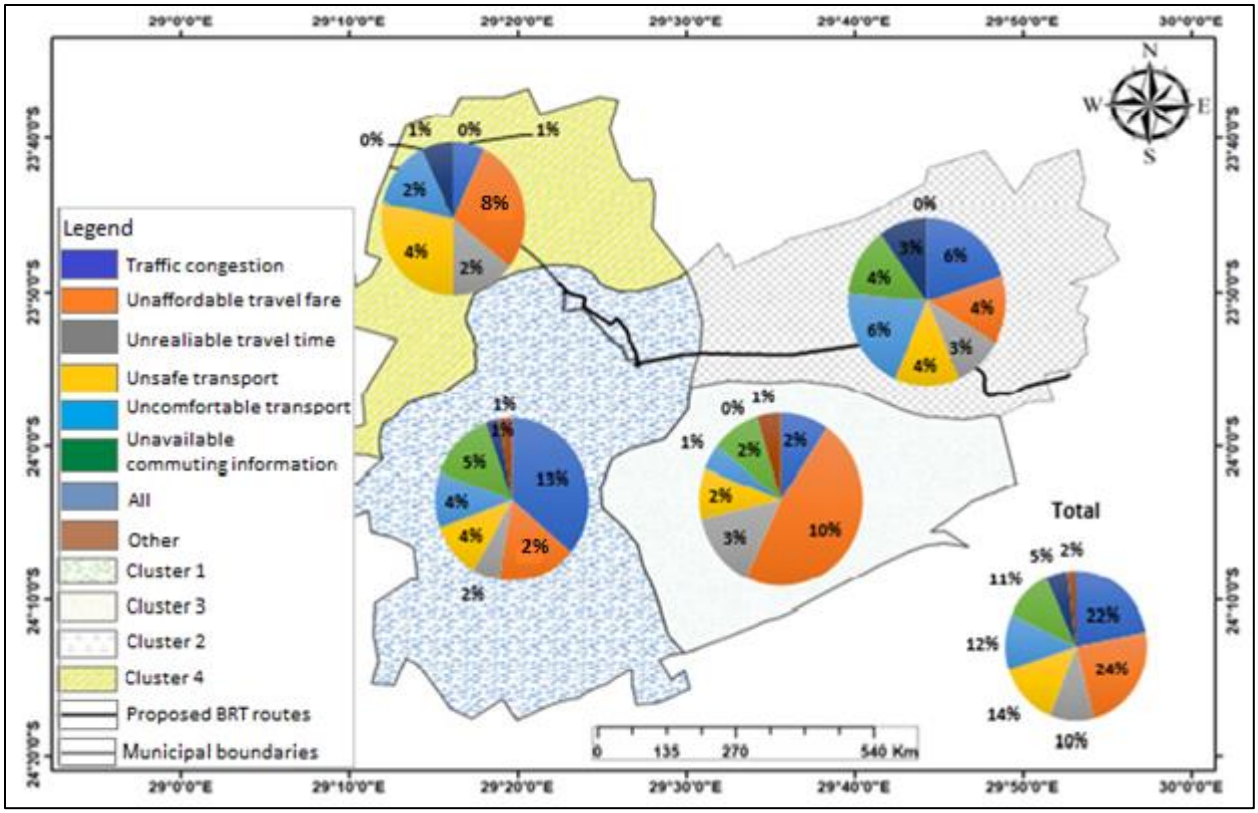

Figure 7.9. Respondents spatial differences of existing transport problems

Source: Author's field data

Sample size: N=250

Figure 7.9 summarises how commuting problems are differentially experienced in the settlement areas in the Polokwane Municipality. This suggests that a land use and transport integration model is one way to address the commuting problems in the Polokwane Municipality. Figure 7.9 further depicts that the majority of survey respondents (10%) from the settlement cluster 3 face unaffordable travel fare problems/challenges. The same applies to the majority of the survey respondents (8%) in cluster 4 who also cited unaffordable travel fare as a major commuting problem. However, this picture changes in settlement cluster 1, where the majority of the survey respondents (13%) were affected by traffic congestion, and settlement cluster 2, whereby a majority of the survey respondents (6%) are affected by uncomfortable transport system.

7.4. Perceptions of commuters on the implementation phases of Polokwane BRT system

One of the key research questions sought to obtain data regarding the commuters' perceptions towards the implementation phases of the BRT system. Consequently, commuters were asked several questions that sought to establish the when, where and how methods of communication and engagement that Polokwane BRT adopted in the implementation of the project. These questions assisted the researcher to make inferences and invariably suggest conclusions for the objective number one of the study (To determine the perceptions of commuters on the implementation phases of Polokwane BRT system). The perceived commuting factors that influenced the implementation of BRT in Polokwane assisted the researcher to draw deeper insights regarding the perception of Polokwane commuters towards the implementation of the BRT systems as follows:

- Number of the commuters that were aware of the Polokwane BRT system;
- Commuter perception towards Polokwane BRT system implementation;
- Identification of the method(s) that the Polokwane municipality used to announce or introduce the Polokwane BRT system;
- The level of stakeholder engagement and their impact towards promoting a modal shift in favour of the BRT system; and
- Commuters' perceptions on the success of each implementation phase of the BRT system.

7.4.1. Number of commuters aware of the Polokwane BRT system

The number of commuters aware of the implementation of the BRT system in Polokwane can have a potential impact on the implementation phases of the Polokwane BRT system. This is in terms of the perception towards the system. Consequently, it was crucial for the researcher to obtain data that would unravel the extent of interaction perceived by commuters towards the BRT implementation. Figure 7.10 below shows whether the survey respondents were aware of the Polokwane BRT system or not.

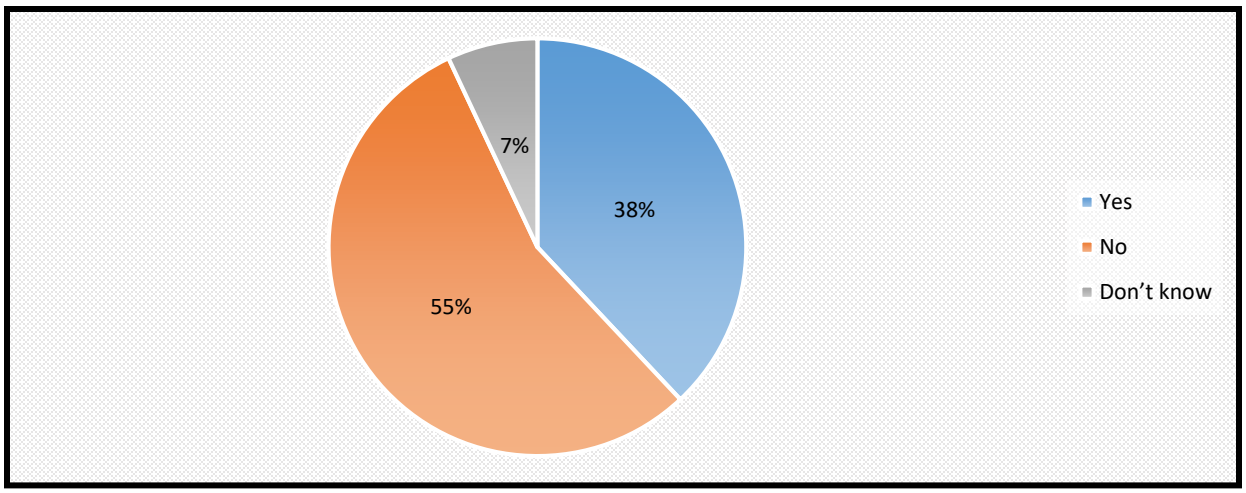

Figure 7.10. Respondents who were aware of the Polokwane BRT system

Source: Authors construct (2018)

Sample size: N=250

Figure 7.10 revealed that the majority of the survey respondents (55%), were not aware of the Polokwane BRT system, while a minority of the survey respondents (7%) did not know about the system at all. However, a modest percentage of the survey (38%) respondents were aware of the system. The study survey results read and interpreted in conjunction with the cognitive dissonance "transport commuting" theory, which indicates that the BRT system would be negatively perceived. For example, Anderson (1973:39), emphasised that the cognitive dissonance "transport commuting" theory indicates that individual's perceptions of an object are based on their past behaviour, experiences or attitudes, while Belwal and Belwal (2010:17), further indicated that the majority of the commuters have unpleasant experiences with public transport. Taking this into account, in a situation whereover half of the survey population (55%) were not aware of the BRT project, the fragmented nature of BRT implementation marketing and communication in Polokwane constituted an implementation project gap. Figure 7.11 displays the survey respondents' awareness of the Polokwane BRT system by settlement cluster areas in the study area.

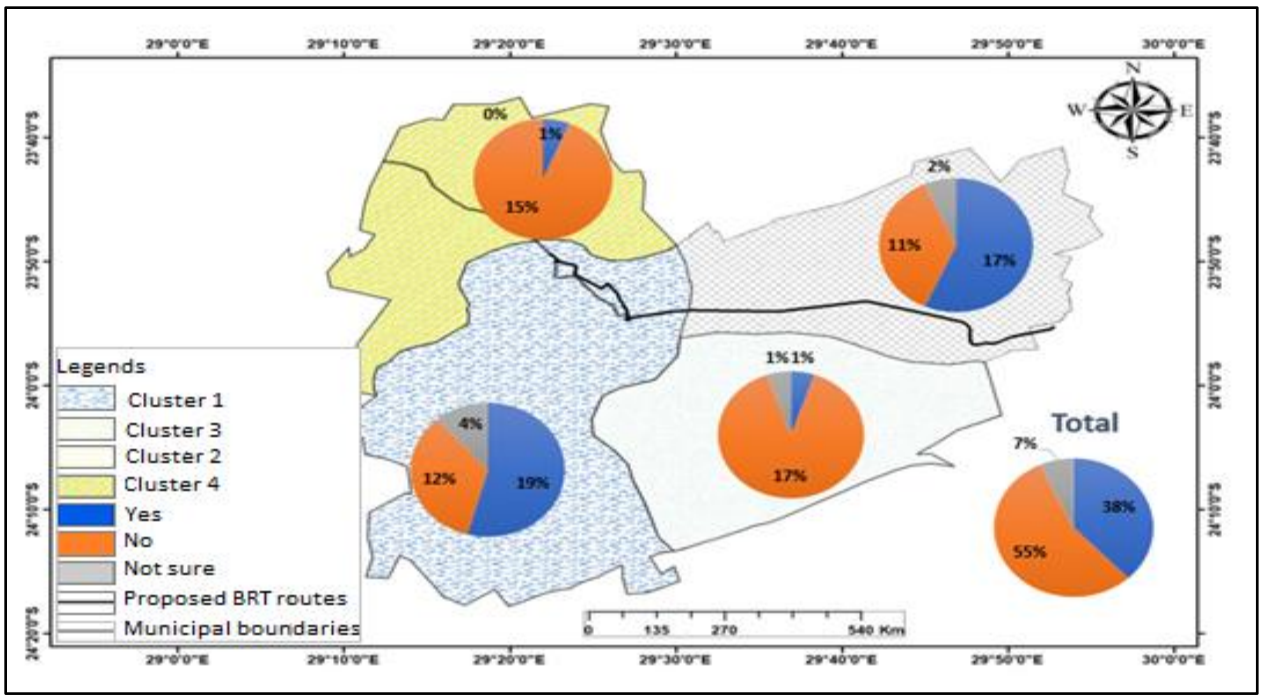

Figure 7.11. Number of respondents aware of the Polokwane BRT system per cluster

Source: Authors construct (2018)

Sample size: N=250

Figure 7.11 shows that from the majority of the survey respondents (17%) from the settlement cluster 3 and (15%) from settlement cluster 4 were not aware of the Polokwane BRT system. Surprisingly, the majority of survey respondents (19%) from cluster 1 and (17%) from cluster 2, were aware of the Polokwane BRT system, while both cluster 3 and 4 consist of (1%) of survey respondents aware of the BRT system. This analysis might result indifferent spatial perceptions of the Polokwane BRT system.

7.4.2. Perceptions towards BRT implementation

The respondents were also asked for their perception of the changes experienced through the implementation of the Polokwane BRT system based on the stakeholder engagement activities implemented so far in the study area. The findings are represented in Figure 7.12 below.

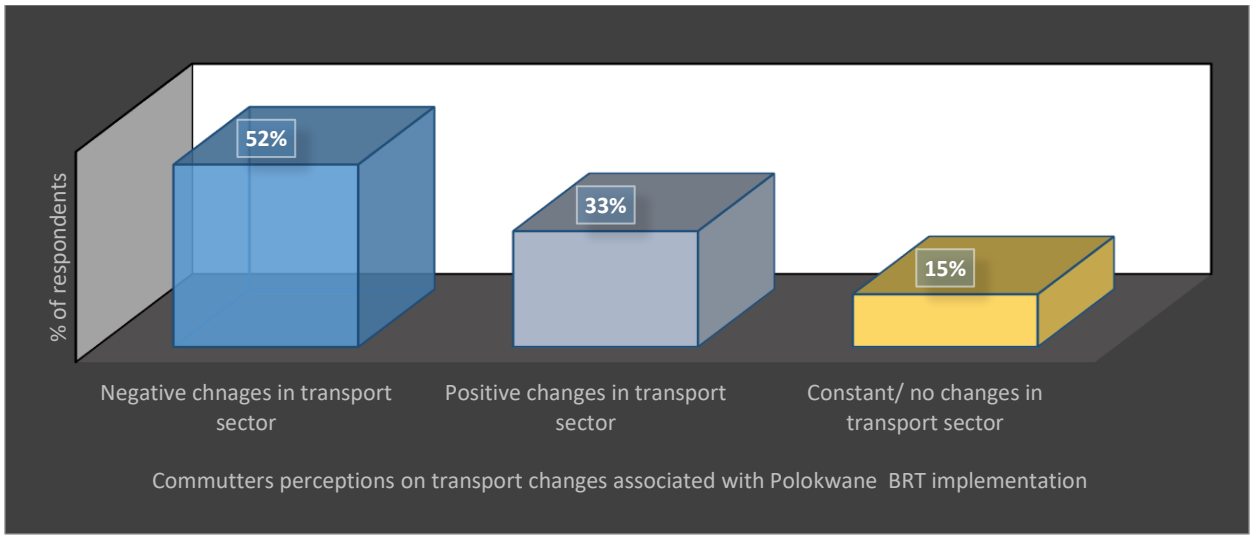

Figure 7.12. Respondents' perception of the changes accompanied by the BRT system

Source: Author's construct (2018)

Sample size: N=250

Figure 7.12 shows that the majority of survey respondents (52%) believed that the BRT system would bring negative changes to the transport and commuting experiences. The reason for this thinking was that BRT would displace the current modes of transport from operating, thereby creating a new transport order in the area. Lack of a very clear BRT implementation transitional and absorptive management model was cited as a potential discord area that could see the return of "taxi" or "commuter wars" in the study area. However, (33%) of the survey respondents believed that BRT implementation would bring positive changes since it is associated with high transport services based on reliability and high frequency operating system protocols. It that this was argued was essential in reducing transport commuting problems that commuters face daily. A minority of the survey respondents (15%), indicated that the BRT project would not bring any changes as the geographical configuration of the BRT lines excluded other areas in the Polokwane Municipality. A transformative and turn-around public transport commuting strategy that is inclusive of all areas and stakeholders in Polokwane was necessary if significant impact and changes to the commuting landscape in Polokwane wEere to be achieved. Figure 7.13 displays the survey respondents on the perceptions of the changes accompanied by the implementation of BRT system.

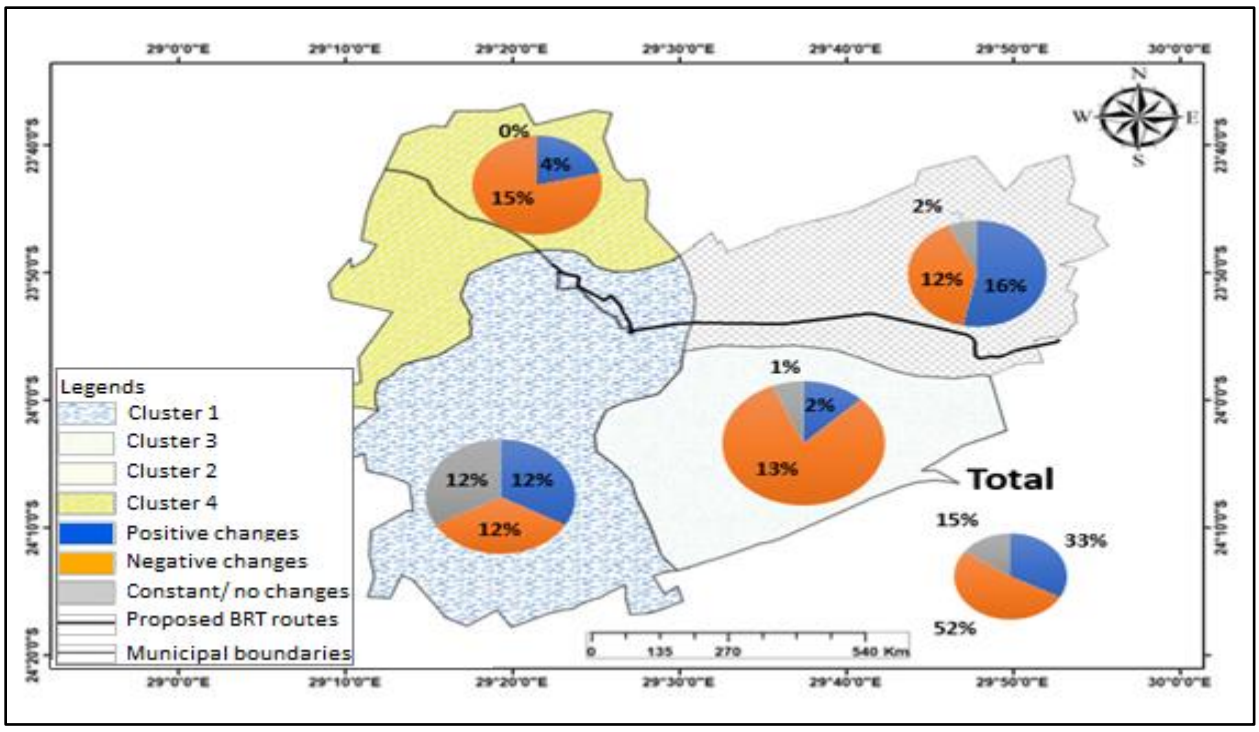

Figure 7.13. Respondents' operceptions of the changes accompanied by the BRT

Source: Authors construct (2018)
Sample size: N=250

Figure 7.13 shows that majority of the survey respondents (13%) from cluster 3 and (15%) from cluster 2 indicated that the system would result to negative changes in transport sectors, while (12%) survey respondents from cluster 1 and 2 were of the view that the system would result to positive changes in transport sector.

7.4.3. Methods used to declare or introduce the Polokwane BRT systems

The survey respondents were asked to indicate the method of communication that was used, or they heard was used regarding the implementation of the Polokwane BRT system. Table 7.2 shows the methods that survey respondents cited as having heard or participated in regarding the implementation of Polokwane BRT system.

Table 7.2. Methods respondents heard were used or participated in during the Polokeane BRT system project implementation

Clusters	Public participation	Stakeholder engagement	Newspaper	Radio	Flyers	Internet	Broachers	Never heard about it
cluster 1	7%	2%	3%	1%	0%	4%	1%	8%
Cluster 2	3%	2%	0%	1%	0%	5%	1%	11%
Cluster 3	0%	0%	2%	2%	0%	1%	0%	14%
Cluster 4	0%	0%	3%	2%	0%	1%	0%	27%
Total	**10%**	**4%**	**8%**	**5%**	**0%**	**10%**	**2%**	**60%**

Source: Author's construct (2018)

Sample size: N=250

Table 7.2 shows that the majority of the survey respondents (60%) had never heard about the BRT implementation. Most of these survey respondents (27%) were from settlement cluster 4. According to the Polokwane IDP (2015:70) settlement cluster 4 is located on the outskirts of the Polokwane Municipality. However, (10%) of the survey respondents indicated that they had heard about the BRT system through public participation hearings and internet, while a minority of the survey respondents (2%) had read about the Polokwane BRT system in broachers. No respondent indicated that they have reade heard about the Polokwane BRT system in flyers. This analysis suggests that inadequate stakeholder and communication methods were used in spreading the word on the implementation of the BRT project in Polokwane. This has a direct link with the commuter perception on the project.

5.4.2.1. Effectiveness of the method used to introduce the Polokwane BRT

Wright (2007:3), indicated that failure to effectively communicate the new public transport plan to key stakeholders and the public can greatly undermine the ultimate viability of the project. Consequently, the data concerning the effectiveness of the method used for the introduction of the Polokwane BRT system were collected. This information is depicted by fFigure 7.14.

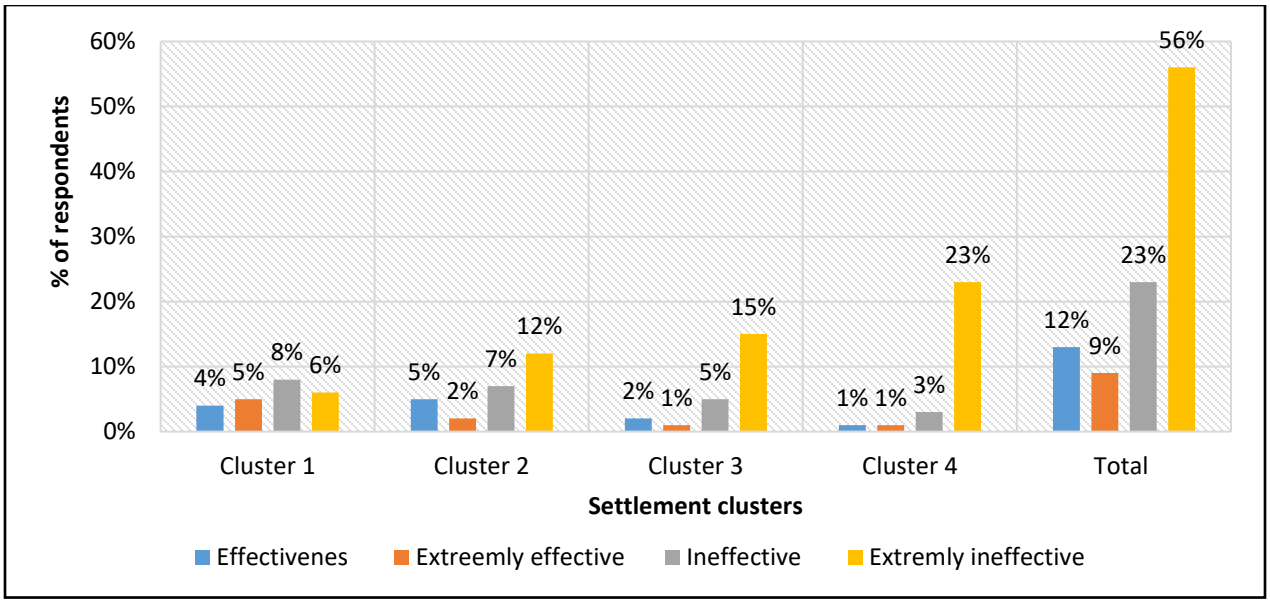

Figure 7.14 Respondents' effectiveness on method of communication

Source: Author's construct (2018)

Sample size: N=250

Figure 7.14 shows the majority of survey respondents (56%) which revealed that the method used to introduce the BRT system in Polokwane were extremely ineffective, whereby the majority (23%) and (15%) who indicated such responses were from settlement cluster 3 and 4 who were least involved in the BRT phase 1 project consultation activities given that they are located physically far away from the BRT phase 1-line precinct area. However, given the complex social dynamics and networks systems in the study area, negative sentiments on the project from one area may result in compromising the success of the project. This ultimately finds expression in terms of the BRT project being undermined by stakeholders, who are expected to champion its cause (Wright, 2005:99).

7.4.4. Commuters' involvement in the confirmation of the Polokwane BRT brand

A BRT system that reflects the needs and culture of communities is likely to attract positive perception from commuters towards the system. Wright (2007:33) further indicated that public perceptions, the level of acceptance and ridership depends on the branding of the BRT system. Consequently, data meant to assist with the confirmation of the BRT branding factors that were considered in coming up with the final BRT name and logo branding, was collected and analysed.

Table 7.3 below shows the percentage of the respondents participated on confirming the enlisted branding factors.

Table 7.3. Percentage of respondents who participated in the confirmation exercises for developing the Polokwane BRT brand

Polokwane BRT factors	**Yes**	**N0**	**Don't know**	Total in percentage (%)
Naming of BRT	29%	61%	10%	100
Emblem/logo	23%	67%	10%	100
Route alignment	15%	71%	14%	100
Envisaged BRT model	8%	74%	18%	100
Carrying capacity	9%	73%	18%	100
Travel fare	9%	72%	19%	100
Travel time	11%	71%	20%	100
Safety and security measures	6%	69%	25%	100
Comfort measures	8%	67%	25%	100

Source: Author's construct (2018)

Sample size: N=250

Table 7.3 above shows the survey results with few respondents confirming their involvement in the branding of the Polokwane BRT system. (29%) of the survey respondents agreed to have been involved in the branding of naming the Polokwane BRT system. The majority of the survey respondents (74%) said they were not involved in confirming the envisaged BRT branding and funding model, while the least number of survey respondents (25%) indicated that they were not sure if they were involved in confirming the safety, security and comfort measures and features expected of the system. This gap has implications given that once the project is rolled out, if the revealed BRT operational system characteristics prove to be contrary to expectations, commuters may exude negative perception towards the system. This is because most of the commuters were not involved during the decision-making and engagement processes that led to the approval and adoption of the final BRT logo and brand in Polokwane. This is supported by the American Public Transportation Association (2010:3), which indicates that implementers must be aware and incorporate the demographic and psychographic insight of the commuter to win the positive perception of the system from the commuters.

7.4.5. Commuters' perceptions on the success of each implementation phase of the BRT system

The study approach noted the importance of gathering data regarding commuters' perceptions on the success of each implementation phase of the BRT system. This data assisted the researcher to draw conclusion regarding the commuter's perceptions on the implementation of BRT system. Figure 7.15 shows the commuters' perceptions on the success of each implementation phase of BRT system.

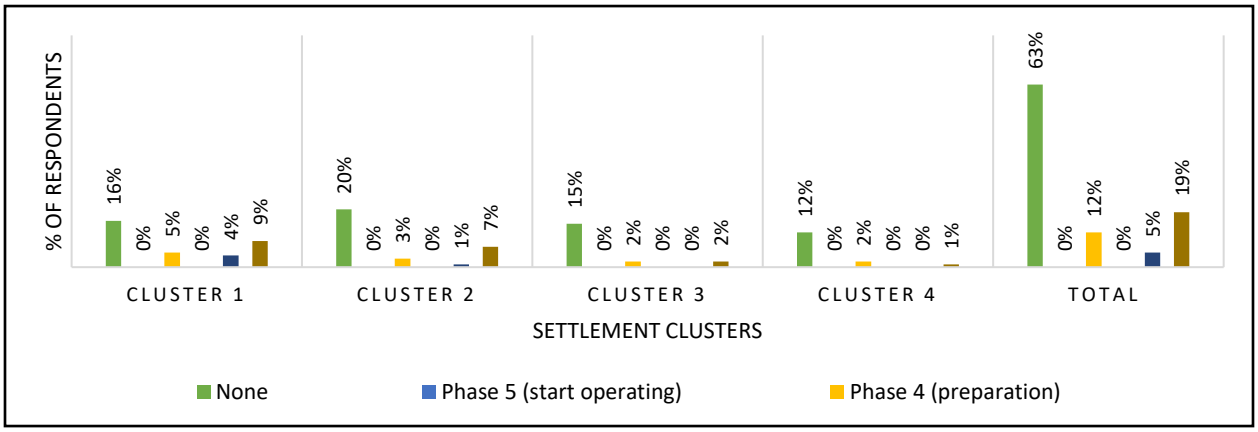

Figure 7.15. Commuters' perceptions on the success of each implementation phase

Source: Author's construct (2018)

Sample size: N=250

Figure 7.15 shows majority of the surveyed respondents (63%) indicated that none of these phases were successful. This finding was affected by the fact that majority of the survey respondents (55%) stipulated on page 132, had never heard or engaged during the implementation process of the Polokwane BRT system. However, aminority of the survey respondents (19%), indicated that phase 1 of the BRT implementation was more successful when compared to phase 4, which had minority of survey respondents (14%). Both phase 5 and phase 3 were found to be extremely unsuccessful since they both contained no respondents (0%) from the surveyed respondents.

7.5. Commuters' stated preferred travel needs.

To determine if the implementation of the Polokwane BRT system would meet the commuters travel needs, commuters were asked their preferred mode of transport, preferred commuters

travel needs considered when selecting a preferred mode of transport, the preferred travel time and the preferred travel fare per kilometre. Therefore, this section is subdivided into four subsections highlighted underneath:

- Preferred commuter's mode of transport and
- Preferred commuters travel needs that are considered when selecting the mode of transport;
- Preferred travel time; and
- Preferred travel fare per kilometre

7.5.1. Preferred commuters' mode of transport

The researcher asked the respondents to indicate their preferred mode of transport, when the BRT system eventually comes into operation. This data was needed to check if respondents would shift from their current mode to use the BRT system. Figure 7.16 spatially shows the preferred travel mode per settlement cluster, as well as the total modal split in the entire municipality.

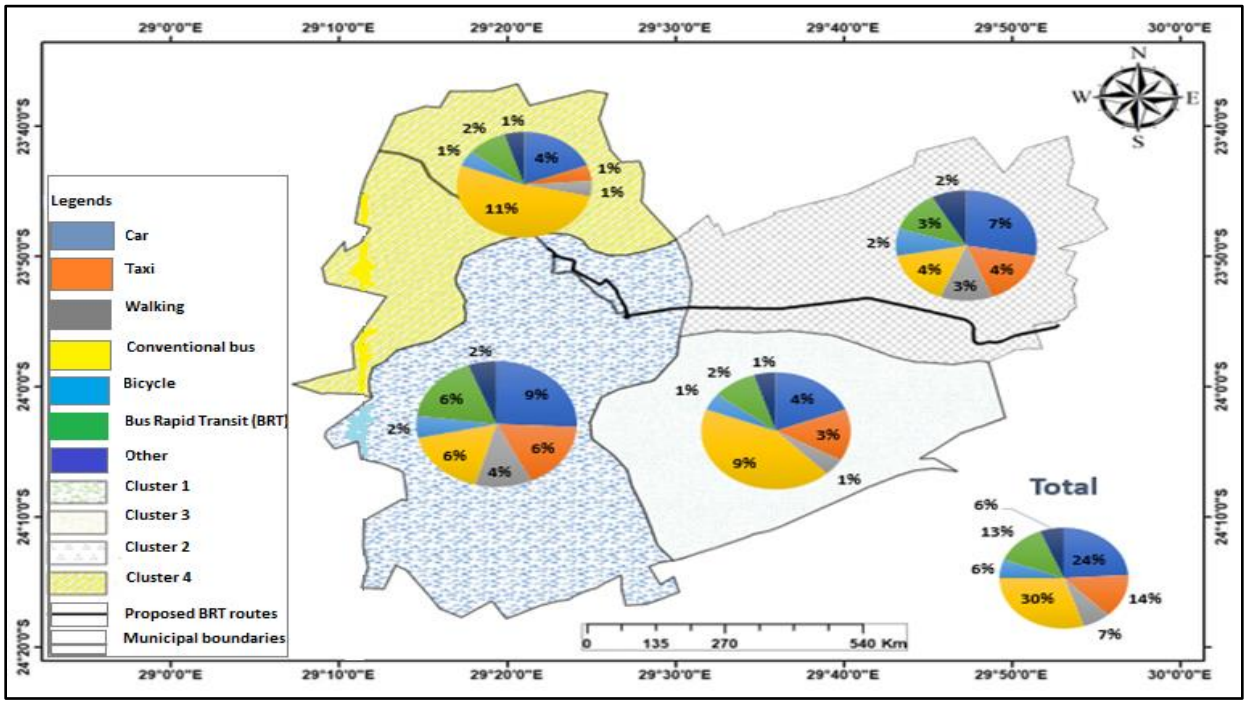

Figure 7.16. Respondents' preferred mode of transport

Source: Author's field data (2018)

Sample size: N= 250

Figure 7.16, the study findings revealed that the majority of survey respondents (30%) prefer to use conventional buses, followed by cars (24%). Surprisingly, the most used mode of transport (taxi) constituted just (14%) suggesting the level of dissatisfaction with the taxi services by commuters. The majority of those that prefer conventional buses are from the settlement clusters located far away from the Polokwane CBD., which is settlement cluster 3 and 4.

7.5.2. Commuters' travel needs considerations when selecting the mode of transport.

The researcher identified the need to collect data regarding the need for commuting. This was because, the need to travel influences the modal choice of transport used for commuting trips/journeys. Figure 7.17 depict the respondents' commuters travel needs selected when the need to commute arises in the study area.

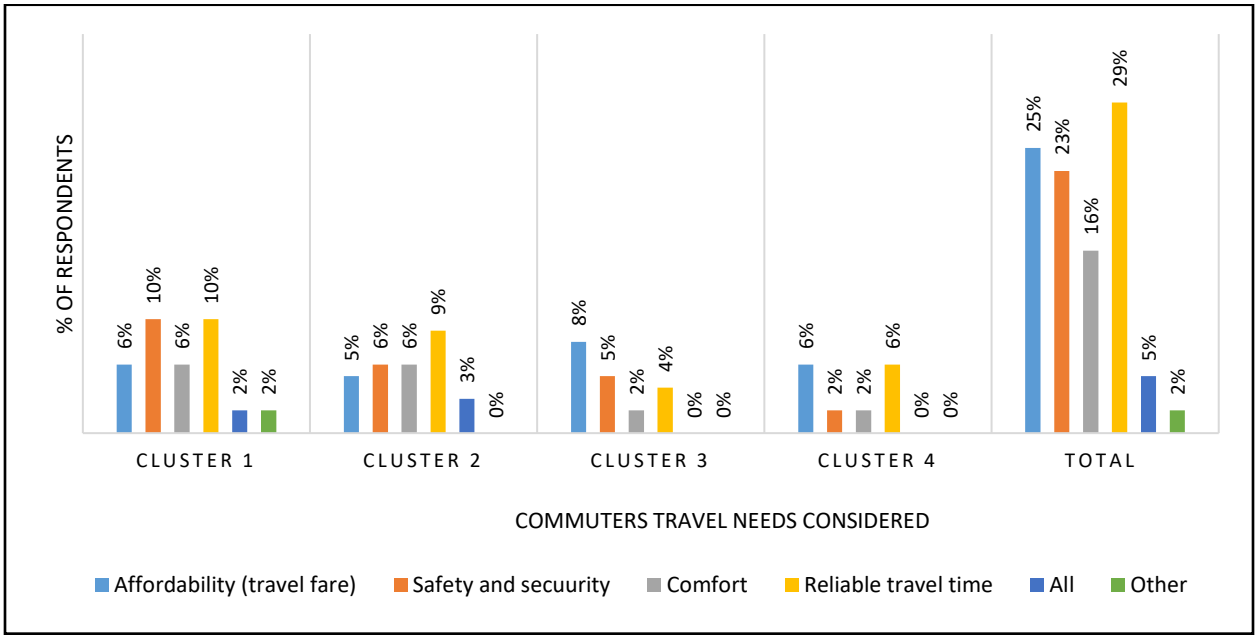

Figure 7.17. Respondents' commuter's travel needs considerations when selecting the mode of transport

Source: Author's construct (2018)

Sample size: N=250

Figure 7.17 illustrates that the majority of the surveyed respondents (29%) indicated that reliability of the commuter service was a top priority. Secondly, the journey/trip is travel time for making use of a specific mode was important as a travel need. This was followed by affordable travel fare

(25%), with a minority of the survey respondents (2%) preferring other modes of transport such as motorcycle, skateboard and kart.

7.5.3. Commuters' preferred travel time.

Data regarding the preferred commuters travel time were collected and analysed. Figure 7.18 shows the findings of preferred commuters travel time from the survey respondents.

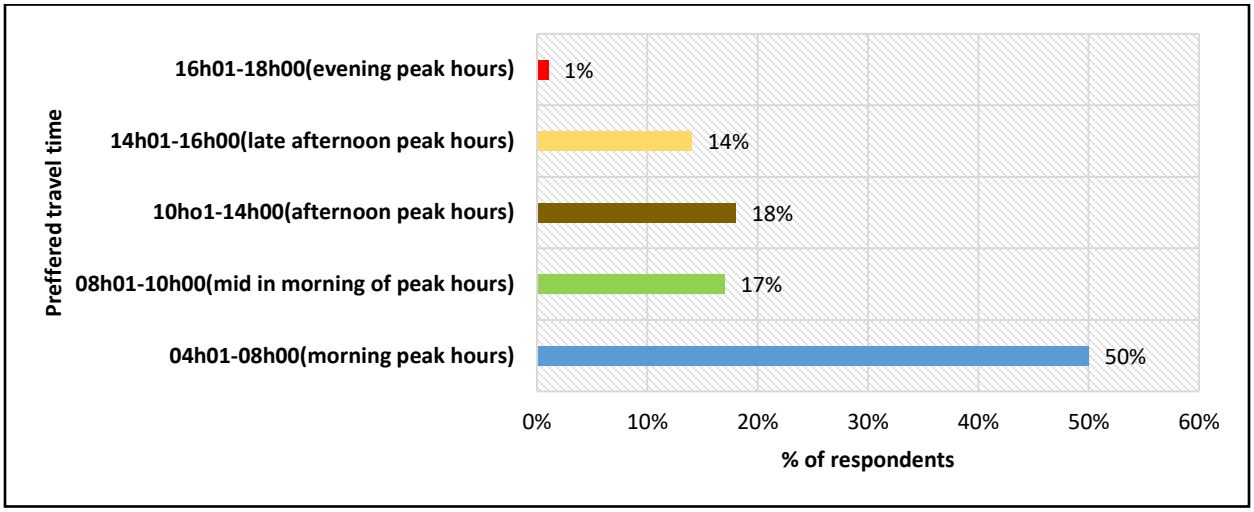

Figure 7.18. Respondents' preferred travel time.Source: Author's field data

Source: Author's construct (2018)

Sample size: N=250

Figure 7.18, the study findings show that survey respondents (50%), prefer commuting between 04h01-08h00 (that is, morning peak hours). This group constituted of workers and scholars who needed to report for work or school as early as possible but before 08h00. (17%) of the survey respondents indicated that they preferred to travel between 08h00-10h00 (that is mid -morning off-peak hours). This group was made up of workers with flexi-hour working arrangements as well as those who can work from home, including housewives and the unemployed. A minority of the survey respondents (1%), preferred commuting between 16h00-18h00 (evening peak hours). These results may be driven by the fact that most people work in the CBD and others go to school, which requires people to be at work before 08h00.

7.5.4. Commuters' preferred travel fare.

As travel fare is associated with the distance travelled, the study data collected was subjected to cross-tabulation, to establish patterns and associations that are not easily detectable on the basis of generic frequency analysis. An understanding of the anticipated travel fares required benchmarking existing travel fares for similar modes in comparison to the proposed fare for BRT, if known. Therefore, in order to assess this, commuters were asked what the average travel fare per settlement cluster was. This travel fare was validated against the stated travel fares modelled and stated in the Polokwane BRT system which would be acceptable and sustainable from the commuter perceptions within the municipal area. This data is depicted in the Figure 7.19.

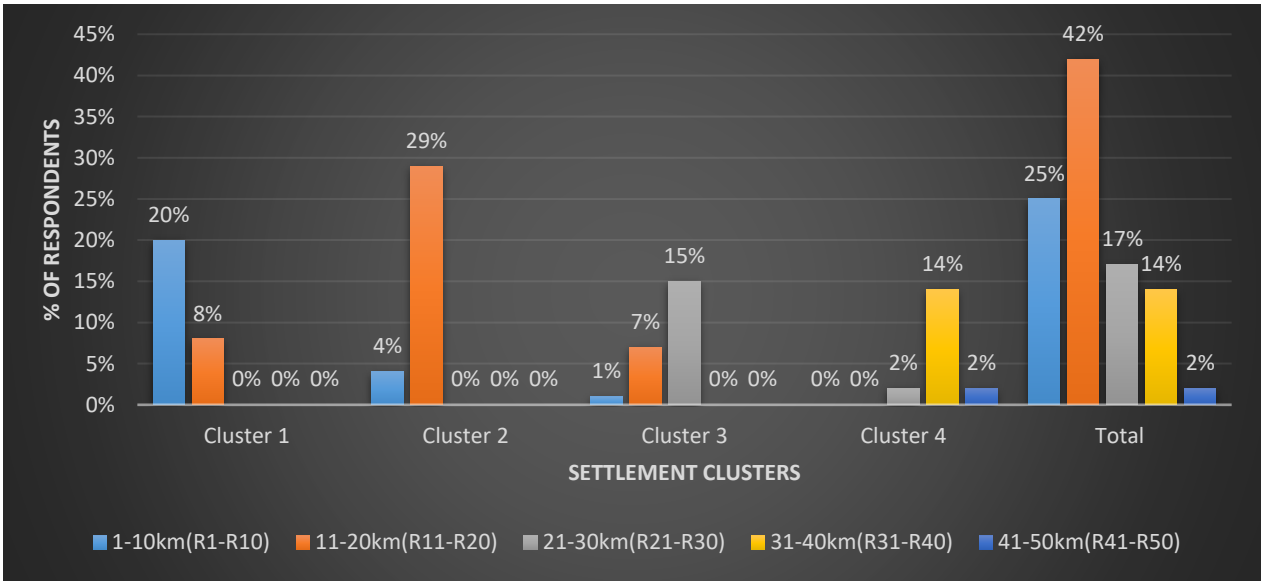

Figure 7.19 Preferred travel fare per cluster.

Source: Author's field data (2018)

Sample size: N=250

Figure 7.19; study findings revealed that majority of survey respondents (42%) preferred paying between R11.00 and R20.00 for commuting, whereby the majority of this survey respondents contributed (29%) were from settlement cluster 2. This was followed by the least survey respondents (25%), whereby the majority of this survey respondents contributed (20%) were from settlement cluster 1. A significant number of survey respondents (17%) preferred paying travel fare of between R 21-R30, whereby the majority of this survey respondents contributed (15%)

were from settlement cluster 3. However, minority of survey respondents (14%) who were from settlement cluster 4, indicated that they preferred paying between R31-R40 travel fare. This result shows that respondents who stay far away from the Polokwane CBD are willing to pay higher travel fare, while those residing closer to the Polokwane town were willing to pay less travel fare. This suggests that the commuters' perception towards fare system is one linked to the distance-based costing fare model rather than a flat or zonal based fare system.

7.6. Operational characteristics

To check if the operational characteristics of the Polokwane BRT system would meet commuters' stated preferred characteristics, data regarding the envisaged operational characteristics of the BRT were collected and analysed. This section is subdivided into six sub-topics which are as follows:

- Commuters' stated preferred operational characteristics;
- Commuters' preferred safety and security measures operational characteristics;
- Commuters' preferred commutes comfort measure of the Polokwane operational characteristics;
- Operational customers service information;
- Shifting from current mode to use the BRT system; and
- Polokwane expected benefits from the operation of BRT system

7.6.1. Commuters' stated preferred operational characteristics

Data concerning the preferred operational characteristics was collected and analysed. This data assisted to answer objective number three of the study. Figure 7.20 below presents the respondents preferred operational characteristics for Polokwane BRT system.

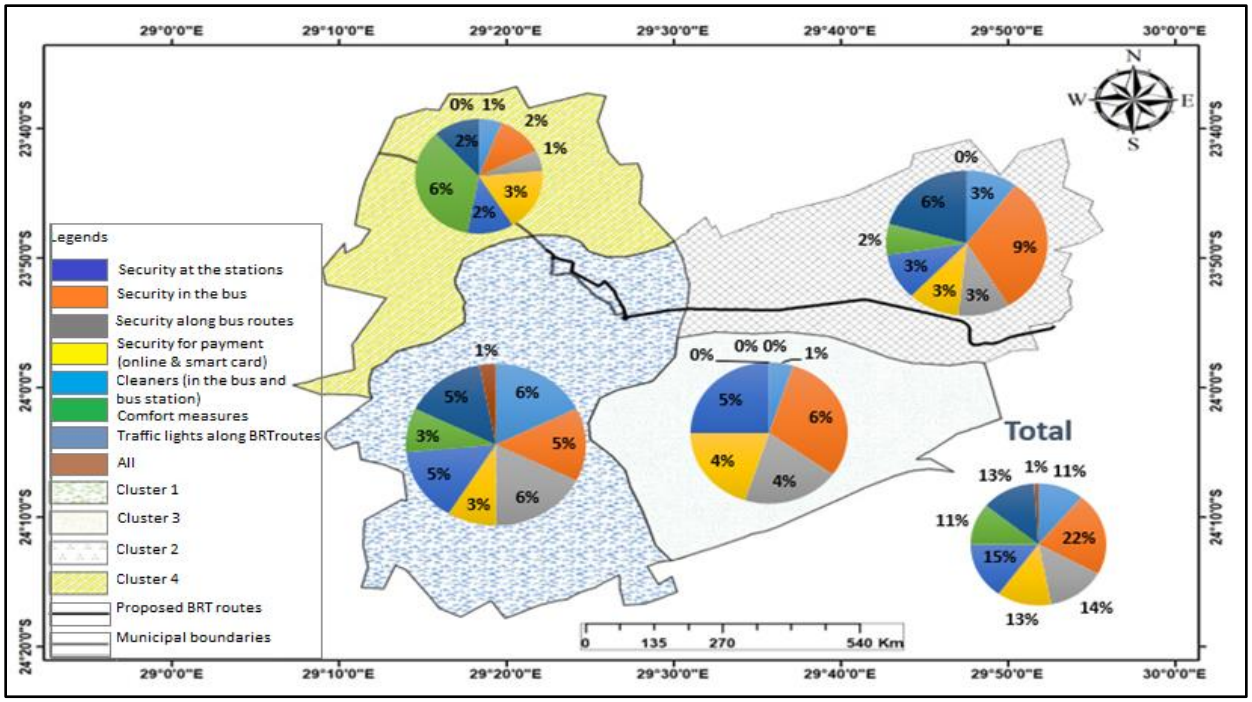

Figure 7.20. Respondents' preferred operational characteristics

Source: Author's field data

Sample size: N=250

Figure 7.20 shows that the majority of survey respondents (22%) preferred the Polokwane BRT system to have tight security in the bus. This refers to the surveillance cameras that can assist to catch criminal activities, such as pickpocketing or thieves on camera. The majority of the survey respondents (9%) who indicated that they should be security in the bus are from settlement cluster 2, where there are many commuters travelling for schooling purposes. This may suggest that school children are soft target for crime (such as intimidation, harassment and bullying) in existing commuting systems. However, (15%) of the survey respondents indicated that they prefer security at the stations or terminals, while the minority (1%), indicated other security measures such as safety belts as important.

7.6.2. Operational safety measures

It was deemed important for the researcher to collect data regarding the preferred operational safety and security measures for the operation of the Polokwane BRT. The findings were analysed and are presented in Figure 7.21 below.

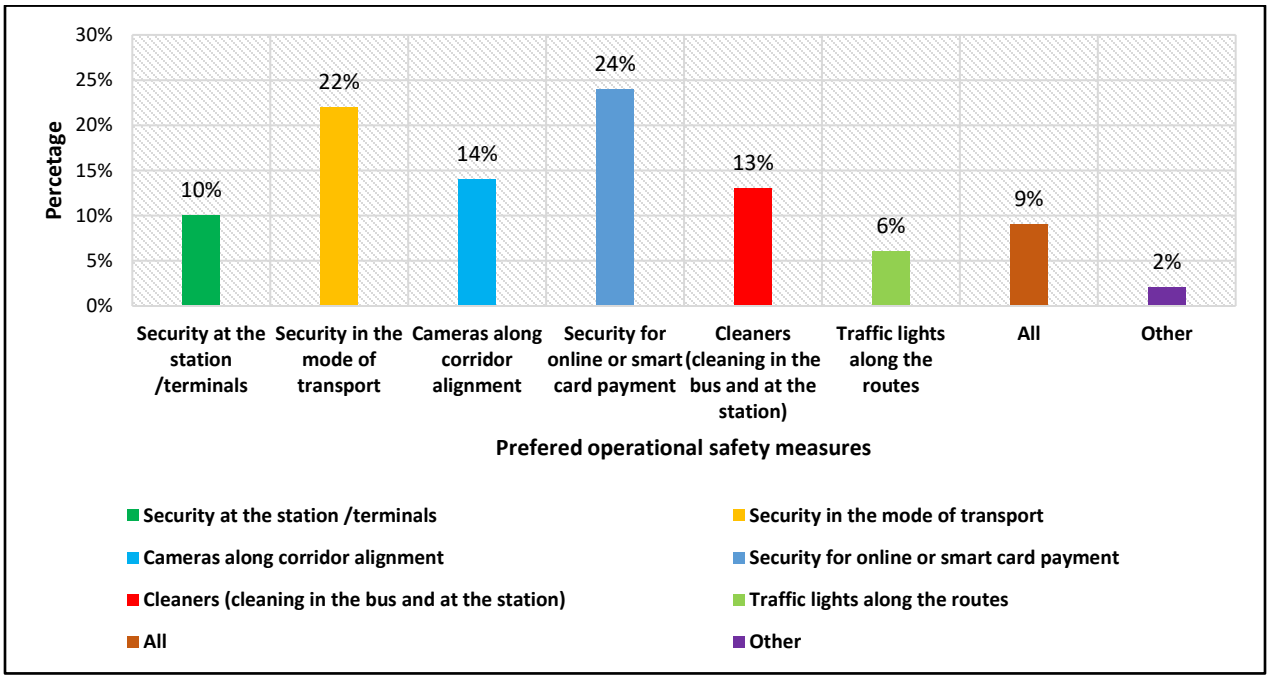

Figure 7.21. Respondent's operational safety measures

Sample size: N=250

Source: Author's field data

From figure 7.21 we can deduce that the majority of survey respondents (24%) prefer security for online or smart card payment, while the least of number of survey respondents (14%), prefer cameras along the corridor alignment. On the other hand, a minority of the survey respondents (6%) prefers traffic lights along the routes as the operational safety and security measures to be incorporated on the Polokwane BRT system.

7.6.3. Operational comfort measures

As indicated by Finn and Mulley (2011:89-107), commuters tend to prefer specific modes of transport, particularly those modes of transport that are safer and comfortable. The operational characteristics of the BRT system is associated with comfort measures which must be incorporated in the system. As a result, Table 7.4 shows the comfort measures that survey respondents indicated as requirements that needed to be incorporated on the Polokwane BRT system.

Table 7.4. Comfort measures respondents require to be incoperared the Polokwane BRT system

Preferred comfort measures	Frequency	Percentage
Security at the station	16	6%
Security(cameras) along the corridor	43	17%
Security at the fare payment area	34	14%
Guaranteed seat	57	23%
Comfortable seat	42	17%
Covered stations	32	13%
It was All	25	10%
Other	1	0%
Total	250	100%

Source: Author's field data

Sample size: N= 250

Table 7.4 shows that the (23%) that the survey respondents preferred comfort, while (13%) preferred security covered stations. However, (6%) of surveyed respondents preferred having security at the station.

7.6.4. Operational customers' service information.

Customer information plays a major role in commuter transportation. This is because it improves the accessibility and reliability of the mode of transport. Accessibility and reliability of the system have implications regarding commuter's perceptions concerning any mode of transport. Consequently, the commuters were asked how they would like customer information to be

displayed. Figure 7.22 depicts the respondents preferred customer information display platform choices.

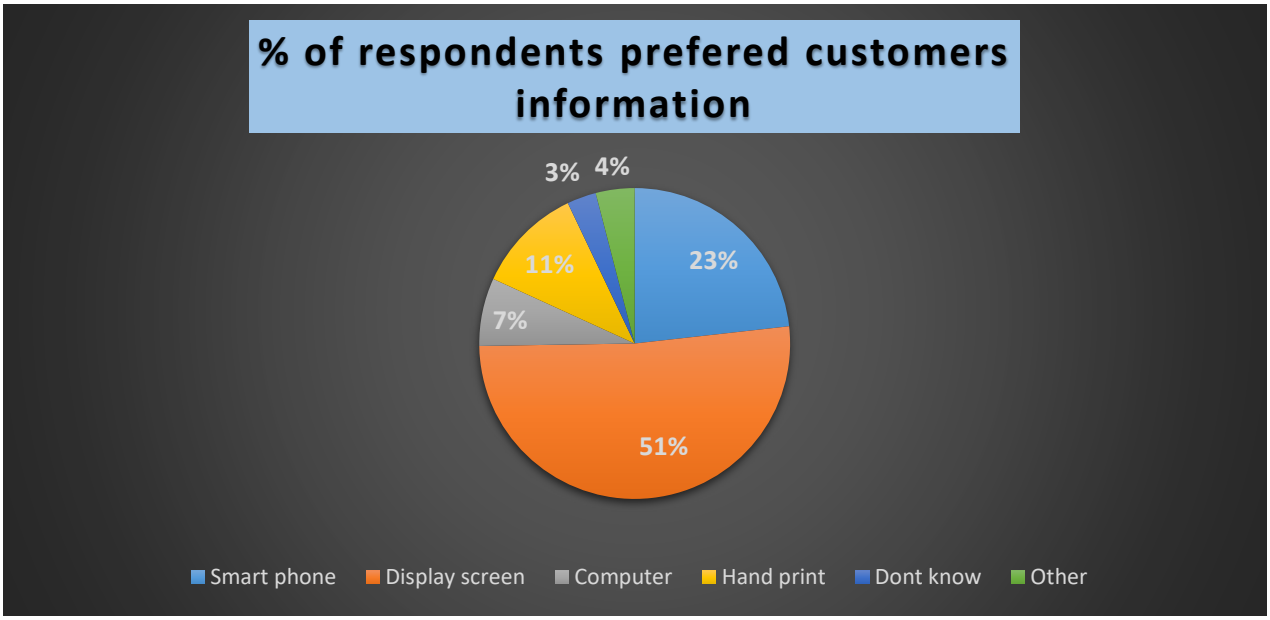

Figure 7.22. Respondents' customers information

Source: Author's field data

Sample size: N=250

Figure 7.22 shpws that the majority of survey respondents (51%) would prefer that the BRT information be displayed on screens, while (7%) of the survey respondents prefers that the custom information be displayed on a computer screen and a minority of the survey respondents (3%) did not know what an appropriate BRT information display system could be.

7.6.5. Shifting from current mode to use the BRT system

The respondents were asked if the Polokwane BRT system contained their preferred operational characteristics, and if they would shift from their current mode of transport to the use of the BRT system. The Figure 7.23 below shows the survey respondents' answers.

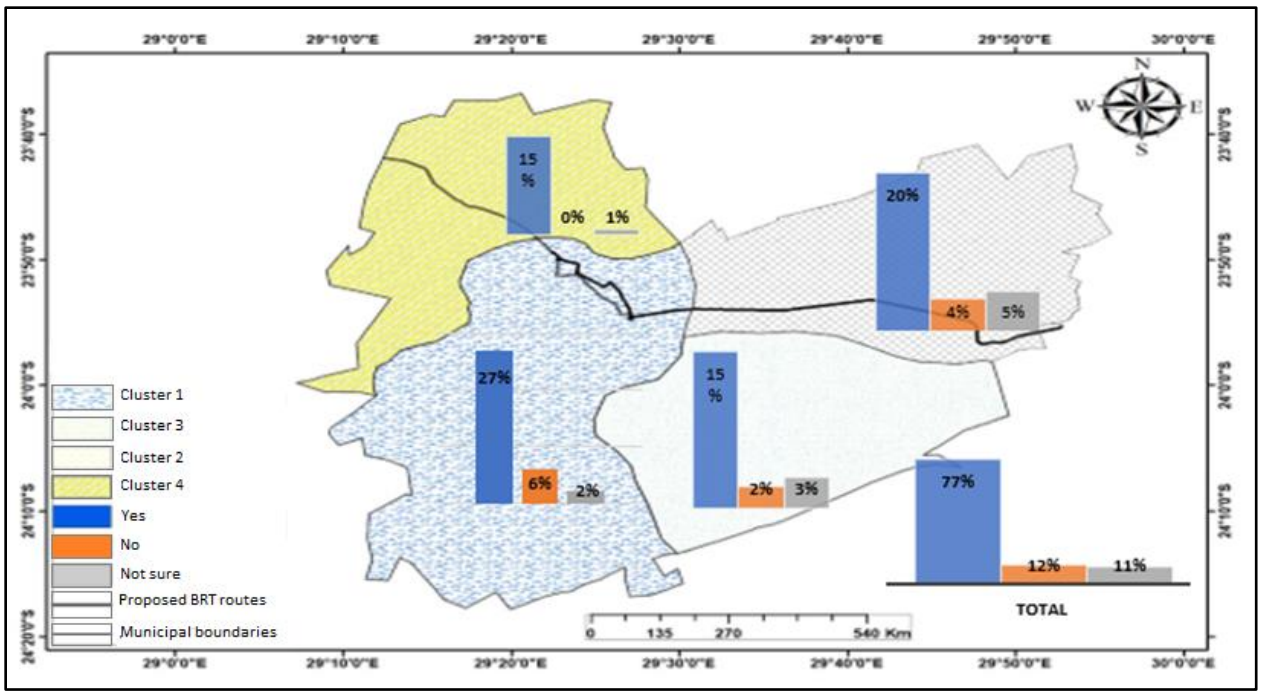

Figure 7.23. Respondents' answers towards readiness to shift from current transport modes to BRT system

Source: Authors field data (2018)

Sample: N=250.

As presented in figure 7.23, the study findings revealed that the majority of the survey respondents (77%) can shift to the BRT system, if their preferred operational characteristics are incorporated, while 12% indicated that they would not switch transport modes because they are comfortable using their current mode of transport. On the other hand, 11% of the survey respondents indicated that they are not sure if they would switch when the system started operating.

7.6.6. Polokwane's expected benefits from the operation of the BRT system

It was also crucial to ask commuters their expected benefits from using the BRT when it starts operating. This information helped the researcher to check the scenario of the Polokwane public transport against a scenario in which the BRT system was in operation. Figure 7.24 below shows the respondents perceived benefits from the Polokwane BRT.

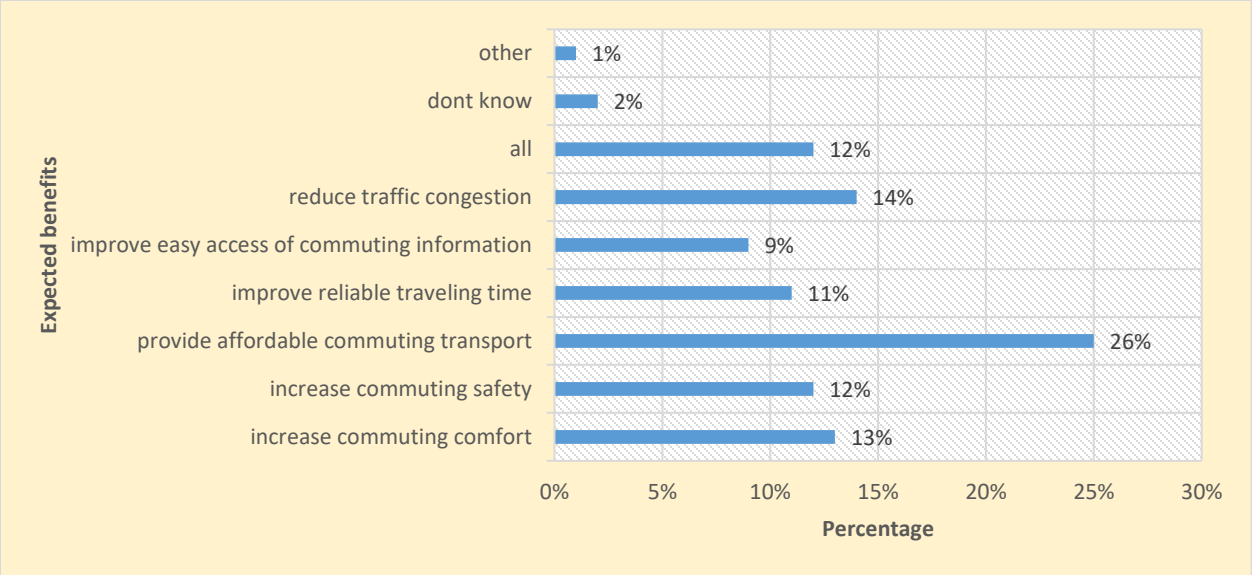

Figure 7.24. Respondents' expected benefits from the Polokwane BRT

Source: Author's field data

Sample size: N=250

As indicated in Figure 7.24, the study results revealed that the majority of survey respondents (26%), expected the Polokwane BRT system to provide an affordable transport system. This makes sense, because according to the Polokwane IDP (2018:107), the majority of the Polokwane residents are unemployed. It was also further revealed that (13%) of the survey respondents were expected to start benefiting from the increasing commuting comfort and a minority of the survey respondents (1%) indicated that benefits such as employment and easy access to the transport were shared expectations that they expected the BRT system to deliver.

7.7. Revealed data

The researcher observed the current transport situation in the study area. In order to have a logic and connect it to the stated preference data, the revealed data was based on 20 targets. The study revealed data was based on four commuters' travel factors that can be observed, which include, weather, travel time, dominate mode of transport and the operation of the current mode. The observed data are summarised in Table 7.5 below.

Table 7.5. Observed study data

Settlement Cluster	Day	Time	Weather	Gender 20 people		Mode of transport 20 modes			Commuters travel information	Safety measures	Comfort measures	Transport problems
				Male	Female	Car	Taxi	Bus				
Cluster 1	13/01/18	06h00-08h00	Warm	7	13	4	9	7	Hand print for the taxis	Uncovered stations No seats at the station	No available security and or surveillance systems	Unavailable and inaccessible commuting information for all modes. Traffic congestion during morning peak hours
		10h00-12h00	Warm	15	5	6	13	1				
		12h00—14h00	Warm	14	10	9	11	0				
		16h00-18h00	Warm	12	8	7	8	5				
Cluster 2	15/01/18	06h00-08h00	Warm	11	9	2	14	4	Taxi drivers source of information	Uncovered stations No seats at the station	Unavailable security measures (securities, cameras)	Unreliable transport Traffic congestion caused by taxis
		10h00-12h00	Warm	9	11	3	12	5				
		12h00—14h00	Warm	13	7	3	13	4				
		16h00-18h00	Warm	11	9	2	10	8				
Cluster 3	16/01/18	06h00-08h00	Warm	5	15	5	9	10	Bus and taxi drivers are source of commuting information	Uncovered stations No seats	Unavailable security measures (securities, cameras)	Poor road condition resulting to slow movement of transport Unreliable transport system
		10h00-12h00	Warm	5	15	2	8	10				
		12h00—14h00	Warm	14	6	3	13	4				
		16h00-18h00	Warm	7	13	3	8	9				
Cluster 4	17/01/18	10h00-12h00	Warm	7	13	2	8	10	Bus and taxi drivers are source of commuting information	Uncovered stations No seats	Unavailable security measures (securities, cameras)	Overloaded modes
		12h00—14h00	Warm	11	9	3	7	10				
		16h00-18h00	Warm	13	7	1	8	9				
		10h00-12h00	Warm	12	8	2	7	11				
Overall findings	**N/A**	**06h00-08h00**	**Warm**	**52%**	**48 %**	**18%**	**47 %**	**35 %**	**Unreliable travel information**	**Poor Safety measures**	**Poor comfort measures**	**High transport congestion**

Source: Authors field data (2018)

Sample size: N=20

The overall revealed data indicates that the majority of the Polokwane commuters' travel time is between 06hh00-08h00, and the survey climatic condition when the observations were conducted was very warm conditions. The majority of these commuters (52%) are male and the current most used mode of transport are taxis constituting of (47%). It was also observed that the current

modes of transport have poor operational characteristics because they are associated with unreliable travel information, poor safety and comfort traveling measures and with high transport problems such as traffic congestion, crime and safety concerns, overloads, taxi route wars and inaccessible travel information.

7.8. Key informant interviews

Key informant interviews were conducted with the Polokwane Local Municipality officials and the company responsible for the implementation of the Polokwane BRT system. The data collected from the key informants was then compared to the data collected from the general commuters to check if the implementation of the Polokwane followed the appropriate process, and if the stated preferences match with what is going to be incorporated on the Polokwane BRT system and operational characteristics. This section is subdivided into three sections which are as follows:

- Key informant demography;
- BRT system implementation analysis;
- Commuting travel needs; and
- Polokwane BRT operations.

7.8.1. Key informants' demography

The key informants' data provided the researcher with the most important information that helped the researcher to achieve the study objectives. The demographic analysis of these informants is presented in Table 7.6.

Table 7.6. Key informant demographic status

Organisation	Department	Position	Gender
1. Company responsible for the implementation of the Polokwane BRT system.	BRT planning and operations	Transport planner and technical advisor	Male
2. Company responsible for the implementation of the Polokwane BRT system.	Project management unit	Project manager: Marketing and stakeholder	Female
3. Polokwane Local Municipality	Transportation planning	Transport planner	Female
4. Polokwane Local Municipality	Communication	Communication officer	Female
5. Polokwane Local Municipality	Engineering services	Transport engineer	Male

Source: Authors field data (2018)

Sample size: N=5

Table 7.6 shows the key informants organisations, departments, positions and gender. It further reveals that only five (5) informants were interviewed, in which 3 females were interviewed and 2 males. The two informants interviewed represent the company responsible for the implementation of the Polokwane BRT system and remaining three key informants were from the Polokwane Local municipality. These key informants all hold different positions from different departments but play a major role on the implementation of the Polokwane BRT system.

7.8.2. Polokwane BRT implementation analysis

In order to precisely obtain the perception of the implementation of BRT system from the key informants, data was collected and analysed into sub-topics. These subsections are as follows:

- Involvement of commuters during the implementation of the BRT system;
- Methods used to communicate the implementation of the Polokwane; and
- Perception towards the implementation of the BRT system.

7.8.2.1. Involvement of commuters during the implementation of the BRT system.

Data regarding the involvement of the commuters during the implementation of the BRT system was collected from the key informants. This data was collected to assess if the commuters were indeed involved in all implementation phases of Polokwane BRT system and the methods used to communicate the implementation of the system. Table 7.7 provides the key informants perceptions on the implementation phases of Polokwane BRT system.

Table 7.7. Key informants perceptions on the implementation phases of Polokwane BRT system

Organisation	Yes	No	Not sure
Company	✓		
Company	✓		
Polokwane municipality	✓		
Polokwane municipality	✓		
Polokwane municipality	✓		
Total in Percentage (%)	100	0	0

Source: Authors construct (2018)

Sample size: N=5

Table 7.7 indicates that the key informants conducted with the municipal officials and the company responsible for the implementation of the Polokwane BRT system, revealed that the commuters were involved throughout the implementation of the BRT system. The informants further indicated that before physical phase 1A (BRT lane from Seshego to Polokwane CBD) starst operating, the commuters will be further engaged and informed when the system is due to start operating.

7.8.2.2. Methods used to communicate the implementation of the Polokwane.

The key informants were also asked to indicate the methods of communication used to introduce the implementation of the BRT system and the branding of the system. This data was required to assess if the mentioned communication methods used by the informants were effective enough to reach out to the general commuters. Table 7.8 shows the methods the officials used to introduce and to involve the commuters regarding the implementation of the Polokwane BRT system.

Table 7.8. Methods used to communicate the implementation and the branding of the Polokwane BRT system

Organisation	Public participation	Stakeholder engagement	News paper	Radio	Internet	Flyers	T.V	Brochure	Other
Company	✓	✓	✓					✓	
Company	✓			✓					
Polokwane municipality	✓	✓			✓			✓	✓
Polokwane municipality	✓	✓	✓						
Polokwane municipality	✓	✓			✓				
Total	**5**	**4**	2	1	**2**	0	0	2	1
Total in Percentages	100	80	40	20	40	0	0	40	20

Source: Authors construct (2018)

Sample size: N=5

Table 7.8 shows that all five (5) key informants interviewed regard public participation as a key method of communication to introduce the implementation of the Polokwane BRT system. Only four (4) key informants used stakeholder engagement as a method of communicating the BRT

system, while two (2) informants used the newspaper, internet and brochures. However, only two (2) officials used radio and other method of communication to communicate the implementation of the system andno official used flyers and television to communicate the implementation of the system. Further analysis and searches revealed that the communication methods used included updates on the websites and exhibitions at national transport and related workshops and gatherings in South Africa and around Polokwane. The big question raised was how much adequate communication and consultation in a world of rapidly changing technologies is.

7.8.2.3. Perceptions towards the implementation of the BRT system.

The key informants were also asked to provide their views on the success of the BRT implementation in Polokwane, depending on the stakeholder engagement they held. This information was crucial to assess whether the commuters involved had a clear understanding of the BRT system. Figure 7.25 show the key informants perception on the BRT project implementation stakeholder engagement success.

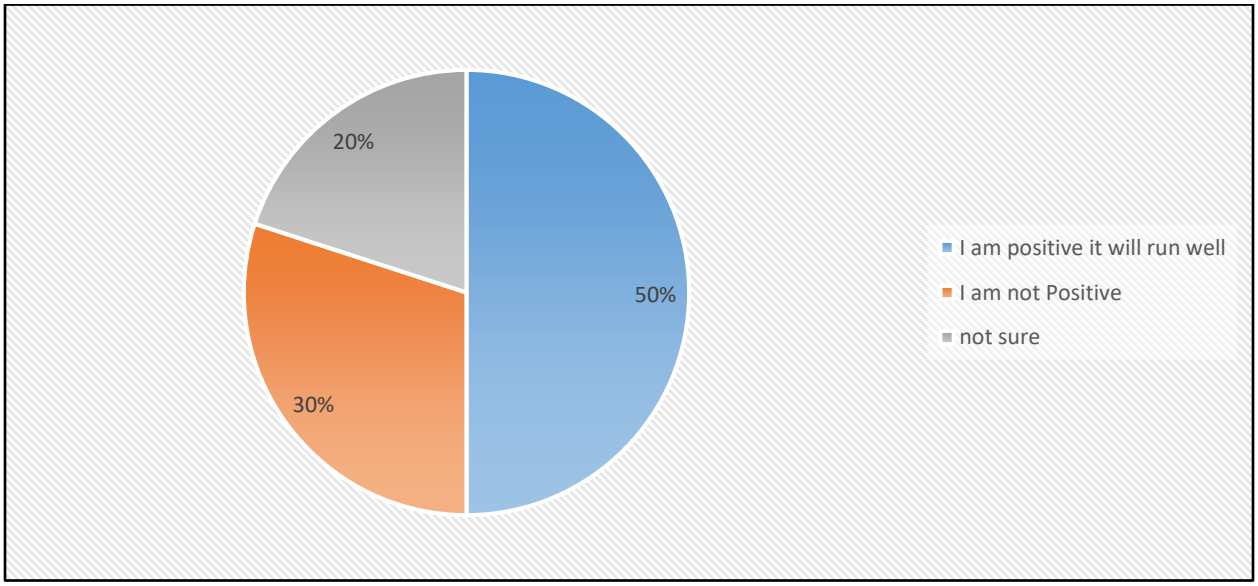

Figure 7.25. Key informants' perception of the implementation of BRT system

Source: Authors construct (2018)

Sample size: N=5

Figure 5.25 shows that the majority of the key informants (50%) were positive that the BRT system would run smoothly because the stakeholders who attended were co-operative and they had integrated all issues raised in the final BRT system to be implemented. This included air conditioning and the provision of seats for the disabled and elderly people. However, about a third (30%) of the surveyed respondents indicated that they were not optimisiticabout the BRT system. However, their opinions will only be firmed up when the system starts operating. This is because most of the attendees were so negative about it, particularly the bus and taxis owners, who saw it as taking away business from their industry. A minority of the surveyed respondents (20%) show that they are not sure, they would just have to observe when the system starts to operate. These findings relate to the findings of Helen (2010:34), who indicated that a poor introduction of the BRT system, can lead to the project being unsuccessful due to lack of support from the commuters' since they would have not been adequently informed.

7.8.3. Commuters' travel needs

The officials were also asked to indicate the commuters' travel needs of the Polokwane BRT system, which would be incorporated in the Polokwane BRT system in order to attract positive commuters' perceptions towards the BRT system. Figure 7.26. Shows the key informants choices of the commuters' travel needs that needs to be incorporated in the Polokwane BRT system for enhanced success.

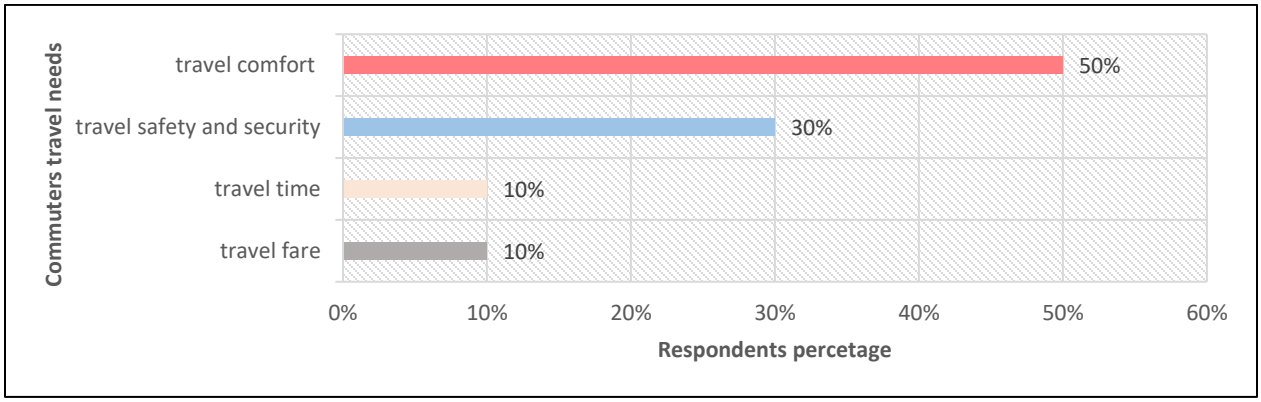

Figure 7.26. Key informants' choices of commuters' travel needs to be incorporated in the Polokwane BRT system

Source: Authors field data (2018)

Sample size: N=5

Figure 7.26 shows that half (50%) of the key informant respondents indicated that travel comfort needs to be achieved by the Polokwane BRT system, followed by travel safety and security which

was mentioned by 30% of the survey response respondents and travel fare with scored the least with 10%. The statistics and reason for considering the above comfort travel needs are discussed in detail as follows:

7.8.3.1. Travel comfort measures

The study revealed that the half of the key informants surveyed (50%) perceived travel comfort measures of the Polokwane BRT system as important. Having a BET mix that responds to the correct configuration of the commuters' travel needs results in a system that attracts positive perceptions from commuters. Furthermore, according to the interviews held with the company responsible for the Polokwane BRT system (2018), the Polokwane BRT system will provide air conditioning, comfortable seats, hand roles for the disabled commuters, low entry buses that also cater for disabled persons, and Wi-Fi, as their main comfort measures that will be incorporated to the system. The municipal official (2018), also indicated that clean and guaranteed seats are the best possible comfortable measures that the implementers promised to be incorporated in the system to increase the system's comfort and attractiveness for use by commuters.

7.8.3.2. Commuters' safety and security travel needs

The study shows that there are four main commuters' travel needs for the Polokwane BRT system. 30% of the surveyed officials indicated that commuters' safety and security measures take first priority. Secondly, commuters' travel needs that attract commuters' positive perceptions towards the Polokwane BRT system are non-negotiables in the project BRT roll-out. The officials further highlighted that the following safety measures (namely, covering personal, operational and vehicle safety) that would be incorporated to attract commuters' positive perceptions towards the system are critical. Table 7.9 below shows the different safety measures to be incorporated for the Polokwane BRT system.

Table 7.9. Safety measures to be incorporated for the Polokwane BRT system

Personal safety	Operational safety	Vehicles safety

Lighting during the night	Covered stations	Purchase new vehicles that meet normal vehicle standard
Security measures -CCTV cameras along the BRT corridors, stations and in the bus - Security at the station and fare payment area	Scheduled service (increase the system operational safety efficiency	Panel handle for those traveling without a guaranteed seat
Commuters linked to control centre, e.g. panic baton to press if there is a robbery or attack in the bus	Operational control centre. It updates the travelling time of each bus, so they can avoid using the same lane at the same time to avoid accidents	Panic buttons and sensors in the bus used to alert the system control managers of crime happening in the bus or for incident management systems

Source: Field data (2018)

Table 5.9 revealed three main types of safety and security measures likely to attract commuters' positive perception towards the BRT Polokwane system. These safety measures include personal safety, operational and vehicle safety that are associated with the Polokwane BRT system.

7.8.3.3. Commuters' travel time.

Based on Table 7.10, 10% of the key informants indicated that travel time will also have an impact on the customers travel needs. In order to assess the reliability of the informant's statement, the key informants were also asked to choose the system frequency during peak and off-peak hours. This information is summarised in Table 7.10.

Table 7.10. Polokwane BRT travel time

Frequency	Travel time	Peak hour schedule	Peak hour timetable
Every after 10 minutes	Peak hours	Morning peak	04H01-09H00
		Afternoon peak hours	13H01-14H00
Every after 30 minutes	Off peak hours		
		Evening peak hours	16H01-18h00

Source: Key informants interview and Polokwane CITP (2013)

Sample size: N=5

Table 7.10 shows that the key informants indicated that the system's frequency during peak hours should be every after 10 minutes and during off-peak hours it should be after every 30 minutes.

These headway frequencies will effectively respond to the transport problems faced by the commuters, particularly during peak hours. For example, The Polokwane CITP (2013:16), indicated that congestion within the municipal area occurs during peak hours, particularly on the roads used by public transport vehicles. Therefore, increasing the system frequency during peak hours will result in the commuters having positive perceptions towards the system and attracting large numbers of commuters' as indicated by Diaz *et al.*(2004:ES-5). The informants further indicated that the BRT system will have morning peak which is between 04H01-09H00, afternoon peak 13H01-14H00 and evening peak at 16H01-18H00.

7.8.3.4. Commuters' Travel fare

According to Figure 7.26, a minority of the key informants (10%) indicated that travel fare will play a role on attracting positive perception of the Polokwane BRT system. According to the interviews held in 2018, with the company responsible for implementing the Polokwane BRT system, the travel fare (affordability) of the system will be calculated based on financial model, which will compare both the distances and the current travel fare prices. As a result, this might not reflect to what extend the commuters prefer one mode of transport over another mode of transport. The municipal officials further indicated that the travel fare for the Polokwane BRT was not based on the commuter's preferences, and that is the reason whythey were hardly involved during the matter. This supports the findings of Table 7.3, which indicates that Most (72%) of the commuters were not involved during the confirmation of the system's travel fare. The officials did not hand over the travel fare, since they said it has to be re-introduced to the commuters first, as they are the first priority. However, the Polokwane IRPTS (2013:105), showed that the travel fare schemes has already been finalised for the first physical phase of the Polokwane BRT system which runs through Seshego to Polokwane CBD. Table 5.7 shows the current finalised travel fare.

7.8.4. Operational characteristics of the system.

To assess if the operational characteristics of the Polokwane BRT system would respond to the commuters' preferences, the key informants were asked various questions. This section is based on three subsections which are as follows:

- Major operational characteristics incorporated in the Polokwane BRT;
- Operation comfort measures; and

- Information display operation.

7.8.4.1. Major operational characteristics incorporated on the Polokwane BRT system.

The informants were asked if the operation of the system would incorporate the specified carrying capacity, provide affordable travel fare, specify travel time, and provide easy access to traveling information, commuters' safety and comfortable measures. The results are indicated on the table below. Table 7.11 shows the operational characteristics of key informants.

Table 7.11. Key informants' major operational characteristics

Operational characteristics	KI-1	KII-2	KIII-3	KIV-4	KV-5	Percentages (%)
Specified carrying capacity	✓	✓		✓		60
Specified travel time	✓	✓	✓	✓	✓	100
Provide affordable travel fare	✓		✓			20
Provide easy access to commuting information	✓	✓		✓	✓	80
Provide commuting safety and security measures	✓	✓	✓	✓	✓	100
Provide commuting comfort measures	✓	✓	✓	✓	✓	100

Source: Authors field data (2018)

Sample size: N=5

Table 7.11 revealed that the majority of the informants (100%) indicated that the operation of the BRT system will have specified travelling time (refer to Table 7.11), provide safe and secure commuting measures and comfort measures. The reason fortheir answers was there there would be a control centre that manages the BRT buses travel time, making it easier for the drivers to use the exact specified route and observe the scheduled traveling time as they would run on dedicated bus lanes with provision for right of ways and priority turning at intersections. The key informants further indicated that the tight safety, security and comfort measures such as CCTV in the bus stations and corridors just to mention few, guaranteed seats, clean stations will be able to effectively address the safety, security and comfort measures. However, 20% of the key informants indicated that the system will be affordable, although in the immediate and short –term some form of resistance from commuters is expected.

7.8.4.2. Operational comfort measures

The key informants were also asked to mention the most essential comfort measures that will be incorporated into the Polokwane BRT system. Figure 7.27 shows the most important comfort measures to be incorporated on the Polokwane BRT system.

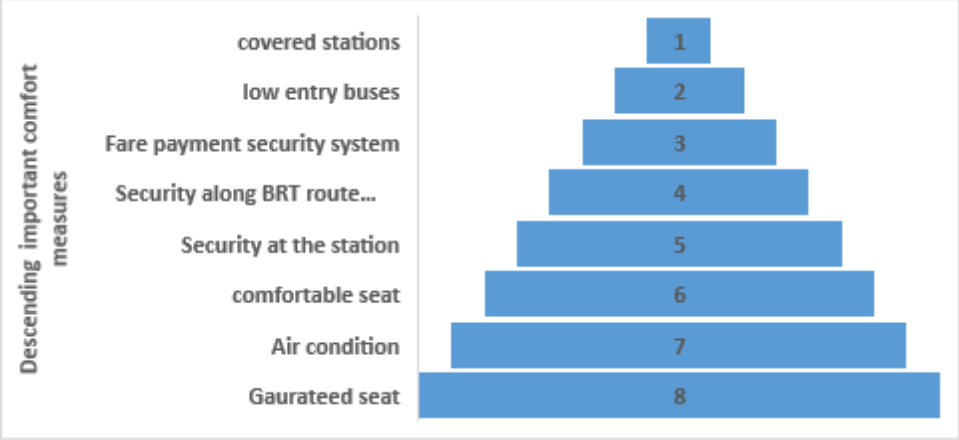

Figure 7.27. Informants' most important comfort measures

Source: Authors field data (2018)

Sample size: N=5

Figure 7.27, study findings revealed that the majority of the informants placed covered station on the top layer of the pyramid (1), which reflects that it is the top measure for commuters' comfort needs that will need to be achieved by the operation of the Polokwane BRT system. The informants indicated security at the station as the (5th) priority comfort measure that the Polokwane BRT aims to achieve. Lastly, the study revealed that guaranteed seat is the least important comfort measure that the system aims to achieve, the reason being, that the commuter seat availability may not be too critical for short-trip distances as some of the commuters will be standing along the way.

7.8.4.3. Information displays operational system

The key informants were asked the on what technology tool and platform should the Polokwane BRT information be best displayed. The findings are represented by the table 7.12.

Table 7.12. Technology toolS and platform to display BRT commuting travel information

Key informants	Smart phones	Display screen	Computer	Hand print	Other
KI	✓				
KII		✓			
KIIII		✓			
KIV		✓			Brochures
KV					
Total	1	2	0		1
Total in Percentage (%)	**20**	**60**	**0**	**0**	**20**

Source: Authors field work (2018)

Sample size: N=5

Table 7.12 revealed that 40% of the respondents selected display screen as the most effective tool for sending commuting travelling information, while (20%) of the informants indicated that smart phones, hand print and brochures are the most effective tools for sending travelling information and communicating with commuters. It is unfortunate that no informant perceived the computer as the most effective tool for updating commuters with their travel information, as desktop computers are increasingly being seen as old technology. However, tables are handy and a good substitute for computers. The informants further justified that they prefer display screens because all commuters can access them, including disabled people as there are control voices speaking at the stations updating what is on the screen. However, one of the officials indicated that smart phones can be effective, but the problem is that not everyone in the society can afford and knows how to use them. Consequently, in the short-term it is not preferred as the most effective commuters' technology.

7.8.4.4. Key Informants' operational targeted outcomes

The informants were also asked to indicate the problems that they want BRT system to address. This data was collected to compare with the commuters' expected benefits from the implementation of the BRT system. Figure 7.28 show the targeted problems to be addressed by the Polokwane BRT system.

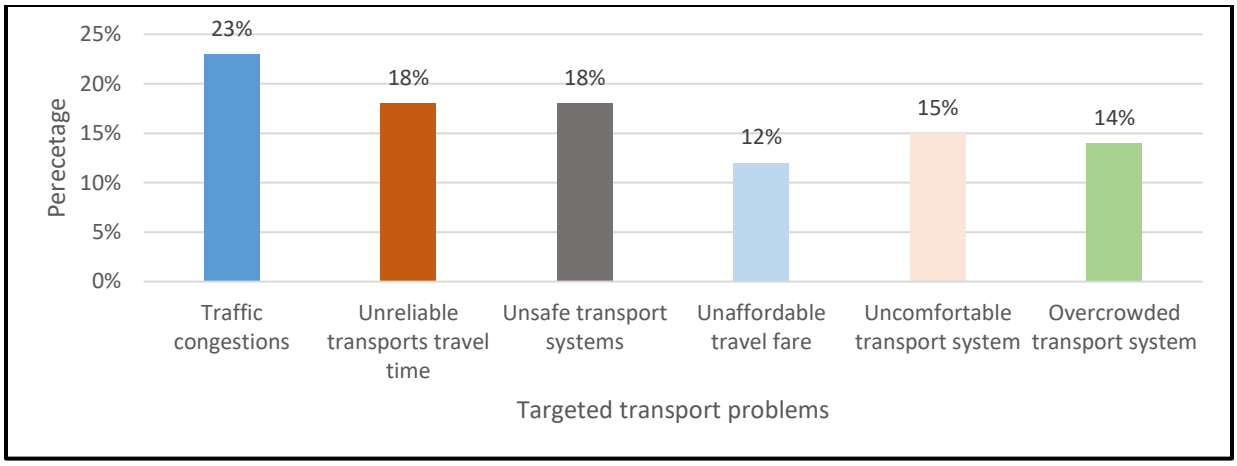

Figure 7.28 Targeted problems to be addressed by the BRT implementation

Source: Authors construct (2018)
Sample size: N=5

Figure 7.28 shows that the study results indicate that the majority of the surveyed key informants (23%) indicated that the BRT system will address traffic congestion problems, while (18%) indicated that the BRT system will address both unreliable transport systems challenges, as well asproblems of an unsafe and insecure transport system. A minority of the surveyed key informant respondents (12%) indicated that the system will address unaffordable travel fare.

7.9. Statistical data presentation and analysis

The study conducted alinear scale and cross-tabulation statistical test analysis in order to test the relationship and the influence of the variables on the questionnaires on each other. The statistical data analysis assisted the researcher to present the findings and recommendations of each objectives and the scenariobased analytical tool adopted in chapter 2 of the study.

7.9.1. Linear regression analysis

The study used the linear regression analysis to assess the relationship between the commuters' perceptions and the implementation of the Polokwane BRT system. Linear regression analysis gives statistical data covering mode summary, ANOVA and the coefficients for influence. The study selected eight variables which were found to be very crucial during the presentation of the study analysis for assessing the influence on each other. These variables showed that the variables played a significant role towards shaping the perceptions of commuters towards the

implementation of BRT system. The variables that were tested using linear regression analysis were as follows:

- The relationship between the awareness of the BRT system and the methods used to communicate the implementation of BRT system;
- The relationship between settlement clusters and the methods used to communicate the implementation of the BRT system;
- The relationship between the commuter's travel needs and preferred mode of transport; and
- The relationship between the preferred operational characteristics and shifting towards the use of BRT system.

7.9.1.1. Summary of the influence of method of communication and awareness of BRT

The study hypothesized that the method used to communicate the implementation of BRT system has some influence on the number of people that were aware of the BRT implementation. The method used to communicate the implementation of BRT and the number of the commuters that were aware of the system were expected to correlate with the rationale of the commuters' perceptions towards the system (Wright and Hook, 2007). Consequently, the study employed the linear regression analysis to determine the relation between the two variables. Table 7.13 shows the model summary of the influence of method of communication to the number of commuters aware of the Polokwane BRT system.

Table 7.13. Model summary for the influence of methods of communication on the number of commuters aware of the Polokwane BRT system

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.788[a]	.622	.620	1.551	.622	407.379	1	248	.000

a. Predictors: (Constant), Method of communication used to introduce BRT system

The results shown in Table 7.13 revealed that the independent variable explain about 62.0 of the dependent variable (that is, the roles of the method of communication influences the volume of commuters aware of the BRT in Polokwane), with the R-squared equal to 0.662. The outcome of

the ANOVA test confirmed the models best fit, which could predict a better outcome than using a mean with the ratio of improvement reached F=407.379 and a significant value equal to 0.000(p<.05). Table 7.14 shows the ANOVA test result of methods of communication and number of commuters aware of the Polokwane BRT system.

Table 7.14. ANOVA test results for the influence of method of communication used to communicate BRT implementation influences the number of commuters aware of the system.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	979.879	1	979.879	407.379	.000[b]
Residual	596.521	248	2.405		
Total	1576.400	249			

a. Dependent Variable: The number of commuters aware of the Polokwane BRT method used to communicate BRT implementation

The outcome of the ANOVA test (Table 7.14) confirmed the models best fit, which could predict a better outcome than using the mean with the ratio of improvement reached F=407379 and a significant value equal 0.000 (p<.05). Table 7.15 shows the coefficients of influence of the methods used to communicate the BRT and the number of commuters aware of the Polokwane BRT system.

Table 7.15. Coefficients for influence of method used to communicate BRT implementation on the number of commuters aware of Polokwane BRT system

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Awareness of Polokwane BRT system	4.071	.202	.788	20.184	.000	3.673	4.468

a**. Predictors: (Constant), Method of communication used to introduce BRT system**

Table 7.15 shows that the relationship between the method of communication in relation to the number of commuters aware of the BRT Polokwane was found to be positive (β=4.071), with an association found to be significant at p<0.1 (P-value+= 0.000). The results SHOW that the methods of communication significantly influence the number of commuters that will be aware of the BRT Polokwane. This in turn would indirectly influence the commuter perceptions towards the system. Consequently, those who were aware of the system would have positive cognitive dissonance towards the BRT system when compared to those who were less or not informed at all (Adajei and Behren, 2012:60 and David 2015:1). Thus, Saitnaam *et al.* (2006:64), indicated that as technology advances, various methods of communication have become available and it

is important for transportation planners to understand which methods of communication to use to reach to a wide range of commuters about BRT transportation.

7.9.1.2. Summary for the influence of effectiveness of the methods on the transport changes associated with BRT

The study hypothesized that the effectiveness of the method on reaching the commuters have influence on the commuters' perceptions towards the transport changes associated with the implementation of BRT. The use of infective method of communication can undermine the success of the BRT implementation (Wright,2002:13). This happened because commuters who are not adequently informed had little information regarding the system that was about to be implemented. Table 7.16 shows a model summary of the influence of the methods effectiveness of the changes associated with BRT implementation.

Table 7.16. A Model summary of the influence of effectiveness of the used methods on the transport changes associated with BRT implementation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.200[a]	.040	.036	2.470	.040	10.342	1	248	.001

a. **Predictors: (Constant), Effectiveness of the methods**

Table 7.16 indicates that study revealed that the effectiveness of the methods used to introduce the Polokwane BRT system would have influenced commuters' perceptions towards the transport changes associated with the implementation of BRT system. Such an association was found to be significant at $p<0.1$ (P-value = 0.001). These results indicate that different settlements clusters affect the effectiveness of the method of communication used to communicate about the implementation of the BRT Polokwane. Thus, different commutation methods should be used for different clusters and this will allow for effective communication about Polokwane BRT. Table 7.17 shows the ANOVA test for influence of the effectiveness of the used methods on the changes associated with BRT implementation.

Table 7.17. ANOVA test for influence of the effectiveness of the used methods on the transport changes associated with BRT implementation

Model	Sum of Squares	Df	Mean Square	F	Sig.

Regression	63.108	1	63.108	10.342	.001[b]
Residual	1513.292	248	6.102		
Total	1576.400	249			

a. Dependent Variable: Transport changes associated with BRT implementation

As indicated in Table 7.17, the outcome of the ANOVA test confirmed the models best fit, which could predict a better outcome that using the mean with the ratio of improvement reached F=10.342 and a significant value equal 0.001 (p<.05). Table 7.18 shows the coefficients for influence of the effectiveness of the methods on the perceptions towards transport changes associated with the BRT implementation.

Table 7.18. Coefficients for influence of the effectiveness of methods on the commuter's perceptions towards transport changes associated with BRT implementation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	cluster	.468	.145	.200	3.216	.001	.181	.754

a. Predictors: (Constant), Effectiveness of the methods

Table 7.18 shows that the effectiveness of the methods found to be positively (β=0.0468), influencing the transport changes associated with the BRT implementation. Such an association was found to be significant at p<0.1 (P-value = 0.001). Various methods affect the commuters' perceptions of the transport changes associated with the BRT implementation. This means that the commuters' perceptions towards transport changes associated with BRT implementation was influenced by the type of method used to communicate BRT implementation. Consequently, the Polokwane Municipality must assess and use appropriate methods when implementing the remaining phases of the BRT system.

7.9.1.3. Summary for the influence of the commuters' travel needs and preferred mode of transport

The study hypothesized that the considered commuters' travel needs would have influenced commuters' preferred mode of transport. Various studies conducted by Belwal and Belwal (2010:17), Noor and Food (2014:395) and Ugo (2014:5), indicated that psychological state of mind and the offered commuters' travel needs, such as comfort, system performances, safety, and travel fare are the major influence of selecting and using a certain mode of transport. Consequently, the employed linear regression analysis to measure the influence that the

commuters' travel needs influence the preferred mode of transport. Table 7.19 shows the model summary of influence of commuter's travel needs on the preferred mode of transport.

Table 7.19. Model summary of the influence of commuters' travel needs on the preferred mode of transport

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.916[a]	.840	.839	.864	.840	1187.423	1	227	.000

a. **Predictors: (Constant), commuters' travel needs**

Results of this study presented in Table 7.19 revealed that the needs of commuters do significantly influence the mode of transport they use. They explain or influence about 0.916 variance, with R-square equal to 0.840 in conjunction, with a significant value of 0.000. This was crucial in understanding the needs of commuters and how best they can be provided for by the BRT in Polokwane. This was in accordance with the results of the study, that the majority of commuters choose their mode of transport due to their travelling needs and how the transport mode would assist them in achieving the traveling needs. Table 7.20 shows the ANOVA test for influence of the commuters' travel needs on the preferred mode of transport.

Table 7.20. ANOVA test for the influence of commuters' travel needs on the preferred mode of transport

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	886.523	1	868.523	1187.423	.000[b]
Residual	169.477	227	.747		
Total	1056.00	228			

a. **Dependent Variable: preferred mode of transport**

Table 7.20 shows the outcome of the ANOVA test confirmed that the models best fit, which could predict a better outcome than using the mean with the ratio of improvement reached F=1187.423 and a significant value equal 0.000 (p<.05). These results showed that the mode of transport commuters' use was influenced by the needs of commuters. Table 7.21 shows the coefficients for influence of the commuters' travel needs on the preferred mode of transport.

Table 7.21. Coefficients for the influence of commuters' travel needs on the preferred mode of transport

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Spatial location of settlement cluster	.754	.022	.916	34.459	.000	.711	.797

a. **Predictors: (Constant), commuter's travel needs**

The study results presented in Table 7.21 indicates that commuter's travel positively influences (β=0.754) the mode of transport commuters prefer to use. The study results also show that such an association is significant (P-value = 0.000). These results also suggest that the reason of a commuter would determine what type of transport mode to use depending on their needs. This has significant impact on the planning and design of the BRT in Polokwane, as it has to meet the needs of commuters for the development to be successful. g

7.9.1.4. Summary for the influence of preferred operational characteristics and shifting towards the BRT system

The study hypothesized that the operational characteristics of the Polokwane BRT would influence the shift from the current mode of transport to the use of BRT system. The hypothesis was based on the various studies conducted by Wright (2005:11), Moylan *et al*., (2013:2), Diaz *et al.,* 92004:2-3 and Saietnaam *et al*., (2006:1 and 69), who indicated that the operational characteristics such as frequent operation, reliability, safety and comfortable measures incorporated to the system, attracts large number of commuters to the use of BRT system. Table 7.22 indicates the model summary of influence on the preferred operational characteristics on shifting towards the use of the Polokwane BRT system.

Table 7.22. Model summary of the influence of preferred operational characteristics on shifting towards the use of BRT system

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df 2	Sig. F Change
1	.270[a]	.073	.066	1.038	.073	19.461	1	248	.000

a. **Predictors: (Constant), preferred operational characteristics**

The model summary presented in table 7.22 shows that 1.038 variance of the influence of preferred operational characteristics and shifting towards the use of the BRT systems. The significant value of F=0.000 results in the great influence of the operational characteristics and the shifting towards the use of the BRT Polokwane. Table 7.23 shows the ANOVA test for influence of the preferred operational characteristics on shifting towards the use of BRT system.

Table 7.23. ANOVA test for the influence of the preferred operational characteristics on the shifting towards the use of BRT system

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	20.976	1	20.976	19.461	.000[b]
Residual	267.300	248	1.078		
Total	288.276	249			

b. **Dependent Variable: shifting towards the use of BRT system**

The outcome of the ANOVA test confirmed the models best fit, which could predict a better outcome that using the mean with the ratio of improvement reached F=19.461 and a significant value equal 0.000 (p<.05). Table 7.24 depicts the coefficients for the influence of the preferred operational characteristics on shifting towards the use of Polokwane BRT system.

Table 7.24. Coefficients for the influence of the preferred operational characteristics on shifting towards the use of BRT system

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Preferred mode of transport	.143	.032	.270	4.411	.000	.079	.207

a Predictors: (Constant), preferred operational characteristics

Table 7.24 shows that the coefficient context factor for preferred operational characteristics (i.e. does the influence of the preferred operational characteristics affect shifting towards the use of BRT system), was found to be positively (β=0.143). Such an association was found to be significant at p<0.1 (P-value = 0.000). These results suggest that the operational characteristics of the BRT influence the shifting towards the preferred use of the BRT.

7.9.2. Cross-tabulation analysis

Cross-tabulation analysis was adopted in order to test the relationship amongst the variables that influences commuter's perceptions towards the implementation of BRT system.

7.9.2.1. Cross-tabulation for the level of stakeholder engagement and the willingness to shift to the BRT system

According to Moylan *et al.* (2013), the level of engaging the stakeholders with the implementation of the BRT system assist in a new attract new commuters and stimulate political, financial willingness from the stakeholders. Consequently, the study assumed that the level of stakeholder engagement affected the willingness of commuters to shift to the use of BRT system. Table 7.25 shows the relationship between stakeholder engagement and the willingness to use the BRT system.

Table 7.25. The Relationship between the stakeholder engagement and the willingness to use the BRT system

		Willingness to use BRT system		
		Yes	No	Not sure
Stakeholder engagement involvement	Yes	49	16	12
	No	5	79	65
	Not sure	4	5	8
	Total count	58	107	85
	Total percentage	23%	43%	34%

Source: Authors construct (2018)

Table 7.25 indicates that there is a strong relationship between stakeholder involvement and the willingness to shift to the use of the BRT system. It also shows that shows that majority of survey respondents (43%) who are not willing to shift to the use of BRT were not involved during the stakeholder engagement, while the least of survey respondents (34%) indicated they are not yet sure, they will have decided after seeing the system operating, while the minority of the survey respondents (23%) indicated that they will use the BRT system since they were involved in its implementation.

7.9.2.2. Cross-tabulation of the preferred travel time and preferred travel fare

The study employed the cross-tabulation data analysis to assess the relationship occurring between travel fare and travel time. Table 7.26 shows the relationship between the preferred travel time and preferred travel fare.

Table 7.26. Relationship between the preferred travel time and the preferred travel fare

		Preferred travel time				
		04h01-08h00(morning peak hours)	08h01-10h00(mid in morning of peak hours)	10ho1-14h00(afternoon peak hours)	14h01-16h00(late afternoon peak hours)	16h01-18h00(evening peak hours)
Proffered travel fare	11-20km(R11-R20)	52	26	22	14	6
	21-30km(R21-R30)	11	6	9	13	0
	31-40km(R31-R40)	18	3	2	8	0
	41-50km(R41-R50)	3	0	1	1	0
	Total	117	43	45	39	7
	Total in percentage (%)	47	17	18	16	3

Source: Authors construct (2018)

The table 7.26 shows that the majority of the survey respondents (47%) who travel during morning peak hours (04h01-08h00) would like to pay for the travel fare that ranges between R11.00-R20 for distances ranging from 11-20km. Therefore, this finding corresponds with the preferred mode of transport such referring to conventional bus, which currently in the study area, is the only transport that allow commuters to pay for the fair travel fare for commuting when compared to the other modes of transport.

7.10. Chapter summary

The chapter analysed, presented and interpreted data collected from the survey population. It has covered the socio-economic demographics, commuter perception of the implementation of Polokwane BRT system, the preferred commuters travel needs and their preferred operational characteristics. The next chapter focuses on the analysis of the obtained data using the Scenario-Based Analytical Approach tool adopted from Wulf *et al.,* (2010:14).

CHAPTER EIGHT: SCENARIO ANALYSIS

8.1. Introduction

This chapter presents on analysis of data and information obtained from the field using the Scenario-Based Analytical Approach (SBAA). The SBAA was adopted from Wulf *et al*. (2010:14), with the aim of assessing the BRT Polokwane implementation phase's scenarios situation of the study. The analysis and discussion of the scenarios enabled the researcher to predict the possible urban commuting scenarios that would unfold with or without BRT implementation given the current public transport situation. Further postulations in terms of the possibilities of changes that may occur to the public transport situation when the different phases and the full Polokwane BRT is implemented are also unravelled. The six stages of the SBAA are also fully discussed, including their implications on public transport. A summary of the BRT Polokwane implementation scenarios in a table format, concludes the chapter. Figure 8.1 depicts the conceptual framework of chapter six.

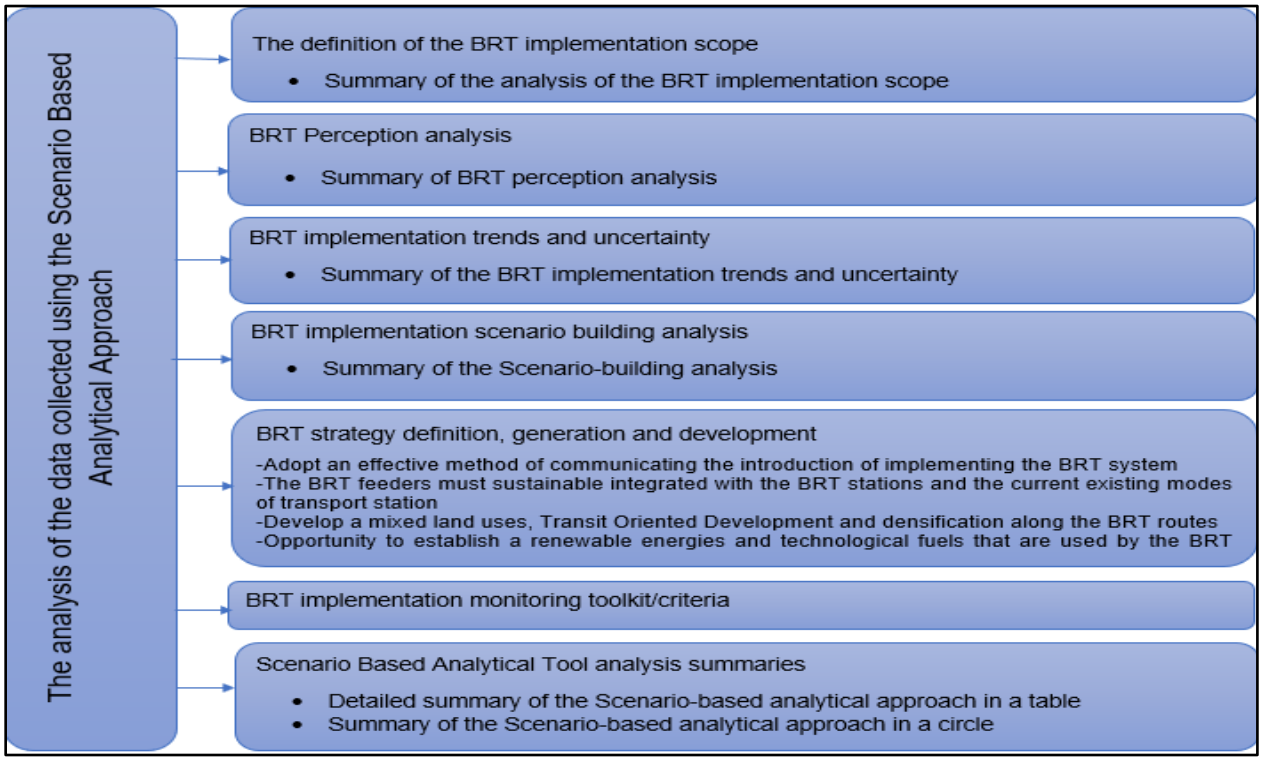

Figure 8.1. Conceptual structure of chapter eight

Source: Authors construct (2018)

Figure 8.1 shows the conceptual structure of chapter eight. The chapter is composed of six steps, adopted from the Scenario based analytical approach and the summary of the SBAA findings. The six steps include the definition of the BRT implementation scope, BRT perception analysis, BRT implementation trends and uncertainty, BRT strategy definition, generation and development and BRT monitoring and evaluation toolkit/criteria. It is this chapter that the summary of the scenario based analytical tool is summarised in a table and a circle.

8.2. The analysis of the data collected using the Scenario Based Analytical Approach

The study was based on two scenarios; namely, the Polokwane public transport system without the BRT system and the Polokwane public transport system with the implementation of the BRT system. Both scenarios can have also further scenario streams linked to critiquing the shortcomings of the envisaged BRT full implementation scenarios as well as discussing the non-BRT implementation scenario that is based on continued different *"massification"* of the existing transport commuting modes. However, fundamentally two scenarios were analysed using the adopted stages of the SBAA. The sections that follow present a summarised discussion of the scenarios as stipulated and adopted for the BRT Polokwane implementation in terms of the six stages of the SBAA tool. In any case, the study is based on the six stages of Scenario-Based Analytical Approach which are:

- The definition of the BRT implementation scope;
- BRT implementation analysis;
- BRT implementation trend and uncertainty analysis;
- BRT scenario building;
- BRT implementation strategy, generation and development; and
- BRT monitoring and evaluation toolkit/criteria.

8.2.1. Definition of the BRT implementation scope

The study was conducted in the Limpopo Province of South Africa, within the Capricorn District municipality, in the Polokwane Local Municipality. The study concentrated on the entire municipal area, within the four main cluster settlements. These cluster settlements included, cluster 1(ward 1-9/Seshego and the CBD cluster), cluster 2 (ward 1019/Mankweng cluster), cluster 3 (ward 20-

29/ Molepo, Maja and Sekgwalaka clusters) and cluster 4 (30-38/Moletji cluster). Figure 8.2 shows the geographical scope of the study and the findings.

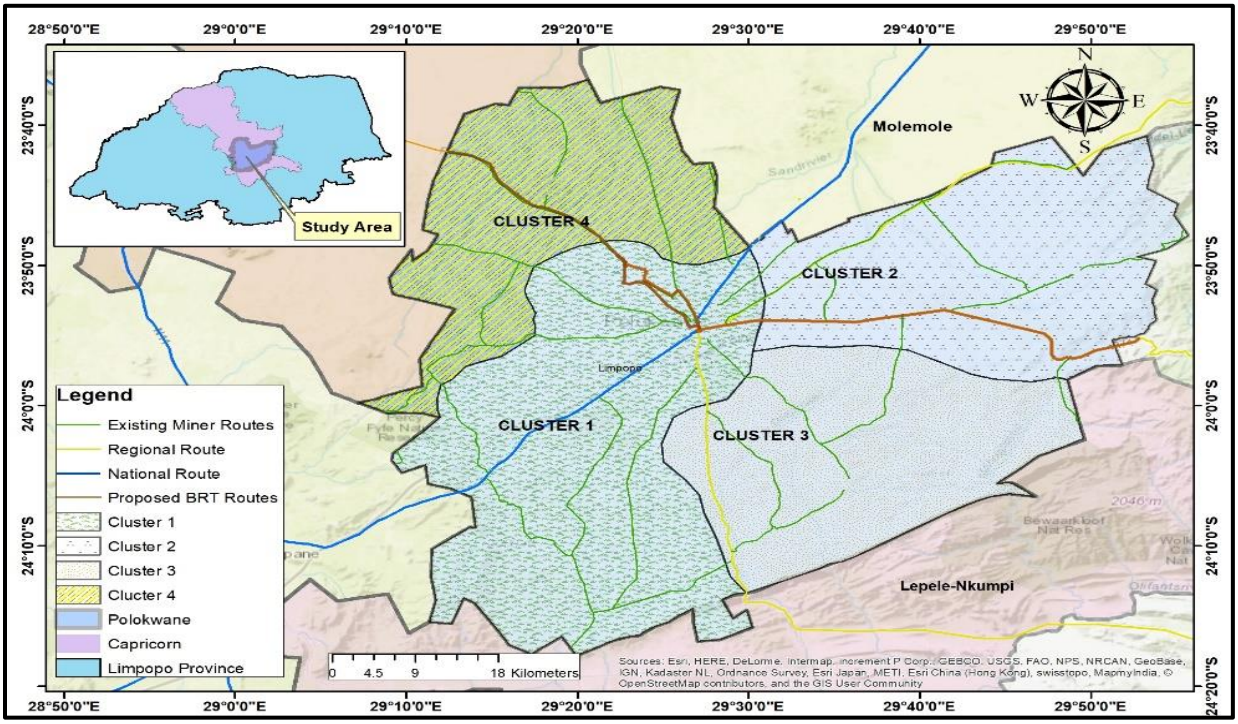

Figure 8.2. The four settlement clusters where questioners were distributed

Source: Authors construct (2018)

Figure 8.2 shows the four cluster settlements where data was collected to analyse the scenarios of the study.

The study findings revealed that the overall majority of the survey respondents of (55%) who were not aware about the system were from cluster 3 with the majority of survey respondents (17%) and cluster 3 with (17%). However, the overall least of the survey respondents (38%) were aware of the BRT system were from cluster (1) with the majority of survey respondents (19%) and from cluster 2 with (17%). Consequently, the least of survey respondents (13%) who indicated that they will shift from the use of the current mode of transport were from cluster 1 and 2. According to the Polokwane CITP (2013:36), Cluster 1 and 2 are closely located to the Polokwane CBD. This could be the reason why they were aware of the system to be implemented. This finding could contribute in influencing the different perceptions of the BRT system within the four main cluster settlements.

As indicated by Adjei and Behrens (2012:58), having access to new information about a project has impact on the choice of mode of transport. Henceforth, the majority of the survey respondents (13%) from in settlement cluster 3 and the majority of survey respondents (15%) from settlement cluster 4 were founegative perceptions about the BRT system and were unable to change their current mode of transport in favour of the BRT system. Therefore, commuters residing within these clusters are more than likely to continue experiencing (22%) of unaffordable transport system transport problems, particularly, in terms of unaffordable travel fare. Respondents from cluster 3 and 4 indicated unaffordable travel fare as their major transport problems. This scenario is further supported by the case study from New Delhi (India), in which according to Hildago (2009:3), the inability in engaging commuters regarding the implementation of New Delhi BRT system resulted in the commuters having a negative perception towards the system and increase in transport problems within the city.

The study analysis also revealed low population densities residing in cluster 3 and 4. It is for this reason that according to the Polokwane IRTP (2014:106), cluster 3 will be served by a BRT trunk extension. However, various studies conducted by Deng and Nelson (2012), and Cervero (2011:121) encourage densification along the BRT routes so to promote the use of the integrated non-motorized transportation. Therefore, it is most likely that the implementation of BRT system would attract major development along the trunk extension of BRT routes in cluster 4 thereby bringing spatial densification and compaction of the cities.

8.2.1.1. Summary of the analysis of the BRT implementation scope

In summary, the emerging BRT implementation scenarios in Polokwane are as follows, namely:

- (12%) commuters residing in cluster 1 and (16%) from cluster 2 have greater positive perception than (1%) from cluster 3 and (0%) from cluster 4.
- The differentiated spatial spread of perceptions might result in changes the transport situation in cluster 1 and 2;
- Commuters residing in cluster 3 (%)and 4 (%) were not adequately involved during the introduction of the Polokwane BRT system, which has negatively impacted on their perception of the BRT;
- The BRT system is likely to be successful in cluster 1 and 2, and likely to fail in cluster 3 and 4, due to the poor introduction of the system in the entire municipality; and

- There is also a need to densify areas around the zones and segments in which BRT trunk extension that lead to cluster 4 are to be implemented. This is in order to build the right densities in those areas to support viable operations of the BRT system.

8.2.2. BRT Perception analysis

Polokwane BRT perception analysis was based on three major factors that could impact the system when it starts to operate. These include, the BRT perception analysis based on communication methods used to communicate the system, preferred commuters travel needs, operational characteristics and the benefits associated with the implementation of the BRT system.

ThePolokwane commuters are likely to slowly switch from their current modes of transport to the use of BRT system. The slight change is reflected in the 13% who indicated that they will prefer to use BRT system once it is implemented. The slow switch is due to ineffective methods used to introduce the BRT system. The study findings ralsoevealed that the majority of respondents (56%) indicated that communication methods used to introduce the implementation of BRT were ineffective. These had negatively affected how commuters perceive BRT, as the majority of the respondents (i.e. 52%), indicated that BRT will continue to pose negative transport challenges. These findings are corroborated by Wight (2002:6) and Moylan *et al.* (2013:3), who indicated that in the beginning of the operation of the BRT system, the methods used to communicate the implementation of the BRT tend to determine the ensuring success levels and the number of commuters attracted to use the new system.

However, the literature reviewed, and the data collected complement the positive perception of the Polokwane BRT system. For example, the study data reflected the top three preferred commuters' travel needs; namely; which are reliable travel time (29%), affordable travel fare (25%) and safety and security (24%), while in terms of travel time, the majority of respondents (50%), preferred commuting during morning peak hours, while majority of respondents (42%), prefer paying travel fare of (R11-R20). In terms of preferred operational characteristics, the majority of respondents (22%) prefer to have security at the station. In terms of operational safety measures, the majority of respondents (24%) considered this a key aspect of a successful BRT system, again indicating the need for security improvement at the station. On the other hand,

another important dimension of the operational comfort measures the majority of respondents (23%), indicated that they prefer guaranteed seats.

Through benchmarking in terms of studies conducted by Moylan *et al.* (2013:2) and *Diaz et al.* (2004:ES-5), this highlighted that BRT systems are associated with frequent and reliable time, and that attracts commuters to the system. Saintnam *et al*., (2006:5), Diaz *et al., (*2004:2-3) and Wright (2005:67), indicated that the BRT system is highly incorporated and associated with comfort, safety and security measures. This included the need for guaranteed seats, specified carrying capacity, covers stations, surveillance cameras and security on the stations.

8.2.2.1. Summary of the BRT perception analysis

In short, the BRT perception analysis reveals the following important findings:

- The slow switch from the current mode to the use of BRT is due to ineffective methods of communication used so far;
- However, there is a big opportunity for the Polokwane BRT to attract a large number of commuters since it has the capacity to incorporate a better and more frequent service with assured reliable travel time. At the same time the BRT system can ensure comfort and security measures. However, there is not enough evidence that they will be enough numbers or densities along the BRT feeders route systems and trunk extensions to support the BRT system.
- The majority of commuters (77%) are willing to use BRT if its incorporates their preferred operational characteristics. According to the literature reviewed, successful BRT systems are those that provide full commuter service associations operational characteristics linked to appropriate levels of service (LOS) (Pulley *et al*, 2006:302).
- In terms of benefits, the current configuration of the Polokwane BRT offering can only result in success in a few areas that will be achieved. However, the downward challenges are that in its current configuration the BRT Polokwane will not be able to alleviate traffic congestion, increase commuting safety and commuting comfort.
- Whether the BRT transport system fare will be affordable is debatable. This is because if the proposed fare system will be very different from the current fare system, then the programme may fail on account of unaffordable travel fares. This may have negative effects on envisaged commuting changes. Some people might not be able to pay the

specified travel fare, as the key informants indicated that the travel fare will be determined by the financial model and not the commuters' preferences.

8.2.3. BRT implementation trends and uncertainty

The BRT trends and uncertainty analysis were based on the data collected from the field and the literature reviewed. To measure the trends and uncertainty, the study compared the current transport situation and the preferred transport when there is BRT. The following findings and scenarios that will be discussed hereunder were observed.

The study revealed that the implementation of BRT system will result in the following commuting trends. Includes a reduction in the use of of cars and taxi commuters in the use of other modes of transport, which include BRT system (13%) and conventional buses (with the majority of 30 %). The interview held with the key informants also indicated that the implementation of the BRT system will result in benefits such as the reduction of traffic congestion (23%), improving reliable unreliable transport (18%), unsafe transport system (18%) and uncomfortable travel system (15%). These findings complement the study findings by Deng and Nelson (2011:75), who indicated that implementation of Curitiba BRT system in Brazil was accompanied by socio-economic and environmental benefits such as reduction of greenhouse gas, as there was decreased dependency on private vehicles.

The Polokwane BRT system is likely to attract new developments along the,economic sectors and a eduction in the need for travelling. According to the preliminary interview held with the Polokwane transport official on the 22 February 2017, the Polokwane Municipality planned to densify open spaces adjacent to the corridors to support the system. this correlates with s the study conducted by Wright and Hook (2007:24) and Deng and Nelson (2012), Cervero (2011:121) and Diaz *et al*. (2014:76), who indicated that the implementation of BRT promotes mixed land uses, transit-oriented development and high densify developments play major role on local economy, employment rate and promote healthy leaving, by enabling people to walk or cycle to the closet socio-economic activity.

However, the study findings also revealed that there was a possibility for the existence of the following uncertainty elements after the implementation of the BRT system. Commuters residing in cluster 4 and 3 are unlikely to shift from the use of conventional buses to use any other mode

of transport provided the new system is affordable, reliable, safe and comfortable. This is because currently they consider conventional buses cheaper and easy to access than other modes of transport.

8.2.3.1. Summary of the BRT implementation trends and uncertainty

In short, the BRT implementation trends and uncertainty modes are the following, namely:

- Implementation of BRT will result in a reduction un dependence on commuting on private cars (from 27% to 24%) and taxis (from 35% to 14%);
- BRT implementation is anticipated to result in increased numbers of people using conventional buses (from to 28% to 30%) and BRT buses (13% from the start day of operation) as their mode of preferred public transport;
- The system is likely to attract more investors, resulting in an increase in the number of job creation and opportunities;
- The highly densified developments will also promote healthy living within the municipality by encouraging walking and cycling;
- Traffic congestion and greenhouse emissions are likely to decrease as most people will prefer using conventional buses and BRT system;
- There are high chances that the Polokwane BRT travel fare will be unable to satisfy the preferred travel fare of the commuters residing in cluster 3 and 4. This is because these clusters are located at the outskirt of the city.

8.2.4. BRT implementation scenario building analysis

The Polokwane BRT implementation scenario building options was based on two major scenarios which are:

- Polokwane public transport without the BRT; and
- Polokwane public transport with the BRT system

These two scenarios further evolved and suggested the formulation of other scenarios based on the Polokwane BRT physical implementation phases and the spatial difference of each phase. The scenarios are best described below as follows:

8.2.4.1. Polokwane public transport without the BRT system

From the study findings, if the Polokwane public transport system continues to operate without the BRT in place, commuting problems are projected to worsen. The Polokwane commuters are likely to continue experiencing transport challenges from being highly dependent on the unscheduled and full-load factor system of operations utilised by taxis (currently used by the majority of 35%) and cars (currently used by the least 28%). This might result in an increase in traffic congestion, air pollution and urban sprawl as indicated by Pojan and Stead (2015:7785), Saitennam *et al*., (2006:60) and Chakwizira *et al*. (2014:564). Transport challenges such as unaffordable travel fare, particularly by people residing in cluster 3 and 4 (clusters located far from the Polokwane CBD) are likely to escalate than other transport problems. This confirms the findings of the study conducted by Vaz and Venter (2012:1), which precisely stated that spatial differences between the transport system and socio-economic land uses tend to increase the travel fare for commuting. It is also evident that transport problems such as unreliable travel time, unreliable travel information and delays, poor safety and comfort measures are likely to escalate. This was further supported by the study conducted by Vilakazi and Govender (2014:260), which indicated that public transport such as provided by taxis and buses are always overcrowded, unsafe, associated with inefficient travelling time and poorly trained drivers.

8.2.4.1.1. Summary of the analysis of Polokwane public transport without the BRT system

In short, without a BRT system, Polokwane public transport scenario will comprise of the following:

- Continued increase in high dependency of taxis and cars;
- Increase in traffic congestions, emission of greenhouse gases, air pollution and urban sprawl;
- Increase in unaffordable travel fare, in particular for those residing in cluster 3 and 4; and
- Increase in transport problems such as overcrowding, unsafe and uncomfortable transport systems, driven by poorly trained drivers.

8.2.4.2. Polokwane public transport with the BRT system

Most of studies conducted by Deng and Nelson (2013:26) and Cervero (2013:14), indicated that the BRT system is likely to bring changes on commuting situation in a particular area. Deng and Nelson (2013:26), further indicated that the majority of the commuters perceived BRT system as a reliable system that addresses transport challenges such as reliable transport, affordable travel fare, and safety and comfort measures. Consequently, the implementation of the BRT system will likely lead to the introduction of commuting changes. This was reported by he 8% respondents, who indicated that they would prefer to use BRT when it begins to operate. Furthermore, the majority of (77%) the respondents indicated that they will shift to use the BRT system if it is incorporated with their preferred travel time, travel fare, stated operational characteristics, operational safety measures and comfort measures. It is evident that Polokwane commuters will shift to use the system, as the study conducted by Wright and Hook (2007:11 and 264) and Werighsen *et al.,* (2013:1), indicated that BRT implementation is associated with high quality operational characteristics and it is customer oriented as it ensures that the system is accessible, affordable, aesthetic, safe and comfortable.

8.2.4.2.1. Summary of the scenario with BRT implementation

In short, with a BRT system, Polokwane public transport scenario will comprise of the following:

- Positive changes in commuting situation in Polokwane Municipality;
- Decreased use of the currently high level of taxis and car usage, which will result in reduction of traffic congestion and greenhouse emission; and
- Increase in use of non-motorized transportation.

8.2.4.2.2. BRT implementation with completed phase 1 scenarios

The study scenario of the completed phase, indicates that the majority of the survey respondents residing in cluster 1, are likely to benefit from the BRT system as compared to the commuters residing in cluster 2, 3 and 4. This is becouse the system has not yet been completed. The majority of the survey respondents (19%) residing in cluster 1, further indicated that the system was well introduced to them as compared to the minority of survey respondents (1%) from both cluster 3 and 4. This could have resulted from the fact that the municipality was continuously engaging with

them before the actual implementation of the phase one. As a result, the majority of the survey respondents (13%) indicated that they will shift to use the system are from cluster 1. The disparity of the settlements and distances from the BRT stations to the residents, requires extensive feeders within the settlements, to attract more commuters to use the system. This was supported by Wright and Hook (2007:8), who stated that a well-integrated BRT system, must be accessible, safe and efficient. It does so by providing walkable urban structure that promotes walking, ensures that the design considers disabled people, and promotes densification along the BRT routes. It was also observed that many areas along the BRT are not yet developed. According to Deng and Nelson (2013), a successful BRT system is supported by active socio-economic development, such as Transit Oriented Development, whose characteristics and footprint are still evolving and being developed in Polokwane municipality currently.

8.2.4.2.2.1. Summary of the scenarios from the completed BRT system

In short, with a completed BRT system, the Polokwane public transport scenario will comprise of the following:

- Commuters residing in cluster 1, are more likely to shift from their current mode of transport, because they were frequently engaged;
- The implementation of the BRT system is likely to promote urban densification along the Seshego BRT routes; and
- Commuters residing in cluster one, served by the completed BRT phase 1, are likely to shift to use Non-motorized transportation such as walking and cycling as their mode of transport over time for short distance travel as a supplement for using BRT for long distance travel.

8.2.4.2.3. BRT implementation with full implementation scenarios

An implementation of the Polokwane BRT system will result in various changes and benefits. However, the method used to communicate the implementation of the system, is likely to slow the chances of commuting progress that can be achieved. However, in terms of transport service quality offered by the BRT system, scholars such as Deng and Nelson (2011:70) and Satiennam *et al.* (2006:69), indicated that BRT system is designed to improve service quality such as reliability, comfort, services, safety and comfort. These service qualities are the most preferred

commuters' travel needs, as reported by the Polokwane respondents. Wright (2005:11), further indicated that the BRT system is designed to suite the customers' needs such as frequent speed (reliable time), comfort, convenience, cost (affordable travel fare), and safety. Consequently, the full implementation of the system will attract commuters from all clusters, thereby reducing taxis and car dependency, while promoting walking and cycling.

Various scholars, including Cervero, (2011:121), Diaz *et al.,* (2014:76), and Mganda, 2017:6, further highlighted that the system is associated with Transit-Oriented Development, urban densification, mixed land uses. This will result in the system being able to promote walking and cycling as major modes of transport within the municipal areas. The creation of new developments will further increase the decentralization of socio-economic services to areas located far from the Polokwane CBD. This includes settlements located in cluster 3 and 4. The decentralization of settlements along BRT corridors serving clusters 3 and 4, will improve the affordable travel fare and people will have better access to basic services.

UNEP (2011:382), indicated the overall benefits of the BRT system implementation, which are likely to be experienced by the Polokwane commuters when there is full BRT system in operation. The benefits include, environmental benefits, such as low greenhouse gases, protection of global climate, and reduction of dependency on non-renewable resources such as BRT buses that use renewable energy and fuel sources rather than oil). Nykvist and Whitmarsh (2008:1374), indicated the overall social benefits that the Polokwane BRT is likely to bring in after the implementation of a full BRT system as the following: fair socio-economic accessibility and mobility, safety and security, fitness and health, equity, social cohesion and affordable transport systems. The study conducted by UNEP (2011:382) Wright and Hook (2007:253) and Nykvist and Whitmarsh (2008:1374), the economic scenarios accompanied by the full implementation of the BRT system include benefits in the municipal revenue, job creation, massive socio-economic developments such as Transit Oriented Development, which support walking and cycling, reduction in travel time which result to increased economic productivity and improved work conditions.

8.2.4.2.3.1. Summary of the scenarios arising from the fully implemented BRT system in Polokwane

In short, emerging scenarios arising from the full implementation of the BRT system in Polokwane will comprise of the following:

- The method used to introduce the implementation of the Polokwane BRT system is likely to result initially in slow changes in the rate of commuters switching over from the use of the current modes of transport to the use of Polokwane BRT system;
- Slow progress in the shift from the use of taxis and cars to the use of the system, as the system provides the major service quality preferred by the Polokwane commuters;
- Creation of new developments, such as mixed land uses, transit oriented development, and densifying areas along the BRT routes. This will promote the use of non-motorized transportation, job creation and promote affordable transport systems.
- The municipality is likely to benefit from the low greenhouse emission, from an environment with less traffic congestion and less dependency on non-renewable energies. This will benefit healthy living within the municipality and improve standards of living.
- The commuters will benefit from the easy access to socio-economic activities, social cohesion and affordable travel fare.
- The implementation of BRT system in Polokwane will address commuting problems such as unsafe and uncomfortable transport system, delays, traffic congestions, unaffordable travel fare, and unreliable travel time.

8.2.5. BRT strategy definition, generation and development

The data collected also indicated loopholes in the implementation of the Polokwane BRT system. However, with the assistance from the reviewed literature, the key informants interviewed held with the municipal officials and the company responsible for the implementation of the Polokwane BRT system, provided critical insights on how the BRT system can be further improved. The study managed to propose the strategic scenarios that will be addressed to overcome identified BRT challenges. The study strategy definition generation and development scenarios are extensively discussed below:

Strategy definition generation and development are meant to address the possible main negative scenarios that may have impact towards the implementation of the Polokwane BRT system. The strategies to be discussed were obtained from the data collected from the key informants and the literature reviewed. The study BRT system strategy definition, generation and development are extensively discussed hereunder:

(i) Adopt an effective method of communicating the introduction of implementing the BRT system.

The study revealed that the majority of respondents (56%) indicated that the Polokwane Local Municipality had used an ineffective method of communication to introduce the implementation of the Polokwane BRT system. As indicated by Jarzab *et al.* (2002:38), an effective method of introducing the system to the commuters, is the key element that determines the success of the BRT system. The study data may imply that the project might fail, and as a result, there would be no changes in the transport situation within the Polokwane municipality, even when BRT has been implemented. However, to avoid the same situation when implementing phase 2 and 3, the municipality must adopt an effective method of communication. Such an effective method of communication will include, effective public participation, marketing strategies such as broachers, the use of video clip, websites, advertisement in the newspaper, television and radios. as these can assist in reaching out and catching the attention of a large number of commuters who are likely to use the BRT system (Seitanaam *et al.,* 2006). These marketing strategies are crucial, as they significantly discuss the concept, its advantages, and benefits and how it differs from the other modes of transport. According to Jazabl *et al.* (2002:38), the marketing strategies for the branding of BRT appear to influence the perception of commuters including the general public, public transport operators, the press and the elected officials who will react to the service when it starts operating.

(ii) The BRT feeders must be sustainable integrated with the BRT stations and the current existing modes of transport station

To maintain the preferred commuters travel needs, there is a need for the Polokwane BRT system to integrate the existing transport system through a feeder system that provides opportunities for including the taxi system as part of the extended BRT system. Taxis are the dominate modes of transport within the Polokwane Municipality (Polokwane CITP, 2013:161), and they can be effectively integrated with the BRT system. This measure would assist in cutting the cost of the BRT system for implementation. At the same time, this would support the efficiency of the system, as they already have the infrastructure in place and can easily penetrate through residential streets. As a result, BRT stations with efficient feeders would increase commuting safety, comfort and reliable travel time. Using these feeders will be optional. The study conducted by Satiennam *et al*. (2006:63), further showed that integrating the BRT system with the existing transport as

feeders increase BRT capacity, but also improve the accessibility of communities around BRT stations.

(iii) Develop a mixed land uses, Transit Oriented Development and densification along the BRT routes

It was also observed during the data collection and in chapter 4 (the study analysis) that areas adjacent to the BRT routes are vacant. Particularly in cluster 3 and 4. According to the literature Litman (2017:5) and Deng and Nelson (2012), a successful BRT system is supported by densified development along the corridors that promote walking and cycling, so as to reduce the use of motorized transportation. Therefore, the Polokwane municipality needs to densify developments along the BRT system, to ensure that the system operates in a successful manner.

(iv) Opportunity to establish a renewable energies and technological fuels that are used by the BRT system

As indicated by the literature (Pienaar *et al.,* 2005:373, Saitiennam *et al.,* 2006 and Pojani, 2015:7791), the system uses renewable energy and clean technological fuels. The municipality can invest in a company that will produce renewable energy and biofuels that can be used by the BRT bus system. This would result in the reduction of the greenhouse emission from the system and promote job creation and healthy living within the municipality.

8.2.6. BRT implementation monitoring toolkit/criteria

The monitoring tool-kit or criteria were designed to address the major identified strategies and the challenges likely to arise during the BRT implementation process. For the Polokwane BRT to be successful in the long run, and to ensure that the municipal officials adopt the monitoring toolkit to successfully implement the remaining phases, the BRT monitoring and evaluation toolkit should be developed and in place to ensure optimal erformance. It is advisable to propose the monitoring toolkit or criteria to be generated on the backdrop of answering the identified BRT strategies and challenges in Polokwane. The table below shows how the strategies, challenges identified can be addressed by the monitoring toolkit. Table 8.1 below show the BRT implementation and evaluation toolkit.

Table 8.1. The BRT implementation and evaluation toolkit

Strategies and challenges	Monitoring	Evaluation
1. Ineffective method of communication	The municipality must assess and adopt the most effective method of communication when implementing the remaining phases of the Polokwane BRT.	Assess and adopt the method of communication the commuters are familiar with.
2. Poor integration of the system with the residential settlements and other socio-economic activities.	The implementers must propose a feeder route system and network of operators that will load and offload commuters closer to the residential settlements. This will increase integration, promote accessibility, affordable travel fare, safety and comfortable commuting, promote the use of the non-motorized transportation and healthy living	Assess the most used current mode that can be used as a feeder to the BRT station/system. For example, Taxis, since these are the dominate modes of transport, which can easily penetrate through residential streets and even in areas in which available road infrastructures for the mode are inadequately developed.
3. Develop a mixed land uses, Transit Oriented Development and densification strategy and plan along the BRT routes/corridors in Polokwane	The municipality must make sure that areas along BRT routes are densified	Assess the type of the socio-economic activities that are in demand per cluster and densify such activities along the corridors to reduce traveling needs and promote the use of NMTs.
4. Attracting all commuters and serving them with their preferred commuters travel needs and BRT operational characteristics.	Re-introducing the Polokwane BRT while ensuring that all commuters from various clusters are well informed.	Re-introduction of the implementation of BRT and ensuring that commuters from different clusters are well informed about the system Ensure that the stated commuters travel needs, and operational characteristics are incorporated when implementing the system.
5. Opportunity of establishing a company that produces sustainable renewable energies and fuel that can be used by the BRT vehicles.	The municipality can propose to develop a company that will produce renewable energies and biofuels that will be used by the Polokwane BRT to generate the municipal revenue and create new jobs.	Assess the skills the local people have in relation to the production of the sustainable renewable energies and clean fuels

Source: Authors construct (2018)

Table 8.1 shows the strategies and challenges that are likely to arise after the implementation of Polokwane BRT system and the monitoring and evaluation toolkit that can assist to reduce the impact of such challenges.

8.2.7. Summary of the findings of Scenario-based analytical approach

The analysis of the study using the six stages of the SBAA is summarized hereunder by Table 8.2.

Table 8.2. Summary of the SBAA findings in table format

Six stages of SBAA	Major arising scenarios
Definition of BRT implementation scope	• The majority of survey respondents of (27%) from cluster 1 and (20%) from cluster 2 have slightly positive perception towards the system, while the minority of the survey respondents of (15%) from both cluster 3 and 4 have extremely negative perception towards the system. • this might result to that the commuters residing in cluster 1 and 2 to transect from their current mode to the use of BRT system, which reflect the success of the system

	• However, the municipality is likely to continue experiencing transport problems from commuters residing in cluster 3 and 4, due to their lower cognitive appreciation towards the system, since they lack information of the new system
BRT implementation perception analysis	• The method of communication used to announce the implementation of the BRT system resulted in the Polokwane commuters negatively perceiving the implementation of the Polokwane BRT system. • Poor communication of the BRT might mean the organizational structure and the adopted institutional framework for BRT implementation was incompetent • This would result to a slow switch-over from the commuters' current mode to the use of BRT system. • The data collected and in conjunction with the reviewed literature, indicated that system that will be able to meet the commuters stated commuters travel needs and commuters preferred operational characteristics. Since the system is associated with safe, comfortable, and reliable transport services. • This will result in massive changes and switch-over from the current modes to the use of BRT systems.
BRT implementation trends and uncertainty analysis	• The Polokwane commuters will shift from the use and high dependency of private cars and taxis to the use of BRT system and the conventional buses. • This was observed from the least of respondents (13%) indicated that they will shift from their current mode of transport to the use of BRT system. • This is likely to result to the reduction of transport problems such as reduction of traffic congestion, greenhouse gases, unsafe, uncomfortable, unaffordable and unreliable transport system
BRT implementation scenario building	The study was based on two major scenarios, which are: • Scenarios of Polokwane public transport without the BRT system ✓ Increase in high dependency of taxis and cars, ✓ Resulting to increase in traffic congestions, unaffordable and unreliable transport systems which contributes to emission of greenhouse gases, air pollution and urban sprawl, particularly in cluster 1 and 2, which are currently experiencing traffic congestions from taxis and private cars; ✓ Increase in unaffordable travel fare, particularly those residing in cluster 3 and 4 • Scenarios of Polokwane public transport with the BRT operating ✓ Changes in commuting situation in Polokwane municipality, ✓ Decreased in the high level of taxis and car usage, which will result in reduction of traffic congestion and greenhouse emission ✓ Increase in socio-economic benefits such as job creation and easy access to services from the newly developed activities • Scenarios from the completed BRT system, phase 1 (one). ✓ Commuters residing in cluster 1, are more likely to shift from their current mode of transport, because they were frequently engaged, ✓ The implementation of the BRT system is likely to promote urban densification along the Seshego BRT routes. ✓ Commuters residing in cluster one, served by the completed BRT phase 1, are likely to shift to use Non-motorized transportation such as walking and cycling as their mode of transport.
BRT implementation strategy generation and development.	The study strategic definitions, generation and development are as follows: • Poor communication methods or strategies • -Poor integration strategies • -Poor land use development strategies
BRT monitoring and evaluation toolkit.	• Assess and adopt the method of communication that the commuters are familiar with. • Assess the most used current mode that can be used as a feeder to the BRT station/system. ✓ For example, Taxis, since it the dominate mode of transport, these can easily penetrate through residential streets and there are available road infrastructures of the mode. • Assess the type of the socio-economic activities are in demand per cluster and densify such activities along the corridors to reduce traveling needs and promote the use of NMTs.

	• Re-introduced the implementation of BRT and ensure that commuters from different cluster are well informed about the system • Ensure that the stated commuters travel needs, and operational characteristics are incorporated when implementing the system. • Assess the skills the local people have in relation to the production of the sustainable renewable energy's and clean fuels

Source: Authors construct (2018)

Figure 8.2 shows the findings of the six critical stages of the Scenerio Based Analytical Approach in a table format. These six stages critically analysed the perception of commuters towards the Polokwane BRT system. Figure 8.3 shows the critical findings of each step of SBAA in a cycle format.

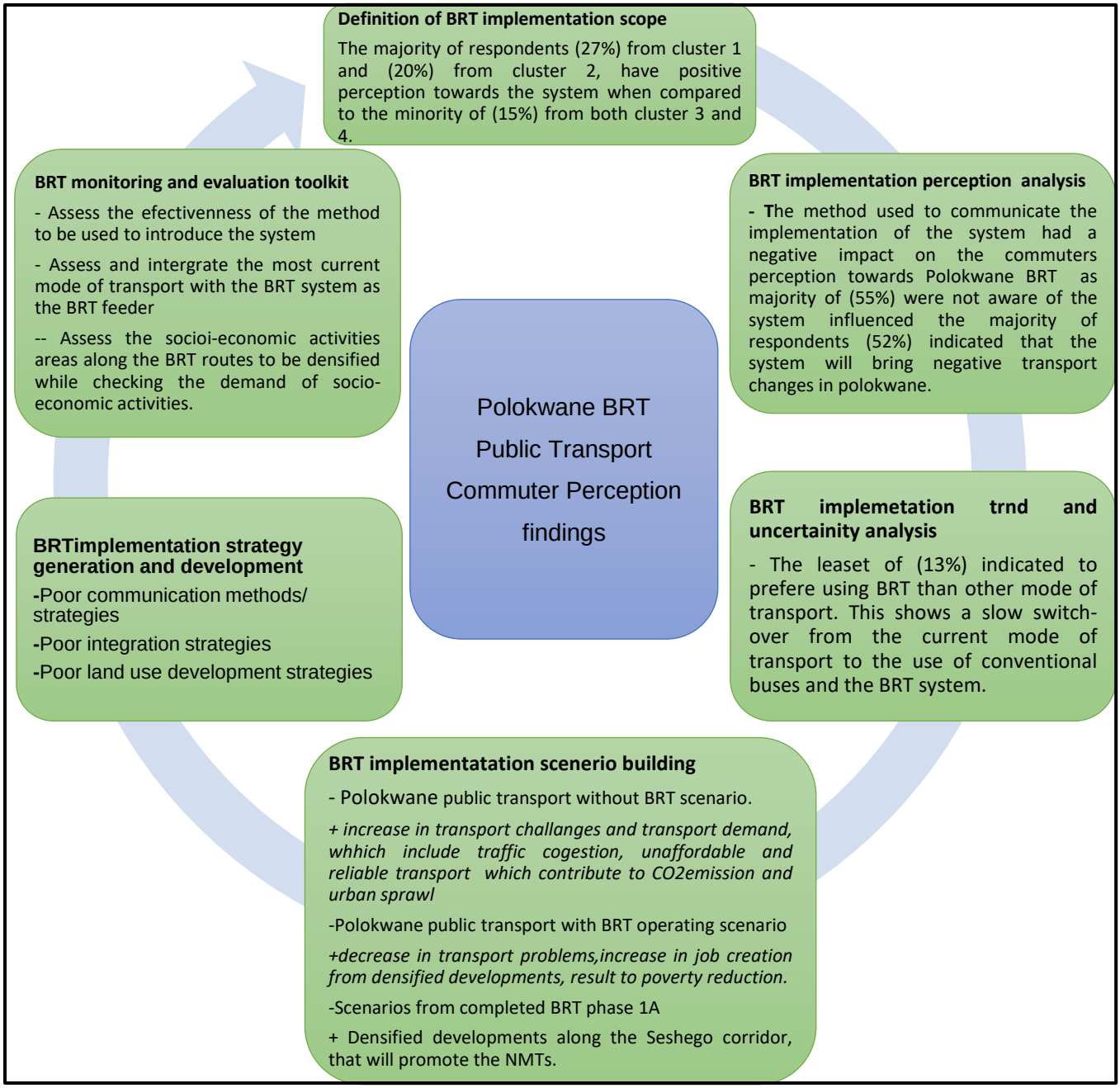

Figure 8.3. Critical findings of the SBAA

Source: Authors construct (2018)

Figure 8.3. shows the critical findings of the six stages of SBAA analysis. The findings revealed that the perception of BRT system varies, depending on spatial dimensions. Commuters residing closer to the Polokwane CBD have greater positive perception towards BRT system, as compared to those residing far away from the CBD. This was influenced by the method used to communicate

BRT implementation, as it was found out to be ineffective since it did not reach the majority of 52% of the commuters. However, regardless of the ineffective method of communication, the study further revealed a slow switch over from the current mode of transport to the use of BRT. Furthermore, the three tested scenarios revealed that without the implementation of BRT, the municipality will continuously experience high transport challenges, but the municipality is likely to reduce transport problems and challenges, increase in job creation from densified developments. The findings further revealed that the municipality adopted poor strategies of implementing BRT system. Furthermore, further findings revealed that there is a need to adopt effective monitoring and evaluation tool kit in order to ensure that the remaining phases to be implemented considers commuters travel needs.

8.3. Chapter summary

The SBAA tool analysed the data collected from the study using the six stages of the approach. It was found that if the Polokwane public transport continues to operate without the the BRT system, the municipality is likely to continue to experience high transport problems, particularly, increase in unaffordable travel fare by commuters residing in cluster 3 and 4, and traffic congestion experienced by commuters residing in cluster 1 and 2. It was also found out that the method used to communicate the implementation of the BRT system was not effective and had a negative impact on the perception of how the commuters perceived the BRT system. The chapter also proposed a possible BRT implementation monitoring and evaluation toolkit based on the challenges and strategies that were identified during the course of the study. The following chapter features the summary of the study findings and the recommendation of the BRT implementation guideline framework that considers commuters travel needs.

CHAPTER NINE: SUMMARY OF THE FINDINGS AND RECOMMENDED GUIDELINE FRAMEWORK THAT CONSIDERS THE COMMUTERS' TRAVEL NEEDS

9.1. Introduction

This chapter presents a summary of the study on commuters' perceptions towards the implementation of the BRT system: a case study of Polokwane BRT system. The summary highlights the summary of the study, main findings, recommendations on guidelines framework that consider commuters travel needs, findings, scenarios findings, areas of future research and the general conclusion. Figure 9.1. highlights the structural settings of this chapter.

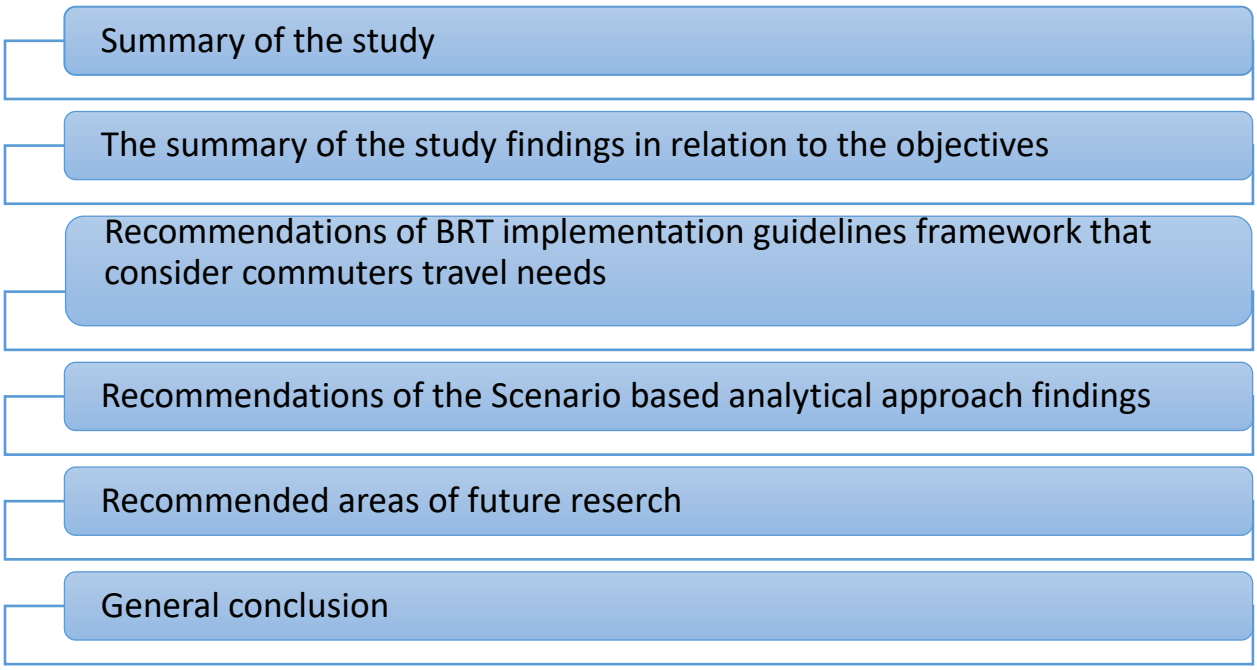

Figure 9.1. Structural settings of chapter nine
Source: Authors construct (2018)

Figure 9.1 shows that chapter nine is structured into six components, which include the summary of the study, the summary of the study findings in relation to the objectives, recommendations of BRT implementation guidelines framework, recommendations of the Scenario based analytical approach findings, recommended areas of future research and general conclusion.

9.2. Summary of the study

This study investigated commuters' perceptions towards the implementation of Polokwane BRT system in Polokwane Local Municipality. The study aimed to assess commuters' perceptions throughout the implementation phases. The study investigated if the Polokwane BRT would be able to meet commuter travel needs and operational preferences, thereby recommending a guideline for implementing BRT system, which considers commuters' travel needs. Data was acquired using the questionnaires and key informant interviews from the general commuters, company responsible for implementing the BRT system and the Polokwane municipal officials. The study used the SBAA to analyse the collected data with the aid of SPSS and Microsoft excel to present the study findings.

9.3. Summary of the study findings in relation to the objectives

The summary of the study findings is based on the four main objectives of the study, which are as follows:

9.3.1. To determine the perceptions of commuters on the implementation phases of Polokwane BRT

The study findings revealed that the methods of communication used to introduce the implementation of the Polokwane BRT system had some influence on the commuters' perceptions towards the BRT system. This was noted from the majority of survey respondents (55%) who were not aware about the BRT system. This influenced the majority of the survey respondents; (52%) indicated that the system would bring negative changes to the transport system in the area, since it would interrupt the operation of the current transport systems. All the key informants indicated that public participation was mostly used to communicate the introduction of the system. The majority of the survey respondents (60%) indicated that they never heard about the system. This has directly impacted on the majority (56%) of respondents who indicated that the methods used for the introduction of the BRT system were extremely ineffective, because they did not effectively reach the majority of the respondents within the study area.

The majority of survey respondents (43%) indicated that they that they will not shift from their current mode of transport in favour of the BRT system because they were not involved in the stakeholder engagement for introducing the BRT system. These findings revealed a negative perception towards the implementation of the BRT system due to poor communication methods used. According to Jazabl *et al*. (2002:38), an ineffective method of communication or marketing strategies of BRT implementation is linked with the failure of the BRT system. Hildago (2006:15), indicated the increase of transport problems such including traffic congestion from private cars. These would result in traffic congestion, high emission of greenhouse gases, unaffordable travel fare and the unsafe and uncomfortable transport systems.

9.3.2. To assess if the implementation in the Polokwane BRT would meet the stated preferences of commuters' travel needs

The study findings revealed that commuters' travel needs influence the choice of mode of transport. This was observed from the analysed data indicating that different commuters travel needs differ from one settlement cluster to the other. However, the majority of the survey respondents (29%) indicated reliable travel time as the most prominent travel need consider by commuters before choosing a mode of transport, followed by affordability with (25%) and least of respondents (16%) considering comfort. This influenced the majority of (30%) preferring to use the conventional bus than other modes of transport for commuting, since it has a specified reliable travel time and its travel fare is the most affordable of them all. These findings influenced the majority of the survey respondents (29%) that preferred paying travel fare that ranges between R11.00-R20 for distances ranging from 11-20km, to be preferring to travel during morning peak hours (Morning peak hours).

According to the interview held with the key informants and the literature, the Polokwane municipality would be able to satisfy the need for a BRT system that provides reliable travel time. For example, according to the Polokwane IRPT (2013:16), the key informants interviewed, and the observed data indicated that the system will have morning early peak hours (06-00 to 0800) that will run at the frequency of 10 minutes intervals, with 15 buses to increase the reliable travel time through increased headway frequencies.

9.3.3. To assess if the Polokwane BRT operational characteristics will respond to commuters' preferences

The study findings revealed that the operational characteristics of Polokwane BRT system will play a major role in attracting commuters to use the system. This was noted from the majority of the survey respondents, (77%) indicated that they will shift to the use BRT system, only if it incorporates the system preferred operational characteristics. It was observed and found out during the study that Polokwane transport systems are associated with transport problems such as traffic congestion, poor safety measures, unreliable travel information, poor comfort measures. Consequently, majority of survey respondents of (22%) indicated that security at the station is a major characteristic that Polokwane BRT must incorporate into the system, in order to attract people to use the system. In terms of operational safety and security measures, (24%), majority of the survey respondents indicated that there must be tight security for online and card payment, to avoid scams and pickpocketing. However, in terms of operational comfort measures, the majority of survey respondents (23%) were concerned about guaranteed seat.

The majority of (51%) survey respondents indicated that the Polokwane BRT system would be able to attract commuters if it displays the commuter travel information on the display screen. This was deemed to be a very crucial since it was found out that the current transport systems in Polokwane are challenged with unreliable travel information. (26%) of the majority survey respondents would shift to the use of BRT if it is affordable. However, (23%) majority of the key informants interviewed indicated that the Polokwane BRT aims to address traffic congestions with (12%) of the minority of survey respondents indicated that it will solve the unaffordable transport problems. Furthermore, the system expected operation logistics might be affected by the lack of supporting developments along the corridors. Consequently, even if the Polokwane BRT system contains the commuters preferred operations characteristics, operating in empty corridors, will cripple the system in the long run. Cervero (2013), thus indicated that BRT system effectively operates where there are high densities, mixed land uses and transit-oriented development.

9.3.4. Recommendations of BRT implementation guidelines framework that consider commuters' travel needs.

The study findings revealed various gaps that needs to be addressed to completely provide commuters travel needs that are preferred by the commuters. These gaps will be addressed by BRT guideline framework. The study recommends BRT implementation guideline framework are as follows:

9.3.4.1. Adoption of effective and familiar method of communication

The study findings highlighted that the poor and negative perceptions of the Polokwane BRT were influenced by the ineffectiveness of the method used to introduce the implementation of the BRT system. Lightboy *et al.,* (2002:38), emphasized that the method of communication and or marketing strategies are the key element that determines the success of the BRT system. Therefore, to ensure and to gain a positive perception of BRT system, particularly when implementing the remaining phases (2 and 3), there is a need to employ a robust and vibrant strategy. The municipality must adopt and use effective methods such as video clips, the use of websites and broachers since they can easily reach all commuters from different clusters.

9.3.4.2. Integrating the existing public transport as the feeders to the systems

The Findings further show that the proposed BRT is not integrated with the existing transport, which already has infrastructure in place. However, to increase the system's commuter travel needs such as safety, affordable travel time, reliable travel time and comfortability, the system needs to sustainably integrate with the current operating public transport. This will also reduce the costs of buying new BRT vehicles, and infrastructure, while meeting commuter travel needs. Satiennam *et al.* (2006:63) and Wright and Hook (2007:8), further emphasized that integrating BRT system with other public transport systems as feeders to the system enhances both sustainable accessibility and efficiency towards socio-economic activities, which increases the ridership of the system.

9.3.4.3. Densifying developments, provision of mixed land uses and Transit oriented development along the BRT routes

The study recommends a densified, mixed land use and transit-oriented development along the BRT routes, in order to maintain, increase the system ridership and positive operations. According to Deng and Nelson (2012:78), mixed land use and TOD improve the operation of the system and reduce the need of using motorized vehicles from operating.

9.3.4.4. Consideration of the spatial differences of the commuters

The study shows that the municipal spatial differences have impacts on the commuter travel needs that must be incorporated when implementing Polokwane BRT system. Therefore, the following factors must be considered.

- Must ensure that commuters travel fare vary depending on spatial location of an area;
- Must ensure that all socio-economic classes are covered by the travel fare;
- Must ensure that travel time for commuting differs depending on the spatial location; and
- Must ensure that safety and security measures are implemented in the hotspot crime areas.

9.3.4.5. Adoption of the Avoid Shift Improve strategy

The company responsible for the implementation of Polokwane BRT system must ensure that the system has factors that support the Avoid Shift Improve strategy. Bos and Temme (2014:3), indicated that the Avoid Shift Strategy promotes the use of environmental friendly mode of transport, which uses cleaner fuels, electric vehicle and effectively integrated or mixed development to support walking and cycling. Considering that (7%) of the survey respondents preferred walking and (6%) preferring other modes such as carts, and motorcycles. Adopting to this strategy might result in attracting commuter perceptions towards the system, and eventually shift to use it or use the other sustainable mode of transport.

9.3.4.6. Appointment of competent institutional framework and organizational structure for facilitating the implementation and operation of the Polokwane BRT system

Institutional framework and organizational structure play a major role in the facilitation and implementation of the BRT system (Tunner *et al.,* 2012:19 and Wright (2002:150). Therefore, poor communication in the implementation of the Polokwane BRT system might have resulted from a poor and incompetent institutional framework and organizational structure appointed. Consequently, the study recommends that the municipality adopt effective institutional structure and appoint competent organizational structure for the facilitation and operation of the BRT system. By so doing, the municipality will be able to win positive perception from commuters towards the system.

9.3.4.7. Adoption of an the effective guideline framework outline that would consider the following outline

The study recommends that a successful BRT implementation that consider commuters travel needs must adopt the effective guideline framework. Figure 9.2. shows the outline of the effective guideline framework.

Guideline framework outline:

1. The role and purpose of BRT implementation of guideline framework that considers commutes travel needs.

1.1. Background
1.2. Focus of the guidelines
1.3. Targeted audience
1.4. Report structure
1.5. Application of the guideline framework

2. Contextualising the policy and legislations that support the implementation of BRT guidelines

2.1. Policy context
2.2. Legislation context
2.3. Founding principles
2.4. Institutional framework and organisational structure

3. Defining the focus of the guideline framework products of commuter's travel needs

3.1 Travel time
3.2. Travel fare (Affordability)
3.3. Comfort measures
3.4. Safety and security measures

4. Recommended guidelines

5. Definition of the guideline framework terms

6. Schematic diagram of the guideline framework that consider the commuters stated travel needs

Figure 9.2. Guideline framework outline

Source: Authors construct (2018)

Figure 9.2 shows that the effective guideline framework outline is composed of six components; namely which include the role and purpose of BRT implementation of guideline framework that consider commuters' travel needs, policies and legislations that support the implementation of BRT guidelines, defining the focus of the guideline framework, defining the terms and conditions of the guideline framework and a schematic diagram of the guideline framework that considers the commutes' travel needs.

9.4. Recommendations of the scenario based analytical approach findings

The study adopted the scenario analytical tool to assess the possible scenarios of public transport without and with the BRT system operating. The findings of the scenarios were slightly similar to the findings of the study objectives. However, to be precise and to effectively respond and recommend the findings of SBAA. The researcher recommends the analytical tool using the six stages of the SBAA. The recommendations are outlined in Figure 9.3.

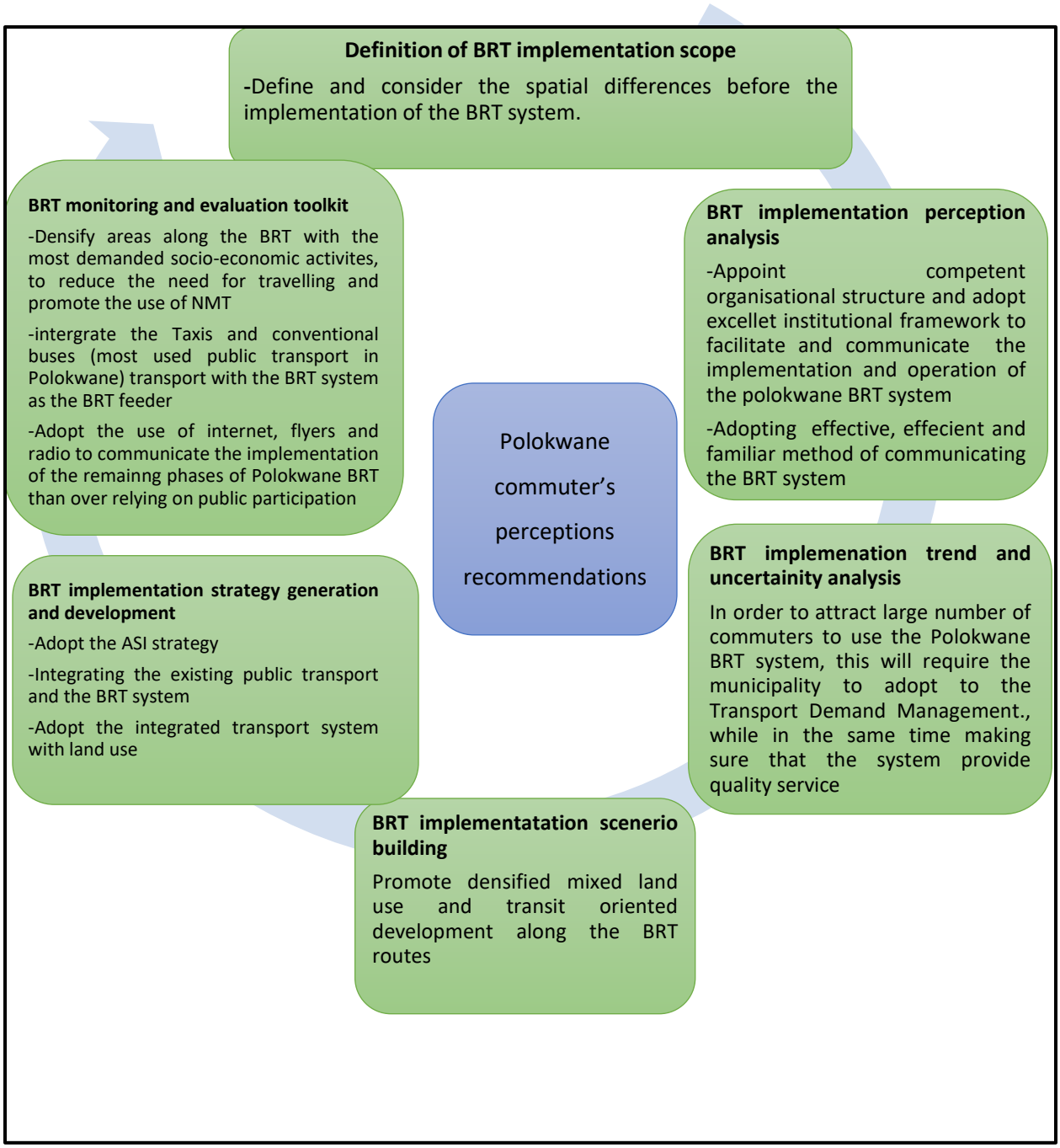

Figure 9.3. Recommendations of the SBAA findings

Source: Authors construct (2018)

Figure 9.3 shows that in terms of the SBAA findings, it is critical that the six steps around BRT implementation are considered in an integrated fashion. The six critical steps relate clearly the defining and amplifying the spatial dimensions that BRT implementation brings to a specific city or town. At the same time, in seeking to understand BRT implementation, it is recommended that

a steering organisational structure and institutional framework be created to maximize the benefits of BRT in a given area. Furthermore, it is recommended that BRT implementors need to adopt to the transport demand management and ensure that the system provide quality service, in order to respond to the BRT implementation trends and uncertainties, while at the same time ensuring that the implementation of BRT promotes densified mixed land use transit-oriented development along BRT routes. These can be easily achieved by adopting effective BRT implementation strategies such as Avoid-Shift-Improve, integration of transport system with land use and integrating the existing public transports with the BRT. In order for the system to be successful and continuously respond to the commuters' travel needs, the study recommended BRT monitoring and evaluation tool-kit such as densification of appropriate development along BRT, integration of public transports, and adopting effective method to communicate the remaining phases of Polokwane BRT.

9.5. Recommended areas of future research

The study envisages impacts from ignoring the perceptions of commuters' when implementing the of Bus Rapid Transit. As stated by Wright (2007), public commuters determine the success of any project including public transport implementation. Therefore, the recommended areas of future research revolve around the perceptions and bus rapid transit.

- Developing complete guidelines that consider commuter travel needs when implementing BRT system, using the above recommended guideline content page as a departure point;
- Assessment of the effectiveness of methods of communication when introducing new mode of transport such as the BRT system;
- A feasibility study on safety and security of Bus Rapid Transit; and
- Investigation of spatial (in)justice in implementing the Bus Rapid Transit.

9.6. General conclusion

The future of BRT system implementation is bright. The BRT system is perceived as one of the most sustainable motorized public transport system worldwide. Consequently, the study findings and literature (Chakwizira *et al.*,2014:564, Jarzab *et al*., 2002:44 and Cervero, 2013:38) revealed

that the implementation of the system can effectively address transport problems faced by the transport sector, such as rapid urbanization and motorization, traffic congestions and emission of greenhouse gases while providing reliable, comfortable, affordable and safe and secured transport system. However, the success of the implementation of the system varies from one country to the other, depending on various factors. These factors include spatial location, political will, and effectiveness of the methods communicating the system. This was also reflected by the study findings indicating that majority of survey respondents (27%) from cluster 1 and (20%) from cluster 2 located closer to the Polokwane Central Business District (CBD), revealed positive perception towards the system when compared to the minority of survey respondents (15%) from both cluster 3 and 4 located at the outskirt of the Polokwane CBD. Furthermore, the study findings and literature (Wright, 2002:13, Moylan *et al.,* 2013), indicated that the methods of communicating the implementation of the system has an influence on the perception of commuters and acceptance towards the BRT system. For example, India's New Delhi BRT was unsuccessful and negatively perceived by commuters due to the ineffective methods of communication and insufficient stakeholders' involvement (Hildago, 2009). Consequently, the present study recommendes the use of effective, efficient and familiar methods for communicating the implementation of the system. Furthermore, scholars such as Lindau *et al*., (2010:274) and Cervero (2013), indicated that a successful implemented BRT system, such as Curitiba in Brazil, is associated with massive job creation, reduction of high dependency on private vehicle, as well as controlling urban sprawl and reducing emission of greenhouse gases. Consequently, the current study also recommendes the need to intensify and integrate the BRT system with land use development, such as mixed land uses, transit-oriented development, densification of development along the BRT corridor system and application of the effective guideline framework that considers commuters' travel needs, in order to ensure that the system is successfully implemented. Therefore, considering and involving commuters during the initial stage of the BRT system is likely to influence the positive perceptions of the system that would later on determine the success or failure of the project.

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APPENDIX A: QUESTIONNAIRE FOR GENERAL COMMUTERS

Questionnaires to be completed by the general commuters (Targeted population N=250)

UNIVERSITY Of VENDA

SCHOOL OF ENVIRONMENTAL SCIENCES

DEPARTMENT OF URBAN AND REGIONAL PLANNING

TOPIC: An Investigation of Commuters' Perceptions Towards the Implementation of the Bus Rapid Transit (BRT) System: A Case Study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa.

Questionnaire No.

RESEARCHER: MS MALULEKE R.G

SUPERVISOR: DR CHWAKWIZIRA JAMES

CO-SUPERVISOR: PROF BIKAM PETER

Dear Respondent: I am conducting a study, on the above-mentioned topic, in partial fulfillment of satisfying the requirements for the award of a Masters Degree in Urban and Regional Planning at the University of Venda. I therefore, kindly request you to assist me in this study by completing this questionnaire. Your participation is highly valuable because it represents views of others who have not been selected to participate in the study. The information you provide will be used solely for the purposes of the study ONLY and remains confidential. (All participants were randomly selected).

INSTRUCTIONS

Please complete **the whole questionnaire**

Where you have been provided with a choice to the question, please kindly **choose one choice or preference**, either by ticking or with the letter **(X) or tick (✓)**

Where there are **no answers** please write your **own view.**

Section A: Administrative questions

1. Gender.

Male	
Female	
Other	

2. Age group.

Below 20	
21-35	
36-55	
56 and above	

3. Language

Sepedi	
English	
Afrikaans	
Other (specify)	

4. Occupation status.

Student (Grade1-12)	
Student (Post-secondary)	
Employed	
Unemployed	
Retired	
Other	

5. Which settlement cluster are you from in Polokwane?

If you're not originally from Polokwane, please kindly choose the cluster settlement where you are currently based.

Clusters	Areas by ward numbers	
Cluster 1	Seshego (ward 1 to ward 9)	
Cluster 2	Mankweng (ward 2 to ward 9)	
Cluster 3	Molepo (ward 19 to ward 27)	
Cluster 4	Moletji (ward 28 to ward 38)	

Section B: Bus Rapid Transit specific questions.

6. What is your current mode of transport for commuting?

Car	
Taxi	
Walking	
Conventional bus	
Bicycle	
Motorbike	
Other	

7. For what purpose do you use the above selected mode?

Work	
Shopping (Including shopping and buying groceries)	
School	
Medical	
Others (Please specify)	

8. Please indicate the most transport problem/challenge associated with your current mode of transport. **NB. Tick or choose one preference).**

Traffic congestion	
Unaffordable travel fare	
Unreliable travel time	
Unsafe transport systems	
Uncomfortable transport system	
Unavailable commuting information	
All	
Other	

Please justify your selection from question no 8.

……

……

9. Please indicate **what would be your preferred mode** of transport when BRT begins to operate. **NB. Tick or choose one preference).**

Car	
Taxi	
Walking	
Conventional bus	
Bicycle	
Bus Rapid Transit	
Other (Please specify)	

10. Please indicate the **commuters travel needs** you consider when selecting your preferred mode of transport. **(NB. Tick or choose one preference).**

Affordability (travel fare)	
Safety and security	
Comfort	
Reliable travel time	
All	
Other	

11. Are you aware of the **BRT system that is under implementation** in Polokwane (PLK) municipality?

Yes	
No	
Not sure	

12. Do you think the operation of the Polokwane BRT system will improve the problems faced by the transportation sector in the municipality?

Yes. They will pose positive changes	
No. It will increase transport problems	
Consistent. No changes at all	

Please justify your answer

……..

13. If your answer in **question 11** is yes, please indicate Where did you hear about Polokwane (PLK) BRT? (**NB. Tick or choose one preference).**

Public participation	
Stakeholder engagement	
Newspaper	
Radio	
Flyers distribution	
Internet	
Brochures	
Other (specify)	

14. Based on the selected option above (Method of communication), Please indicate the effectiveness of the method used to introduce the implementation of BRT in Polokwane?

	Extremely ineffective	Infective	Effective	Extremely ineffective	Others (Please indicate)
Public participation					
Stakeholder engagement					
Newspaper					
Radio					
Flyers distribution					
Internet					
Brochures					
Other (specify)					

15. Were you involved during the stakeholder engagement of **introducing the implementation of Polokwane (PLK) BRT?**

Yes	
No	
Not sure	

16. Were you involved during the confirmation of the following BRT branding iterms regarding the implementation of Polokwane BRT system?

	Yes	Not sure	No
Naming of the BRT			
Emblem of the Polokwane BRT			
Route alignment			
Envisaged BRT model to be purchased			
Carrying capacity			
Travel fare			
Travel time			
Safety and security measures of Polokwane BRT system			
Comfort measures of Polokwane BRT systems			

17. Based on the stakeholder engagement you were involved; would you shift from your current mode of transport to use Polokwane (PLK) BRT system?

Yes	
No	
Don't know	

18. Please indicate your **preferred travel times** of your mode of choice. **(NB. Tick or choose two preference).**

0H00-04H00	Early morning hours	
04H01-08H00	Morning peak hours	
08HO1-10H00	Mid in morning of peak hours	
10H01-14H00	Afternoon peak hours	
14H01-16H00	Late afternoon peak hours	
16H01-18h00	Evening peak hours	
18H01-23H59	Late evening of peak hours	

19. Please indicate your **preferred travel fare** of your mode of choice per kilometer. **(NB. Tick or choose one preference).**

Distance	Preferred Travel fare
0 - 10km	
11- 20km	
21 - 30km	
31 – 40km	
41-50km	
>51km	
Other (Please specify)	

20. Please indicate your most **preferred safety measures** that you consider when selecting mode of transport **(NB. Tick or choose just one measure).**

Security at the station/terminal	
Security in the bus	
Security along the bus route/corridor alignment	
Security for on-line payment or smart card payment systems	
Cleaners (Cleaning the bus and at the bus stations)	
Traffic lights along BRT routes	
All	
Other (Please specify)	

21. Please indicate your most **preferred comfort measures** you consider when selecting a mode of transport (**NB. NB. Tick or choose one measure**):

Security at the station/terminal	
Security along BRT route/corridor	
Fare payment security system	
Guaranteed seat	
Comfortable seat	
Covered stations	
All	
Others (Please specify)	

22. Please indicate the **operational characteristic** that your preferred mode of transport must mostly have. (NB. Tick or choose one preference)

Specified carrying capacity	
Affordable travel fare	
Specified travel time	
Easy access to commuters' information	
Commuters safety measures	
Commuters comfort measures	
All	
Other	

23. Would you change from your **current or preferred mode** of transport to use BRT system if it has the **selected** operational characteristics?

Yes	
No	
Don't know	

Please justify your answer from question 23

……
……
……

24. What would you want to **benefit from using the Polokwane BRT system** when it starts operating? **(NB. Tick or choose one preference).**

Increase commuting comfort	
Increase commuting safety	
Provide affordable commuting transport	
Improve reliable traveling times	
Improve and easy access of commuting information	
Reduce traffic congestion and delays	
All	
Don't know	
Other (specify)	

25. How will you **prefer the commuters' service information** of Polokwane BRT system to be sent out to the commuters? **(NB. Tick or choose one preference).**

Smart phone	
Display screen	
Computer	
Hand print	
Don't know	
Other	

26. In your opinion regarding the implementation of BRT, what will you recommend to maximise commuters travel needs?

.....
.....
.....

27. Based on your engagement with the officials, which of the following phases of BRT do you consider to be successful? **(NB. Tick or choose one preference).**

Phase 1 (Status quo analysis)	
Phase 2 (Pre negotiations)	
Phase 3 (Contract negotiations)	
Phase 4 (Preparations)	
Phase 5(Start preparation)	
Don't know	

Please justify

……
……
……

28. What would be your recommended strategy for successfully implementing the BRT system?

Effective method of communication	
Employing competent organization for facilitating and implementing BRT	
Other	

Thank you for participating in this study.

APPENDIX B: QUESTIONNAIRES FOR THE KEY INFORMANTS

***BRT questionnaires and interview questions to the key informants*.**

UNIVERSITY Of VENDA

SCHOOL OF ENVIRONMENTAL SCIENCES

DEPARTMENT OF URBAN AND REGIONAL PLANNING

TOPIC: AN Investigation of Commuters' Perceptions Towards the Implementation of the Bus Rapid Transit (BRT) System: A Case Study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa.

RESEARCHER : MS MALULEKE RIVONINGO

SUPERVISOR : DR CHAKWIZIRA JAMES

Dear Respondent: I am conducting a study, on the above-mentioned topic, in partial fulfillment of satisfying the requirements for the award of a Master's Degree in Urban and Regional Planning at the University of Venda. I hereby kindly request you to assist me in this study by completing this questionnaire. Your participation is highly valuable because it represents the views of other officials who could not be made part of this study. It must be emphasized though that there is no intention to discredit the Municipality or any of its employees. The information you provide is for the purpose of the study ONLY and remains confidential. (All participants were randomly selected).

INSTRUCTIONS

- Please complete **the whole questionnaire**
- Where you have been provided with a choice to the question, please kindly **choose one choice or preference**, either by ticking or with the letter **(X) or tick (✓)**
- Where there are **no answers** please write your **own view.**

Section A: Administrative information

Date: ……

Place of interview.....

Position.....

Department.....

Organisation: Municipality ☐ or company ☐

1. Gender

Male		
Female		
Other		

Section B: Specific BRT questionnaires to the AMCE company (Transport Planner Manager).

2. Did you involve/ engage commuters in **all phases during the implementation** of BRT system?

Yes	
No	
Don't know	

3. Which of the following methods of communication were used to communicate the implementation and branding of the Polokwane BRT system?

Type of communication	Tick one relevant respond
Public participation	
Stakeholder engagement	
Newspaper r	
Radio	
Internet	
Flayers	
T. V (Television)	
Broachers	
Other	

4. Based on your stakeholder involvement or engagement with the commuters, what is your perception towards the implementation of Polokwane BRT system?

I am positive it will run well	
I am not positive it will run well	
Not sure	

Please justify your answer

……
……
……

5. Please specify commuters travel needs to be incorporated to the Polokwane BRT system. Kindly indicates and support how each travel need will be able to attract commuters.

Travel comfort	
Travel safety and security	

Travel time	
Travel fare	
Other	

6. Please indicate which of the following **operational characteristics** of the Polokwane BRT system would respond to the commuters' travel preference.

Bus specified carrying capacity	
Specified travel fare	
Provide affordable travel fare	
Provide easy access to commuting information	
Provide commuting safety and security measures	
Provide commuting comfort measures	

Please justify your answer for question number 6.

……

……

7. Please mention the most essential comfort measures that will be incorporated to the Polokwane BRT system. starting from the most essential measure to the least essential.

8. What will be the service frequency of the Polokwane (PLK) BRT during the peak-hours? Would it pass the BRT station per the following times?

Every after 1 minute	
Every after 2 minutes	
Every after 3 minutes	
Every after 4 minutes	
Every after 5 minutes	
Every after 10 minutes	
Every after 15 minutes	
>15 minutes	
Other	

9. What will be the service frequency of the Polokwane (PLK) BRT during off-peak periods? Would it pass the BRT station per the following times?

Every after 10 minutes	
Every after 15 minutes	
Every after 30 minutes	
Every after 1 hour	
Every after 1hr and 30 minutes	
Evert after 2 hours	
Other	

10. How will the commuters' service information be sent out to the commuters?

Smart phone	
Display screen	
Computer	
Hand print	
Other	

11. Please indicate the transport problems that would be addressed by the implementation of the BRT system?

Traffic congestion	
Unreliable transport travel time	
Unsafe transport systems	
Unaffordable travel fare	
Uncomfortable transport system	
Overcrowded transport system	

12. What strategies would you recommend for the successful implementation of BRT system that consider commuters travel needs?

.....

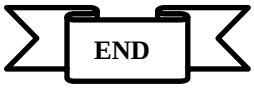
.....

13. In your opinion regarding the implementation of BRT, what will you recommend to maximize commuters travel needs?

.....

.....

Thank you for participating in this study.



APPENDIX C: OBSERVATION (REVEALED) CHECKLIST DATA

Settlement Cluster	Day	Time	Weather	Gender 20 people		Mode of transport 20 modes			Commuters travel information	Safety measures	Comfort measures	Transport problems
				Male	Female	Car	Taxi	Bus				
Cluster 1	13/01/18	06h00-08h00	Warm	7	13	4	9	7	Hand print for the taxis	Uncovered stations No seats at the station	No available security and or surveillance systems	Unavailable and inaccessible commuting information for all modes. Traffic congestion during morning peak hours
		10h00-12h00	Warm	15	5	6	13	1				
		12h00—14h00	Warm	14	10	9	11	0				
		16h00-18h00	Warm	12	8	7	8	5				
Cluster 2	15/01/18	06h00-08h00	Warm	11	9	2	14	4	Taxi drivers source of information	Uncovered stations No seats at the station	Unavailable security measures (securities, cameras)	Unreliable transport Traffic congestion caused by taxis
		10h00-12h00	Warm	9	11	3	12	5				
		12h00—14h00	Warm	13	7	3	13	4				
		16h00-18h00	Warm	11	9	2	10	8				
Cluster 3	16/01/18	06h00-08h00	Warm	5	15	5	9	10	Bus and taxi drivers are source of commuting information	Uncovered stations No seats	Unavailable security measures (securities, cameras)	Poor road condition resulting to slow movement of transport Unreliable transport system
		10h00-12h00	Warm	5	15	2	8	10				
		12h00—14h00	Warm	14	6	3	13	4				
		16h00-18h00	Warm	7	13	3	8	9				
Cluster 4	17/01/18	10h00-12h00	Warm	7	13	2	8	10	Bus and taxi drivers are source of commuting information	Uncovered stations No seats	Unavailable security measures (securities, cameras)	Overloaded modes
		12h00—14h00	Warm	11	9	3	7	10				
		16h00-18h00	Warm	13	7	1	8	9				
		10h00-12h00	Warm	12	8	2	7	11				
Overall findings	**N/A**	**06h00-08h00**	**Warm**	**52%**	**48 %**	**18%**	**47 %**	**35 %**	**Unreliable travel information**	**Poor Safety measures**	**Poor comfort measures**	**High transport congestion**

Sample size: N=20

Source: Authors field data (2018)

APPENDIX D: ETHICAL CLEARANCE

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms RG Maluleke

Student No:
11594875

PROJECT TITLE: **Investigation of commuters' perceptions towards the implementation of the Bus Rapid Transit (BRT) System: A case study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa.**

PROJECT NO: SES/17/URP/03/2802

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr J Chakwizira	University of Venda	Supervisor
Prof P Bikam	University of Venda	Co - Supervisor
Ms RG Maluleke	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: February 2018
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2018 -02- 20
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950 LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8504/8513 FAX (015) 962 5000
"A quality driven financially sustainable, rural-based Comprehensive University"

APPENDIX E: REQUEST FOR PERMISSION TO CONDUCT THE RESEARCH

University of Venda
School of Environmental Sciences

Department of Urban and Regional Planning
University Road, Thohoyandou, Limpopo
Private Bag X5050, Thohoyandou, 0950
Limpopo, South Africa
+27 15 962 8585
+27 15 962 8597
james.chakwizira@univen.ac.za
azwidowi.mashangu@univen.ac.za

10/01/2018

TO WHOM IT MAY CONCERN

REQUEST FOR PERMISSION TO CONDUCT M.URP RESEARCH IN YOUR ORGANISATION (POLOKWANE MUNICIPALITY/COMPANY RESPONSIBLE FOR POLOKWANE BRT IMPLEMENTATION.

With reference to the above mentioned subject, I the undersigned hereby request for permission for the following M.URP student to collect data required for the completion her masters research within the University of Venda. The student's details and topic are as follow:

NAME: MALULEKE R.G. STUDENT NUMBER: 11594875

Research Topic: *Investigation of Commuters' Perceptions Towards the Implementation of the Bus Rapid Transit (BRT) System: A Case Study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa.*

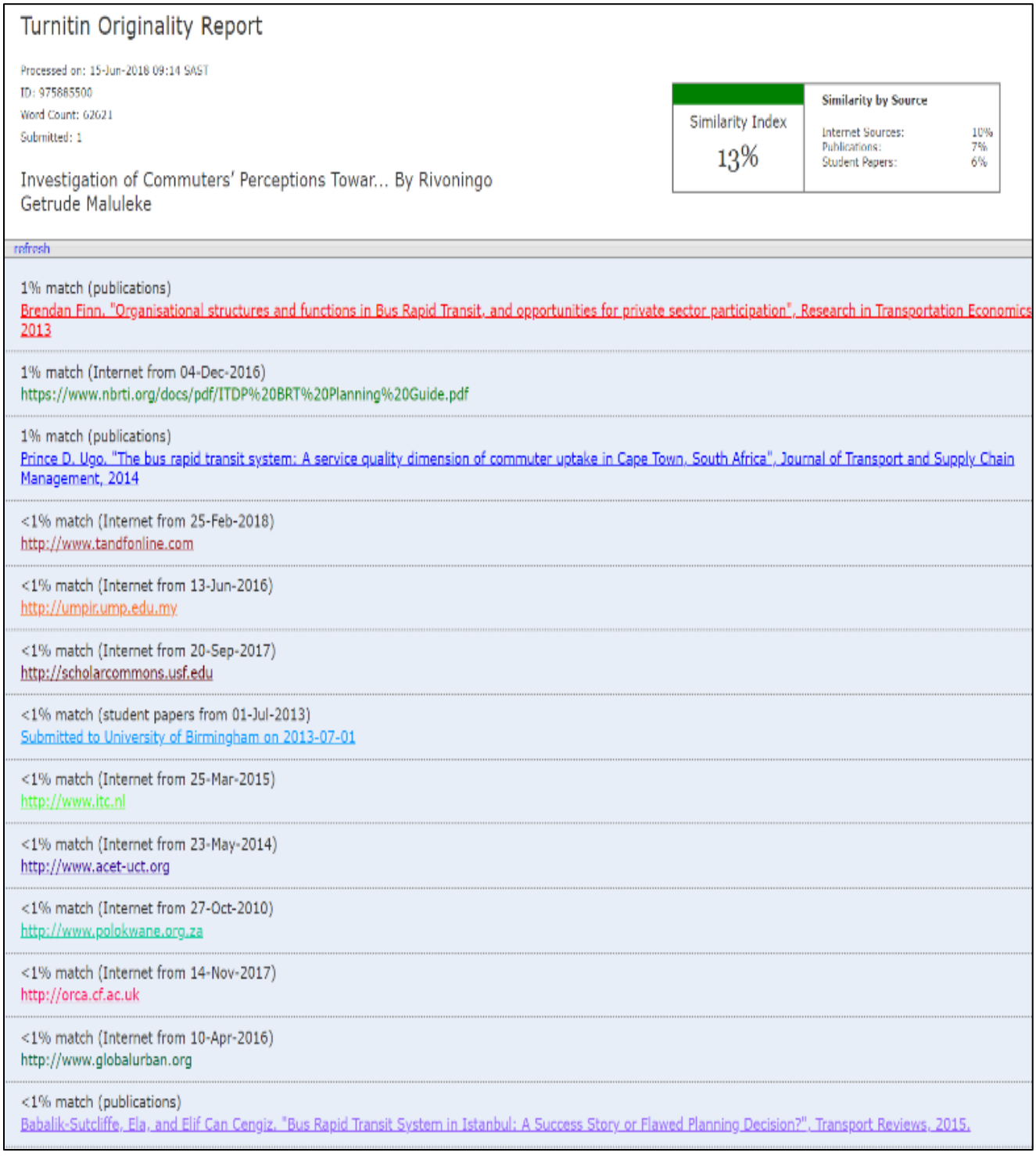
Your Assistance in this regard will be highly appreciated.

Thank you

Dr. James Chakwizira

Head, Urban and Regional Planning

APPENDIX F: TURN IT IN ORIGINALITY REPORT



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APPENDIX G: LETTER OF LANGUAGE EDITOR (1)

Editing and Proofreading Report

This letter serves to confirm that I, Nyete Liberty, Takudzwa from the English Department, University of Venda, have proofread and edited a Research for a Master's degree (MURP) by Maluleke Rivoningo Getrude (11594875) titled *Investigation of Commuters' Perceptions Towards the Implementation of the Bus Rapid Transit (BRT) System: A Case Study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa*

I carefully read through the proposal, focusing on proofreading and editorial issues. The recommended suggestions were highlighted.

Yours Sincerely

Nyete

Nyete Liberty, Takudzwa (PhD Candidate)

APPENDIX H: LETTER OF LANGUAGE EDITOR (2)

SCHOOL OF HUMAN AND SOCIAL SCIENCES

24 August 2018

School of Environmental Sciences
University of Venda
Thohoyandou
0950

Sir/madam

This serves to certify that I have proof-read Ms R.G. Maluleke's dissertation titled, "Investigation of Commuters'Perceptions Towards the Implementation of the Bus Rapid Transit (BRT): A Case Study of the BRT System in Polokwane Municipality, Limpopo Province, South Africa".

The proof-reading entailed editing some parts from it; for example, to avoid wordiness, redundancy; sub-dividing sentences, and so on, to make the document more understandable. However, I have not tampered with the content of the document, except where this constituted repetition or made the document confusing.

The proposal is presently ready for examination.

Sincerely

V.T. Bvuma

University of Venda

UNIVERSITY OF VENDA