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ECO-MOBILITY INFRASTRUCTURE AND ITS EFFECTIVENESS IN THE CITY OF JOHANNESBURG

By

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A Research Report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Management (in the field of Public and Development Management)

20 August, 2018

ABSTRACT

As a car-captive society, the City of Johannesburg is faced with mobility challenges which contribute to high traffic congestion and air pollution. Hence, the City is investing significant resources in Eco-Mobility infrastructure with the aim of reducing traffic congestion and improving air quality. This includes the construction of cycling and walking lanes, the expansion of the Rea Vaya BRT system to other areas of the City, expansion of the City's roads, and the construction of pedestrian bridges. One of the main findings of the research was that the Rea Vaya BRT system is successful in attracting users and continuously increasing its ridership numbers, year on year. Most importantly, research findings also indicate that for any City to effectively implement Eco-Mobility approaches, it needs the full support of its political leadership. This should also include regular, and continued awareness campaigns about Eco-Mobility, showing residents the socio-economic benefits of the infrastructure, good legislation, improved signage on the roads, safety campaigns and demarcation of already organised roads. This will assist in generating co-ownership of the infrastructure built between the City and its residents.

DECLARATION

I, Benji Seitlhamo, declare that this research report is my own, unaided work. It is submitted in partial fulfilment of the requirements of the degree of Master of Management (in the field of Public and Development Management) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

_____ 20 August 2018

Benji Seitlhamo **Date**

DEDICATION

This research report is dedicated to God with thanks for His daily protection, provision and support in my life.

Thanks to the following people for being my pillar of strength: MmaKeletso, Keletso and my parents Lenah and Freddy.

To the Seitlhamo clan, *Dikwena tsa Modimosang*! I thank you all for your support, patience and belief in me throughout my study journey.

My friends and colleagues for their unwavering support and guidance.

Finally, thanks to all the participants for their contribution towards this research.

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LIST OF ABBREVIATIONS

ANC	African National Congress
BRT	Bus Rapid Transport
C40	Cities Climate Leadership Group
CoJ	City of Johannesburg
DA	Democratic Alliance
DoT	Department of Transport
EFF	Economic Freedom Fighters
EVs	Electric Vehicles
GCRO	Gauteng City Region Observatory
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GHG	Greenhouse Gas
GPC	Global Protocol for Community-Scale GHG
GTFS	General Transit Feed Specification
ICLEI	International Council for Local Environmental Initiatives
JSE	Johannesburg Stock Exchange
JUCA	Johannesburg Urban Cyclists Association
MoU	Memorandum of Understanding
NAMAs	Nationally Appropriate Mitigation Actions
NMT	Non-motorised transportation
SANEDI	South African National Energy Development Institute
SANTACO	South African National Taxi Council
SDF	Spatial Development Framework
UN	United Nations
UNIDO	United Nations Industrial Development Organisation

CHAPTER 1
INTRODUCTION

1.1 Introduction

In the 21st century, prosperous cities are those that have prioritised modern urban planning to address societal challenges and further the progression of their citizens. Hence, the sustainable progress of city inhabitants is correlated to high levels of liveability and economic growth. A liveable city is where a community equitably thrives on the development and progression of itself (ICLEI, 2016). Such societies are models of success which other cities want to emulate to drive their own development and growth.

Over 50 percent of the world's total population now comprises city inhabitants and contributes to the challenges experienced by the environment (Batagan, 2011). By 2050 the world's urban population will exceed six billion people (ICLEI, 2016). Cities will need to invest heavily in physical and social infrastructure, enabling economic growth and addressing social and governance requirements (Bulkeley, 2010). Global cities are increasingly driving world affairs — economically, politically, socially and culturally.

In pursuing economic growth and development, cities inadvertently produce high levels of greenhouse gasses (GHG). As such, cities are now joining global city networks to develop solutions that will reduce emissions in their territories. Cities understand that they are now also responsible to influence national and global policy positions and there is an international drive by local government to secure a seat at the global table. Local governments can thus no longer focus on service delivery alone. Cities need to be

competitive, attract global capital, and simultaneously address socio-economic inequalities.

A city like Johannesburg is not immune to such challenges. Johannesburg was officially declared a City in 1886, following human settlement that sought to exploit the discovery of gold deposits in the area (South African Cities Network, 2016). The CoJ is now one of the most prominent cities of the African continent. It is the financial centre of South Africa and its largest city. The Municipality covers an area of 1 645 km^2 and is the provincial capital of Gauteng Province (CoJ, 2011). It is considered the economic powerhouse of South Africa, contributing significantly to the wealth of the country and creating jobs for the population.

Like any other metropolitan city in the world, the CoJ experiences transport challenges within and outside its jurisdiction as a result of the transportation needs of its residents (CoJ, 2011). One outcome of this is the increase in GHG emissions, and the CoJ has embarked on developing and implementing new ways to transport people in the CoJ through its Eco-Mobility projects. The term Eco-Mobility is defined as an approach which encourages city residents to use environmentally friendly modes of transport such as walking, cycling, wheeling, and passengering to reach their destination of work, residence and leisure (Kodukula, 2012). The term was first introduced in 2007 by Konrad Otto-Zimmermann, the then Secretary General of ICLEI and of the Global Alliance for Eco-Mobility. Through constant messaging, the term was able to gain popularity within the transport and related fields (ICLEI, 2016). In addition, ICLEI holds the rights to Eco-Mobility as its trademarked intellectual property (Batagan, 2011).

This study highlights the broader concerns of cities in responding to challenges of climate change by adopting environmentally friendly approaches which contribute towards the reduction of GHG emissions. It

focuses on the Eco-Mobility infrastructure and its effectiveness in the City of Johannesburg. The aim of this study is to examine whether the use of walking, cycling and mass public transportation in the CoJ can reduce traffic congestion, air and noise pollution, and the associated negative costs for the city's economy. It also highlights the socio-economic and environmental benefits associated with Eco-Mobility in the CoJ. The associated negative impact of Eco-Mobility on travelling time are also discussed.

1.2 Background to the Study

All cities face challenges with regard to collecting and reporting data related to their GHG emissions, and Johannesburg is no exception. Good data collection is the first and most important step in understanding the CoJ's emissions and also allows cities and their residents to track progress against targets and understand how well programmes are performing. The CoJ works with ICLEI to produce a GHG emissions inventory. The work undertaken by ICLEI is through a service level agreement with the City of Johannesburg. In 2014, the CoJ conducted its second city-wide inventory using the global protocol for community (GPC) scale GHG emissions methodology (ICLEI, 2016). The first city-wide inventory was compiled by Siemens for the 2007 calendar year. Siemens prepared the initial report under an arrangement with C40 in 2012 and is presently analysing the high-level changes between the two inventory years (Buxbaum, 2014).

The inventory indicates that the majority of the CoJ's GHG emissions have reduced since 2007. The inventory also highlights that 61 percent of CoJ's emissions are from the consumption of electricity, with 33 percent amounting from the use of fuel in transportation and emissions arising from waste, with only around 6 percent accounting for emissions from inter-city rail transport and aviation. (ICLEI, 2016).

In 2007 the greater part of CoJ's transport emissions came from road transportation (82 percent) with the majority of fuel use estimated to be from private cars and minibus taxis within the CoJ. Aviation accounted for 14 percent and rail 4 percent (ICLEI, 2016). In 2014, these figures changed to 79 percent and 17 percent for road transportation and aviation, respectively (Buxbaum, 2014). The percentage for railways has remained at 4 percent despite the inclusion of the Gautrain in the rail data for 2014 (South African Cities Network, 2016). No data for the Rea Vaya rapid transit system could be obtained as it is not available from the CoJ official records. So it is not possible to separate out the emissions from that particular transport mode. Further analysis of the shift in transportation mode is required to better understand the emissions impacts of the various transport initiatives underway in the CoJ.

With this background in hand, it was critical for this research study to evaluate the Eco-Mobility infrastructure and its effectiveness in the City of Johannesburg. In particular, the aim was to assess the infrastructure built and its effectiveness in influencing patterns of mobility in the City.

1.3 The field of study

The focus of the study is governance, multilateralism, global city networks and Eco-Mobility. Definitions of key terms and concepts are provided below:

- Governance refers to the development of policies by a diverse group of actors to produce consensus and support for a common societal issue (Loorbach, 2010);
- Multilateralism is when three or more states practice policy co-ordination (Muldoon, 2012; Milner & Tingley, 2012), and different people and institutions collaborate to pursue common and shared interests (Commission for Global Governance, 1995);
- Global City Networks are a specific system with three levels of structure (Taylor, Catalano & Walker, 2002); and

- Eco-Mobility aims to encourage the use of environmentally friendly modes of transportation by city residents (Kodukula, 2012).

1.4 Research Problem

Due to pressures of climate change and their devastating effects on communities, cities are encouraged by the United Nations to devise eco-friendly approaches to address climate change and reduce GHG emissions in the atmosphere caused by human activities. Additionally, these eco-friendly approaches assist cities to adapt and mitigate climate change challenges and to minimise damage to infrastructure and loss of life. The CoJ, a car-captive society, is confronted daily with challenges of traffic congestion and high GHG emissions, forcing it to continue investing resources into infrastructure built for the purpose of Eco-Mobility approaches in order to transform the way its residents move within the CoJ. However, there has never been an academic assessment of the infrastructure built for the purpose of Eco-Mobility, thereby providing an area of investigation. The basis of the study was therefore to assess the infrastructure built and its impact on Eco-Mobility approaches in the City of Johannesburg.

1.5 Rationale of the study

The research paradigm that guided this study was qualitative interpretive study. It adopted the view which aimed to understand or identify meanings for actors through providing descriptive details to understand a phenomenon using data that might be collected in a variety of ways, such as interviews, observations and document review (Wagner, Kawulich & Garner, 2012). The study involved a researcher being interested in exploring a situation or purpose (Merriam, 2002). Through such methods, similarities and commonalities were discovered and analysed to provide a significant framework (Merriam, 2002). The purpose of the study was to

recognise and identify similarities that emerge in order to construct a meaningful context (Leung, 2015).

In addition, the research also employed the use of core descriptive statistics which are summative methods depicting data in a concise approach (Wagner et al, 2012). This allowed the researcher to quantitatively describe or understand features of the collected information, thereby only focusing on summarising the sample population (Leung, 2015). For instance, the research sampled the extent of new cars sales in Johannesburg, Rea Vaya BRT ridership and GHG emissions produced by cars. Therefore, both qualitative and quantitative methods of research were used to understand the infrastructure built and assess its effectiveness on Eco-Mobility approaches in the City of Johannesburg.

1.6 Research Questions

In order to assess the infrastructure built and its impact on Eco-Mobility approaches in the City of Johannesburg, the primary research question of this thesis asked: *How effective is infrastructure built for Eco-Mobility approaches in the City of Johannesburg?*

The three supplementary questions were as follows:

1. How effectively has the development of Eco-Mobility approaches increased mass transportation, walkability and cycling for commuter purposes in the CoJ?
2. Has the use of private cars in the City significantly reduced or increased since the implementation of Eco-Mobility approaches?
3. What impact do Eco-Mobility approaches have on developmental programmes such as the Transit-Orientated Development Corridors?

1.7 Scope and limitation of the study

The study focused on assessing the infrastructure built for the purpose of implementing Eco-Mobility approaches in the City of Johannesburg. Therefore, the role of government officials and global city networks in influencing the development and implementation of Eco-Mobility approaches in the City of Johannesburg was assessed. However, due to time constraints, the study was not able to elicit views from the broader public on the infrastructure built for the purpose of Eco-Mobility approaches.

1.8 Chapter Summary

Climate change is a reality facing cities and therefore requires concerted effort from all city stakeholders. While cities are engines of development and growth, they are consequently contributing to the declining environment atmosphere. Therefore, it is incumbent of cities to conceptualise innovative strategies that will mitigate climate change and minimise its negative impact on cities and its people. Eco-Mobility approaches are sustainable urban mobility initiatives employed by cities across the globe to address climate change and traffic congestion.

Due to traffic congestion and poor air quality, the City of Johannesburg is currently investing resources into the development and implementation of Eco-Mobility approaches. This is to ensure that the City meets its targets of reducing GHG emissions to improve its environment, while on the other hand, it provides alternative modes of transportation. The City's transport emission currently accounts for a third of the total GHG emission produced. Therefore, it is crucial for the City to encourage its residents to change their behavior in relation to the environment.

As the City continues to invest significant resources in the infrastructure built for Eco-Mobility approaches, there is a need for an academic study to assess the impact of the infrastructure in the City of Johannesburg. The

primary research question focused on the effectiveness of the infrastructure built for Eco-Mobility approaches in the City of Johannesburg. Hence, a qualitative research study was undertaken to extract in-depth data to identify and understand emerging themes emanating from the study. This included interviewing government officials and global city networks who are influential in the development and implementation of Eco-Mobility approaches in the City of Johannesburg. However, due to time constraints, the study was unable to interview public participants.

The next chapter focuses on the literature review. It explores and examines literature on Eco-Mobility, global governance in Eco-Mobility, the role of global city networks, the practice of Eco-Mobility in South Africa, and particularly in the City of Johannesburg.

CHAPTER 2
LITERATURE REVIEW

2.1 Eco-Mobility

Eco-Mobility reduces traffic congestion, improves air quality and encourages healthier lifestyles. Eco-Mobility challenges and transforms old methods of road transportation and emerges with new and creative practices of addressing traffic congestion (Reeds & Lirsa, 2015). Eco-Mobility addresses climate change in a sustainable manner, promoting social cohesion and also improving environmental and public health. The transformation of old cities and construction of new cities around the world is geared towards green spaces and Eco-Mobility approaches (Kodukula, 2012).

Public and non-motorised transportation are prioritised through Eco-Mobility practices with emphasis on the use of low to no emission modes of transportation. It encourages the use of green and renewable energy to produce electricity and other fuel sources. Discontinued use of private cars in favour of mass transportation and the use of integrated modes of transportation are objectives of Eco-Mobility approaches. The aim is to reduce all road transport related challenges caused by high traffic flows and congestion.

Due to an increase in GHG emissions, the United Nations began advocating for the world to change its behaviour in relation to the environment (Batagan, 2011). Various cities around the world began to find ways to assist in reducing GHG emissions, mainly focussing on Eco-Mobility. For instance, Kaohsiung City in Taiwan is promoting green vehicles and public transportation systems for use by its residents (ICLEI, 2015). The City of

Paris has also successfully provided bicycles to the public to use as a short distance mode of transport (PEARL Initiative, 2015).

Given the success and efficiencies of these projects in these cities, the United Nations promulgated the formation of ICLEI in 1990 (Reeds & Lirsa, 2015). ICLEI−Local Governments for Sustainability is a city network established to address and monitor climate challenges, in particular reducing GHG emissions within cities. When founded, it was known as the International Council for Local Environmental Initiatives. (Batagan, 2011). In the official launching of ICLEI, the United Nations hosted over 200 local authorities from only developed countries (ICLEI, 2016).

The organisation works with local governments around the world, and has programmes and campaigns that have resulted in these cities being able to achieve their given targets (PEARL Initiative, 2015). ICLEI assist their members by providing technical services such as training, knowledge and information-sharing, capacity-building and also the implementation of sustainable development projects within cities (Brugmann, 1996).

The initial mandate of ICLEI focused on advancing clean and sustainable governance within local government (Bulkeley, 2010). However, in 2003 its mandate was expanded to include the development of sustainable Eco-Mobility approaches and green programmes and the organisation was then renamed ICLEI–Local Governments for Sustainability (Kodukula, 2012). Due to this expansion, ICLEI today boasts more than 1 200 members around the world and over 600 are from the United States of America (Bloomberg & Pope, 2017). ICLEI has become one of the largest multilateral organisations in the United Nations focussing on addressing environmental challenges in the cities (Bulkeley, 2010).

Members of ICLEI are entitled to various support mechanisms of capacity-building and training. Cities are also provided with educational knowledge

to deal with various issues of climate change. In addition, ICLEI provides its members with co-ordinated opportunities to engage and co-operate with other multilateral organisations, thereby expanding their knowledge (Bloomberg & Pope, 2017). Being represented in 84 countries since inception, ICLEI has established 15 offices and global centres in all continents. These offices provide cities with regular access to technical expertise and educational programmes (Brugmann, 1996).

2.2 Effectiveness of global governance in Eco-Mobility

The tsunami of 2004 was an international disaster that required countries and cities to start taking the issue of climate change seriously. The cause of the tsunami was largely viewed as a result of surface increase of temperature in the atmosphere (Bulkeley & Betsill, 2003). After this natural disaster, the need for a multilateral approach became apparent because the loss of lives gave some urgency to addressing climate change (Reams, Clinton & Nina Lam, 2012). Stakeholders from different fields came together in addressing this important issue.

Governance is understood to be the development of policies by a diverse group of actors to produce consensus and support for a common societal issue (Loorbach, 2010). For governance in Eco-Mobility to be effective, cities have to comply with plans and systems that embrace peer-learning experiences and information sharing (Okereke & Bulkeley, 2007).

According to ICLEI, the successful implementation of the governance framework would be made possible if cities belonged to a multilateral organisation like ICLEI (Bulkeley & Betsill, 2003). On the other hand, multilateralism is when three or more states practice policy co-ordination (Muldoon, 2012; Milner & Tingley, 2012), and different people and institutions collaborate to pursue common and shared interests (Commission for Global Governance, 1995). Therefore, one could argue

that the shared interests and values between cities make it possible for them to plan and implement Eco-Mobility more effectively.

Cities have tended to focus strongly on mitigating the negative impacts of climate change. For instance, in contributing towards climate change discourse, stakeholders such as cities, non-governmental organisations, communities and the private sector have over the years introduced various projects to address climate change in their own environments (Okereke & Bulkeley, 2007). Despite the conventional view that climate change solutions should be addressed by nation-states, it may be argued that cities in particular are the focal point of contact and impact in the environment. Evidence has shown that cities should be the agent of change, rather than the nation-state (Baloyi, 2017) and that they are best located to minimise the impact of climate change in the environment (Reams, Clinton & Nina Lam, 2012).

Estimates suggest that 75 percent of global emissions is produced by cities (International Energy Agency, 2016) and usually linked to damage to the environment (Rees & Wackernagel, 1996). ICLEI is advancing eco-friendly methods to reduce GHG emissions (Bulkeley & Betsill, 2003).

Cities from the developed countries have dominated the discourse around global environmental governance. This has served to marginalise cities from developing country to also play a meaningful role in the climate change discourse and governance framework (Bulkeley, 2010). In addition, most researchers on climate change have previously concentrated on developed country cities, thus neglecting the developing country cities (Reams et al, 2012). This meant that developing country cities were overlooked even though they were largely impacted by climate change (Okereke & Bulkeley, 2007). The impact thereof had effects on developed countries as they had to assist developing countries in rebuilding their cities and economies.

Although developing country cities had been overlooked by their counterparts from developed country cities, there was progress made in establishing international governance frameworks and multilateral institutions that assisted in addressing climate change (Bulkeley, 2010). This resulted in ICLEI becoming more inclusive in its membership and designing progressive policies that assisted with the engagement and participation of developing country cities in addressing climate change (Loorbach, 2010). This was followed by the rise and emergence of other city networks with a global membership focusing on environmental issues, such as the C40.

2.3 The role of global city networks in fostering city peer-learning

Global city networks are described as a singular system with three levels of structure (Taylor, Catalano & Walker, 2002). The system is commended for highlighting the opportunities of cities in addressing climate change (Bulkeley, 2010). Through such networks, cities share experiences, ideas and information to address climate change threats. Cities have learned that collectively they can use their influence to address common interests and opportunities and learn from each other's experiences (Brugmann, 1996). In addition, these networks provide cities with opportunities to co-operate with other stakeholders, including the private sector and other multilateral organisations. For example, leaders in academia, business, politics and other fields are now ordinarily requested to participate in the deliberations and exchange of knowledge on various best approaches that can enhance Eco-Mobility (Moir, Moonen & Clark, 2014).

Moreover, cities use the membership in such networks to attract foreign direct investment and to secure pool funding from their sister cities for development in their own districts (Bloomberg & Pope, 2017). The ability to attract foreign direct investment allows developing country cities to support implementation of Eco-Mobility approaches. This leads to job creation,

sustainability of the green economy and reduction in GHG emissions (CoJ, 2011).

Cities are therefore fully aware that environmental costs are transferrable to other areas outside their jurisdictions. Hence there is a need for cities to collaborate with each other on strategies that address climate change (Reeds & Lirsa, 2015). Globalisation has created interdependencies between cities and challenged the traditional governance framework on international relations, which only recognised nation-states as the primary actors in international relations (Kodukula, 2012). On the other hand, bilateral city engagements are still influenced by the individual country's foreign policy. For example, the City of Johannesburg (South Africa) shares a close relationship with the City of Lilongwe (Malawi) due to both countries' historical and political relationship. Nonetheless, city networks are able to counter international relations dynamics that prohibit other cities from collaborating and partnering with each other. Global city networks have opened their membership to all cities interested in joining up (Bloomberg & Pope, 2017).

Global city networks collaborate because of the view that they will achieve progressive gains and prosperity if and when united by common interests. Incentives and motivation, as chronicles of power, are some of the drivers whereby networked interactions between cities actors are developed (Allen, 2010). Therefore, the benefits of being a member of global city networks far outweigh the costs.

2.4 Eco-Mobility in South Africa

South Africa is sparsely populated in the rural areas with its urban areas being more densely populated. The population of South Africa is over 54 million and 65 percent of the population resides in cities, of which the majority is in metropolitan municipalities (United Nations Department of Economic and Social Affairs, 2015). Major cities are the largest emitters in the country because of car pollution, mining, industrial parks and production of energy. High transport emissions remain a challenge for major cities such as Johannesburg, Cape Town and Ekurhuleni, while Buffalo City, Nelson Mandela Bay, Tshwane and Mangaung are faced with high industrial pollution (South African Cities Network, 2016). Compounding the challenges is the increase in percentage of South African households that have access to a car from 22.9 percent in 2003 to 28.5 percent in 2013 (Jennings & Quental, 2011). Currently South Africa has over 7 million light vehicles on the roads, which are responsible for 10 percent of the country's carbon emissions (ICLEI, 2016).

In 1993 South Africa signed a global treaty on climate change led by the United Nations and endorsed it in 1997. It made a pledge to decrease GHG emissions by 34 percent in 2020 and 42 percent in 2015 under the Copenhagen Accord (Wolpe & Reddy, 2015). The country's vision of responding to an effective climate shift and transition to a low-carbon resilience is captured in numerous national transport and climate change policies which aim to develop a sustainable economy (Jennings & Quental, 2011). For example, the National Climate Change Response Policy gives the country a clear roadmap for responding to the urgency of climate change as it pushes towards a "green" economy. On the other hand, the National Environment Management: Air Quality Act of 2004 acknowledges that various parts of the country are not conducive to providing a healthy air environment for residents (South African Cities Network, 2016).

In the Draft Green Paper – Road Policy for South Africa, the National Department of Transport notes that non-motorised transportation (NMT) is an important potential transport solution for South Africa. The draft policy paper states that NMT has many health and economic benefits, but the fact that it has zero carbon emissions aligns well with the global call for climate change. NMT is regarded as a viable and sustainable alternative to the use of private vehicles but has encountered challenges that inhibited its widespread roll-out countrywide (Draft Green Paper – Road Policy for South Africa, 2016). Additionally, in 2008 at the Paris Motor Show the Department of Science and Technology Innovation Fund unveiled an electric car named Joule to contribute to cleaner energy. Unfortunately, the project was scrapped by the South African government in 2012 (Mangena, 2017).

South Africa continues to be one of the largest emitters of GHG in the world due to its high dependence on fossil fuel energy production and use. For example, the country depends on 75 percent of the coal supply to generate 91 percent of electricity, meaning fossil fuels remain the dominant source of energy (Mwakasonda, 2007). There is also a sustained upsurge of transport emissions due to the increase in households' access to cars, in particular around major cities. This challenge contributes to the emergence of Eco-Mobility.

Whether South Africa as a country is ready for Eco-Mobility is a question that will not be answered by this research. Nonetheless, the culture of car ownership remains embedded in the South African society, especially the emerging middle class populations in major cities. Shifting the culture of car ownership to the use of public transportation is not feasible in the near future due to poor public transport infrastructure. The inadequate public transport system negatively influences the cost effectiveness of time, money and spatial planning for vehicles parked the whole day. In addition to this challenge, automotive manufacturers have struggled to develop and promote eco-friendly vehicles in South Africa, thereby failing to contribute

to addressing air pollution. The South African government takes a protectionist approach to the automotive industry and has imposed a 43 percent import tax on electric vehicles (Snyman, 2017). In addition, government departments and entities are blamed for lack of policy co-ordination, legislation that is contradictory, as well as clashing policies in relation to the green transport strategy (Kings, 2017).

More recently there have been positive developments towards enabling the manufacturing of electric vehicles (EVs) in the country. Government and industry came together in late 2016 to launch the Electric Vehicle Industry Association (EVIA) which aims to advocate for a shift to clean transport to assist in reducing GHG emissions in the country (South African Cities Network, 2016). In addition, the country's submission to the Paris Agreement on climate change has committed South Africa to invest over R6.5-trillion in the electric cars industry. Hence, in 2017 the Department of Trade and Industry introduced the Strategy for Policy Direction Promoting Green Transport Technologies in South Africa. The aim of the strategy is to ensure that there are over three million electric cars in South Africa by 2050 as aligned to the commitments to the Paris Agreement (Kings, 2017). It appears that South Africa aims to emulate countries like Norway where electric cars recently reached 42 percent of total new car sales, with Oslo recognized as the Electric Vehicle (EV) capital of the world (Lambert, 2017). This illustrates to some extent the commitment of the South African government to clean energy and green transportation.

2.5 International Eco-Mobility Best Approaches

Due to cities been confronted by rapid urbanisation, increased population growth and severe impact of climate change, there has been an upsurge of Eco-Mobility approaches to address the challenges of highly densified cities. Most of the successful approaches have gained prominence in the global city networks and are regarded as best practices of Eco-Mobility. These best approaches are shared in the global city networks, through benchmark visits and study tours. Sharing of knowledge and expertise have enabled the experiences of international cities to be replicated in various parts of the world. Though the approaches are not identical, most of them exemplify the same principle of Eco-Mobility. This section will highlight some of the international Eco-Mobility best approaches that are celebrated by ICLEI, its partners and other city global networks. These approaches have been replicated in numerous cities due to their effectiveness and efficiency in promoting Eco-Mobility, illustrating the value of collaborative learning and exchange of experiences within different cultures and planning spaces.

2.5.1 City of Wonju, South Korea

Due to its high population, the City was faced with high traffic congestion and GHG (Reeds & Lirsa, 2015). It introduced weekly car-free days every September to encourage city inhabitants to use other modes of transportation (Reams et al, 2012). In addition, the City conducts a bicycle promotion campaign, related facility monitoring and bicycle map building to encourage the use of bicycles rather than private cars by its residents. The success of the project is seen in the improved air quality in the city due to the reduction of 1,362 kg GHG over a few months (ICLEI, 2016).

2.5.2 City of Seoul, South Korea

The City's objective is to be a "walkable city" to improve public health, the municipal economy and the environment. In 2003 it introduced 'self-car-free days' using license plates to ban private cars on the roads and encourage the use of public transport (Reams et al, 2012). The City also established a dedicated Walking and Bicycle Department to carry out projects that encourage walking and cycling. The City has created certain road sections in its central business district where cars are restricted to encourage walking by city inhabitants (Reeds & Lirsa, 2015).

2.5.3 Kaohsiung, Taiwan

The City is highly dependent on private vehicles, with over 80 percent of trips dependent on cars and scooters (PEARL Initiative, 2015). According to data, there are 242 cars per thousand people, and 719 scooters per thousand people, with a severe impact on the City's air quality (Reams et al, 2012). Some of the approaches to deal with traffic congestion include the improvement of the pedestrian environment to encourage walking by the inhabitants, dedicated bike path systems, a public bike sharing system with over 184 stations around the city, electric car-sharing system and introduction of the first-ever light rail transit system in the country (ICLEI, 2016).

2.5.4 Bogota, Colombia

The City introduced the TransMilenio Bus Rapid Transit System (BRT) to address traffic congestion and poor air quality (CoJ, 2011). The private sector in collaboration with the City played a key role in investing in the project. The BRT system is well integrated with feeder services as well as non-motorised modes like cycling and walking. The City of Johannesburg's BRT system was influenced by this system (Reeds & Lirsa, 2015).

2.5.5 London, United Kingdom

The City runs a congestion pricing scheme which involves charging single occupant vehicles a fee for entering the central London area during peak hours (Reams et al, 2012). The approach is meant to reduce traffic congestion and air pollution, and encourage the use of mass public transportation over private cars (ICLEI, 2016).

2.5.6 Buenos Aires, Argentina

Due to deterioration in the existing transport system and increased traffic congestion in the City, the pedestrian priority programme was introduced to increase pedestrian movement, discourage car use and reclaim public spaces for pedestrians (ICLEI, 2016). Narrow streets were created to encourage walking by the city inhabitants. In addition, car-free zones, pedestrian walkways, sidewalks and dedicated cycle lanes were created (Reeds & Lirsa, 2015).

2.6.7 Paris, France

Public transport users in global cities like Paris already enjoy the convenience of seamless modal integration. The underground train system, the regional suburban train system, the bus system, and smaller systems such as the two light rail lines, are all interlinked and integrated with regard to networks, scheduling, information systems, through-ticketing and transfer facilities (ICLEI, 2016). This approach is referred to as an integrated fare system (PEARL Initiative, 2015).

2.5.8 Copenhagen, Denmark

Copenhagen is famous for its cycling culture and is officially the first Bike City in the World (Bloomberg & Pope, 2017). In 2016 it was voted the ‘Best

city for cyclists' and the 'World's most liveable city'. Copenhagen has over 390 kilometres of designated bike lanes (Denmark.DK, 2017).

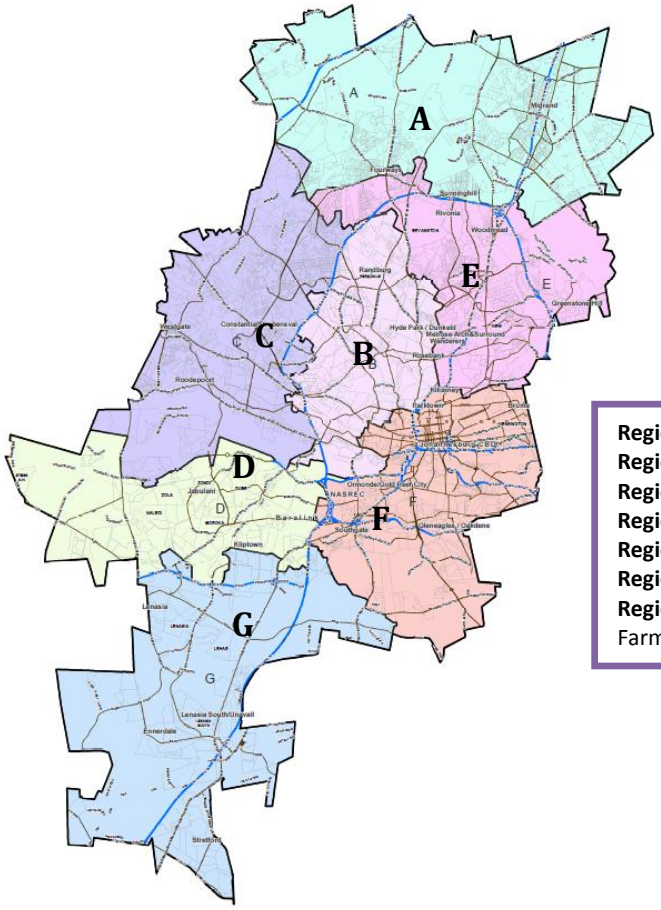
Other examples include the creation of an Office of Low Emission Vehicles by the United Kingdom government, as well as the installation of national fast-charging infrastructure for electric vehicles in Ireland (PEARL Initiative, 2015).

2.6 Eco-Mobility approaches in the City of Johannesburg

The Johannesburg Stock Exchange Limited (JSE), the largest stock exchange on the continent (United Nations Department of Economic and Social Affairs, 2015) and 16th largest in the world is based in the City of Johannesburg (Madhavan & Landau, 2011). The City of Johannesburg is a developing city with a world class infrastructure and a growing economy (CoJ, 2011). Johannesburg is the financial centre of South Africa, home to the headquarters of mining companies, financial institutions and many other multinational corporations. The headquarters of 70 percent of South Africa's businesses are located here (Bremmer, 2000).

The merger of five previously independent municipal areas created what is today known as the City of Johannesburg Metropolitan Municipality (Madhavan & Landau, 2011). The City's population totals 4.4 million with an annual increase of 3.4 percent (CoJ, 2017). Population density figures in the City are relatively low at 2 700 per square kilometre (South African Cities Network, 2016). Due to migration, the City's population numbers continue to increase compared to other cities of the country (Statistics South Africa, 2015). Johannesburg is also a young city with 42 percent of the population under 24 years of age (CoJ, 2011).

The CoJ is divided into seven administrative regions as shown in Figure 1 below.



Region A: Diepsloot & Midrand
Region B: Northcliff & Randburg
Region C: Roodeport
Region D: Greater Soweto
Region E: Sandton & Alexandra
Region F: Inner City
Region G: Ennerdale & Orange Farm

Figure 1: **City of Johannesburg regions**

Migrants (both national and cross-border) continue to move into the City, and this and other factors, including aging infrastructure, places excessive pressure on the City's service delivery capacity (Madhavan & Landau, 2011). Research into the City's GHG production indicates that electricity and transport emissions remain high (CoJ, 2013). However, there has been a significant decline in electricity related emissions and an incline in transport related emissions.

The CoJ residents use various modes of transportation to get to work, places of leisure and home. The main mode of transportation is motor vehicles which account for 37 percent, while walking accounts for 31 percent and minibus-taxis for 23 percent. On the other hand, cycling accounts for only 0.2 percent (CoJ, 2011).

Given this context, a city such as Johannesburg continues to be confronted and affected by climate change. In addressing climate change, the City seeks to devise innovative approaches to address climate change issues such as traffic congestion, GHG emissions and high energy consumption (Moir et al, 2014). One such innovative strategy is the Eco-Mobility approach of eco-friendly modes of transportation such as cycling, wheeling, passengering and walking. Through the 2009 Non-Motorised Transportation (NMT) Strategy the City promotes and advocates for the use of NMTs by its residents (CoJ, 2009).

As a member of ICLEI, the City of Johannesburg has an obligation to develop and implement Eco-Mobility approaches that are designed to address traffic congestion and reduce GHG emissions (ICLEI, 2016). With regard to its membership with ICLEI, the City of Johannesburg is obliged to fulfil its mandate by implementing and enhancing public confidence in Eco-Mobility approaches (Reeds & Lirsa, 2015).

In light of its international commitments, the City provides, *inter alia*, Metrobus which uses green fuel and the Rea Vaya bus services to encourage mass transportation amongst residents in order to decrease the number of private cars on the city's road infrastructure. In addition, the City works with private businesses to provide buses and minibus-taxis as other modes of transportation. The CoJ has also constructed cycling lanes to enable the culture of cycling as another mode of transportation.

In 2014 the CoJ was the first in the world to issue green city bonds worth R1.5 billion to fund city projects on climate change (CoJ, 2016). This illustrated the CoJ's commitment towards reducing GHG emissions in the City by securing funding for Eco-Mobility projects that are being implemented city-wide. However, since the new Democratic Alliance administration took office after the 2014 local government elections, some projects have been put in abeyance (Mngadi, 2017).

Eco-Mobility approaches are global sustainable urban models which the CoJ has learned from other developed cities. It is important to note that cities favour co-operation with each other instead of competition. This has contributed to a cohort of global city networks collaborating for the benefit of cities. For instance, during a survey on global city networks, the City of Johannesburg confirmed that co-operation within its city networks is more beneficial to them especially in relation to strategies of climate change (Buxbaum, 2014).The CoJ conducted investigations into Bus Rapid Transit systems in cities such as Brisbane in Australia, and Boston and Los Angeles in the United States, and Jakarta in Indonesia (South African Cities Network, 2016). South American cities such as Quito in Ecuador and Bogota and Pereira in Colombia were also visited to investigate their Bus Rapid Transit systems (CoJ, 2016). Once the investigations were completed, the lessons learned were used to influence the development and implementation of the Rea Vaya Bus Rapid Transport System (South African Cities Network, 2016).

2.6.1 The City's participation in global city networks

As the only city in South Africa that has independently developed an international relations strategy outside the ambit of the national department of International Relations and Co-operation, the City of Johannesburg positions itself as an investment and tourism destination. Adopted in 2012, the strategy aims to guide and monitor the City's engagements with other cities (National Planning Commission, 2012; CoJ, 2012). The City of Johannesburg aims to channel its effort and expertise in local government administration into transforming city networks to support cities from the Global South with financial and non-financial resources (Moir et al, 2014).

The participation of the City of Johannesburg in city networks also aims to advance the city's diplomacy in line with its International Relations Strategy (CoJ, 2012) where the City aims to enhance and sustain its development paradigm within such networks and positively communicate and share its position and strengths. It also promotes the African Agenda through African urbanism and the agenda of emerging economies (Buxbaum, 2014). It also influences networks and associations through its strategy following consistently the provincial and national mandate (Segbers, 2007). Due to the participation of South Africa in the BRICS forum, the City prioritises relations with cities from the Global South and particularly those from the four BRICS countries (Buxbaum, 2014). However, the City partners and collaborates with any global city interested in working together to achieve mutual benefits (CoJ, 2012).

The City aims to participate in these city networks with the intention of occupying leadership positions (CoJ, 2011). However, the City is aware that participation in the governance structures of these city networks requires resources such as funding, travelling and time. For instance, during elections for leadership positions within city networks, the City would have

to invest in resources, capacity and personnel to garner and mobilise support for its appointment (Buxbaum, 2014). Competition for leadership positions within city networks is intensive and demands resources to be made available for lobbying, whereas such resources could be used for service delivery (Allen, 2010). Therefore, it is necessary for the City to promote a balance between its strategic international relations objectives and financial prudence.

The City enjoys improved international stature within the city networks and has previously occupied leadership roles in some of the city networks (CoJ, 2011) including leadership positions in ICLEI and the Co-Presidency of Metropolis in 2013. The City has hosted global city networks events such as the World Summit on Sustainable Development in 2002, the Metropolis Summit in 2013, the C40 Summit in 2014 and the Metropolis Annual Meeting in 2018 (CoJ, 2017). It is important to note that cities bid for hosting such events and it is evident that the City of Johannesburg is seen as an important role-player in such networks, with its expertise in hosting global events acknowledged by its peers (Moir et al, 2014). It is thus critical that as populations in cities such as Johannesburg continue to increase with the consequences of traffic congestion and severe impact on the environment, appropriate decisions must be made by city planners for a sustainable future. These decisions include ways for people to live and travel in cities, in addition to cities sharing experiences and knowledge with each other (Wolpe & Reddy, 2015).

Under the auspices of the ICLEI which runs an international campaign on Eco-Mobility to transform how people should live and travel in cities, the City of Johannesburg engages with other cities and experts to share and exchange ideas on sustainable urban mobility experiences (ICLEI, 2016). As a world class African city and the financial centre of South Africa, the City of Johannesburg is faced with the challenge of reducing traffic congestion on its roads (Reeds & Lirsa, 2015). The modes of transportation

in the City are private vehicles, minibus taxis, rail and buses and all of these contribute to the City's high GHG emissions (UrbanAfrica.Net, 2015).

2.6.2 Sustainable urban mobility in the City of Johannesburg

The City of Johannesburg has the challenge of private vehicles occupying most of its public roads (Buxbaum, 2014). Accordingly, there is a need to transform road transportation and reduce travelling time (City Protocol, 2015). Road transportation and in particular private vehicles represents the highest percentage of emissions than any other road transport (Wolpe & Reddy, 2015). The transportation of people and goods on the roads of Johannesburg consumes extensive energy and contributes to noise and air pollution, high traffic flows and the need for continuous road repairs (Reeds & Lirsa, 2015).

It is important, therefore, to encourage the City's residents to be Eco-Mobile and use various methods of travelling which include cycling, wheeling, passengering and walking to reach their places of work, residences, schools and leisure destinations (CoJ, 2016). ICLEI has provided technical expertise, access to resources and educational programmes and other resources to capacitate cities in addressing climate change and devising innovative methods of living and travelling (ICLEI, 2016).

The increase in population and urbanisation are driving cities to implement innovative and sustainable transport systems for ease of mobility for their residents (Kodukula, 2012). Hence the building and refurbishment of cities is now constructed to minimise the environmental impact of GHG emissions and the consumption of energy. Big cities around the world such as Johannesburg are investing significant resources in mass transportation infrastructure to address traffic congestion and encourage other means of transportation (Segbers, 2007).

As presented in the Joburg 2040 Growth and Development Strategy document, Johannesburg aims to create a liveable city which is pro-public transport, walking and cycling, all of which are Eco-Mobility features (CoJ, 2011). Having a low-carbon city economy and a radical increase in public transport use is necessary for the growth and sustainable development of Johannesburg. Having previously served in leadership positions of the ICLEI, the City has access to resources and technical expertise to assist it in devising an Eco-Mobility strategy as a viable response to its challenges (ICLEI, 2016)

The City of Johannesburg Eco-Mobility strategy involves the provision of infrastructural changes within the City such as bus and taxi lanes to encourage the use of public transport (CoJ, 2013). In addition to these, the City is currently implementing the Transit-Orientated Development Corridors (formerly known as the Corridors of Freedom) which is a R2 billion project. The project aims to provide high density accommodation nearer to offices, recreational parks, hospitals, police stations, schools. This includes other social amenities along transport corridors such as the Rea Vaya Bus Rapid Transport system (ICLEI, 2016). In this way, these corridors will give residents increased freedom of movement as well as economic freedom (CoJ, 2016). This will reduce travel time for city residents, reduce the number of cars on the roads, improve air quality and ultimately increase disposable income. The residents who are disadvantaged will spend less of their income on transport (CoJ, 2011). The project will also assist in linking residents with potential places of employment (CoJ, 2016).

2.6.2 Johannesburg hosts the 2015 Eco-Mobility World Festival

To illustrate its commitment to implementing Eco-Mobility approaches, the City of Johannesburg hosted the second Eco-Mobility World Festival in Sandton, Johannesburg in October 2015, which is South Africa's Transport Month. The City collaborated with the ICLEI on the Festival in ensuring that

all members of the network attended the event (UrbanAfrica.Net, 2015). Sandton was chosen as the location of choice due to its complexity, busy traffic and location of headquarters of multinational companies. For example, the Johannesburg Stock Exchange is located in Sandton.

In 2013, ARUP, a transport consulting company, conducted a Sandton transport study to address the issues of traffic congestion within the area (CoJ, 2013). The study revealed that over 100 000 cars drive through Sandton per day and this makes the area a congested space which needs to be decongested, so as to reduce carbon emissions and thereby boost the health of the city's economy (ARUP, 2013).

Therefore, the Festival was held in Sandton to celebrate Eco-Mobility approaches implemented by the City. The Festival also illustrated the support provided by ICLEI and its partners with regards to the implementation of Eco-Mobility approaches (ICLEI, 2016). In addition, there was notable support by City residents for the Festival. Most importantly, during the festival, traffic flows and use of private cars in Sandton was reduced to 22 percent (Culwick & Katumba, 2015). In addition, sidewalks in the area were always full of pedestrians seen walking to and from work (Khubeka, 2015).

The City's future development plans include widening of the sidewalks in Sandton to encourage pedestrian walking, increasing the number of cycling lanes, providing dedicated public transport lanes, building commuter shelters and stops, and developing a mobile application to provide information on Eco-Mobility programmes and services (Ngcobo & Morais, 2015). This is in addition to the newly constructed bridge over the M1 motorway to accommodate some 10 000 people who walk between Alexandra and the Sandton CBD every day (SA Building Review Magazine, 2015). Most importantly, the City is not only focused on Sandton, but also constructs pedestrian bridges in other areas, as illustrated in Figure 12.

2.6.3 Assessment of Eco-Mobility approaches by the new leadership

During the local government elections in August 2016, a Democratic Alliance led coalition government was elected to govern the City of Johannesburg, removing the African National Congress from power. In the second sitting of council, the new Executive Mayor, Mr Herman Mashaba, announced that the City of Johannesburg would discontinue the bicycle lane project worth R70 million and instead focus on tarring all roads in the City (Tandwa, 2016). The proponents of Eco-Mobility, including former Executive Mayor Parks Tau, viewed this announcement as a setback to the progress made by the previous City administration in introducing sustainable modes of transportation. To date, a final resolution on the project has not been taken since the announcement by Executive Mayor Mashaba, thereby engendering uncertainty on the future of the project (CoJ, 2017).

In addition, Executive Mayor Mashaba has announced that the City will not hold any political positions in international networks in the short term but that involvement in such networks at technical and administrative levels should continue (CoJ, 2017). The consequences of this decision on Johannesburg's standing in global networks is yet to be determined.

On the other hand, Johannesburg seems to be making positive progress in countering traffic congestion. According to the 2017 TomTom Traffic Index which measures traffic congestion in major cities, the City of Johannesburg ranked 70th in global terms and below the City of Cape Town which ranked 48th (IOL Motoring Staff, 2017). The City is credited for infrastructure development such as the Gautrain, Rea Vaya and the Gauteng Freeway Improvement Project which have had a positive impact on traffic congestion.

In addition, Bloomberg & Pope (2017) asserts that the Transit-Orientated Development Corridors is a city transportation strategy combined with a

climate strategy and an anti-poverty strategy. This is due to the vision of the strategy which anchors new city developments around new public transit routes, thereby expanding economic opportunities along those transit routes to encourage people to live, work and play in those areas.

However, the City continues to be one of the largest GHG emitters in South Africa and around the world (Earthlife Africa, 2015) and needs to reverse this trend gradually by introducing Eco-Mobility approaches in all parts of the City. Hence in March 2017, Executive Mayor Mashaba and the City's Department of Public Safety, which includes the Johannesburg Metro Police Department, launched a new 24-hour traffic hotline for motorists to report on traffic congestion, accidents and car breakdowns on the City's roads (Masweneng, 2017). This is in addition to the City's strategic priority of continuously improving the quality of public transport through its 2017 Budget which allocated an operating budget of R1.5 billion for the 2017/18 financial year to fund the expansion of Metrobus and Rea Vaya, also solidifying a strong working relationship with the bus and taxi industry and other transport service providers (City of Johannesburg, 2017).

For instance, the City will pay compensation worth more than R805 million to minibus taxi operators for implementing Phase 1C of the BRT project. The 17km Phase 1C route – along Louis Botha Avenue between the Johannesburg Inner City, Alexandra and Sandton – is expected to be operational by October 2018 (CoJ, 2017). It is expected that the removal of minibus taxis and buses from the Phase 1C route will contribute to reduced traffic congestion and a cleaner environment (Mngadi, 2017). This will increase the infrastructure built to accommodate public transport and reduce the number of private cars on the roads. Additionally, the City has also constructed special public transport lanes in Sandton that are now exclusively used by Gautrain buses, Putco, Metrobus and minibus taxis. Private cars are not allowed to travel in those lanes (Mahlangu, 2017). This

is a clear indication that the City is affirming its commitment to Eco-Mobility infrastructure.

2.7 Chapter Summary

The chapter explained the importance of Eco-Mobility approaches in encouraging cities to address traffic congestion and climate change. Cities can no longer ignore the importance of walking, cycling, wheeling and passengering to reach destinations of work, residence and leisure. Therefore, cities need to accommodate Eco-Mobility approaches in their future spatial development plans to cater for new ways of mobility.

As GHG emissions continue to rise, cities are collaborating with each other through global city networks such as the ICLEI to learn best practices of Eco-Mobility. These include the construction of cycling lanes and pedestrian bridges, BRT systems and expansion of passenger lanes.

With transport accounting for higher percentages of the total GHG emissions, the City of Johannesburg has been instrumental in investing resources in Eco-Mobility approaches. This is intended to encourage behavioural change by residents in order to realise a shift from private cars to eco-friendly mobility approaches.

Encouragingly, the 2017 TomTom Traffic Index indicated that the City is slowly making progress against traffic congestion. The City is credited for infrastructure development such as the Gautrain, Rea Vaya and the Gauteng Freeway Improvement Project which have had a positive impact on traffic congestion. Moreover, the City continues to invest significant resources to fund the expansion of Metrobus and Rea Vaya into other areas of the City.

Nonetheless, the City continues to be one of the largest GHG emitters in South Africa and therefore there is a need for a concerted effort in ensuring that the development and implementation of Eco-Mobility approaches is successful in addressing traffic congestion and poor air quality.

The new political leadership in the City of Johannesburg currently has no desire to contest for political positions in the global city networks. Additionally, a decision has been taken to discontinue the bicycle project and redirect the funding towards tarring all roads in the City. These decisions are posing a challenge to the City's stature in the international community as a champion for Eco-Mobility approaches.

The next chapter focuses on the research methodology employed in the assessment of the infrastructure built for the purpose of Eco-Mobility approaches and its effectiveness in the City of Johannesburg.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Design

The aim of this chapter is to provide an outline of the research method used to understand and answer the research questions. This research employed a qualitative interpretive methodology for answering most questions. According to Wagner et al (2012), qualitative research is concerned with understanding the processes and the social and cultural contexts that shape human behaviours and the methodology involves a researcher being interested in exploring a situation, purpose or reality (Merriam, 2002). The aim of qualitative interpretive methodology is to understand and identify experiences, thoughts and perspectives that emerge in order to construct the importance of the context from the participants through first-hand experience, truthful reporting, and quotations of actual conversations (Leung, 2015).

Qualitative interpretive study uses an in-depth process of collecting information through discussions, interpretation and documentary analysis. Such a process allows for unique and valuable data to be discovered and analysed in order to provide a significant framework which enables theme trend identification (Merriam, 2002). This allows the researcher to construct theory and hypothesis through linking various concepts and theories from data collected (Wagner et al, 2012).

The methodology was most appropriate as it seeks to assess the infrastructure built for the purpose of Eco-Mobility and its effectiveness in the City of Johannesburg. Research data was gathered through interviews, documentary analysis and desktop research to provide a degree of assessment in understanding the infrastructure built for the purpose of Eco-

Mobility and its effectiveness in the City of Johannesburg. The researcher also employed the use of core descriptive statistics in highlighting the level of emissions by various modes of transportation.

As the research study was assessing a policy intervention by the City, a theory of public policy was employed to address the methodological issues of this type of research. Public policy is defined as the overall framework within which the actions of the government are undertaken to achieve its goal through purposive and consistent courses of action devised in response to a perceived problem of a constituency, formulated by a specific political process, and adopted, implemented and enforced by a public agency (Parsons, 2002). For example, Eco-Mobility is a project aimed at fulfilling the goal of a car-free society, within transport policies of the City of Johannesburg. Therefore, it is considered a public policy.

As part of assessing this policy intervention, rational choice theory was applied by the researcher in evaluating data collected. Rational choice theory is defined as an approach which argues that all action is fundamentally rational in character and that people calculate the likely costs and benefits of any action before deciding what to do. According to the theory, all social action can be seen as rationally motivated and as instrumental action, however much it may appear to be irrational or non-rational (Parsons, 2002). Rational choice theory aims to achieve maximum social gain/benefit by enabling government to choose policies resulting in gains to society that exceed their costs by the greatest amount.

Therefore, through data collected, the research employed stakeholder analysis as the methodology to assess the effectiveness of Eco-Mobility approaches in the City of Johannesburg. Stakeholder analysis is a method of thoroughly gathering and analysing qualitative evidence to define whose interests should be taken into account when developing and/or implementing a policy or programme (Wagner et al, 2012). For instance,

these interests can include of private citizens, taxi and bus associations, cycling associations, non-governmental organisations and environmentalists, amongst others.

Table 1: Stakeholder Theory and Matrix

Influence and Power of stakeholders ↑		
	KEEP SATISFIED → MEET THEIR NEEDS City residents	**MANAGE CLOSELY** → KEY PLAYERS Taxi - bus operators – cyclists - pedestrians
	MONITOR → LEAST IMPORTANT NGOs – CBOs – Media	**KEEP INFORMED** → SHOW CONSIDERATION Lobby groups – unions – political parties
Interest of Stakeholders →		

Table 1 indicates the stakeholder theory and matrix assumed to have been undertaken by the City in the development and implementation of Eco-Mobility approaches.

As indicated, the project was initiated to satisfy the mobility needs of residents of the City by providing alternative modes of transportation such as the Rea Vaya BRT system, cycle lanes, expanded roads and pavements. This was aimed at addressing traffic congestion and air pollution in the City.

On the other hand, it was critical for the City to manage its relations with key players deemed to be affected by the project. This included taxi and bus associations, pedestrians and cyclists. This was to ensure that there is commitment to, and support for, the project. For example, the Rea Vaya BRT system is in direct competition with taxi and bus associations.

Views and actions of media, NGOs and CBOs were monitored by the City as their influence in directing the discourse around the project was important. Opposition parties in the Council, lobby groups and labour unions were informed of the City's plan to develop and implement Eco-Mobility approaches. This was done through official Council meetings and documents to garner support and promote an official Council mandate for the project.

3.2 Data Sources

Table 2 below indicates how each of the research questions was translated into various data collection methods.

Table 2: Data Collection Methods

Research question	Methodology	Approach	Participants
How effectively has the development of Eco-Mobility approaches increased mass transportation, walkability and cycling for commuter purposes in the City?	Qualitative	Semi-structured interviews Desktop research City documents	City officials, Elected representatives and Government officials
Has the use of private cars in the City significantly reduced or increased since the implementation of Eco-Mobility approaches?	Quantitative	Unstructured and semi-structured interviews Desktop research City documents	Environmental NGOs, City officials, Elected representatives, Government officials and Business officials

What impact do Eco-Mobility approaches have on developmental programmes such as the Transit-Orientated Development Corridors?	Qualitative	Semi-structured interviews Desktop research City documents	City officials, Elected representatives and Government officials

3.3 Data Collection Techniques

Leung (2015) states that a qualitative methodology provides a great deal of descriptive detail, emphasises process and is concerned with explanations. Therefore, to assess the effectiveness of Eco-Mobility approaches in the City of Johannesburg, interviews, desktop research and documentary analysis were used as valuable sources of information to obtain this information. In addition, the research also employed the use of core descriptive statistics to assist in sampling the new vehicles sales data in Johannesburg, and also the year-on-year Rea Vaya ridership numbers. These methods were useful in exploring deeper issues of inquiry.

3.3.1 Interviews

An interview guide was developed and included basic questions that were developed using the literature review. This methodology was useful in responding to the research questions. Interviews provided the basis for understanding the different responses from interviewees and validated desktop research and documentary data that emerged, thereby allowing for useful analysis of data through thematic analysis (Merriam, 2002).

Twelve interviews were conducted to obtain in-depth data from the participants. Eight face-to-face interviews were held and took between 25 and 40 minutes. During face-to-face interviews, a tape-recorder was used

to collect data and assisted with avoiding the need to ask participants to repeat their responses.

Four interviews were conducted via email as participants were not available to be interviewed in person. An interview guide was relevant here in order to ensure that interviewees did not deviate from the standard process and questions to allow for a comparison of data from different respondents.

3.3.2 Documentary Analysis and Desktop Research

A documentary analysis was used to strengthen data collection. Documentary analysis is a useful approach that can be adopted by researchers in the full confidence that it is also a scientific method that requires rigorous adherence to research protocol (Leung, 2015). Therefore, for the purposes of this research, the sources of documentary analysis were both primary and secondary public documents. Primary documentary sources included Statistics South Africa for descriptive statistics, State of the Cities Reports, the City's published documents such as the Integrated Development Plan, Joburg 2040–Growth and Development Strategy, Annual Reports and other official documentation. Secondary sources included media reports, unpublished reports and other sources available online.

Relevant documents were also sourced using the 'pearl-growing' technique, i.e. further references were identified using the bibliographies of relevant documents the researcher was already aware of, the bibliographies of which were – in turn – checked, until data saturation was reached (Merriam, 2002).

Additionally, the following journals contributed towards the study: Urban Studies, Environmental Impact Assessment Review, The Annual Review of Environment and Resources, Sustainability, An International Journal of Policy, Administration, and Institutions, Population and Development

Review, The Review of International Organizations, Public Policy and Administration, National Institute of Urban Affairs, Informatica Economica, Cities, Environmental Impact Assessment Review, Society and Business Review.

3.3.3 Categorising data into groups and themes

With the questionnaire as the basic structure for organising and compiling all collected data, a method of open coding was used to classify collected data into groups and themes to discover their significance without any preconceived notions or pre-established category names (Farrokhi & Mahmoudi-Hamidabad, 2012). This is known as discourse analysis. This process assisted the researcher to identify themes and patterns that emerged during the study period. This was followed by axial coding, which connected categories by providing similar theoretical ideas (Stiles, 1993). This allowed themes to be clearer and organised efficiently. This is known as thematic analysis. Once done, selective coding was used to ensure that themes are frequently associated to fit the data collected (Farrokhi & Mahmoudi-Hamidabad, 2012).

Open-ended questions which aim to encourage participants to provide honest responses (Wagner et al, 2012) were posed to participants so that the research was enhanced by more information. The aim was to allow the participants to speak freely and honestly about their experiences and context. Open-ended questions also assisted the researcher to avoid probing moral and ideological questions (Stiles, 1993).

3.3.4 Reliability and Validity

The value of qualitative research may be questioned due to problems of validity, reliability and commonality (Leung, 2015). However, there have been progressive steps taken by qualitative researchers to advance the quality of their research (Rabie, 2004). In qualitative research, validity is

when the research question, choice of methodology, design, sampling and data analysis are all truthful and suitable in reaching the conclusions derived from the research (Wagner et al, 2012) and the analysis and findings are credible (Stiles, 1993).

Reliability is a process whereby a study and its results can be replicated and the outcome thereof will remain the same. Reliability is about consistency during repeated trials and being able to generalise the study in another environment (Shenton, 2003) and where data or observation is dependable (Stiles, 1993).

To ensure that data and evidence was credible, the research methodology ensured that relevant individuals who were essential to the infrastructure built for the purpose of Eco-Mobility were identified for interviews. This was not only limited to the City's senior administrators; NGOs and multilateral organisations were also interviewed. In addition, data from credible sources such as the City's published documents were analysed for the research.

The researcher employed a process of triangulation to validate and support data collected during the study. These included using other researchers, alternative sources of data and theories (Wagner et al, 2012). This also assisted with testing the relevance of the data collected. The researcher triangulated all the data collected for the purpose of data extraction and analysis (Shenton, 2003).

3.3.5 Sampling Techniques

Purposive sampling was used to make the study more participatory and inclusive by selecting a wide range of participants (Rabie, 2004). This ensured that the study selected and identified people who had knowledge and experience of the infrastructure built for Eco-Mobility and its effectiveness in Johannesburg.

Table 3 below lists the participants in the research study, who were able to communicate their experiences and opinions on the subject matter. In respect of the ethics code guidelines, their full names and official job positions were kept confidential.

Table 3: List of participants, description of role and date of interview

Interview participant	Role and/or Job Description	Date	Location	Type of interview
Participant SL	Transport Specialist	01 June 2017	CBD, Johannesburg	Face-to-face
Participant PL	Climate Change Advisor	07 July 2017	Hatfield, Pretoria	Face-to-face
Participant GM	Cycling Specialist	14 July 2017	Douglasdale, Johannesburg	Face-to-face
Participant MKG	Climate Change Specialist	19 July 2017	Braamfontein, Johannesburg	Face-to-face
Participant MA	Retired Academic	20 July 2017	Rosebank, Johannesburg	Face-to-face
Participant CH	Global City Network leader	21 July 2017	Braamfontein, Johannesburg	Face-to-face
Participant HM	Transport Specialist	21 July 2017	Sandton, Johannesburg	Face-to-face
Participant EJJ	Strategy and Relations Specialist	25 July 2017	Braamfontein, Johannesburg	Face-to-face
Participant PdD	Cycling Specialist	28 August 2017	Sandton, Johannesburg	E-mail
Participant CA	Policy and Research Specialist	26 September 2017	Braamfontein, Johannesburg	E-mail
Participant WD	Development Planning Specialist	28 September 2017	Braamfontein, Johannesburg	E-mail

Participant BR	Health Specialist	03 October 2017	Braamfontein, Johannesburg	E-mail

The study also utilised convenience selection which is a method of including readily available participants (Farrokhi & Mahmoudi-Hamidabad, 2012). Through interactions with selected participants, the researcher encouraged and requested information about other possible participants who were then also interviewed. This method is defined as snowballing sampling due to its ability to refer the researcher to other possible participants that are willing to form the study population (Wagner et al, 2012). This process was able to secure one-third of the research participants.

3.4 Limitations of the study

There were limitations that pertained to this study. For instance, due to time constraints the study was not able to elicit views from the broader public on the infrastructure built for the purpose of Eco-Mobility approaches. Whilst it is recognised that the City of Johannesburg undertook an in-depth public consultation process, the methodology did not undertake a survey on attitudes and/or perceptions of the general public. Rather, the role of government officials and global city networks in influencing the development and implementation of Eco-Mobility approaches in the City of Johannesburg was assessed. In addition, NGOs involved in promoting Eco-Mobility approaches were interviewed to give the study a broader perspective. It was difficult to secure interviews with important stakeholders such as national government officials and taxi associations. Nonetheless, interviews were held with stakeholders who were available and interested in the research topic.

3.5 Ethical Considerations

3.5.1 Confidentiality

This research did not focus on any controversial practices nor sensitive groups. However, there were other potential ethical considerations that emerged from this research such as the non-participation of the broader public. The researcher interviewed present and past City officials and senior administrators and engaged with official documents of the City. A biographical form was issued to all participants to obtain their personal information.

In addition, as the researcher is presently employed as a City official, he ensured that the research did not conflict with his professional responsibilities and no prejudice or bias occurred during the drafting of this research report. The researcher was not involved in the infrastructure built for the purpose of development and implementation of Eco-Mobility approaches in the City of Johannesburg as that process happened before the researcher joined the City as an employee. Secondly, the researcher is not involved in any official discussions about the continued/discontinued infrastructure built for the purpose of Eco-Mobility approaches in the City. Therefore, to ensure ethical professionalism, the researcher observed and conformed to the code of conduct as declared in the Singapore Statement (Resnik & Shamoo, 2011).

3.5.2 Informed Consent

All participants provided their consent to participate in the research study.

3.5.3 Provision of debriefing, counselling and additional information

Participants received a transcript of the interview and were reassured that withdrawal from the process was possible at any point. All information obtained from the interviews was kept confidential.

3.6 Chapter Summary

The chapter highlighted the use of qualitative interpretive research methodology to assess the effectiveness of Eco-Mobility approaches in the City of Johannesburg. It also detailed the stakeholder theory and matrix analysis undertaken by the City in the development and implementation of Eco-Mobility approaches to identify all stakeholders interested in the initiative.

The chapter also underlined the data collection methods that were employed in extracting data. Twelve interviews were conducted, including documentary analysis and desktop research. Successively, data was categorised into groups and themes in order to identify emerging trends. A process of triangulation was undertaken to address issues of reliability and validity emanating from the study.

Due to time constraints, the broader public was not interviewed. Therefore, the chapter highlighted the issue as a limitation of the study. The study did not focus on controversial nor sensitive issues. Nonetheless, the researcher adhered to the code of conduct as declared in the Singapore Statement, including keeping confidential the names of the research participants and the information collected.

The next chapter focuses on presenting data results. This is done through synthesising key aspects from the research participants and providing a critical analysis of the interview results.

CHAPTER 4
DATA RESULTS

4.1 Introduction

The most important finding of the study suggest that for any City to effectively implement Eco-Mobility approaches, it needs the full support of its political leadership.

The process of triangulation to substantiate data collected was undertaken during the study. These included using other researchers, alternative sources of data, and theories. Moreover, data collected from city officials, global city networks and non-governmental organisations was compared to determine emerging themes.

The questionnaire was valuable in keeping the participants' response consistent. Subsequently, the researcher identified general statements and theories that emerged from the collected data. This assisted the researcher to place data in a systematic, organised and interpretable manner in order to respond to the research questions. At this point, the researcher reached data saturation**.**

Therefore, this chapter provides an account of other key findings that emanated from the data collection process. The description and analysis of data collected is provided in a narrative form and organised in sectional form responding to the following three research questions:

1. How effectively has the development of Eco-Mobility approaches increased mass transportation, walkability and cycling for commuter purposes in the City?
2. Has the use of private cars in the City significantly reduced or increased since the implementation of Eco-Mobility approaches?

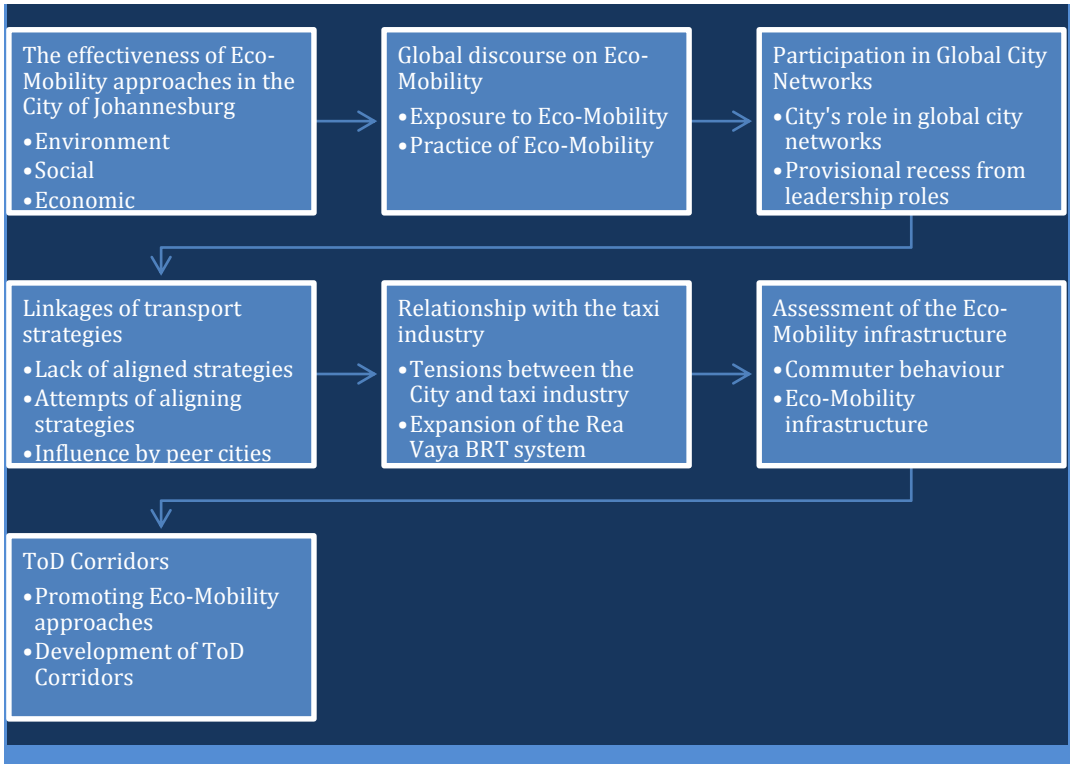
3. What impact do Eco-Mobility approaches have on developmental programmes such as the Transit-Orientated Development Corridors?

Therefore, section one of this chapter provides a narrative and critical account on the effectiveness of the City's infrastructure development towards the implementation of Eco-Mobility approaches for commuter purposes in the City of Johannesburg. This includes defining the concept of Eco-Mobility and its relation to the practice and exposure of Eco-Mobility in the City. Additionally, this section provides an account of the importance of the City's participation in global city networks. The lack of transport policy coordination between the three spheres of government (local, provincial and national) in South Africa is also highlighted. The City's relationship with the taxi industry is also highlighted to illustrate the co-option benefits accrued by the industry in supporting the Rea Vaya BRT project.

Section two of this chapter provides findings on the use of private cars since the implementation of Eco-Mobility approaches. It focuses on commuter behaviour and its impact on the usage of the bicycle lanes. The section also details the increase of private cars on the City's roads and the 24-hour traffic hotline as a response by the City to the increasing traffic congestion. The section explains the outcomes of the 2015 Eco-Mobility World Festival and the legacy projects that emerged thereafter.

Lastly, section three clarifies the impact of Eco-Mobility approaches on other developmental programmes such as the Transit-Orientated Development Corridors. The findings focus on the City's promotion of Eco-Mobility approaches to its residents and how the Transit-Orientated Development Corridors is anchored on the development of Eco-Mobility approaches.

The chapter is detailed in the following thematic analysis:



4.2 Effectiveness of Eco-Mobility approaches in the city

The definition of Eco-Mobility approaches is critical in understanding the infrastructure development towards the implementation of Eco-Mobility approaches in the City of Johannesburg. This provides an account of the understanding and experience of those who were intrinsically involved in the development and implementation of Eco-Mobility approaches in the City.

4.2.1 Defining Eco-Mobility approaches in the City of Johannesburg

During the research process, the participants were asked to describe in their own words their understanding of the meaning of Eco-Mobility. From their responses, it became clear that there is no standard definition of Eco-Mobility. Participants each had their own understanding of the term and there were differing and diverse views. However, the definitions had

similarities centered on three themes: Environment, Social Spaces and Economics.

4.2.1.1 Environmental aspect of Eco-Mobility

In relation to the environment aspect of Eco-Mobility, Participant SL, a transport specialist in the City's Transport Department, noted that the definition of Eco-Mobility has its own complexities and is not easily definable. However, it involves all green transportation (Participant SL, personal communication, June 01, 2017). Additionally, Participant MKG, a Climate Change Specialist in the City of Johannesburg describes Eco-Mobility as a transition from the conventional methods of mobility which mostly involves fossil fuels to those which are environmentally friendly and less damaging to the atmosphere (Participant MKG, personal communication, July 19, 2017). Participant CA, a Policy and Research Specialist in the City of Johannesburg, similarly describes Eco-Mobility as finding the correct balance between mobility and environmental sustainability. Essentially this means implementing modes of transport with a decreased ecological impact, such as minimised GHG emissions (Participant CA, personal communication, September 26, 2017).

On the other hand, Participant MA, a retired academic in urban planning, defines Eco-Mobility as the development and usage of mobility infrastructure that avoids having a negative impact on the environment (Participant MA, personal communication, July 20, 2017). On behalf of a non-governmental organisation which works with megacities around the world in the mitigation and adaptation of climate change, Participant CH defines Eco-Mobility as a clean way of people moving from point A to point B, without causing damage to the environment (Participant CH, personal communication, July 21, 2017).

According to Participant EJJ, a Strategy and Relations Specialist in the City of Johannesburg, Eco-Mobility is a concept addressing all forms of

transport, both motorised and non-motorised, and which specifically shifts towards a non-motorised and public transport component (Participant EJJ, personal communication, July 25, 2017). A Johannesburg volunteer cycling association which promotes cycling as a mode of transport, describes Eco-Mobility as transport that is friendly to, or considers the impact on, the environment of transport more generally but also the environment it travels through. For instance, it would include noise pollution reduction as an outcome of eco-mobility transport (Participant PdD, personal communication, August 28, 2017).

4.2.1.2 Social aspect of Eco-Mobility

On the other hand, in relation to the social aspect of Eco-Mobility, Participant WD, a Development Planning Specialist in the City of Johannesburg, provides an emerging definition of Eco-Mobility by stating that cities are places of connection and accessibility. The reason that humans group together in cities is to have better access to one another, to jobs and to services (healthcare, education, water). Because of car-oriented development and other factors (for example, apartheid planning in South Africa) cities internationally have sprawled, making access to city amenities harder. In Johannesburg, many people have to travel long distances at high cost (time and monetary) to access jobs and other amenities. Not only is this expensive and time-consuming, it also has negative effects on the environment through high emissions from motorised transport (Participant WD, personal communication, September 28, 2017).

Participant BR, a Health Specialist in the City of Johannesburg, describes Eco-Mobility as being descriptive of an environment which is healthy and conducive to making people mobile in a manner that improves their overall health and well-being. He further mentions that it is a socially acceptable form of non-motorised transport which not only lowers atmospheric pollution but allows for overall health improvements through various alternative

modes of transport (Participant BR, personal communication, October 03, 2017).

4.2.1.3 Economic aspect of Eco-Mobility

Participant PL, Climate Change Advisor for a German developmental agency operating in South Africa, asserts that Eco-Mobility has to do with looking at various aspects of sustainability in terms of transportation, which includes an element of economics and sustainability (Participant PL, personal communication, July 07, 2017).

Speaking on behalf of a non-governmental organisation which provides people with bicycles, Participant GM, defines Eco-Mobility as talking about a bicycle being economical and having a number of positive aspects to it, such as being an extremely inexpensive and eco-friendly form of transportation (Participant GM, personal communication, July 14, 2017).

While there are variations in defining Eco-Mobility, it was also evident that there is to a large extent a shared understanding of Eco-Mobility and its intended purpose. Nonetheless, the researcher supports the definitions that Eco-Mobility seeks to make it more economically, socially and environmentally sustainable to access the City amenities. This includes increasing the supply and efficiency of public transport, but also transforming the City into one where public transport is more efficient (higher densities and mixes of land use around public transport) and one where more amenities and opportunities can be accessed by people close to where they live (through increasing residential densities around centres of jobs and city amenities, and through diversifying land use and increasing amenities in areas of residential high density parts of the City). The Spatial Development Framework (SDF) 2040 for Johannesburg provides extensive detail on this approach.

4.2.2 Global discourse on Eco-Mobility

Cities around the world have long been implementing Eco-Mobility approaches without defining them as such. For instance, cycling became popular in Denmark in the 1960s due to the oil crisis, the environmental movement and some controversial road projects in the country (Denmark.DK, 2017). It is notable that the concept and practice of low-carbon emissions in transport was already in evidence at the Rio Summit of 1992, with discussions around climate change and issues of Eco-Mobility.

4.2.2.1 Exposure to Eco-Mobility

Interview participants such as SL, PL, GKM and EJ played a central role in the development and implementation of Eco-Mobility approaches in the City of Johannesburg. They confirm that the concept was influenced by the City's international peers as the previous Executive Mayor Parks Tau was a proponent of urbanism and international city collaboration. Eco-Mobility was one of the lessons derived from overseas experiences.

Accordingly, the City was exposed to the term Eco-Mobility when the then previous Member of the Mayoral Committee for Transport, was invited to attend the first Eco-Mobility World Festival in Suwon, South Korea in 2013. She returned keen to restructure the transport department to oversee both the construction of public transport infrastructure and non-motorised infrastructure for walking and cycling, to be called the Eco-Mobility Department. However, that plan did not materialise due to bureaucratic and institutional challenges. Despite those challenges, the City was able to embark on a project to implement Eco-Mobility approaches (Participant SL, Participant MKG, personal communication, 2017). This includes branding the City's buildings with messages on Eco-Mobility. Please see Figure 2 for a sticker posted on the main entrance of the City's council building.

Participants BR and CA (personal communication, 2017) maintain that the practice and exposure of Eco-Mobility approaches has a long history in the City. They both assert that the City has to date initiated the following projects in support of Eco-Mobility approaches:

- Cycling lanes which were constructed in 2015/16;
- The Healthy Parks initiative which introduced gym equipment;
- The various “walks”/marathon events hosted/partnered by the City;
- The healthy exercise project for senior citizens at old age homes;
- The campaign to encourage greater use of cycling/walking (Sandton);
- The Rea Vaya Project which has the latest technology in reducing fossil fuel emissions; and
- Dual-fuel busses and hybrid vehicles as part of the City fleet.

4.2.2.2 Practice of Eco-Mobility

However, the discourse on Eco-Mobility was not presented in a way which was meaningful and attractive to political leadership and perhaps more importantly, to cities. ICLEI was able to do this for its member cities (Participant CH, personal communication, 2017). Participant MKG (personal communication, 2017) admits that the CoJ did not utilise the term Eco-Mobility but has been practicing Eco-Mobility as a way to move people from point A to B. This suggests that the CoJ has always had an awareness of these various forms of mobility.

Eco-Mobility has been a subject of global discourse, especially on the United Nations platforms. SANEDI continuously advocates for the practice and exposure of Eco-Mobility approaches in collaboration with its partners (Participant HM, personal communication, 2017). It is evident that cities are urbanising and growing rapidly, and this presents an increasingly urgent need for alternative forms of transportation to ensure that the City of Johannesburg can move people − in the most cost-effective way and with

the least impact on the environment − between the places where they live, work and play (Participant EJJ, personal communication, 2017).

Participant PL (personal communication, 2017) is in support of the view that Eco-Mobility approaches have always been present but have not been accessible to the people and the concept was not discussed broadly, as climate change and sustainable development are. People were utilising transport structures in their usual manner, without being aware that what they are doing is closer to Eco-Mobility approaches. However, she argues that the term still needs clarity and better definition as it is informed by space and the factors that define it. This may also vary between cities.

The researcher notes that the previous Executive Mayor was an urbanist and very instrumental in positioning the City as a leader in the global climate change discourse. It is thus understandable that during his tenure, the City was exposed to the concept and practice of Eco-Mobility. Nonetheless, the participants do emphasise that the City had been practicing Eco-Mobility approaches without being aware of it.

4.2.3 The importance of the CoJ's participation in global city networks

Cities are realising the importance of global city networks. This is illustrated through the expansion of city networks in various issues affecting cities such climate change, migration, public safety, but to name a few. The City of Johannesburg is a member of these networks and actively participates in the various work streams to benefit exponentially from the technical expertise and knowledge exchanges provided through these organisations.

4.2.3.1 City's role in global city networks

Participant EJJ (personal communication, 2017) affirms that cities are the closest sphere of government to the people. Therefore, the voice of local government in international affairs is extremely important in terms of the

issues that affect all cities. It is important to interact in global city networks to ensure peer learning and to influence the discourse. Additionally, Participant PL (personal communication, 2017) asserts that participation in global city networks allows local government to expose itself to best practices, learnings and sharing of experiences. The City of Johannesburg cannot be an island.

The City of Johannesburg is one of the founding cities of the C40 structure and plays an important role in the organisation. There are only eleven cities in Africa in the C40 and four of those are from South Africa (Participant CH, personal communication, 2017). According to Participant MKG (personal communication, 2017), the City of Johannesburg plays an important role in representing issues that affect the Global South and African cities and due to its history, the City is seen as transcending both the developing and developed worlds and is well positioned to understand both worlds.

Participant CH (personal communication, 2017) states that the CoJ actively participates in most of these global city networks due to its stature in South Africa and Africa. The CoJ is strategic in selecting which global city networks it participates in and that has assisted the CoJ to position itself as a global leader. For instance, the CoJ provides leadership and guidance to other cities in the implementation of BRT systems. He further adds that he was honoured when the C40 Summit was convened in Johannesburg. This provided the opportunity for participating mayors to learn about Africa, African cities and how they operate. Participant PL (personal communication, 2017) emphasises the importance of an African city like Johannesburg participating in international city forums and learning from its peers.

4.2.3.2 Provisional recess from leadership roles within global city networks

The City continues to be a member of global city networks such as the ICLEI and C40, although the Executive Mayor has indicated that his administration will for now focus on domestic challenges. However, Participant HM (personal communication, 2017) argues that it is critical for cities to participate in global city networks. It provides them with the exposure and ability to benchmark their peers. UNIDO promotes peer-learnings in its projects with partner countries and cities and it is therefore useful for the City to continue participating in such forums.

The Department of Transport (DOT) is presently not participating in international forums focused on transportation due to the position taken by the new City leadership to focus on domestic challenges (Participant SL, personal communication, 2017). This has resulted in a reduction in City participation in such forums. According to Participant CH (personal communication, 2017), it is unnecessary and costly for a city to participate in a global city network if there is no specific need for it. However, he suggests that most of the issues that Johannesburg needs to address are shared by many other cities and this provides a reason to participate in global city networks.

The researcher supports the continued participation of the City in global city networks in order to position the City as a final destination for tourism, investment and knowledge. Hence, the researcher is against the City's provisional recess from leadership positions within global city networks. As detailed in the literature review section, cities compete for leadership positions within global city networks and demands resources to be made for lobbying, workshops and travelling. Therefore, the City would have to spend significant resources if and when it reviews its current decision of not standing for leadership positions within global city networks. These resources could instead be used for service delivery requirements.

4.2.4 Linkages in transport strategies

4.2.4.1 Lack of aligned strategies

Transport experts in South Africa have highlighted the lack of alignment between the City's transport strategy and policy developed by both the provincial and national governments. According to Kings (2017), government departments and entities are blamed for lack of policy co-ordination, misaligned laws as well as clashing policies with regard to the green transport strategy. Participant PL (personal communication, 2017) argues that cities become frustrated. They have to deliver results within the five-year political term, so they overtake the provincial and national department in order to fulfil their targets. This causes the national government to lag behind the cities, when it should in fact be the opposite.

Participant GM (personal communication, 2017) agrees that transport strategies between the City, provincial and national governments do not reflect synergy and co-ordination, especially with regard to cycling in the city and the country. This contributes to a lack of respect for cyclists on the roads and limited safety campaigns which are intermittent and largely directed at motorists.

Participant MA (personal communication, 2017) indicates that there is a lack of co-ordination between the three spheres of government with regard to their transport strategies. For instance, there is no seamless integration between Gautrain (provincial) and Rea Vaya and Metro Bus (local) buses. Each transport mode has its own card system, and the services provided by the two CoJ bus systems (Rea Vaya and Metro Bus) are not properly aligned or synergised. However, there is currently an initiative to promote seamless integration between the Rea Vaya and Metro Bus systems through the Vaya Moja App. Please see Figure 10 for more information on the App.

Participants PL and HM (personal communication, 2017) observe that the City's transport strategy is supposed to be linked to provincial and national government. However, there is a discrepancy between what the national government and City are doing, creating a disjuncture. The City is moving at a faster implementation pace than the national government as the City encounters less stringent bureaucracy. However, there is an argument that the City and the province should work collaboratively to address transport issues. Participant SL (personal communication, 2017) states that there is good collaboration between the City and the provincial department of transport. The provincial government is fully supportive of the projects initiated by the City and tends to duplicate initiatives undertaken by the City. For instance, the province drafted Eco-Mobility and NMT strategies based on the City's strategies.

Participant EJJ (personal communication, 2017) states that the Office of the Premier hosts an integrated transport forum which all Gauteng municipalities attend and which provides a broad perspective of the Gauteng City Region transport needs. There is thus some co-ordination and alignment of mobility initiatives to create cross-boundary synergy and ease of movement for all residents of the province.

4.2.4.2 Attempts at aligning strategies

The United Nations Industrial Development Organisation (UNIDO) and the South African National Energy Development Institute (SANEDI) are currently collaborating on a project to create awareness and promote the use of electric vehicles and non-motorised transportation in cities. UNIDO works primarily with the national department of transport in drafting and implementing policies which aim to promote green transportation in South Africa (Participant HM, personal communication, 2017).

There has, however, been some concern that the national and provincial government focus on developing and formulating policies while cities are

concerned with implementation, which contributes to tensions within these relationships (Participant GM, personal communication, 2017). Hence, participant PL (personal communication, 2017) maintains that cities must learn to adhere to the national legislative policy framework, without feeling it is imposed on them. Furthermore, cities themselves should begin to influence national policy to ensure alignment between strategies for a seamless integration of Eco-Mobility approaches country-wide.

The BRT Rea Vaya project originated from the public transport action plan which came from the national government. National government continues to develop a set of common standards for bus rapid transport projects around South Africa. This has presented certain challenges since the conditions vary between towns and cities. Furthermore, while the national government has developed standards for NMTs, the City of Johannesburg was working more with the local conditions, as illustrated in Figure 15. National standards are too generic and too expensive in the context of Johannesburg. For instance, based on the national guidelines, the national department has advised the City to retrofit an intersection in Sandton for universal access. However, the City has not implemented that decision as it will cost an additional R25 million to do so (Participant SL, personal communication, 2017).

Participant SL (personal communication, 2017) further notes the lack of learning and networking by South African major cities that have implemented BRT systems, including the CoJ, Tshwane and Cape Town. She argues that the three cities could use such an opportunity to learn from each other in order to address common challenges emanating from their varying BRT systems (Participant SL, personal communication, 2017).

4.2.4.3 Influence by peer cities

Participant SL (personal communication, 2017) asserts that the City's transport strategy is influenced by transport strategies of other big cities

rather than of the provincial and national governments. She explains that the previous Executive Mayor was a proponent of urbanism and international city collaborations and this contributed to the City drawing on international best practice.

The researcher agrees that the country's transport strategies between the three spheres of government (local, provincial and national) are not strategically aligned, thereby creating lack of policy co-ordination, misaligned laws as well as clashing policies. However, the researcher is aware of attempts by the three spheres of government in creating synergy and coordination of transport strategies, as demonstrated through the Premier's integrated transport forum. Notably, the City's transport strategy is influenced by peer cities. For example, the literature review details the journey undertook by the City on a benchmarking study tour to South American cities to learn about the development and implementation of the BRT system.

4.2.5 The City's relationship with the taxi industry

4.2.5.1 Tensions between the City and taxi industry

Participant SL (personal communication, 2017), asserts that the relationship with the taxi industry is not uniform. It varies according to the area, the nature of the association, and whether it is a relationship with the taxi leadership or a direct relationship with the people. In Soweto there was a serious division between the taxi owners who embraced the first phase of the BRT and those who opposed it. The City managed to successfully introduce two phases of the BRT. Some taxi owners have become shareholders and are proud of the BRT, but there are others who have remained outside and in competition with Rea Vaya. These owners have realised they cannot continue to oppose the BRT but still believe it is not a viable option for them.

The City does not have a formal relationship with the South African National Taxi Council (SANTACO) which is a national association of taxi owners, but instead has informal relationships with the Greater Johannesburg Taxi Council, Top 6 taxi management and a third group called the Johannesburg/Gauteng National Taxi Alliance (Participant SL, personal communication, 2017). It therefore appears that the CoJ only finds it practical to work with taxi associations operating within its jurisdiction.

4.2.5.2 Expansion of the Rea Vaya BRT system

The City will be spending over R805 million in the 2017/18 financial year to compensate minibus taxi operators for implementing the Phase 1C, which is the expansion of the BRT project along Louis Botha Avenue, between the Johannesburg Inner City, Alexandra and Sandton. It is expected that the removal of minibus taxis and buses from the Phase 1C route will contribute to reduced traffic congestion and a cleaner environment (Participant SL, personal communication, 2017).

In the North East Quadrant of the City, where the Phase 1C of the BRT is being implemented, there are taxi owners who want to exit the industry and see the BRT as an opportunity. However, there are others who consider taxis as a lucrative business. There is no uniformity with regard to support for the Rea Vaya BRT. Although there is a push to decongest the City and have fewer taxis on the roads, participant MA (personal communication, 2017) believes that taxis are highly efficient in moving large numbers of the population from home to work and back every day and they should be allowed to continue operating in certain business districts within the City, and the BRT should only focus on long distance trips.

The researcher agrees that the relationship between the City and the taxi industry is not based on co-operation. There are noticeable tensions as the City continues to expand the BRT system to other areas. However, there has been positive financial benefit for taxi operators who have decided to

become shareholders of the BRT system and those who have opted to entirely exit the transport industry.

4.3. Use of Private Cars in the City

The City of Johannesburg is experiencing high traffic congestion as it continues to develop and grow its economy. As such, the City has embarked on the development and implementation of Eco-Mobility approaches to decongest the roads by reducing the number of private cars on the road. This would assist the City to achieve a modal shift towards mass public transportation, walking and cycling. Please see Figure 17 for an image portraying a modal shift the City aims to achieve with Eco-Mobility.

4.3.1 Private cars continue to increase on the City's roads

While the City is currently investing significant resources towards Eco-mobility, Participant GM (personal communication, 2017) contends that the number of cars on the City's roads has not reduced significantly, if at all. There are still not enough bicycles on the roads and limited acceptance of cycling as another mode of transport. The Eco-Mobility infrastructure has not made significant progress towards reducing cars on the roads and the City continues to be challenged by the large numbers of vehicles on the roads even though there is infrastructure provided for other modes of transportation.

This view is also supported by Participants SL, PL and HM (personal communication, 2017) who both concur that there is still a significant number of people who either use cars or want to use cars. They argue that City has not achieved a significant modal shift with regard to encouraging people to use public transport. There is still a need to introduce more public transport, and this means the City will take years before it decongests. In addition, Participants EJ and GM (personal communication, 2017) also maintains that the City's Eco-Mobility approaches have been unsuccessful in shifting people towards walking, cycling or using mass transportation.

Instead, the infrastructure is being used to accommodate existing movement patterns.

Lightstone Auto, a company that provides data-driven insight, online market intelligence and new vehicle sales data to the South African motor industry, supports the interpretation that private cars continue to increase on the CoJ's roads. This is supported by data collected on new vehicle sales in Johannesburg as presented in Table 4 below:

Table 4: New vehicle sales data in Johannesburg

Market	License District	2012	2013	2014	2015	2016	2017	Total
PAS	Johannesburg	31854	33014	30170	28960	25777	26610	176385
LCV	Johannesburg	9739	10168	9438	10490	11583	11639	63057
Total		**41593**	**43182**	**39608**	**39450**	**37360**	**38249**	**239442**

Data provided by Lightstone Auto: www.lightstoneauto.co.za

Data collected on new vehicle sales reveal that from 2012 to 2017, over 25 000 units on average per annum were sold in Johannesburg. In addition, there has also been an increase in the purchase of light commercial vehicles in the same period. Thereby, an inference could be made that the Eco-Mobility infrastructure has not achieved its intended purpose of moving people from private cars to alternative modes of transportation.

However, on the other hand, there is a confidence that the City's Eco-Mobility infrastructure is making progress. This is the view of Participant CA (personal communication, 2017) who asserts that to some extent the number of private cars has decreased on the roads. However, the impact has been minimal in his opinion. He argues that the convenience of private cars, and their position as a status symbol, continues to promote their usage. Also, according to the association of cyclists, the cycling infrastructure has assisted in marginally reducing private cars on the roads.

Unfortunately, the City infrastructure was built without considering or investing any material effort or funding towards providing access to bicycles, education, promotion, policing and similar, which are required to grow cycling and utilise the lanes (Participant PdD, personal communication, 2017). In support of these sentiments, Participant WD (personal communication, 2017) suggests that the BRT and Gautrain infrastructure is being very well utilised. Therefore, one may assume that those interventions have taken some cars off the road, or indeed may have reduced expansion in car use.

Participant MKG (personal communication, 2017) holds an impartial view. He firmly believes that even with the construction of the Eco-Mobility infrastructure, the City will continue to see the increase of private cars due to upward social and economic mobility by the middle class population. He suggests that the CoJ should therefore employ a disruptive culture shock such as banning private cars in the Inner City in order to encourage people to shift from private cars to public transport. Moreover, the City should maintain the need for more Eco-Mobility infrastructure, stronger advocacy and more cyclists or people using public transport (Participant SL, personal communication, 2017). In doing so, the City will address the three challenges facing it: traffic congestion, lack of cycling, and lack of walking (Participants MA and HM, personal communication, 2017).

In early 2017, in response to the challenge of traffic congestion, the City's leadership introduced a 24-hour traffic hotline to address traffic congestion and related issues. However, Participants SL and GM (personal communication, 2017) argue that the traffic hotline is not assisting the City in reducing traffic congestion. Instead the City should focus on investing resources in public transportation, walking and cycling to reduce traffic congestion, all of which are Eco-Mobility approaches. Also, there is a need for the City to move towards a smart city traffic system which will provide intelligent data to deal with issues of traffic congestion. Rio de Janeiro, for

example, was able to develop a smart system to address its traffic challenges (MKG, personal communication, 2017). The researcher was duly informed that the CoJ is currently exploring the use of a similar smart city traffic system to address congestion. It is, however, too soon to evaluate the impact of the traffic hotline in addressing congestion in the City.

Contrastingly, the traffic hotline has instead created an unintended outcome. According to Participant PL (personal communication, 2017) the traffic hotline is also assisting with visible policing. She mentions that there is a tendency to drive recklessly more frequently after the usual working hours than when there is visible policing during the day. Therefore, the management of traffic hotspots by the Johannesburg Metro Police Department also promotes public safety.

4.3.2 Cycling infrastructure

Under the City's NMT strategy, which aims to reduce the number of private cars on the road, the construction of bicycle lanes is an important initiative in implementing Eco-Mobility approaches. Hence, the cycling project started off in Orlando, Soweto as a legacy project of the 2010 Soccer World Cup. The initial plan was to develop cycle lanes in Mooki Street and link them with the schools around the area and with the various public transport facilities in the area. The City then proceeded to collaborate with three schools in the area. Bicycles were donated in collaboration with a bicycle NGO and private sector companies such as Deloitte. To date, over 6 700 bicycles were donated to four schools along Mooki Street in Orlando (Participant GM and SL, personal communication, 2017).

According to Participant SL (personal communication, 2017) the DoT has constructed an adequate cycling infrastructure in the City, even though it is not used as often as the City would like to see. There are three reasons for this:

1. The City was informed internationally that it should develop cycling lanes in order for people to start cycling. Unfortunately, that has not been the case in the CoJ, particularly because poor people do not have the financial resources required to buy bicycles.
2. It is difficult to retrofit cycle lanes into existing roads. While the City tried to do that, it has not always been successful. While some people feel safer in the cycle lanes, others do not, and do not feel confident using the lanes.
3. The Democratic Alliance nationally and in Cape Town is supportive of cycling. However, in Johannesburg the Democratic Alliance is in a coalition with the Economic Freedom Fighters which has stated that there should be no investment in cycle lanes until all City residents have proper roads and sanitation. There is thus no political promotion of the project.

The researcher noted the acknowledgement of failure by the DoT to have more residents using the cycling infrastructure. In his own view, this vindicated Mayor Mashaba's decision to temporarily suspend the project. In its defence, the DoT argued that the fact that the project was stopped is challenging because significant investments have already been made in the project. Also, the City did not encourage the use of infrastructure for the intended purposes as taxi drivers and motorists continue to use bicycle lanes as informal parking spaces.

Additionally, the City should have constructed bicycle lanes only in areas where there would be high or potential utilisation of the infrastructure. Lastly, affordability for bicycles for the majority of City residents should also be considered. This could be done through co-sponsorship initiatives supported by the City and the private sector (Participants EJ, GM, SL and BR (personal communication, 2017).

4.3.3 Planned expansion of the cycling infrastructure

Research participants do indicate that there were plans for the City to expand the cycling infrastructure into other areas of the City. This is supported by Participant SL (personal communication, 2017) who states that the plan was to build cycle lanes between Diepsloot and Fourways, where there are currently lot of cyclists. Unfortunately, the project has been put in abeyance until further notice by Mayor Mashaba, thus resulting in the city-wide project on promoting cycling not allocated funding in 2017. Nonetheless, the DoT has indicated that it intends to consolidate the second phase of the project in Alexandra, and also expand it to other areas of the City such as Tshepisong, Orange Farm and the Inner City.

The researcher notes this statement as interesting because it indicates the differing and contesting views by City officials and the political leadership on the project. It is also evident that there are serious tensions between the City officials and political leadership on the future of Eco-Mobility infrastructural projects that commenced in the previous mayoral term.

The majority of the research participants continue to advocate for the expansion of the cycling project as they do not support Mayor Mashaba's decision. However, they all argue that the project should continue on a limited pace. For instance, the association of cyclists mention that the Executive Mayor has overlooked the fact that most cyclists are low income individuals who cycle as they cannot afford to spend between 20 percent and 40 percent of their income on transport. The Diepsloot cycling community of approximately 100 cyclists who cycle into Bryanston and Sandton each day (20km-40km round trip) is evidence of this (Participant PdD, personal communication, 2017).

Additionally, the Executive Mayor is accused of overlooking the fact that cycling promotes healthier lifestyles, improved air quality, better use of limited urban space, household savings on mobility costs, improved access,

and safety for all categories of road users. The proposed approach of tarring all roads before promoting cycling (or building cycle lanes) is not going to deliver these benefits or resolve the congestion problems in the City. Furthermore, the Executive Mayor has not provided clarity on the position of the City position towards NMT and in that respect may be failing the City (Participant GM, personal communication, 2017).

However, some of the research participants are in support of Mayor Mashaba's decision. These include Participant HM (personal communication, 2017) who maintains that Mayor Mashaba's argument for temporarily suspending the project has merit as there is currently limited use of the built cycling infrastructure. It is thus wasteful expenditure. This view is also supported by Participant CA (personal communication, 2017) who mentions that the reality is that cycle lanes add to the construction cost of roads yet remain largely unused.

The bicycle donation programme by the City and NGO to supply residents with bicycles is an attempt to encourage their use of the infrastructure built, but this has failed as there is less usage of the infrastructure. This is an example of assumptions being made about what citizens would like to see in their City. Ultimately it is about trade-offs. The additional expenditure to build bicycle lanes in Sandton while residents of the City's approximately 180 informal settlements do not have access to even gravel roads cannot be justified.

Further to this, the condition of the City's roads is far below what it should be and continues to decline, largely due to a lack of funding. While it is desirable that bicycle lanes should form part of a City's transport infrastructure, this cannot be considered a priority in the current economic environment.

The researcher believes that further expansion of the cycling project should occur in consultations with City officials, the political leadership and opposition parties in City. This should also include the broader public, community organisations and cycling associations. This would ensure broader support for the project from diverse stakeholders.

4.3.4 Challenges with the cycling infrastructure

The research participants highlighted some of the challenges inhibiting the effectiveness of the cycling infrastructure in the City of Johannesburg. These include cycling safety, bike storage, the typography of Johannesburg and most importantly, the suspension of the project by the Executive Mayor.

In regards to cycling safety, Participant SL (personal communication, 2017) assert that while cyclists and bicycle organisations have noted the significant efforts made by the City in making Johannesburg a safer city for cycling, the issue of safety continues to be a major concern for all stakeholders. This view was also supported by the association of cyclists.

While the City continues to promote and build cycling infrastructure, the City does not have storage facilities for residents to pay for their bicycles to be stored. The DoT has tried to provide bicycle parking in Braamfontein and next to some Rea Vaya stations where people can park their bicycles, but with limited success (Participant SL, personal communication, 2017). The typography of Johannesburg makes it difficult for cycling to be an everyday habit (Participant MA, personal communication, 2017).

Hence, in early 2017, SANEDI conducted a study on behalf of the City to examine various methods of promoting the use of the built cycling infrastructure. The study revealed that culture, lack of bicycle schemes, the City's topography, safety, incomplete and inconsistent cycling infrastructure were all inhibiting the use of the built cycling infrastructure (Participant HM, personal communication, 2017). Additionally, Johannesburg is one of the

pilot projects under the C40 for a study on the co-benefits of cycling and health which examines how the cycling infrastructure is contributing towards improved health outcomes (Participant CH, personal communication, 2017).

4.3.5 Salvaging the cycling project

Since Mayor Mashaba has announced the temporary suspension of the cycling project, there are attempts of salvaging the project by interested stakeholder. The attempts include having more bicycles on the roads, communicating the successes of the infrastructure, development of cycling map, and benchmarking other cycling cities. For instance, Participant GM (personal communication, 2017) contends that there should be more bicycles on the roads for funding towards that infrastructure to continue and agrees with the Executive Mayor that there should be more bicycles on the roads before additional infrastructure is provided.

Additionally, participants argue that the successes of the cycling infrastructure should be more communicated to Mayor Mashaba and the broader public. For instance, there were previously few bicycles around Diepsloot but this has changed and cyclists travel from Diepsloot into Fourways, Randburg and Sandton. Also, the City's success has been its ability to shift people away from taxis to Rea Vaya buses. However, there are still challenges in relation to excessive traffic congestion (Participants MA and GM, personal communication, 2017).

More successes are also experienced through the bicycle donation programme. As illustrated in Figure 6 and Figure 7, the bicycle NGO through its partnership with the City of Johannesburg and the private sector, has donated over 80 000 bicycles in various parts of the City. Participant GM (personal communication, 2017) explained that the NGO intended to donate 20 000 bicycles by the end of 2017 and a further 30 000 bicycles in 2018. The plan includes distributing 50 000 bicycles per year from 2019.

Moreover, as illustrated in Figure 5, Figure 8, Figure 9, and Figure 11, Participant SL (personal communication, 2017) proudly notes the success in cycling in Soweto despite the lack of city-wide implementation and a lack of political commitment to the project. She argues that cycling still happens in Soweto even though the DoT experiences some challenges in the project. Under the DoT's leadership, NGOs are organising sports and recreational activities and learners use bicycles as transport to schools. Nonetheless, the lack of political leadership and support for the project remains a concern.

Participants also assert that the cycling project is a good initiative as part of promoting non-motorised transportation in the City. Participants BR and PL (personal communication, 2017) note that the utilisation of cycling lanes was quite successful in some areas although less so in others. They are of the view that the City should continue to encourage the use of the established cycling lanes as well as other forms of Eco-Mobility approaches, and this should be done incrementally – especially in areas where prior focused "research" has been done to assess the participation of the community where these lanes would be built. However, the successful implementation/participation will likely take many years.

The cycling association has also developed a map for cyclists to avoid highways and busy intersections to promote mobility and safe passage for cyclists (Participant GM, personal communication, 2017). This illustrates the importance of the culture of cycling in the City. The association has expressed its concerns regarding the response of the Executive Mayor to what it states is a highly complex issue, which has impeded the growth of cycling in the City and potentially within South Africa.

There are also concerns within global city about the City's participation and posture. Participant MKG (personal communication, 2017) adds that within global city networks, the Executive Mayor is seen as being opposed to climate change mitigation because of halting the cycling project. However,

participants emphasise that such notions could be addressed by the City through communicating its decision within the global city networks and also following in the footsteps of countries such as the Netherlands, where there are more bicycles than residents in cities like Amsterdam and The Hague, with up to 70 percent of all journeys made using bicycles.

Participants also argue that the City of Johannesburg should consider adopting a more progressive approach to cycle transport in support of the health and social benefits associated with walking and cycling. Participants note that both walking and cycling reduce obesity and the side effects of obesity/overweight, control/reduce diabetes and hypertension, reduce cardiac-related illnesses, improve mental, physical (and spiritual) well-being and also contribute to social cohesion (Participants GM, BR and MA (personal communication, 2017).

Nonetheless, Participant SL (personal communication, 2017) argues that due to budget constraints, the City has never collected data on the bicycle infrastructure usage and therefore the usage of the infrastructure cannot be quantified. It is thus empirically difficult to argue whether the infrastructure has had the desired impact by the City. However, she notes that the current achievements are encouraging to all the stakeholders committed to promoting cycling in the City of Johannesburg.

4.3.6 Bus infrastructure

The Rea Vaya BRT system is an important aspect of the City's NMT strategy as it is affordably priced for local commuters. The economy, viability and the mobility of such infrastructure is critical to note (Participant PL, personal communication, 2017). Both the BRT and Gautrain systems have already seen great changes in the City, both in terms of how people commute and in terms of development patterns. Much development is taking place along the Transit-Orientated Development Corridors and this is likely to increase over time. The Sandton and Rosebank Gautrain stations

have catalysed significant investment and development around them (Participant WD, personal communication, 2017). The C40 is currently assisting the City with technical expertise to ensure seamless connectivity between modes of transportation (Participant CH, personal communication, 2017).

Research findings reveal that, although the City has made available affordable and reliable public transport through Rea Vaya and Metrobus, the use of private cars has increased on the City's roads, causing traffic congestion and air pollution. This indicates a need for educational awareness and campaigns to promote the use of the infrastructure built for walking, cycling, passengering and mass public transport (Harrison et al, 2017).

Encouragingly on the other hand, data collected reveal that annual Rea Vaya BRT ridership continues to increase as indicated by the 2017/18 ridership numbers, from June 2017 to January 2018. By end of the financial year, these could possibly surpass 1, 5 million riders. Therefore, it can be assumed that more people are using the infrastructure. On the other hand, it can also be assumed that the majority of users are those who do not own private cars as indicated by Statistics South Africa. Chart 1 below provides detailed information on Rea Vaya BRT ridership numbers.

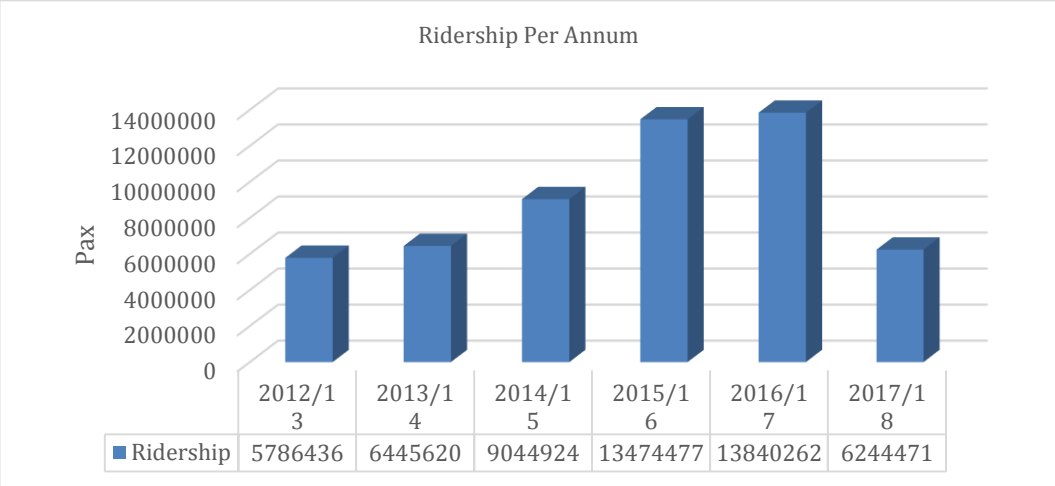


Chart 1: Annual Rea Vaya BRT ridership numbers: 2012 – 2017, data provided by City's DoT

Therefore, there is optimism that the City's residents are starting to appreciate the Rea Vaya BRT system which is experiencing a continuous increase of its ridership numbers, year on year. Hence, the City continues to make further investments towards the project as indicated in the implementation of the Phase 1C of the BRT project in Alexandra and Louis Botha Avenue (Participant SL, 2017). This indicates that more impact will be experienced in the near future as the City continues to expand the Rea Vaya BRT system into other areas of the City.

4.3.7 Commuter behaviour

Commuter behaviour is critical for the effectiveness of Eco-Mobility approaches. However, Participant GM (personal communication, 2017) acknowledges that the construction of Eco-Mobility approaches has not led to changes in commuter behaviour. He believes the money spent on the infrastructure was thus fruitless expenditure as there is now infrastructure that is not utilised. While the infrastructure has been put in place it is not been used to the extent that it should be. Hence interested stakeholders are trying to put more bicycles on the road to ensure that the infrastructure is used.

Participant CA (personal communication, 2017) argues that the current challenges facing the successful implementation of Eco-Mobility approaches derives from the limited use pending the implementation of additional interventions such as the introduction of Rea Vaya Phase 1C. Cycle lanes are under-utilised and many BRT busses are empty during off-peak hours. The majority of residents who have access to private cars continue to make use of them. Residents of the City have not embraced the culture that underlies Eco-Mobility, in many instances because they perceive the public transportation options to be unreliable or not traversing the appropriate routes.

Therefore, Participants SL, CH and GKM (personal communication, 2017) emphasise that it is still too soon to evaluate the impact of Eco-Mobility approaches in increasing mass transportation, walkability and cycling for commuter purposes in the City. The City has made it easier for people to travel, have access to transport terminals and has given people the opportunity to have dignity when travelling. For instance, the sidewalks in Soweto and the CBD provide a more dignified walking space than previously. Participant PL (personal communication, 2017) states that she does not think the City will reach a point of zero emissions or 100 percent achievement. There is nonetheless a need for behavioural change, education and awareness in order for the infrastructure to be successfully utilised.

For future planning, Participant EJJ (personal communication, 2017) emphasises that the City can through by-laws introduce mobility measures that encourage behavioural change by the residents. For instance, these could include having passenger-only districts within the City to encourage greater use of the infrastructure already built for the purposes of Eco-Mobility. Furthermore, the City could also encourage the use of alternative transport by its residents in order to shift them from private car usage. This should not only focus on the infrastructure that has been built but also support the utilisation of other modes of vehicle such as electric vehicles (Participant HM, personal communication, 2017).

Participant SL (personal communication, 2017) argues that for any kind of big change in public transport, there is a need for political support, leadership, and role-modelling. For instance, during the Eco-Mobility Festival, the former Executive Mayor rode on a bicycle and used public transport. When cycling became popular in London, Mayor Boris Johnson was the political champion for the project. Participant SL (personal communication, 2017) further states that data collected reveal that annual

Rea Vaya BRT ridership continues to increase and it can be assumed that more people are using the infrastructure.

4.4 Outcomes from the 2015 Eco-Mobility World Festival

The 2015 Eco-Mobility World Festival hosted by the City of Johannesburg invited companies and organisations working in the transport sector to form part of the organising team and collaborate to produce a successful Festival. A bicycle NGO was one of those organisations which started partnering with the City through a memorandum of understanding (MoU) during the Eco-Mobility Festival. It was tasked with mobilising people with bicycles specifically in areas where cycling infrastructure was installed (Participant GM, personal communication, 2017). Additionally, the City partnered with a cycling association to assist in defining a number of cycle routes into the Sandton CBD that were marked during the month. The cycling association also promoted the event through its social networks and encouraged cyclists to cycle into the CBD (Participant PdD, personal communication, 2017).

Since then, the City has promoted new kinds of transportation which include motorised personal vehicles, electric bikes and electric scooters. This was done through a partnership with SANEDI for it to demonstrate the use of electric vehicles (EVs) and other green transportation (Participants SL, GM and HM, personal communication, 2017). The participants acknowledge that residents of Johannesburg appear to be averse to change and the City should continue to promote Eco-Mobility approaches to accustom people to the new culture of mobility. This should be done through regular and continued messaging and awareness campaigns, showing people the socio-economic benefits of the infrastructure, legislation, road signage, safety campaigns, and demarcation of already organised roads. Additionally, they assert that the Executive Mayor should be invited to champion the initiative so as to encourage residents to use the infrastructure.

Additionally, Participant EJJ (personal communication, 2017) asserts that the Festival was able to create awareness of Eco-Mobility approaches as it was deliberately disruptive against conservative methods of mobility such as the use of private cars. It encouraged residents to explore other kinds of mobility and also to be aware of other forms of transportation than private cars. However, Participant CH (personal communication, 2017) argues that awareness alone without the required infrastructure inhibited the success of the Festival.

Most importantly, the activities undertaken during the Festival highlighted the linkages between the 2014 C40 Summit and the 2015 Eco-Mobility World Festival, both hosted in Johannesburg. While the C40 Summit focused on broad issues of climate change and was attended by political leaders, practitioners and academics, the Festival was able to narrow down the issues to reducing transport carbon emissions and was open to the residents of Johannesburg for participation (Participant CH, personal communication, 2017).

Some of the successes of the Festival include more construction of widened roads, sidewalks and other catalytic projects in Sandton and the surrounding areas (Participant MA, personal communication, 2017). The Festival was also able to illustrate that even with the existing and limited public transport, it was viable and possible for the City's residents to shift from using private cars to other modes of transportation (Participants MKG, CH, personal communication, 2017).

Example of data retrieved from the snap survey conducted by the Gauteng City Region Observatory (GCRO) after the Eco-Mobility Festival to measure the shift from using private cars to other modes of transportation revealed the following as illustrated in Figure 18:

1. Private car usage in Sandton reduced during the Festival from 90 percent to 70 percent;
2. Gautrain usage increased from 14 percent to 24 percent;
3. Bus usage increased from 3 percent to 7 percent;
4. Cycling increased from 1 percent to 7 percent; and
5. Walking increased from 1 percent to 8 percent.

It is important to note that the Festival was only planned for a month and the results were a temporary impact. Immediately after the Festival, Sandton was again experiencing congestion due to the high usage of private cars.

Other findings of the survey include the dissatisfaction experienced with travelling to Sandton during the Festival, and other commuter opinions on the Festival. There is, however, a view that the planning of the Festival was rushed. For instance, Participants HM and CH (personal communication, 2017) explain that there was no community participation obtained before the Festival. Secondly, there was no early educational awareness for residents on the meaning of Eco-Mobility. Furthermore, the timing for hosting the Festival was not ideal. They both suggest that the Festival should have been hosted at a later date to give the City more time to expand its Eco-Mobility infrastructure.

Nonetheless, the survey also revealed a shift in commuting patterns by City residents and illustrated that there may be opportunities to promote a public transport culture, particularly among private car users. However, the results also show that more effort is needed to improve public transport infrastructure and shift public perceptions (Culwick & Katumba, 2015).

Participant MKG (personal communication, 2017) asserts that the snap survey results indicate that people would stop using their cars only if the City provides them with safe and reliable public transport. Therefore,

Participant GM (personal communication, 2017) argues, the City should host another Eco-Mobility Festival as part of a continued programme to encourage and promote Eco-Mobility as a better alternative to conservative ways of mobility. Detailed information is provided in Annexure B.

4.4.1 Legacy projects influenced by the 2015 Eco-Mobility World Festival

The Eco-Mobility Festival provided some businesses and non-governmental organisations with an impetus and inspiration since the hosting of the Festival. Participant GM (personal communication, 2017) observes that since the Festival, the bicycle NGO has seen more electric bikes and more infrastructure development for different modes of transport, specifically NMT. For instance, Sandton has experienced an increase in the provision of public buses, even though the buses are not always full. Another challenge to the provision of public buses includes limited provision of departures throughout the day for bus trips and often unreliable public transport.

Moreover, Eskom, which is the country's electricity supplier, has begun to work with SANEDI on the development and production of eco-electric vehicles (Participants PL, HM and SL, personal communication, 2017). On the other hand, the City is working with SANEDI on a pilot project to introduce non-motorised transportation as an alternative to private cars. This also includes the work by GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), which is a German development agency operating in South Africa, to develop the Nationally Appropriate Mitigation Actions (NAMAs) to measure emission reduction actions in cities. Johannesburg has enrolled as one of the pilot cities within the NAMAs. The programme is implemented through the National Department of Transport as the main partner with GIZ and it is hoped that the outcomes of the project can be disseminated for other South African cities to draw on best practice (Participant HC and HM).

Another success was the ability of the Festival to raise consciousness around Eco-Mobility and quality public transport. While infrastructure development in Sandton has been slower than expected, Sandton is now more walkable than previously (Participant EJJ, personal communication, 2017).

Participant SL (personal communication, 2017) remains concerned about the future of Eco-Mobility projects and suggests that the hostile relationship between the Democratic Alliance and the African National Congress is a political challenge that should be overcome, in order to provide residents with mobility solutions.

Some of the easily identifiable legacy projects that emerged after the 2015 Eco-Mobility World Festival are the following:

1. The Vaya Moja App, which is a public transport app developed as part of the City's move towards a seamless integrated public transport system. The App is now used for MetroBus and Rea Vaya.
2. Production of a Climate Change Green Transport Strategy by the National Department of Transport, which took into account the outcomes of the 2015 Eco-Mobility World Festival.
3. The construction of the Great Walk pedestrian bridge which connects Alexandra to Sandton. The City aims to have waste-pickers who pull trolleys and trailers to use it.
4. Expansion of "tuk-tuk" taxis and Uber services in Sandton and the surrounding areas.
5. Construction of special public transport lanes in Sandton that are now exclusively used by Gautrain buses, Putco, Metrobus and minibus taxis. Private cars are not allowed to travel in those lanes.

4.5 Impact of Eco-Mobility on the Transit-Orientated Development Corridors

The City advocates for Eco-Mobility approaches in the implementation of developmental programmes such as the Transit-Orientated Development Corridors. This is achieved through promoting Eco-Mobility approaches as integral to addressing the spatial challenges caused by apartheid and providing residents with cheap and affordable methods of mobility. Therefore, Transit-Orientated Development Corridors and other developmental projects are viewed as influential in creating an equal and just society. It is thus critical for the City to promote Eco-Mobility approaches to its residents.

4.5.1 Promotion of Eco-Mobility to the City's residents

In regards to promoting Eco-Mobility approaches to the City's residents, Participant WD (personal communication, 2017) argues that the City has reasonably good public transit infrastructure. Although this infrastructure can and must be improved, he believes that better communication about the existing infrastructure would improve usage. For example, integrated trip planning data could relatively easily be created for trip planning, and for information on where all of the public transport in the City runs, using a General Transit Feed Specification (GTFS), which is a common format for public transportation schedules and associated geographic information.

He further states that such a system would share integrated information on Gautrain, Metrorail, Metrobus and Rea Vaya services. Other than this, integrated ticketing may help (this is currently under discussion with the provincial government) and better integration between different public transit modes would be useful. Lastly, the SDF and Transit-Orientated Development Corridors promote modifications to the City's urban form that would support public transport use and reduce travel time for all commuters.

On the other hand, Participant BR (personal communication, 2017) asserts that the City should start at the community level by creating greater awareness of the benefits of walking, running and cycling, with politicians and City officials having understood and accepted the advantages. Moreover, there should be strong linkages with NGOs, community-based organisations and faith-based organisations, and all schools should have a daily Walking Programme (15-20 minutes), in addition to the establishment of “Walking Groups” in as many neighbourhoods as possible. This would allow the City’s Health Department to have a ward-based approach to monitor trends per ward on a monthly basis.

On the other hand, Participant CA (personal communication, 2017) argues that it is not only a case of promoting the idea. Certain changes need to be made and these include:

- A more reliable and safer bus system with an integrated fleet management system that provides real-time information on delays;
- An upgraded bus fleet (Metrobus in particular is aging); and
- A review of bus routes and fare structures.

The researcher notes it is apparent that while the City needs to continue promoting Eco-Mobility approaches, there are various issues to be addressed to ensure the successful implementation of the initiative. These include continued consultations with the community and all interested stakeholders and consistent ongoing efforts being made to improve the commuter experience on public transport.

4.5.2 Transit-Orientated Development Corridors are anchored on the Eco-Mobility infrastructure

The Transit-Orientated Development Corridors are anchored on the Eco-Mobility infrastructure. It is thus critical for the City to continue having such infrastructure close to where people live, play and work. Participant SL (personal communication, 2017) notes that when the City started to

implement Eco-Mobility approaches, it was not possible to retrofit the cycle lanes into existing roads. The City was forced to construct cycle lanes at a different alignment next to the BRT stations, and also the Great Walk in Sandton. The City hopes to make all forms of mobility more accessible around the Transit-Orientated Development Corridors, whether cycling, public transport or walking. This would ensure that Eco-Mobility is more easily promoted to those communities.

The City is expanding its pavements to accommodate more residents who prefer walking, as illustrated in Figure 3, Figure 4 and Figure 13. Participants SL and PL (personal communication, 2017) argue that every journey begins with walking. Even to reach public transport, one has to walk initially. Therefore, there are socio-economic benefits to walking, such as people having opportunities to socialise, improve their health and save money on transport.

Nonetheless, walking in the City is not safe due to existing crime and lack of pedestrian safety. In addition, the transport system in the City does not provide safe and accessible feeder transport for commuters, making commuting difficult in the City (Participant HM, personal communication, 2017). However, the City continues to provide walking infrastructure and in recent years has emphasised the promotion of personal safety features in the construction that has taken place (Participant BR, personal communication, 2017).

For instance, the cycling lane project was in principle a good project for the City. It had the capacity to connect various modes of transportation to each other. Unfortunately, cycling lanes are now used for other uses like pushing recycling trolleys and have also limited the space for cars (Participants SL and MA, personal communication, 2017). Nonetheless, various public transport modes, walkability and cycling plans are in place in the City and are being implemented. Other than that, the spatial policies in place, such

as the SDF 2040 and the Transit-Orientated Development Corridors, all emphasise the importance of transit-oriented development, which is about not only providing public transport but also transforming the City to make it more efficient and accessible and to make public transport work better.

Therefore, Eco-Mobility is anchored around the spatial policies of the City. The Transit-Orientated Development Corridors project supports Eco-Mobility through transforming the City to be more efficient. One example of this from the SDF is that public transport needs a population density of 15 000 people per square kilometre for it to work (for enough people or a critical mass to use the public transport system). This is higher than the current density of the City and the Transit-Orientated Development Corridors seek to increase densities around the BRT Rea Vaya routes, and introduce better amenities and a higher mix of land use. The Transit-Orientated Development Corridors are thus conducive to Eco-Mobility (Participants WD and CA, personal communication, 2017).

However, research participants argue that it is too early to measure the impact of this infrastructure on the City's spatial development agenda. They maintain that the City will only see the results of this intervention in the next decades (Participants WD, SL, PL CA, EJJ and MKG, personal communication, 2017).

Therefore, the researcher notes that Eco-Mobility approaches have an impact on the Transit-Orientated Development Corridors project. The various Eco-Mobility approaches are anchored around ensuring that people live, play and work within close proximity. This ensures that the City's spatial transformation project continues to accommodate historically disadvantaged communities.

4.6 Chapter Summary

The chapter provided a critical analysis of the interview results by

synthesising the key aspects from the participants. For instance, there were noticeable similarities in the participants' responses regarding definition of Eco-Mobility (section 4.2.1), practices and exposure of Eco-Mobility (4.2.2), the importance of CoJ's participation in global city networks (4.2.3), linkages of transport strategies (4.2.4), city relationship with taxi industry (4.2.5) and the expansion of the Rea Vaya BRT system, which were all critically synthesised and discussed. With regards to the Transit-Orientated Development Corridors, the participants' responses were similar in maintaining the importance of Eco-Mobility approaches in the development of the Corridors (4.5.2).

On the other hand, there were contrasting views from the participants. These were on the cycling lane project (section 4.3), encouraging modal shift from private cars to mass public transportation, cycling and walking (4.3), and the timing of the 2015 Eco-Mobility World Festival (4.4). Also, the chapter noted the participants' responses on the on-going efforts by the City in promoting Eco-Mobility approaches. This included their ideas on creating a seamless public transportation within the City and the legacy projects that emerged since the Festival (4.5.1).

The next chapter provides a conclusion and recommendation section which will recapture the purpose and the findings of the research. It also highlights the limitation and problems arising from the research. The chapter also details the implications of the research findings and recommendations for future research. Lastly, it provides a brief summary on the contribution to research knowledge made by this study.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The research methods relied on participants to recall past events and processes that were taken into account during data presentation. As such, the intention of this study was to assess the effectiveness of Eco-Mobility approaches in the City of Johannesburg.

Therefore, the chapter discusses findings from the data presented in the previous chapter. It focuses on the City of Johannesburg's investment in Eco-Mobility approaches to encourage changes in modal shift. It also highlights the ineffectiveness of Eco-Mobility approaches in decreasing private cars on the roads. Based on evidence, this chapter articulates that the City's history of apartheid spatial development has made it amenable to implement an efficient and effective infrastructure built for Eco-Mobility approaches.

5.2 Research Finding Discussion

5.2.1 The effectiveness of Eco-Mobility approaches in the City

Research findings confirm that the infrastructure built for Eco-Mobility approaches in the City of Johannesburg is ineffective in encouraging behavioural changes in modal shift, particularly towards walking, cycling and public transport. The City's residents prefer using private cars than other methods of mobility. However, the findings by Engelbrecht, Peers and Mokitimi (2016) emphasise that Eco-Mobility approaches present an opportunity to demonstrate that walking, cycling and using public transport is as efficient as using private cars. Nonetheless, there is a need for

behavioural change, education and awareness in order for the infrastructure to be successful.

It is therefore important that the City's participation in global city networks continues in the interest of peer learning and sharing information. This has proven to be beneficial to the City and its position as a regional and global leader in addressing issues affecting cities in the Global South and African cities in particular. The research indicates that the City has a political and moral obligation to continue participating in these networks to provide leadership to sister cities that seek to be informed and to learn from Johannesburg. This replicates the findings by Florida (2017) that any City's power is based on the relative degree of its economic and political power. Therefore, it can be assumed that cities participate in global city networks for exposure and the ability to benchmark their peers. This includes the ability to exert their command of power on other cities.

Research findings have shown that the understanding of Eco-Mobility as practiced in the City is narrowly defined and limited to only cycling, passengering, wheeling and walking. The implementation thereof excludes other forms of green transportation such as the use of electric vehicles (EVs), conventional hybrids, and plug-in hybrids. The City's exclusion of other forms of green transportation is supported by Quak and Nesterova (2014) who argue that although it is technically possible to implement the EVs infrastructure in cities, the practice is relatively limited. Therefore, cities tend to only focus on affordable and easy-to-construct Eco-Mobility approaches. In contrast, countries such as Germany, United Kingdom and France are moving towards 2 million EVs in the national car fleet by 2020 (Dosch, 2011).

Research findings also indicate that there is also lack of learning and information sharing between South African metropolitan cities that have implemented the BRT systems (CoJ, Tshwane and Cape Town). However,

this should be addressed through the local government structure such as the South African Local Government Association. This will ensure that different learnings is exchanged between these cities in order to address common challenges and opportunities emanating from their BRT systems.

The researcher may therefore assume that there is still an opportunity for the City to demonstrate the positive socio-economic benefits of Eco-Mobility approaches to the residents. The City could do so by learning and benchmarking implementation and communication techniques from cities such as Copenhagen, London, Seoul, Paris, Kaohsiung and Buenos Aires. Additionally, ICLEI is available to provide technical assistance on promoting Eco-Mobility approaches to member cities such as Johannesburg.

5.2.2 Use of private cars in the City

Research findings suggest that residents of the City do not see cycling as a safe mode of transportation nor as an aspirational lifestyle choice. The main mode of transportation remains cars, while walking, the use of minibus taxis and cycling account for lesser usage. This finding is supported by Engelbrecht et al. (2016) in that the majority of the residents felt that the cycling infrastructure was limited and that they would cycle to work if the catchment of the routes were extended and the infrastructure was convenient and safe. Furthermore, the typography of Johannesburg makes it difficult for cycling to be an everyday habit.These are the challenges that the City must address if it wants to see more usage of the approximately 80km of cycle lanes constructed to date.

The other challenge is the collection of data with regards to the number of cyclists using the infrastructure. Research reveals that due to budget constraints, the City has never collected such data and therefore the usage of the infrastructure cannot be quantified. This makes it difficult for one to argue whether the infrastructure has had the desired impact by the City.

However, SANEDI and C40 have already undertaken individual research studies on the impact and usage of the bicycle lanes in Johannesburg. The research reports are publicly available for the City's review and comment. Therefore, it is prudent upon the City's DoT to use the readily available resource materials to counter the absence of budget and data.

Statistics indicate that the majority of Johannesburg's residents do not own cars and rely on subsidised buses, commuter trains, and mostly on private minibus taxis. This is supported by data from Statistics South Africa asserting that on average there are 9.6 million trips made by commuters travelling on minibuses or taxis each month versus the 778 000 and 898 000 trips made by commuters using trains and buses respectively.

Furthermore, research findings reveal that new private car sales in Johannesburg have been reducing in the period 2012 to 2016. The only minimal increase was experienced in 2017. Data suggests that while new private car sales have decreased over the years, the use of private cars have increased. This is exacerbated by the increase of light commercial vehicles on the City's roads. Therefore, there is a suggestion for the City to focus its attention on regulating the mobility of light commercial vehicles as their numbers continue to increase on the roads.

Research findings further suggest that the City needs to engage in educational awareness and promotional events to highlight the importance of Eco-Mobility approaches and promote a behavioural shift from private cars to use of other modes of transportation. It is important for a world-class City like Johannesburg to have a political champion promoting its Eco-Mobility infrastructure to the residents and this should be its Executive Mayor. London was able to promote cycling through former Mayor Boris Johnson. The findings by Haysom (2016) indicate that during his tenure as Mayor of London, Boris Johnson publicly set out to 'revolutionise' cycling in London, investing in more prominent cycle lanes and in large-scale efforts

to make cycling safer, training lorry drivers and improving traffic signage for drivers and cyclists at dangerous junctions, and increasing integration with the underground metro network. Therefore, political support is critical for the successful implementation of Eco-Mobility approaches in the City of Johannesburg.

Throughout the research, it was illustrated that cities are promoting eco-friendly methods of mobility to address transport emissions. The City of Johannesburg is one such City that is investing significant resources into Eco-Mobility approaches to address traffic congestion and mitigate poor air quality. This research finding is supported by Ashanti Mbanga, a Junior Transport Economist, who during the roundtable on the 2015 Eco-Mobility World Festival commended the initiative in seeking to change the way people move in the City: *"The City is saying it is okay to use two wheels, it does not mean you are poor, it means there are more benefits, it's great for your health, social cohesion and public transport is great for capitalizing in the economy,"* (Staff Reporter, 2015).

Research findings also indicate that different political parties have different priorities. This is illustrated through the varying degree of political support between the DA and the ANC for the bicycle lane project. Evidence has shown that the previous government of the City, which was the ANC, supported the project. However, since coming into power through a coalition government, the Democratic Alliance has acted cautiously towards the project. Therefore, this suggests that different political mandates have an impact on the City's projects and their implementation thereof. As research findings indicated, most of the research participants support the continuation of the bicycle lane project. Some argue for the City to continue implementing the project only in areas where it is proven that the infrastructure would be used. It is therefore incumbent upon the City to consider such a recommendation.

5.2.3 Impact of Eco-Mobility approaches on the Transit-Orientated Development Corridors

Research findings reveal that the City's history of apartheid spatial development has made it challenging to implement an efficient and effective infrastructure built for Eco-Mobility approaches. Nonetheless, Professor Philip Harrison indicates that Transit-Orientated Development Corridors is a good choice to ensure a spatially transformed Johannesburg by 2057. He maintains that the City should continue to pursue spatial development transformation to redress past injustices (Harrison, Rubin & Appelbaum, 2017). Please see Figure 14 for a project undertaken by the City to transform spatial development in a historically disadvantaged area.

Research findings reveal that not all international learnings and experiences can be easily replicated to address local challenges. While international cities have found it easy to implement Eco-Mobility approaches and experience high propensity usage for the infrastructure, the City of Johannesburg has failed to persuade residents to use the Eco-Mobility infrastructure. Anthopoulos (2017) observes that the failure could be attributed to the lack of a common understanding of what Eco-Mobility is. Engelbrecht et al (2016) blames this on how such projects are implemented. They explain that the notion of top-down implementation of a sustainable development strategy at the urban level is inappropriate but should rather be based on continuous engagement with society. This indicates the need for thorough stakeholder and cost-effectiveness investigations by the City to determine societal benefits and appropriate beneficiaries.

It is assumed that Transit-Orientated Development Corridors will create a viable public transport service in addition to bringing more residents closer to work, social services, shopping centres and leisure opportunities. Most importantly, Transit-Orientated Development Corridors are attractive environments for walking and cycling and also contribute to a reduction in

air pollution and traffic congestion on the City's roads. Data collected indicate the following development and investment impacts that have been made since the implementation of the Transit-Orientated Development Corridors:

1. 60 new developments in planning to construction;
2. 4 500 new affordable housing units combined in all corridors;
3. Private development of student housing in the Auckland Park and Empire-Perth corridors;
4. Private development of office park next to the Parktown corridor, as illustrated in Figure 16;
5. Affordable mixed-use development in the Louis Botha and Empire-Perth corridors;
6. 9 000 residential units in the pipeline (Empire-Perth and Louis Botha corridors); and
7. The Inner City as a preferred location for funding of 20 000 new social housing units over the medium term by the City.

This supports the view of Professor Philip Harrison on the continuation of the Transit-Orientated Development Corridors project city-wide in order to address the negative effects of spatial transformation, unemployment, inequality and poverty currently facing many residents of the City. Most importantly, as indicated in the research, the Transit-Orientated Development Corridors are essential in satisfying private sector interests and investment opportunities. In addition, Transit-Orientated Development Corridors are an enabler in creating a denser and more efficient spatial developmental trajectory for the City, aiming to bring more residents closer to work, social services, shopping centres and leisure opportunities.

5.3 Recapitulation of purpose and findings

Chapter 1

The chapter highlighted the determination of the United Nations to have cities leading in the implementation of climate change mitigation and adaptation strategies. It detailed challenges faced by cities with regards to climate change and traffic congestion as they continue to drive economic development and growth. The City of Johannesburg faces the same challenges. It currently produces high electricity and transport GHG emissions. Additionally, the City's traffic congestion is one of the highest in the world. Hence, the City embarked on the implementation and development of Eco-Mobility approaches in order to encourage a modal shift from private cars to the use of mass public transport, walking and cycling. Therefore, the purpose of the study was to assess the effectiveness of Eco-Mobility approaches in the City of Johannesburg, as there has never been an academic assessment done on the issue. The study undertook to research three key questions in order to fully assess the effectiveness of Eco-Mobility in the City of Johannesburg. In the process of collecting data, the broader public was not interviewed due to time constraints.

Chapter 2

The chapter detailed the literature focusing on Eco-Mobility. The literature provided a definition of Eco-Mobility, which is centred on providing sustainable modes of transportation. The literature also demonstrated that Eco-Mobility is supported by global city networks such as ICLEI and C40. Hence, member cities are encouraged to share learning between each other through study tours and benchmarking visits in relation to best international Eco-Mobility approaches. The main findings from the literature have shown that Eco-Mobility approaches are implemented with positive outcomes particularly in densified cities.

The literature also demonstrated that South Africa is not making significant progress in reducing high GHG emissions, especially in transportation. This justifies the findings which recommend that South Africa must fully commit to the Paris Agreement targets and also provide support mechanisms in increasing the number of electric vehicles on the roads.

The main findings from the literature indicated that Eco-Mobility approaches are a phenomenon currently gaining momentum across the world. This is in line with the City's GDS strategy, which aims to create a liveable city which is pro-public transport, walking and cycling, all of which are Eco-Mobility approaches. The literature also highlights the positive outcomes of the 2015 Eco-Mobility World Festival. However, it also details the challenges experienced during the Festival. This is also justified by research findings which indicated the frustration and lack of co-ownership by residents during the Festival. This is also supported by the survey results on the Festival by the GCRO.

The literature revealed that the City continues to make significant investments towards Eco-Mobility approaches, in particularly the expansion of Rea Vaya BRT system. This is justified by research findings which demonstrate that Rea Vaya BRT system is experiencing a continuous increase of its ridership numbers, year on year. Research has indicated that residents of the City effectively use this infrastructure. Therefore, it can be assumed that the City has been successful in implementing this specific Eco-Mobility approach for the benefit of residents.

On the other hand, the main findings from the literature highlighted the less usage of the cycle infrastructure and an increase of private cars on the roads. This is affirmed by the research findings. Therefore, this illustrates a failure and less appetite for such infrastructure by residents of the City. Hence, it is incumbent upon the City to create awareness campaigns to promote the current cycling infrastructure and also other modes of

transportation in order to decrease the number of private cars on the roads. This also means encouraging behavioural change by residents towards Eco-Mobility approaches.

The literature findings suggested that the Transit-Orientated Development Corridors play a critical role in aiming to create a viable public transport service in addition to bringing more residents closer to work, social services, shopping centres and leisure opportunities. This is supported by research findings which affirm the importance of Transit-Orientated Development Corridors in transforming the spatial injustices of the City through the provision of socio-economic opportunities.

Finally, the literature also highlighted the different political mandates between the previous ANC-led government and the now DA-led coalition government. This is in regards to the continued implementation of Eco-Mobility approaches. For example, the DA-led coalition government has for now suspended the continued construction of bicycle lanes until there is a verifiable need for further development. This is also justified by research findings which assert that the political wrangling between the ANC and DA has dented the continuation of the bicycle lanes project. Additionally, research findings indicate the lack of political support towards Eco-Mobility approaches by the new political leadership.

Nonetheless, the main findings of the literature in conjunction with research findings, suggested that the infrastructure built for the purpose of Eco-Mobility approaches is effective, but awareness campaigns must be undertaken by the City to increase the use of the infrastructure built.

Chapter 3 and 4

Chapter 3 detailed the qualitative research methodology employed to respond to the research questions. This included the use of interviews,

documentary analysis and desktop research to collect data. In terms of the first research question, which looked at the effectiveness of of Eco-Mobility approaches in increasing sustainable urban mobility in the City of Johannesburg, the findings of this study seem to build in particular on the work of some researchers reviewed in Chapter 2. Many of these studies affirm that Eco-Mobility approaches aim to challenge orthodox methods of urban mobility in the City of Johannesburg by introducing environmentally friendly modes of transportation to address traffic congestion and poor air quality, as discussed in Chapter 4.

The findings of Chapter 4, in the investigation of the second research question, looked at the use of private cars since the implementation of Eco-Mobility approaches. The findings suggest that traffic congestion continue to increase even though the sales of new cars is decreasing. Therefore, this is a strong motivational factor for the continuation of Eco-Mobility approaches. This is also supported by the success demonstrated by the Rea Vaya BRT system.

The notion that Eco-Mobility approaches will inevitably encourage behavioural changes in modal shift, seems to be borne out from international experiences (Engelbrecht et al, 2016). However, the findings run counter to the widely expressed view that residents will effortlessly support and use Eco-Mobility approaches. For instance, through observation, the researcher have realised that in Soweto and the surrounding areas, cycling lanes are used for various purposes including cycling, side car-parking and by waste-pickers who are pulling trolleys. Therefore, there is a need to educate and create awareness about the intended use of cycle lanes in order to make them more effective.

The participants were also influential in showing me a clear preference for the implementation and development of Eco-Mobility approaches, in particularly the bicycle project. Most of them urged the City to reconsider its

decision of temporarily suspending the project. They argued that the project should continue in areas where there is high propensity for usage.

The analysis of data in relation to the third question, seems to follow closely on from Harrison et al (2017), who advocate for a city-wide implementation of the Transit-Orientated Development Corridors to address spatial transformation and attract private investments in the City of Johannesburg. More generally, the findings in Chapter 4 seem to back up the various assertions in the literature that Transit-Orientated Development Corridors assist the City in providing socio-economic infrastructure in densified areas. The findings are consistent with previous research by Engelbrecht et al (2016), which also seem to confirm that Transit-Orientated Development Corridors are catalysts for socio-economic growth and development in the City of Johannesburg. The researcher also supports this notion through observing the City's current construction boom, particularly in areas where there is development of Transit-Orientated Development Corridors.

Importantly, I found out that campaign awareness of Eco-Mobility approaches was a major perceived influence on ensuring that the infrastructure built is used for the intended purpose.

5.3.2 Limitation of the research

The public was not interviewed for this study due to time constraints. However, the findings of the study do not imply that a balance in the study was not established. Conversely, this was achieved through the inclusion of the bicycle NGO and the association of cyclists as research participants. Both organisations represent important stakeholders who are integral to the successful implementation of Eco-Mobility approaches in the City of Johannesburg.

5.3.3 Problems arising during the research

Several problems arose during data collection. The most serious of these was the unavailability of prospective research participants, including senior officials from the Provincial and National Government and taxi associations. As a result, interviews were only held with research participants who were available and interested in the research topic. This was a great disappointment as it eliminated the possibility of having a broad discourse on the development and implementation of Eco-Mobility approaches in the City of Johannesburg.

A second problem was conducting four interviews via e-mails as research participants were not available to be interviewed in person. Therefore, I was unable to extract in-depth data from these participants. However, an interview guide was forwarded to the participants to ensure consistency with the other interviews. Merriam (2002) does point out to the limited value of not interviewing participants in person. Nonetheless, she does assert that in such instances, a researcher should provide an interview guide to assist in extracting in-depth information from and keeping the responses consistent.

5.3.4 Implications of the research findings

My study offers as a suggestive evidence the importance of political support in promoting Eco-Mobility approaches. On the face of it, this suggests that political support for Eco-Mobility approaches may be an important factor in encouraging behavioural changes in modal shift by the City's residents. Therefore, it is important for the City's political leadership to champion the message around Eco-Mobility approaches in order to garner co-ownership of the initiative from the residents. This would ensure that residents appreciate and effectively use the infrastructure built for the purpose of Eco-Mobility approaches.

5.3.5 Recommendations for future research

It is important that future research should focus on interviewing the broader public on their assessment of Eco-Mobility approaches. In addition to car makers in South Africa, this should also include bus and taxi operators on the impact of Eco-Mobility approaches on their businesses.

5.3.6 Contribution to research

In addition to the provision of some directions for future research, my study has made three major contributions to the literature on Eco-Mobility approaches, since research in this area is relatively new and the related literature is still limited.

Firstly, my participants were primarily involved in the development and implementation of Eco-Mobility approaches in the City of Johannesburg. Therefore, their participation in this study has provided an academic opportunity to archive their knowledge and contribution towards Eco-Mobility approaches. My study should contribute doubly to the understanding of the development process by policy makers and designers of interventions when undertaking such initiatives.

Secondly, my study focused on the City of Johannesburg, research into which the learning of Eco-Mobility approaches is limited in comparison to that involving cities from Global North and Asian cities. As a result, my findings should enhance knowledge in Eco-Mobility approaches, particularly for Global South and African cities undertaking such initiatives.

Finally, the study clearly indicates that the success of Eco-Mobility approaches depends primarily on the support of the City's political leadership. The concept and its impact remain unfamiliar to the political leadership. Hence, there is a need for the political leadership to be modelled

into champions of Eco-Mobility approaches in order to garner support from the residents for the infrastructure built.

Therefore, I hope that the findings of my study would attract attention to the concept of Eco-Mobility approaches, particularly for cities dealing with the challenges of providing sustainable urban mobility.

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ANNEXURES

ANNEXURE A: IMAGES



Figure 2: Eco-Mobility sticker posted on the entrance corridors of the Metro Council Building, Braamfontein, Johannesburg



Figure 3: Pavement next to a separated bicycle strip in Berea, Johannesburg



Figure 4: Pavement next to a separated bicycle strip in Hillbrow, Johannesburg



Figure 5: A cycling march which took place in Soweto on the 24th June 2017 against women and children killings



Figure 6: Bicycles donated to residents by the NGO working with the City



Figure 7: A sprinter used for delivering donated bicycles



Figure 8: Cyclists in Soweto, Johannesburg



Figure 9: Cyclists in Soweto, Johannesburg



Figure 10: The Vaya Moja App provides information on Joburg's bus routes, times and fare



Figure 11: Pop up bicycle repair shop in Central Western Jabavu, Soweto



Figure 12: New Canada pedestrian bridge in Pennyville, Johannesburg



Figure 13: Widened pavements in Westbury, Johannesburg



Figure 14: Westdene Dam Redevelopment, Johannesburg



Figure 15: Alexandra NMT, Johannesburg



Figure 16: Times New Media Offices in Parktown, Johannesburg

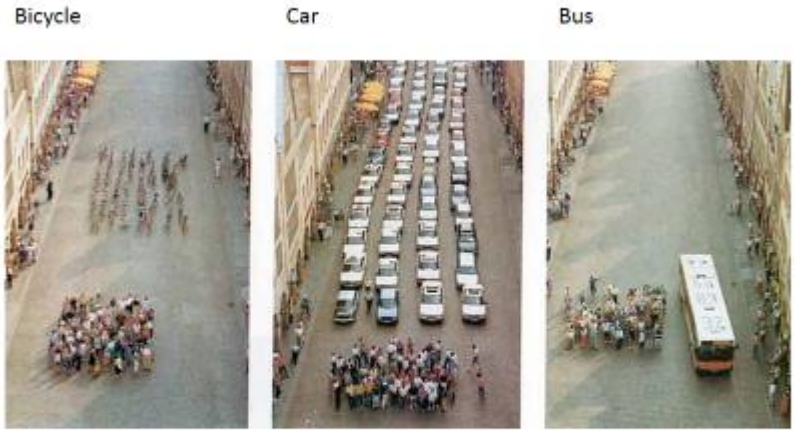


Figure 17: Illustration of the impact of Eco-Mobility

ANNEXURE B: SURVEY RESULTS OF THE 2015 ECO-MOBILITY FESTIVAL

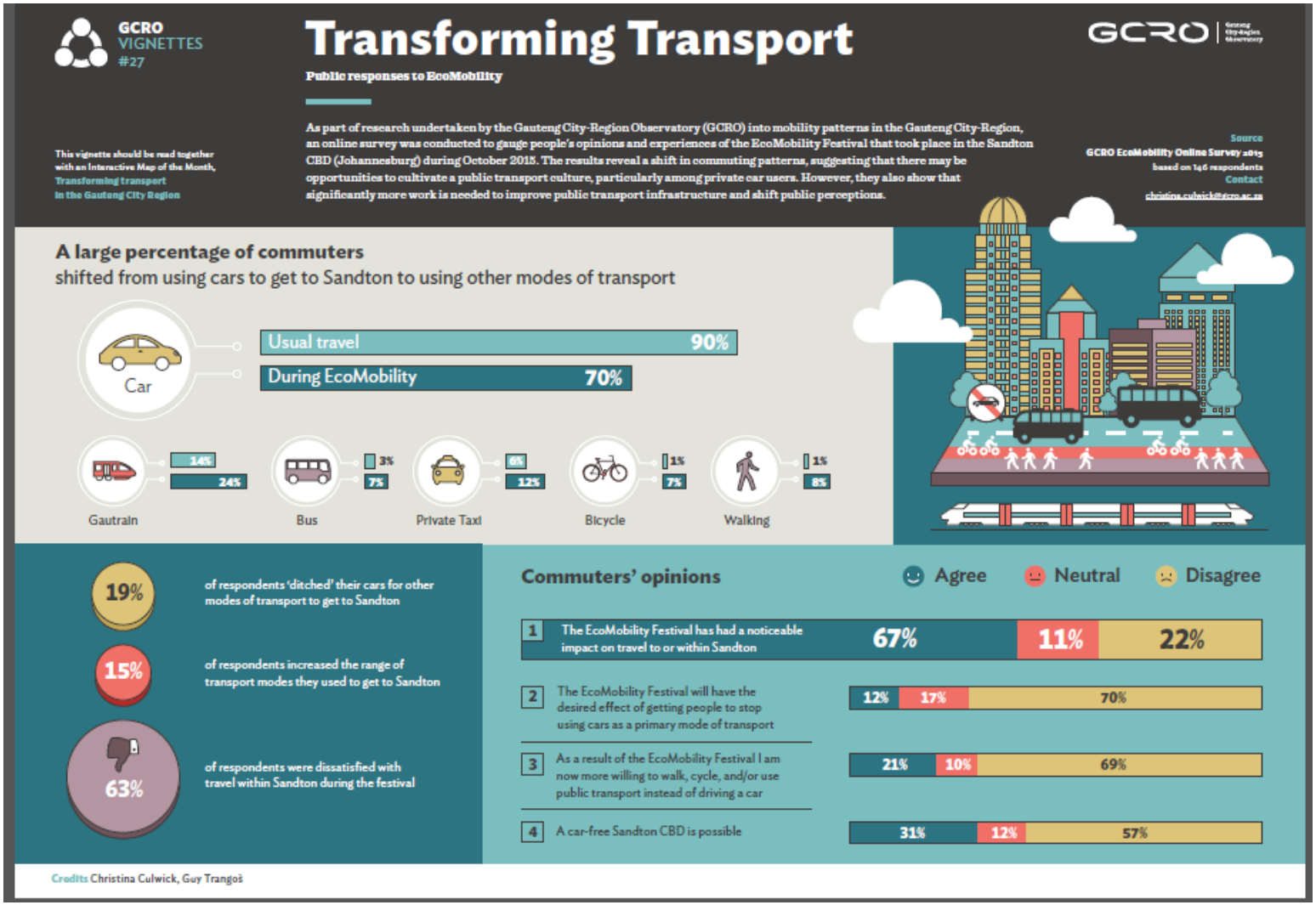


Figure 18: Survey results of the 2015 Eco-Mobility Festival