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THE IMPACT OF THE INVESTMENTS IN THE TRANSPORT INFRASTRUCTURE ON THE GAUTENG ECONOMY

Research report submitted by

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ABSTRACT

This study explores the impact of investments in the infrastructure of transport on the economy of Gauteng, focusing on assessing how these investments contribute to economic growth and social equity. Through the lens of the Multi-Level Perspective (MLP) framework, this study investigates the interactions between niche innovations, regime dynamics, and broader landscape pressures within Gauteng's transport sector. Specific objectives include examining the allocation of funding from both the public and private sectors, evaluating the role of transport infrastructure in socio-economic development, and analysing the impact of policy frameworks and digitalisation trends.

The study reveals important connections between infrastructure growth and economic outcomes, shedding light on how strategic investments in transportation can spur economic productivity while fostering social inclusivity. Additionally, this study focuses on the key success factors for financing public-private partnerships in Gauteng's road and transport sector, identifying legal, regulatory, and financial mechanisms that can enhance the sustainability and effectiveness of such collaborations. Findings indicate that while large-scale projects like the Gautrain have enhanced mobility for specific groups, challenges remain regarding the equitable distribution of public resources across diverse socio-economic demographics.

Ultimately, this research enhances understanding of how targeted transport infrastructure investments can drive balanced economic growth, address social disparities, and position Gauteng for a resilient and inclusive future. Recommendations are provided to guide policymakers and stakeholders in optimising infrastructure investments to achieve long-term economic and social benefits.

Key words: Economic growth, Gross Domestic Product, unemployment rate, investments, transportation.

DECLARATION

I, Gabisile Priscilla Linda, I assert that this research report is my original work, completed independently. It is presented as part of the requirements for the Master of Business Administration degree at the University of the Witwatersrand in Johannesburg, South Africa. This report has not been submitted for any degree or examination at this or any other institution.



……..

Gabisile Priscilla Linda

Date: 28 April 2025

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TABLE OF CONTENTS

COPYRIGHT NOTICE I

COVER PAGE II

ABSTRACT III

DECLARATION IV

ACKNOWLEDGEMENTS V

LIST OF TABLES VIII

LIST OF FIGURES IX

LIST OF APPENDICES X

CHAPTER ONE 1

BACKGROUND TO THE STUDY 1

1.1 Background of the Study 1
1.3 Research Question 4
1.4 Research Objectives 4
1.5 Importance of the Study 4
1.6 Delimitation of the Study 5
1.7 Organisation of the Study 5
1.8 Conclusion 6

CHAPTER TWO 7

LITERATURE REVIEW 7

2.0 Introduction 7
2.1 Empirical Review 7
2.2 Theoretical Framework 11
2.2.1 The Multy-Level Perspective (MLP) *12*
2.2.1.1 Niche Level (Micro-Level) 13
2.2.1.2 Regime Level (Meso-Level) 15
2.2.1.3 Landscape Level (Macro-Level) 18
2.2.1.4 MLP Map Interactions and Key Relationships 20
2.2.1.5 Opportunities 21
2.2.2 Neoclassical Economic Growth Theory *21*
2.3 Research Gap 22
2.4 Conclusion 23

CHAPTER THREE 24

RESEARCH METHODOLOGY 24

3.0 Introduction 24
3.1 Research Methodology 24
3.2 Research Paradigm 25
3.4 Data Source 26
3.5 Data Collection Methods 26
3.5.1 Steps Taken in Data Collection *26*
3.5.2 Inclusion and Exclusion Criteria *27*
3.5.3 Sample and Sampling Technique *27*
3.6 Data Analysis Strategies and Interpretation 27
3.7 Limitation 28
3.8 Quality Assurance 28
3.8.1 External Validation and Transferability *28*

3.8.2 Internal Validity *28*
3.8.3 Reliability *29*
3.9 Ethical Consideration 29
3.10 conclusion 29
CHAPTER FOUR **30**
DATA PRESENTATION AND ANALYSIS **30**
4.0 Introduction 30
4.1 Transport Budget on Gross Domestic Product and Employment. 30
4.2 Gauteng Provincial Revenue 31
4.3 Gauteng Population and Employment 32
4.4 Other Funders of Transport in Gauteng 33
4.5 Policy Analysis 35
4.6 Limitations in Evaluating Transport Infrastructure Outcomes 35
4.7 Conclusion 37
CHAPTER FIVE **38**
RECOMMENDATIONS AND IMPLICATIONS **38**
5.0 Introduction 38
5.1 Recommendation 38
5.2 Suggestion for Further Studies 40
5.3 Comparative Case Analysis 41
5.4 Conclusion 42
REFERENCE: **44**

LIST OF TABLES

Table 1: Gauteng Special Project (Data from States SA and Gauteng Province) 33
Table 2: Passenger trips per financial year (data from Gautrain Management Agency) 34

LIST OF FIGURES

Figure 1: MLP Map Interactions.....21
Figure 2: Transport budget impact on GDP and employment (Data from Statistic SA and Gauteng Province) 31
Figure 3: Unemployment rate compared to percentage allocated transport budget and GDP (Data from Statistic SA and Gauteng Province) 31
Figure 4: Gauteng provincial own revenue (Data from Gauteng Province) 32
Figure *5*: Population and employment data in millions (Data from Statistic SA) 33

LIST OF APPENDICES

APPENDIX A: Gauteng Province budget (Gauteng Province and Statistic SA).....50
APPENDIX B: Gauteng Province conditional grant and special projects (Gauteng Province) 51
APPENDIX C: Gauteng Province gross domestic product (GDP) and Labour data (Statistic SA).....52

CHAPTER ONE

BACKGROUND TO THE STUDY

1.0 Introduction

This chapter provides the context for the research, outlining key elements essential for understanding its foundation. It covers the problem statement, research questions, and objectives, it also identifies the research gap. Additionally, the significance of the study is highlighted, emphasising the importance of enhancing transportation infrastructure to foster economic growth and boost employment rates.

1.1 Background of the Study

The pivotal drivers of economic growth and sustainability encompass the triumvirate of energy, communication and transportation industries, whose role is to profoundly shape the economic landscape (Adedoyin, Bekun, Driha, & Balsalobre-Lorente, 2020). The population growth in South Africa is outpacing gross domestic product (GDP) growth. This is largely attributable to the lack of funding strategy, particularly for the public transportation industry, to effectively accommodate the increase in demand for population and ensure sustainable mobility for all (Stander & Brink, 2019).

There are several studies that established a very good correlation between the government support of microfinance, bank activities and the economic growth of developing countries; loans and advances to the public significantly impact economic growth. Nigeria's government established microfinance institutions after unsuccessful trials in the Directorate of Food, Road, and Rural Infrastructure (DFRRI), Rural Banking by commercial banks, and People's Banks programs. Over time, NGOs were licenced and Universal Banks were encouraged to engage in microfinancing services to increase funding capabilities. Recently, regulations and supervisory guidelines were introduced (Ayodele & Arogundade, 2014). Therefore, this led to economic growth and transformation of microfinance in Nigeria.

Collaboration between financial institutions such as commercial banks and microfinance organisations with the government to fund the transportation industry holds immense potential

to catalyse growth and expansion within this vital industry. By pooling resources and expertise, these entities can unlock new avenues for investment and innovation in transport infrastructure, strengthening their capacity to meet the evolving needs of society. Through strategic partnerships, financial institutions offer customised financial products and services that cater for the unique requirements of transport projects, whether it is financing the acquisition of vehicles, construction of new infrastructure projects, or adoption of sustainable technologies (National Treasury, 2023).

Government involvement can offer regulatory support, incentives and risk-sharing mechanisms that mitigate uncertainties and encourage private sector participation in transportation development initiatives (Castelblanco, Guevara, Mesa, & Flores, 2020). By aligning their interest and leveraging their respective strength, banks and government entities can foster a conducive environment for sustainable transportation growth. This process facilitates enhanced connectivity, accessibility, and more importantly provides accessible and easy access to insurance policy. The transportation industry brings economic prosperity to communities across South Africa (Stander & Brink, 2019).

There are numerous problems facing the transport industry in Gauteng. These problems include traffic congestion, which has become more common due to rapid urbanisation and the strain on existing infrastructure and the lack of well-coordinated, efficient, and reliable public transportation systems (Chakwizira, Bikam, & Adeboyejo, 2018) However, the current research focused on finance. Lack of investment in the transportation industry resulted in slow economic growth in Gauteng. Before and after the COVID-19 pandemic, the Passenger Rail Agency of South Africa (PRASA) faced challenges in upgrading and maintaining Metrorail due to lower revenue to cover operation costs (Luke, 2021). This has led to dependency on grant subsidies to cover its operational costs (PRASA, 2022). The South African National Roads Agency SOC Ltd had to stop pursuing motorists from paying Gauteng e-toll due to a legal battle with the Organisation Undoing Tax Abuse (OUTA) (OUTA, 2024).

South African National Development of Transport (NDOT) has experienced significant challenges in implementing a Bus Rapid Transit (BRT) system, particularly in Gauteng (Gumbo & Moyo, 2020), necessitating meticulous planning and comprehensive feasibility assessments. Gauteng Province can unlock numerous benefits, including technological

advancements and environmental sustainability when allocating more funds into the transportation industry. Proper planning allows for optimising institutional arrangements, considering existing characteristics and potential environmental and societal impact. Moreover, assessing service reliance and quality ensures a seamless and efficient transportation network. Technical analysis of infrastructure integration, demand forecasts, and environmental performance metrics is essential for sustainable development. Additionally, consideration of life cycle costs ensures long-term viability and affordability. Therefore, a holistic approach to planning, encompassing various aspects such as technology, environment, and economics, is imperative for successfully implementing BRT systems in South Africa (Okoro, Muleya, & Musonda, 2022). This has negatively affected Gauteng's economic development, particularly in the aftermath of the COVID-19 pandemic.

1.2 Problem Statement

The Gauteng province, as a significant economic hub in South Africa, requires efficient and sustainable transportation infrastructure to support its economic growth and socio-economic development (Chakwizira *et al.*, 2018). However, there are challenges related to the allocation and strategic utilisation of funds from both the private and public sectors, which could affect the overall impact of funding the transportation industry. Some of these challenges stem from the complexities of infrastructure development, governance, and socio-economic factors such as budget constraints. Limited public funds often lead to the underfunding of critical infrastructure projects. There is competition with other sectors, like health and education, for government resources. There is also inefficiency in leveraging private sector investments through Public-Private Partnerships (PPPs). Fragmentation in planning among local, provincial, and national authorities poses additional problems. Furthermore, there is a lack of alignment between transport policies and economic development goals, along with poor integration of long-term urban planning with transportation strategies. Economic and environmental pressures include rising costs of materials and labour, compounded by economic instability. Environmental concerns and the need for sustainable and green transport solutions can increase project costs. Additionally, there are technological and innovation gaps, such as insufficient investment in digital and smart transport technologies and a lack of skills and expertise necessary to implement and manage advanced infrastructure.

Transportation infrastructure is vital for economic growth, there is limited research on its socio-economic impact, particularly in Gauteng. This study examined the impact of the investments in the transport infrastructure on the Gauteng economy and the influence of policy frameworks and digitalisation on investment outcomes. Addressing these aspects provided insights into optimising infrastructure investments to maximise economic benefits and improve socio-economic conditions in Gauteng.

1.3 Research Question

Main Question: What is the impact of the investments in the transport infrastructure on the Gauteng economy?

Supporting questions:

- What strategies are used for optimising funding allocation to maximise economic inclusion and sustainability benefits in Gauteng?
- What is the role of effective transportation systems and economic advancement in Gauteng?
- What policy frameworks and digitalisation are used in the transportation infrastructure in Gauteng?

1.4 Research Objectives

This study aims to enhance the understanding of the impact of investments in the transport infrastructure on the Gauteng economy. The study further aims to:

- Identify key strategies for optimising funding allocation to maximise economic inclusion and sustainability benefits in Gauteng.
- To investigate the role of effective transportation systems and economic advancement in Gauteng.
- To assess the policy framework and digitalisation in the transportation infrastructure in Gauteng.

1.5 Importance of the Study

The escalating trend in rural-to-urban migrations is anticipated to escalate ecological, social, and infrastructural pressures in numerous major cities of developing nations, particularly

within the transportation sector (Tan & Taeihagh, 2020). As individuals migrate from rural areas to urban centres in pursuit of a better life, the demand for transportation services inevitably surges. This heightened demand strains transportation infrastructure, leading to congestion, increased emissions, and greater resource strain (Tan & Taeihagh, 2020). Urban growth creates transportation problems, making access to essential services and employment opportunities difficult for marginalised communities. Sustainable, equitable, and efficient transportation solutions are vital to address these challenges and ensure the well-being and mobility of urban residents in developing countries.

1.6 Delimitation of the Study

This research study concentrated on transportation infrastructure, funding allocation, and economic indicators within the borders of Gauteng. It analysed the trends and changes in transportation infrastructure funding allocation and economic indicators from 2006 to 2023. The modes of transportation that are included are rail, air, and other road modes of transport. The sources of funding that contribute to the development of transportation infrastructure in Gauteng include government funding, private investment, commercial banks, international aid, and private-public partnerships, which were considered in this research. Economic metrics like Gross Domestic Product (GDP) and the employment rate were analysed. This research examined the correlation between transportation investment and changes in economic indicators over time and identified any causal relationships or significant patterns. Lastly, this research used secondary data from government reports, academic studies, industry publications, and economic indicators in Gauteng.

1.7 Organisation of the Study

This section provides the outline of the chapters. Chapter one forms the background of the study, discussing the research problem, objectives, questions and identifying the limitations of the study. Chapter two is the review of literature related to the topic of the study. The chapter looks at literature informing the study as well as the framework underpinning the study. Chapter three discusses the methodology of the study. In this chapter, the methods, design, population, sampling and data analysis technique are discussed and justified for their choice in this study. The chapter also highlights ethical issues and validity aspects of the study. Chapter four outlines

the findings, unpacking the analysis and the interpretation of data. Chapter five looks at the analysis and interpretations of the findings of the study, recommendations and conclusion of the study.

1.8 Conclusion

The current chapter outlined the background of the study, research problem, research objectives and questions. The study provided the limitations of the study. In the next chapter, literature is reviewed.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews the literature on the economic impact of developing the transportation industry, specifically focusing on transportation infrastructure.

2.1 Empirical Review

The Nation Development Plan (NDP) 2030 is a long-term plan that recognises investment in transportation infrastructure and public transport as critical to achieving the country's objectives. Investing in public transport can significantly reduce poverty and inequality. The plan outlines objectives to enhance the mobility of low-income households, improve transportation affordability, ensure reliable and safe transportation, and facilitate access to economic opportunities (NDP 2030, 2015). Improved mobility and economic access enhance social opportunities and reduce poverty.(Kgwedi, 2022) asserts that multistage journeys result in increased travel durations and elevated commuting expenses. This issue arises from the poor integration of public transport within the overall commuter experience. As travel distance increases, so does daily commuting time, leaving less opportunity for activities that enhance socioeconomic well-being. It is essential for policymakers to back investments and initiatives that are fair to low-income transit users. Transport infrastructure grants access to markets, resources, and economic prospects. Consequently, transportation systems are intricately connected to socioeconomic shifts and economic growth by enhancing accessibility (Rodrigue, 2020).

Evaluating urban accessibility is complex due to transportation quality, infrastructure, and design. A well-planned transportation system improves accessibility, including public transportation. Accessibility should be a priority when designing public transportation infrastructure. Public transportation impacts mobility, sustainability, employment, health, and social exclusion, so planning should consider its impact on society (Saif, Zefreh, & Torok, 2019).

(Selamolela, 2018) argues that government intervention in infrastructure development can enhance connectivity and boost infrastructure potential. Moreover, a positive collaboration exists between GDP (or Economic growth) and gross domestic fixed capital structure. As economic growth rises, household income tends to increase, leading to a surge in tax revenue. This can lead to increased investment. in gross domestic fixed capital formation, with a substantial portion allocated towards the investment of transport infrastructure.

A study conducted by (Adedoyin *et al.*, 2020) asserts that investing in aviation infrastructure can facilitate sustainable strategic planning and economic growth, particularly in the tourism sector, which is a vital contributor to the economy. Additionally, air transport plays a significant role in generating national income. Gauteng is South Africa's smallest province by area, but it has the highest population, including the megacity formed by its three major municipalities, Johannesburg, Tshwane, and Ekurhuleni (Chakwizira *et al.*, 2018). This concentrated urban landscape has led to a steadily increasing energy demand and a pressing need for effective public transport solutions to meet the mobility needs of over 11 million inhabitants. The transport infrastructure in Gauteng is essential for fostering economic development in the province. As the main economic centre, Gauteng is located approximately six hundred kilometres from the nearest ports, making road transport a vital component of the logistics and supply chain (Mitchell & Walters, 2011). The transport sector's performance and the associated costs of infrastructure development significantly impact the Gauteng region's overall economic performance.

Public-Private Partnerships (PPPs) have become pivotal in addressing the funding gaps in Gauteng's roads and transport sector, enabling enhanced infrastructure development and economic growth (Mudau, 2022). However, financing such partnerships requires a clear understanding of critical success factors to ensure sustainability, effectiveness, and mutual benefit for both public and private entities. Key success factors include robust legal and regulatory frameworks that provide clarity on roles and responsibilities, risk-sharing mechanisms that protect the public interest while offering fair returns to private investors, and financial models that accommodate long-term infrastructure maintenance. Additionally, stakeholder engagement and transparency play essential roles in fostering public trust and collaboration.

The benefits of a sound transport system extend beyond economic gains, encompassing significant social impacts that contribute to overall societal well-being. Enhanced mobility

facilitates more accessible to essential services such as education facilities, healthcare and social support, reducing barriers that often hinder social equity (Rajagukguk, 2021). By connecting communities and promoting inclusivity, a well-developed transport network can improve the quality of life, empower disadvantaged communities, and foster social cohesion. Ultimately, the ripple effects of an efficient transport infrastructure contribute not only to economic growth but also to a more resilient and equitable society.

One study suggests that the Gautrain project, a prominent large-scale public transportation initiative, may have inadvertently exacerbated mobility-related exclusion by prioritising the needs of affluent commuters over those of lower-income citizens (Thomas, 2013). This raises critical concerns about the equitable allocation of public funds, as resources were directed towards a project that primarily serves wealthier demographics while potentially neglecting more accessible, affordable transport options that could benefit the broader population. Such outcomes underscore the need for inclusive transport planning that balances efficiency with equity, ensuring that infrastructure investments contribute to social cohesion and accessible mobility for all socioeconomic groups. However, other research suggests that enhancing the efficiency of transportation networks, fostering innovation, and reducing regulatory barriers could be effective strategies to stimulate economic growth in Gauteng (Mitchell & Walters, 2011).

Research in the United States, Netherlands, Spain, Pakistan, and Nigeria indicate a positive correlation between investment in road transportation and economic development (Hlotywa & Ndaguba, 2017). The study of China's high-speed rail (HSR) system is a testament to the transformational power of transportation infrastructure . (Kong, Li, Jiang, Sun, & Peng, 2022) conducted a study on HSR in China; this monumental endeavour has not only revolutionised travel within the country but has also brought forth a multitude of socioeconomic benefits. The high-speed rail network connects cities over vast distances, boosting integration, accessibility, and regional cooperation. This project has attracted foreign and private investment, revitalised local economies, spurred innovation, and generated job opportunities. Furthermore, the project has served as a platform for exchanging knowledge and management experience, both domestically and internationally, as China shares its expertise in building and operating high-speed rail systems with the global community. In essence, the high-speed rail system in China stands as a shining example of the multifaceted benefits that strategic investment in the

transportation industry can yield, propelling economic growth, fostering innovation, and enriching the lives of millions (Kong *et al.*, 2022).

The role of government entails regulating various forms of investments through implementing policies and regulations designed to encourage greater investment in the transportation industry (Hlotywa & Ndaguba, 2017). To boost the transportation industry, the government can increase funding and implement favourable policies to encourage private investment, innovation, and sustainable growth. A world-class transportation infrastructure system requires large capital expenditures. Policymakers are pivotal in advising the government on investing in integrated transportation (Holland, Mansur, Muller, & Yates, 2021).

South Africa has a robust infrastructure including roads, health, and educational facilities, but significant investment has been needed for expansion, maintenance, and upgrade of infrastructure like railways and ports since the dawn of democracy (Hlotywa & Ndaguba, 2017). GDP growth is often used as a proxy for economic growth, yet true economic progress encompasses more than just monetary metrics. It includes factors such as the national product and social equity, including eliminating poverty, inequalities, and unemployment. Therefore, while investment in the transportation industry may correlate with GDP growth, its impact extends beyond economic indicators. Developing the transportation sector can stimulate economic growth and address social issues in South Africa (Hlotywa & Ndaguba, 2017).
Hollard et al., (2021) advocate for the widespread adoption of electrical buses, citing substantial environmental benefits over traditional diesel or compressed natural gas (CNG). There is an emphasis that electronic buses significantly reduce harmful emissions, contributing to cleaner air and mitigating the detrimental effects of climate change. This research offers insights into an integrated transportation industry's economic and environmental benefits. Encouraging mass transportation in big cities can reduce emissions and provide economic benefits for commuters who use public transport.

The transportation industry is key in developing smart cities, and collaboration between government and citizens emerges as a fundamental cornerstone. This symbiotic relationship fosters an environment where the sharing of information becomes not just beneficial but essential (Tan & Taeihagh, 2020). Governments tap into local knowledge to co-create solutions tailored to meet specific community needs by engaging citizens in decision-making processes.

This collaboration fosters transparency and trust, leading to effective governance and economic development in smart cities. Ultimately, the synergy between government and citizens drives inclusive prosperity and a higher quality of life.

The correlation between employment rates and a robust transportation system is undeniable, each playing a crucial role in shaping economic opportunities and societal well-being (Saif *et al.*, 2019). A robust transportation network enables the efficient movement of goods and services, acting as a vital resource for those searching for employment opportunities. Accessible transportation infrastructure connects job seekers to employment centres, reducing barriers to employment. A lack of reliable transportation options limits job accessibility, aggravating unemployment rates and perpetuating socioeconomic inequalities. Investing in transportation systems can lead to economic growth, increased job market participation, and improved productivity. A strong transportation system promotes mobility, connectivity, and access to essential services for all members of society, resulting in a more dynamic and inclusive economy.

Integrating technology development within transportation industries is pivotal in driving economic development and fostering sustainable growth. Utilising cutting-edge technologies like artificial intelligence, the Internet of Things (IoT), and automation can enhance the efficiency, reliability, and eco-friendliness of transportation infrastructure (Tan & Taeihagh, 2020). These innovations optimise route planning, reduce congestion, and enhance safety, thus improving overall productivity and reducing costs for businesses and individuals. Tech-powered transportation systems promote economic development and access to essential services for all. This has supported the transportation industry in the United Kingdom despite its population, and it's not a doubt that South Africa can critically align itself to this. In the next decade, South Africa's economy will rank among the best in the world.

2.2 Theoretical Framework

The Multy-Level Perspective (MLP) and Neoclassical Economic Growth Theory are two essential frameworks guiding the current study as they offer different perspectives on economic development and growth. The MLP emphasises the importance of considering multiple levels of analysis, ranging from individual behaviours to institutional structures, in understanding the complexity of economic systems (Geels, 2020). This approach recognises the

interconnectedness of various social, political, and environmental dimensions and their influence on economic outcomes. On the other hand, Neoclassical Economic Growth Theory, based on classical economic principles, focuses on the role of capital accumulation growth (Spencer & Dimand, 2010). It emphasises resource allocation efficiency and the importance of factors such as savings, investment, and productivity growth. This research explored how these two frameworks can complement each other and offer important perspectives on the dynamics of economic development, particularly within the context of funding in the transportation infrastructure.

2.2.1 The Multy-Level Perspective (MLP)

This study analysed funding allocation in Gauteng's transportation infrastructure. Using the MPL, it examined how different levels of the socio-technical system interact and impact funding decisions and economic development (Annema, 2022).

At the niche level, the focus was to scrutinise emerging innovations and alternative funding mechanisms within the transportation infrastructure. At the regime level, it is important to consider the dominant structures, policies, and stakeholders. This requires examining government budget allocations, public-private partnerships, and regulatory frameworks that govern transportation funding. Finally, when considering transportation funding, it is important to consider broader economic, social, and environmental factors at the landscape level. This includes trends in economic growth including Gross Domestic Product (GDP) and employment rate, inflation, etc (Roberts & Geels, 2019) used MLP to analyse what makes policymakers change policies for economic and socio-technical development.

MLP framework was used to gain insights into the relationship between niche innovations requiring funding, the current transportation infrastructure funding system, and the broader factors influencing funding priorities. This comprehensive approach helped in understanding the dynamics of funding allocation in the transportation industry in Gauteng and guided the development of sustainable transportation strategies that can lead to improved outcomes. The link between investment in transportation infrastructure and economic growth has been thoroughly studied, particularly in developing nations. Grasping this connection is vital for

Gauteng province in South Africa, which serves as an important economic centre and a key contributor to the national GDP.

Existing literature suggests that infrastructure development, especially investments in transport networks, can significantly impact economic growth. For example, a study on the Indian economy discovered that infrastructure development had a greater positive contribution to growth than both private and public investments (Timilsina, Stern, & Das, 2021). A review of existing literature regarding the effects of infrastructure investment on economic growth revealed that, while no consensus exists, numerous studies indicate a strong positive correlation between the two (Timilsina *et al.*, 2021).

Recently, Gauteng province has invested heavily in transport infrastructure, such as building high-speed rail, expanding road networks, and upgrading airports. The primary goal of these investments is to enhance connectivity, ease congestion, and boost the overall efficiency of the transportation system. Such advancements are anticipated to foster economic growth and development in the area (Gauteng Roads and Transport, n.d). However, the impact of these investments may be complex, as various factors, including the stage of economic development, geographic characteristics, and the broader policy and institutional environment, influence the connection between transportation infrastructure and economic factors outcomes.

2.2.1.1 Niche Level (Micro-Level)

At the micro level, the impact of investments in transportation infrastructure may differ across various sectors and companies, depending on their specific requirements and their ability to take advantage of the enhanced connectivity.

The Gauteng Department of Roads and Transport has introduced a vision called "Growing Gauteng through Smart Mobility" to boost the economy of the province and transform access to transportation options in the urban area. The initiative aims to position the province as the primary logistics and freight centre for both the nation and the continent, taking advantage of its gateway status to Africa. The plan integrates public transport and develops a smart transport infrastructure using available technology. One key objective is to create interconnected and efficient transport systems that cut across every type of transportation, streamlining travel for

commuters. The establishment of the Transport Authority of Gauteng is a critical step in aligning transport planning between municipalities and the provincial government (Gauteng Roads and Transport, n.d).

The Smart Mobility 2030 plan centres on three strategic focus areas: infrastructure, operations, and institutions. These areas are supported by technology and environmentally friendly transport, which encompasses non-motorised options. Additionally, a crucial objective of the plan is to establish Gauteng as the hub for freight and logistics by developing a smart freight network, enhancing efficient logistics handling capabilities, and implementing data-driven mobility solutions (Gauteng Roads and Transport, n.d).

Additional essential projects for implementation encompass the following:

- Enhancing the road network to link new nodes and boost the efficiency of transporting people and goods. These connections should utilise intelligent transport systems that are integrated with other systems to create a smart infrastructure city.
- Digitalize and chart all minibus taxi routes across the province, establishing a hierarchy of both formal and informal intermodal minibus taxi service facilities.
- Assess the current infrastructure and create standard layouts for Minibus Taxi Facilities to be used throughout the province.
- Encouraging transit-oriented development minimises travel distances for work, leisure, education, and home while establishing measures to ensure spatial development is upheld frameworks.
- Accelerate the growth of the Gauteng Rapid Rail Link to reduce congestion and offer safe, efficient, and fast public transport service.
- Collaborate with the Transport Authority to integrate Gautrain with various transport modes, establish Integrated Fare Management, and enhance infrastructure to improve freight efficiency and reduce congestion. This initiative involves constructing a dedicated freight road and developing a rail bypass around Gauteng to facilitate new intermodal terminals Transnet (Gauteng Government, n.d).
- The department will work alongside all government tiers to implement smart mobility solutions aimed at decreasing traffic congestion, improving road safety, safeguarding the environment, and making transportation more accessible and affordable.

Self-driving cars have already made significant progress in cities such as San Francisco, Phoenix, and Singapore. Autonomous vehicle technology has been integrated into public and private transportation systems in these cities (Kasznar, Hammad, Najjar, Linhares Qualharini, Figueiredo *et al.*, 2021). These vehicles contribute to economic growth by reducing traffic congestion, lowering transportation costs, and increasing productivity, as commuters can utilise travel time for work or leisure. They also promote sustainability by optimising driving patterns and reducing fuel consumption and emissions (Ruch, Ehrler, Hörl, Balac, & Frazzoli, 2021).

For South Africa, and specifically Gauteng, adopting autonomous vehicles could position the region as a technological leader on the continent. Early adoption could attract international investment, create high-skilled jobs, and improve transportation efficiency. Although South Africa does not have self-driving cars, Gauteng could become the first province to introduce them, paving the way for smart city innovations and long-term economic benefits. Adopting this technology soon will ensure the country stays competitive and embraces the future of transportation. Gautrain system has embraced more user-friendly payment options, allowing commuters to use bank cards and contactless tap-and-go methods at train stations and on buses. By expanding the use of these advanced payment solutions across all modes of public transport, the province can significantly improve the convenience and appeal of its transportation system to a broader range of users.

On 28 May 2022, the Gauteng Department of Road and Transport launched the Pothole Fixing GP Application (App). The app allows road users to report potholes in various parts of the province. This allowed continuous maintenance of road infrastructure with the collaboration of road users and the Department of Road and Transport. Gauteng can rapidly improve its transport infrastructure by tapping into more technological advancements.

2.2.1.2 Regime Level (Meso-Level)

At the meso-level, investments in transport infrastructure are likely to influence the spatial organisation of economic activities. This has facilitated the emergence of new industrial clusters and prompted the relocation or growth of current ones. These shifts can enhance the efficiency of supply chains, reduce transportation costs, and improve market access. Ultimately, this contributes to the Gauteng region's overall competitiveness and economic

dynamism. The government primarily oversees Gauteng's transport infrastructure. In 2007 Gauteng freeway improvement project embarked on improving the N1, N3, N12, and R21 highways and installed 43 overhead gantries, which will now be used for speeding cameras, road safety surveillance, and crime prevention (Gauteng Government, n.d) .

Gautrain was implemented in 2000. Its goal was not just to improve public transport but also to improve the economy of Gauteng Province by reducing travel time, leading to more productivity hours, improving socioeconomic development by creating job opportunities directly or indirectly, and furthermore repurposing the budget that was spent on road accidents (KPMG, 2014). Moreover, Gautrain was developed to create an integrated transport system that will promote tourism.

The O.R. Tambo International Airport stands as Africa's largest and busiest airport, boasting features that define a top-tier airport, such as its location, accessibility, and connectivity. Nestled in Johannesburg, within Ekurhuleni Municipality—the city's industrial centre—the airport is seamlessly integrated into the national road network via excellent infrastructure. It caters to airlines from five continents, fulfilling the air transport requirements of both local and international travellers. As the flagship facility in Airports Company South Africa's portfolio of nine airports, O.R. Tambo International Airport serves over 21 million passengers each year, with a capacity to handle 28 million passengers annually (Airports Company South Africa, n.d).

The Passenger Rail Agency of South Africa (PRASA) is essential for providing affordable and accessible public transport in Gauteng, which is the country's economic hub. PRASA operates mainly through Metrorail and serves millions of commuters daily. It helps workers, students, and communities travel between key urban centres such as Johannesburg, Pretoria, and surrounding areas. Despite challenges like ageing infrastructure, vandalism, and operational inefficiencies, PRASA's operations in Gauteng are crucial for the province's economic growth and mobility. Ongoing efforts to modernise rail services, upgrade infrastructure, and improve safety are vital for establishing a reliable and sustainable public transport system that can address the needs of the increasing urban population.

Gauteng's rail system experienced a backlog after COVID-19 due to infrastructure vandalism. On July 2022, The government commemorated the completion of the 100 train set at the Gibela

Rail Consortium's Dunnottar factory Ekurhuleni. This milestone positions Gibela to achieve its goal of producing 600 six-car trains for the rail agency.

In the bustling region of Gauteng, the industry minibus taxi has emerged as a crucial component of the transportation landscape. In contrast to the formal public transportation systems, minibus taxis in Gauteng have exhibited unique characteristics that make them indispensable. These informal operators have been able to adapt to the region's diverse transportation needs, providing a level of flexibility and responsiveness that traditional systems often struggle to achieve. Moreover, the affordability of minibus taxi services has been a crucial factor, as a significant portion of urban dwellers in the region have limited access to public transport due to high costs (Sovacool, Daniels, & AbdulRafiu, 2022).

Improving public transportation systems is a major issue in many cities in the developing world. This is especially important when dealing with problems like traffic congestion and air pollution and making transportation more accessible. In South Africa, the absence of dependable and formal public transport has prompted the suggestion of integrated rapid public transport networks in various metropolitan regions, including Gauteng Province. Gauteng, which includes Johannesburg, Ekurhuleni, and Tshwane, is a key urban growth area facing challenges typical of developing cities. Establishing a Bus Rapid Transit (BRT) system in Gauteng has been a crucial part of the province's efforts to tackle these challenges (van der Berg & du Plessis, 2022).

The transportation landscape in Gauteng has changed significantly with the introduction of Uber, a popular ride-hailing service. Uber's innovative approach to passenger transportation has disrupted the traditional taxi industry and has the potential to improve the region's transportation infrastructure and accessibility. A major advantage of Uber in Gauteng is its ability to expand transportation options for residents. Many urban dwellers in Gauteng need more access to reliable and affordable public transportation, often relying on expensive and inaccessible services. Uber's platform has provided an alternative that is more accessible and responsive to the community's needs. The convenience and user-friendly technology of Uber have made it an attractive option for communities who may have previously had challenges in accessing transportation (Sovacool *et al.*, 2022).

2.2.1.3 Landscape Level (Macro-Level)

At a macro level, the investments in transport infrastructure in Gauteng may have directly impacted the region's economic performance. Improved connectivity and reduced transportation costs can boost productivity and encourage the flow of goods and individuals while drawing in investments. The development of the infrastructure of transportation in Gauteng, a key economic hub of South Africa, is significantly influenced by various macroeconomic factors. Economic growth, fiscal policies, and Investment trends significantly influence priority setting and strategies for transport infrastructure development in the region (Park, Seo, & Ha, 2019). Economic growth drives the need for better transport infrastructure. As the economy grows, the demand for moving people and goods increases. This requires investment in transportation systems to support the growth. The Gauteng city region, which includes Ekurhuleni, Johannesburg and Tshwane, is leading South Africa's socio-economic development and growth. Rapid urbanisation and rural-urban migration in the region have intensified pressure on existing infrastructure, creating an urgent need for strategic transport solutions (Gauteng Government, n.d).

The national government's policy initiatives, such as the New Growth Path, reindustrialisation efforts, and the National Development Plan 2030, have significant implications for Gauteng's transport investments. These large-scale strategic interventions aim to unlock South Africa's economic constraints. The impacts of these policies are channelled through metropolitan-level decision-making processes. The successful implementation of these national-level plans can provide the necessary support and resources for Gauteng to develop its transport infrastructure in alignment with the broader economic development goals (Gauteng Roads and Transport, n.d).

Fiscal policies significantly influence transport investments in Gauteng. Over the past three decades, insufficient funding in South Africa's public transport sector has posed a major challenge (Gopaul, Friedrich, & Stretch, 2019a). The government's budget allocations and funding mechanisms for transportation projects can either support or impede the creation of effective and sustainable transportation systems. The Gauteng province of South Africa faces a complex web of challenges in its pursuit of sustainable transport solutions. Rapid urbanisation, growing environmental concerns, and shifting societal patterns have profound

implications for the region's transport infrastructure and policies (Nhamo, Rwizi, Mpandeli, Botai, Magidi *et al.*, 2021).

When analysing the national and regional policies related to transport, economic development, and environmental sustainability, it is evident that there are both areas of alignment and conflict with local transport goals in Gauteng. At the national level, South Africa is dedicated to cutting greenhouse gas emissions and encouraging renewable energy, which is in line with the need for greener transport solutions in Gauteng (NDP 2030, 2015). However, certain policies focused on road expansion and e-tolling have faced criticism, as they may worsen congestion and reliance on cars instead of promoting the use of public transport. At the regional level, the Gauteng City Region has recognised the importance of integrating land use, transport, and environmental considerations in its development plans. Efforts to create more compact, mixed-use urban environments and improve public transport connectivity are underway, but progress has been hampered by funding constraints and the impact of apartheid-era spatial planning (Gauteng Roads and Transport, n.d).

The changing trends in society could greatly affect transportation in Gauteng. The growing environmental consciousness, especially among younger people, has led to a higher demand for sustainable transportation options like cycling and walking infrastructure. Moreover, the COVID-19 pandemic has sped up the acceptance of remote work, which could decrease the necessity for daily commuting and change travel habits. The region also grapples with challenges stemming from urbanisation and social cohesion. The movement of individuals from the countryside to city regions has significantly strained Gauteng's transportation systems. Additionally, the historical spatial planning from the apartheid era has led to socioeconomic disparities, impeding fair access to transportation services.

Environmental issues, including air pollution, climate change, and limited resources, are putting substantial pressure on transportation choices in Gauteng. The region heavily depends on private vehicles, leading to harmful emissions and poor air quality. Transportation is a major contributor to greenhouse gas emissions. Furthermore, climate change impacts, including rising temperatures and an increase in extreme weather events, are putting the region's transportation infrastructure at risk. Consequently, the demand for sustainable and eco-friendly transportation is growing options, like improved public transit, electric vehicles, and walking or cycling (Gopaul *et al.*, 2019a).

The Department of Roads and Transport is committed to improving mobility and accessibility across Gauteng by developing transportation and socio-economic infrastructure. The department's vision is to create an integrated and sustainable infrastructure that encourages innovation and prioritises people, making sure that the movement of individuals, products, and services is accessible, safe, and affordable. The key stakeholders in investing in the transportation industry are mainly the government. The National Department of Transport provides conditional grants for road maintenance and infrastructure to Municipalities (Serfointein & Govender, 2020). Gauteng Government will invest R120 billion in the expansion of Gautrain to Soweto via Fourways; Mamelodi; Atteridgeville; Lanseria; and Springs in less than two years. In addition, the is currently major revamp of R21 (Albertina Sisulu Highway) for the next five years.

2.2.1.4 MLP Map Interactions and Key Relationships

Figure 1 below is the illustration of the Gauteng MLP map interaction and key relationships, as discussed above in section 2.2.1.At the landscape level, Gauteng is facing various challenges, such as urbanisation, economic growth, and environmental concerns, which are driving the need for greener and more efficient transport systems (Jacobs, David, & Stiglingh-Van Wyk, 2023). These challenges are impacting the government and large-scale transport systems at the Regime level, which are adapting to meet growing demand and sustainability targets. However, the existing transport systems, such as reliance on road transport and traditional methods like minibus taxis, are resistant to rapid change due to institutional inertia. On the other hand, at the niche level, new innovations like autonomous vehicles, smart mobility apps, and integrated transport systems are emerging. While these innovations are still in their initial stages of development, they have the potential to significantly transform the transport system under the right conditions (McKay, 2020).

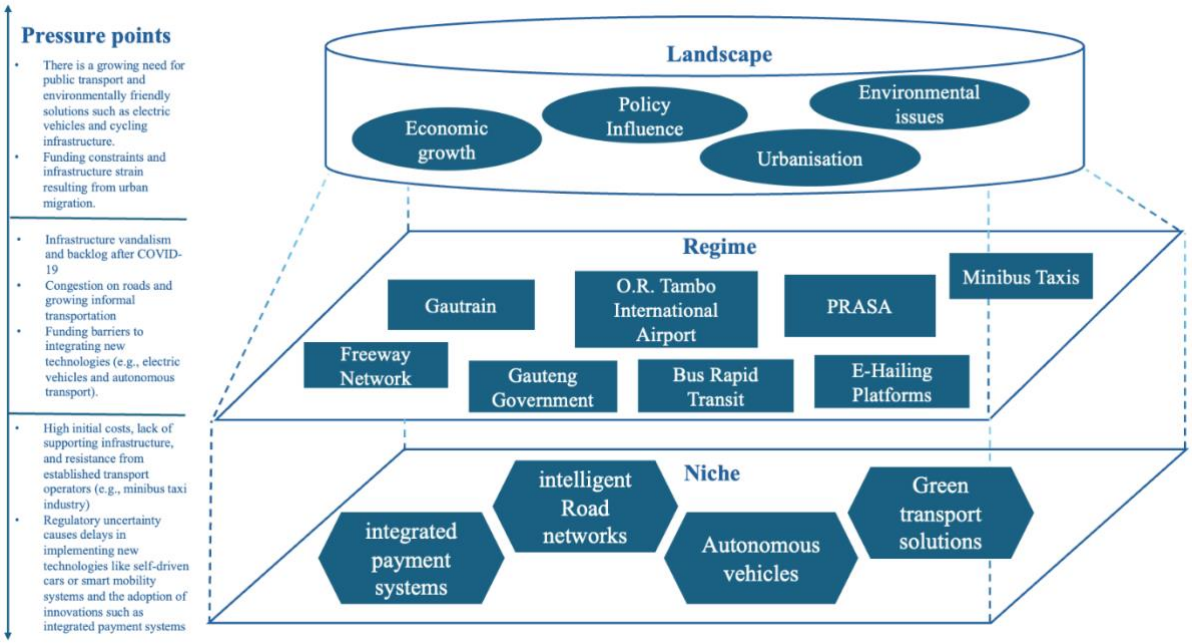


Figure 1: MLP Map Interactions

2.2.1.5 Opportunities

The early adoption of autonomous vehicles and other smart innovations, such as self-driving cars, can be scaled up when opportunities arise from the landscape level. There are also niche developments in digitisation, like minibus taxi routes and freight optimisation. Landscape pressures, such as an increasing focus on environmental sustainability and the strain from urban migration, lead to situations where the existing transportation system encounters challenges. Currently, the government faces challenges with traffic congestion, informal transportation, and outdated systems, it creates opportunities for specialised innovations such as self-driving cars, intelligent transport systems, and eco-friendly solutions to expand and potentially replace or significantly modify the existing regime. Smart mobility initiatives, such as the Transport Authority's efforts to integrate various modes of transport and autonomous vehicle technology, could benefit from these regulatory pressures, pushing the region closer to a sustainable, technology driven transport system.

2.2.2 Neoclassical Economic Growth Theory

Neoclassical Economic Growth Theory can serve as a theoretical foundation for comprehending the probable impact of transport infrastructure funding allocation on economic growth in Gauteng. This theory considers important economic indicators like GDP,

employment rate, and inflation, which measure economic performance and stability (Gallen & Winston, 2021).

(Gallen & Winston, 2021) Used Neoclassical Economic Growth Theory to analyse the impact of US transportation on economic activity. In this research, applying the Neoclassical concept of capital accumulation to transportation investment can assess the funding in transportation infrastructure, such as road infrastructure, railway lines, ports, and airports, contributing to capital accumulation and higher productivity and economic growth over time. Neoclassical growth theory highlights the importance of capital accumulation in driving economic growth. Transport infrastructure, viewed as a form of public capital, aligns with this theory, as investments in roads, rail, and public transit in Gauteng can increase the stock of capital available and lead to enhanced productivity (Okolo, Edeme, & Emmanuel, 2018).

Technological progress in the transportation sector has the potential to significantly impact regional economic growth and productivity. In the case of the Gauteng province in South Africa, assessing the convergence hypothesis and the potential impact of increased investment in transportation infrastructure could provide valuable insights for policymakers. The existing literature highlights several key considerations in this regard. As a middle-income country, South Africa struggles to enhance its transportation infrastructure while ensuring fair allocation of its limited resources among different economic sectors (Page, 2005). The transport sector is particularly crucial for Gauteng, as the province's economic centre is located far from major ports, underscoring the importance of efficient road networks (Mitchell & Walters, 2011).

2.3 Research Gap

The transportation industry has a profound impact on economic development, policy formulation, social inclusion, environmental sustainability, and knowledge transfer in Gauteng. However, significant gaps remain in addressing these interconnected aspects within transportation research. For instance, there is limited exploration of the long-term socio-economic outcomes of transport investments on marginalised communities, insufficient integration of environmental sustainability metrics into transport policy frameworks, and a lack of focus on how digital innovations and smart mobility systems can enhance knowledge transfer and economic inclusivity. Furthermore, little attention has been given to the alignment of private and public sector objectives in funding transportation infrastructure, or the role of governance structures in mitigating challenges such as inefficiencies. The current study aimed

to fill this gap by examining how transportation infrastructure developments can foster economic growth through adequate funding, shape policies, promote social and economic inclusion, and ensure environmental sustainability. Through rigorous analysis and empirical exploration, this research's aim was to provide actionable insights for policymakers, effective decision-makers, industry leaders, and communities navigating the rapidly evolving transportation infrastructure landscape.

2.4 Conclusion

Improved transportation infrastructure is directly linked to economic growth and development. It creates more investment, trade, and employment opportunities. It also reduces inequalities, promotes social inclusion, and provides better access to essential services like education and healthcare. Sustainable modes of transportation and well-designed infrastructure can reduce congestion and environmental degradation.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter highlights the methodology and design of this quantitative research. It offers an appropriate and deeper understanding of the research topic by exploring different literature and collecting data from data-based sources (Mulisa, 2022), consolidating those views to give informed advice to the private and public sectors in Gauteng. To form the basis of this research, the exploration of themes is employment rate, GDP growth rate, socioeconomic factors, environmental impact, and technology development. The scope of the study will cover 18 years (2006 to 2023).

3.1 Research Methodology

The current study used a quantitative research methodology, which entails the systematic investigation of phenomena through measurable data and statistical analysis. Quantitative research is particularly effective for examining relationships, trends, and patterns, as it provides objective and replicable findings (Mohajan, 2020). This methodology often includes structured data collection methods, such as surveys, experiments, or the analysis of existing datasets. In this study, quantitative research was chosen for its capacity to yield numerical insights that could be analysed statistically, ensuring the reliability and validity of the findings.

In the current study, quantitative research was employed to examine the impact of transport infrastructure investments on the Gauteng economy. The methodology facilitated the collection of data on variables such as funding allocation and economic growth metrics. This approach was selected because it provides clarity in identifying relationships between transport infrastructure and economic outcomes, enabling evidence-based conclusions. Furthermore, the use of statistical tools ensured a thorough analysis of trends and correlations within the dataset, aligning with the study's objective to provide actionable insights for policymakers and stakeholders.

3.2 Research Paradigm

The research adopted a positivist paradigm, grounded in the belief that reality is objective, measurable, and independent of the observer. This paradigm aligns with quantitative methodology, emphasising the use of empirical evidence and statistical techniques to test hypotheses. The positivist approach prioritises objectivity, ensuring that findings are unbiased and reproducible, making it suitable for studies seeking to establish cause-and-effect relationships.

In this study, the positivist paradigm directed the examination of transport infrastructure investments and their economic impacts. By adhering to this paradigm, the research concentrated on observable and quantifiable data, such as funding trends, economic indicators, and transport efficiency metrics. The positivist lens enabled the study to draw generalisable conclusions, providing a structured framework for understanding the economic effects of transportation infrastructure in Gauteng. This approach also permitted rigorous testing of hypotheses, ensuring that the findings are grounded in empirical evidence rather than subjective interpretations.

3.3 Research Design

The study employed a descriptive research design aimed at providing a detailed understanding of the phenomena being investigated. Descriptive research focuses on observing, describing, and documenting aspects of a situation as they naturally occur without manipulating the environment (Barroga, Matanguihan, Furuta, Arima, Tsuchiya *et al.*, 2023). This design was selected because it effectively captures the current state of transport infrastructure investments and their economic impact in Gauteng, offering a comprehensive snapshot of relevant trends and relationships.

In this study, the descriptive research design facilitated the systematic collection and analysis of data related to funding allocation, infrastructure usage, and economic performance. By employing this design, the research successfully identified key patterns and correlations without altering the variables under investigation. This approach was particularly effective in addressing the research objectives, as it allowed for a detailed exploration of the role of transportation infrastructure in economic development. The descriptive design ensured that the

study’s findings were not only accurate but also presented in a manner that is meaningful for policymakers and stakeholders.

3.4 Data Source

The research used secondary data from external sources from government publications, industry reports, books, academic journals, online databases, and websites. These sources contain data, statistics, case studies, and expert opinions relevant to the research questions (Tong & Yu, 2018). Government publications provided insight into funding allocation and policy frameworks; industry reports offered data on industry strategies and investment; academic journals provided theoretical frameworks and empirical studies. Using secondary data is cost-effective and time-efficient, and given the scope of this research question, this study chooses this method to assess the level of government allocation to the transportation infrastructure over the years, among other benefits.

3.5 Data Collection Methods

This study used archival research because it allows access to documents that provide context for understanding current funding allocation, strategies, and policy frameworks in the transportation infrastructure. The financial and economic databases offer quantitative data and indicators that complement insights from archival research, enabling a comprehensive analysis of the industry's economic significance and development impact.(Kong *et al.*, 2022) used a similar approach in evaluating economic growth by developing transportation infrastructure in Chinese cities.

3.5.1 Steps Taken in Data Collection

Data for this study was systematically collected from credible and authoritative sources, including Statistics South Africa and the Gauteng Department of Roads and Transport. The process involved identifying and extracting relevant information from budget allocation documents and publications related to economic development. These documents were selected due to their direct relevance to the study's objectives, as they provide detailed insights into financial allocations, infrastructure investments, and their economic implications.

To ensure a comprehensive analysis, a structured approach was employed. This included reviewing publicly accessible reports, verifying the accuracy of the data, and organising it for analysis. The documents were chosen based on their publication date, relevance to transport infrastructure, and alignment with the study's focus on Gauteng's economic development. Particular attention was given to obtaining the most recent and complete data to ensure the reliability of findings.

3.5.2 Inclusion and Exclusion Criteria

Inclusion criteria were established to ensure the relevance and quality of the selected data. Only documents that specifically addressed transport infrastructure investments, budget allocations, or economic development within Gauteng were included. Publications had to be from credible institutions, such as government agencies or reputable research bodies.

Exclusion criteria were applied to omit documents that were outdated, lacked specific data on Gauteng, or focused on unrelated sectors of the economy. Additionally, documents with incomplete or unverifiable information were excluded to maintain the integrity of the research. By adhering to these criteria, the study ensured that the collected data was both relevant and robust, providing a solid foundation for analysis and conclusions.

3.5.3 Sample and Sampling Technique

For this research, stratified sampling was used due to the diverse nature of the transportation industry in Gauteng. Utilising stratified sampling was highly beneficial for the current study as it ensued a more representative and comprehensive analysis of data The population was stratified based on relevant characteristics such as sector (public vs private), geographic region, and type of transportation (road, rail, and air) (Rahman, Tabash, Salamzadeh, Abduli, & Rahaman, 2022). By doing the study ensured to capture a representative sample from each stratum and effectively analyse funding allocation and strategies within each subgroup.

3.6 Data Analysis Strategies and Interpretation

The study used quantitative analysis, which involves converting the dataset into numerical information while retaining its meaning by using time series analysis (Okulski & Heshmati, 2010). The data collected are GDP rate, employment rate, and level of funding from private

and public sectors. The data was analysed to see if there were trends and patterns. The trend analysis provided valuable insights into how variables change and evolve over various time intervals, particularly for studying phenomena that exhibit seasonality, cyclical patterns, or long-term trends. According to Kivikunnas (1998 p. 395) “one interpretation of the meaning of trend analysis is that they widen the temporal scope of knowledge based control system”

3.7 Limitation

In defining the scope of this study, it is crucial to note that the study relies on secondary data analysis methods to explore and evaluate the transportation infrastructure within the Gauteng context. While field research could offer valuable insights, the constraints of time, resources and access to relevant stakeholders necessitated a focus on utilising existing data, literature, and online resources. This study’s aim was to comprehensively analyse the transportation infrastructure in Gauteng, encompassing various facets such as infrastructure, regulation, challenges, and opportunities. This approach allowed for a systematic examination of the infrastructure landscape, enhancing comprehension of its dynamics and adding to the existing body of knowledge in this domain.

3.8 Quality Assurance

3.8.1 External Validation and Transferability

In assessing the external validity or transferability of this research on the funding allocation and strategies of the transportation infrastructure in Gauteng, it is imperative to scrutinise several key aspects that influence the generalisability of the findings. Firstly, the sample population selected for the study plays a critical role. Utilising data from a diverse range of secondary data, including government databases, private companies such as commercial bank data, and industry publications, enhanced the representativeness of the findings. By incorporating multiple perspectives, the research aimed to capture a comprehensive picture of the transportation infrastructure landscape, thus strengthening its external validity.

3.8.2 Internal Validity

Factors such as economic fluctuation, policy framework, and political stability can affect the internal validity of this research. Carefully controlling or measuring variables increases the

internal validity of this study. The current study extensively evaluated policies and financial database, thus the findings of the current study can be extended to other similar sectors as they reflect , thus reflecting the study's reliability.

3.8.3 Reliability

The data was collected from public sources available to everyone, such as government publications that the government has vetted. Data was also collected from the private sector, such as commercial banks, whose data are regulated and available to the public.

3.9 Ethical Consideration

This research ensured compliance with copyright laws by properly crediting the original authors. Moreover, it verified data accuracy, evaluated source reliability, and identified conflicts of interest. Furthermore, anonymise data to avoid identifying individuals/entities without their consent and respect their privacy.

3.10 conclusion

This chapter outlines the research methodology employed in the study to examine the impact of transport infrastructure investments on the Gauteng economy. A quantitative research approach was adopted, leveraging statistical tools to analyse data collected from credible sources, including Statistics South Africa and the Gauteng Department of Roads and Transport. A descriptive research design was used to provide a comprehensive understanding of trends, patterns, and relationships within the data. Stratified sampling was utilised to ensure that the analysis encompassed diverse aspects of transport infrastructure investments, such as funding allocation and economic outcomes. Inclusion criteria focused on selecting recent and relevant documents related to budget allocations and economic development, while outdated or irrelevant data was excluded. This systematic approach ensured the reliability, validity, and applicability of the study's findings.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.0 Introduction

This chapter presents an in-depth data examination obtained primarily from the Department of Gauteng and Statistics South Africa, focusing on understanding the economic impacts of transport infrastructure investments in Gauteng Province. By leveraging reliable and comprehensive datasets from these key sources, this chapter aims to assess the effectiveness of transport funding and its contribution to the region's socio-economic development. Through descriptive and comparative analyses, the chapter evaluates trends and outcomes in economic indicators such as funds allocated to road and transportation, employment, unemployment rate, and GDP growth, providing insights into the broader role of transport infrastructure in supporting Gauteng's economic goals. This analysis also serves as a foundation for evaluating the impact of investment in transportation in Gauteng.

4.1 Transport Budget on Gross Domestic Product and Employment.

Gauteng Province's budget comprises funds from the national treasury, which comprises equitable shares and conditional grants, and the Provincial treasury, which includes its own revenue and provincial financing less direct charges (see Appendix A). Gauteng treasury then allocated this budget per department, of which transport infrastructure was allocated per year an average of R7.7 billion (bn) per year out of a total of R125 billion for the past 9 years (2015 to 2023) which is about 6% of Gauteng budget per year. In this period, Gauteng gross domestic product (GDP) was stable at an average of R1.53 trillion (tn) and growing at 2% per year except for 2019 and 2020 COVID-19 years, where there were minimal economic activities (see Figure 2).

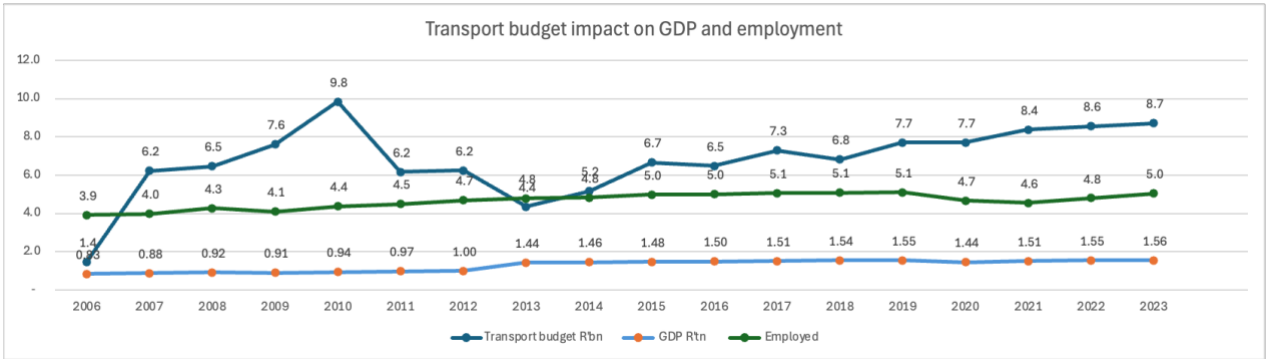


Figure 2: Transport budget impact on GDP and employment (Data from Statistic SA and Gauteng Province)

The number of people employed has remained almost the same for the past ten years (2014 to 2023 see Figure 2). This indicates that the budget allocated to transport remained the same at 6% of the total budget, which led to no growth in employment during this period. The transport department had no significant project to improve the transport infrastructure for the Gauteng community. Compared to 2006 to 2011, Gauteng had a special project budget in which road and transport were allocated an average of 73%, which was largely used for the Gautrain project. In this period, the employed people in Gauteng grew by 5% except the 2008/9 economic crises; this shows that the increased budget allocated to transport infrastructure does bring economic benefit to the community because the GDP also grew by 4.4% in addition, the unemployment rate was average at 25.6% (see Figure 3 and Appendix C)

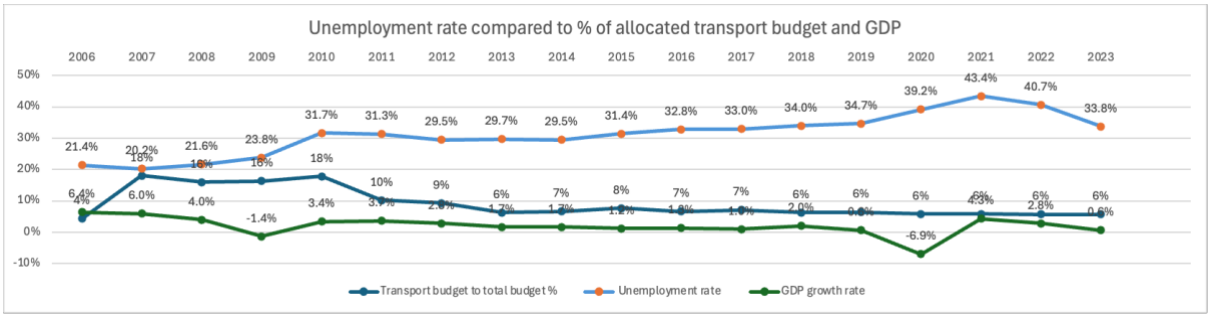


Figure 3: Unemployment rate compared to percentage allocated transport budget and GDP (Data from Statistic SA and Gauteng Province)

4.2 Gauteng Provincial Revenue

Gauteng treasury generates revenue from several activities, such as sales of goods and services, gambling and betting taxes, and other services (see Appendix A). This includes motor vehicle

licences, which have contributed about 64% for the past 10 years (2014 to 2023) (see Figure 4). This indicates that the Transport Department is a vital department that needs better strategies in terms of investment and infrastructure improvement.

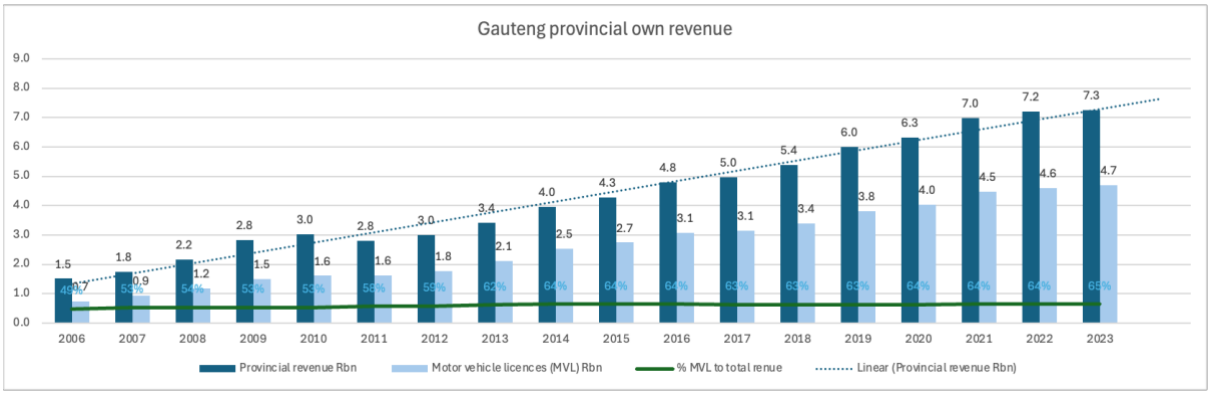


Figure 4: Gauteng provincial own revenue (Data from Gauteng Province)

4.3 Gauteng Population and Employment

Gauteng, the economic hub of South Africa, has witnessed a significant influx of people from rural areas and other provinces, driven by the pursuit of economic opportunities and better living (McKay, 2020). Urban migration and high unemployment rates have significantly contributed to Gauteng's rapid population growth, increasing pressure on its infrastructure and public services.

With an increasing number of individuals relocating to urban areas in pursuit of opportunities, the demand for efficient transport systems rises. A well-developed and accessible transport network is essential to accommodate the growing population, reduce congestion, and improve access to jobs and basic services. Addressing these challenges through strategic investment in transportation can enhance mobility, boost economic growth, and alleviate some of the pressures caused by unemployment and urban migration.

Gauteng population has been growing while the unemployment rate has been increasing (see Figure 5). The factors contributing to Gauteng's population growth are multifaceted. Urban migration, driven by the promise of economic opportunities, has been a significant driver. Gauteng, region contributes to the country's gross domestic product, is estimated to be around 34% , despite occupying merely 2% of the entire land area (Statistics South Africa, n.d).

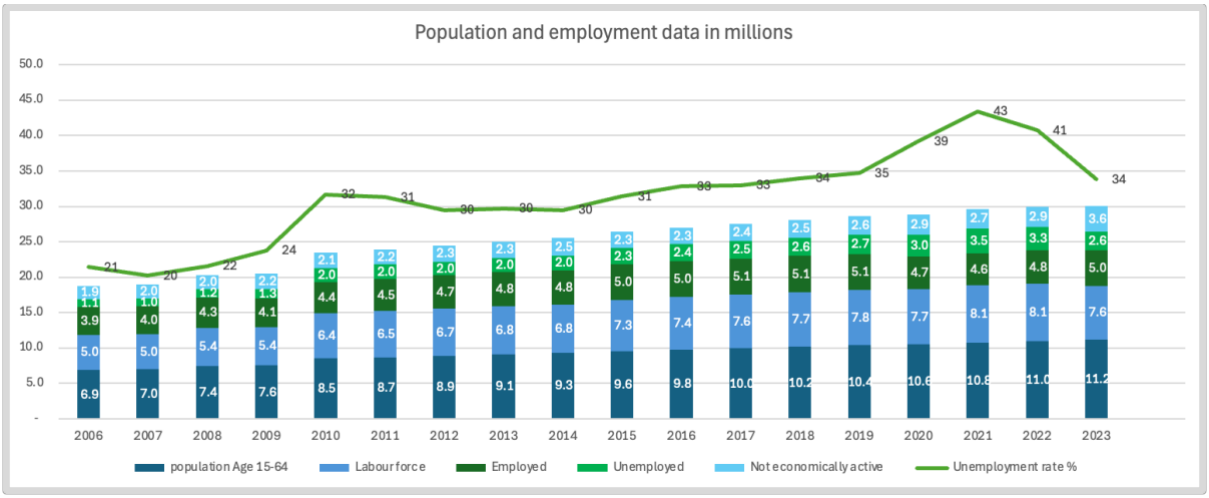


Figure *5*: Population and employment data in millions (Data from Statistic SA)

4.4 Other Funders of Transport in Gauteng

The Gautrain, a rapid rail system in South Africa, has been a significant infrastructure project that has transformed the transportation landscape of the Gauteng province. The project received funding from government sources, private-sector investments, and public-private partnerships, Through the Gauteng Provincial Government and the Gauteng Department of Roads and Transport, the South African government played a crucial role in the project's funding and development (Doyle, 2020). The construction of the Gautrain was a massive undertaking, with a budget of approximately R25.4 billion (Fourie, 2008). During Gautrain's contraction, there was significant economic development; Gauteng's GDP grew at a rate of 4.4% (see Table 1). The GDP growth rate has been lower after the completion of Gautrain project as the department did not have any other major transportation project (see Appendix B and C)

Table 1: Gauteng Special Project (Data from States SA and Gauteng Province)

Period	Special Projects Rbn	Gautrain, Road Safety Rbn	Transport to Special project %	GDP R'Trillion	GDP Growth rate	Unemployment rate
2006	1.6	0.9	59%	0.83	6.4%	21.4%
2007	5.4	4.9	91%	0.88	6.0%	20.2%
2008	5.2	4.9	94%	0.92	4.0%	21.6%
2009	5.6	5.1	92%	0.91	-1.4%	23.8%
2010	5.9	5.6	95%	0.94	3.4%	31.7%
2011	6.0	2.5	42%	0.97	3.7%	31.3%
2012	5.5	2.2	40%	1.00	2.8%	29.5%

The Gautrain commenced its operations on 8 June 2010, with its initial phase connecting OR Tambo International Airport to Sandton Station. The route from Rosebank to Pretoria and Hatfield commenced operations on 2 August 2011, while the remaining section from Rosebank to Johannesburg Park Station opened on 7 June 2012.The Gautrain initiative aimed to enhance the transportation infrastructure in Gauteng by linking Johannesburg, Pretoria, and OR Tambo International Airport. Since its inception, Gautrain passenger trips have increased annually for both rail and bus services, apart from the COVID-19 period. This trend highlights the critical need for continued investment in transportation infrastructure to meet community demands. Furthermore, these passengers have significantly contributed to reducing road congestion, particularly by alleviating traffic volumes (see Table 2).

Table 2: Passenger trips per financial year (data from Gautrain Management Agency)

Reporting Period	Year	Gautrain Rail	Rail Yearly growth rate %	Gautrain Bus	Bus Yearly growth rate %	Total Passengers	Total Yearly growth rate %
Apri 2011 to March 2012	2012	6,663,727	0%	1,438,271	0%	8,101,998	0%
Apri 2012 to March 2013	2013	11,002,502	65%	3,508,025	144%	14,510,528	79%
Apri 2013 to March 2014	2014	13,639,059	24%	4,559,432	30%	18,198,491	25%
Apri 2014 to March 2015	2015	14,909,939	9%	4,930,931	8%	19,840,870	9%
Apri 2015 to March 2016	2016	15,465,526	4%	4,955,916	1%	20,421,442	3%
Apri 2016 to March 2017	2017	15,612,070	1%	5,125,673	3%	20,737,743	2%
Apri 2017 to March 2018	2018	15,023,312	-4%	4,803,061	-6%	19,826,373	-4%
Apri 2018 to March 2019	2019	13,966,482	-7%	3,982,971	-17%	17,949,453	-9%
Apri 2019 to March 2020	2020	13,929,916	0%	4,255,503	7%	18,185,419	1%
Apri 2020 to March 2021	2021	2,653,160	-81%	861,706	-80%	3,514,865	-81%
Apri 2021 to March 2022	2022	4,366,451	65%	1,332,671	55%	5,699,123	62%
Apri 2022 to March 2023	2023	7,132,622	63%	2,326,389	75%	9,461,035	66%

4.5 Policy Analysis

The city of Gauteng region, comprising the Ekurhuleni, Johannesburg and Tshwane metropolitan areas, is a key focus of transportation infrastructure investments and policy frameworks. Johannesburg's future hinges on the city's capacity to tackle the challenges of urban expansion, management, and economic progress (Rogerson & Rogerson, 2015). The region has recognised the importance of transit-oriented development and the Gautrain, a high-speed rail system, as catalysts for local development. However, The Gautrain has influenced property prices and sales activity mixed, with proximity to stations not necessarily ensuring increased property values (Arnold, Le Roux, & Hattingh, 2017). Alongside infrastructure investments, digitalisation in the transportation sector has the potential to enhance efficiency, connectivity, and accessibility in Gauteng. The national government's long-term development plans, such as the New Growth Path and the National Development Plan 2030, aim to unlock South Africa's economic constraints, which will have significant implications for the economic prospects of the Gauteng city region (Chakwizira *et al.*, 2018).

4.6 Limitations in Evaluating Transport Infrastructure Outcomes

Survivorship bias is a common challenge in assessing investment results, leading to a distorted perception of how transport infrastructure projects affect the Gauteng economy. This bias occurs when we concentrate only on successful projects while overlooking failed ones, underperforming initiatives, or projects that were never completely carried out.(da Rocha & Saes, 2018). This selective observation results in an inflated perception of the benefits of infrastructure investment, failing to consider the wasted resources, missed opportunities, and possible adverse effects linked to unsuccessful projects (Agénor & Moreno-Dodson, 2006). For a thorough and realistic evaluation, it's essential to recognise and examine both achievements and shortcomings in transport infrastructure investments. By considering a wider array of project results, including those that fell short of expectations, we can gain a more detailed and precise insight into the actual effects of these investments on the Gauteng economy.

One of the main reasons for survivorship bias in transport infrastructure assessment is the tendency to spotlight success stories while downplaying or ignoring failures. This can be attributed to several factors, including political motivations, the desire to maintain public confidence, and the inherent difficulty of objectively evaluating complex infrastructure projects

(Mitchell & Walters, 2011).Governments and project developers frequently feel pressured to highlight successful initiatives to validate past expenditures and garner backing for future projects. The absence of detailed data regarding project failures and underperformance intensifies this issue, complicating efforts to conduct a fair and impartial evaluation. This situation is characterised by insufficient accountability, a lack of transparency, and limited in-depth analysis of project failures. There is a pressing need for stringent evaluation frameworks to accurately measure the actual effects of transport infrastructure investments on the Gauteng economy, considering both successes and failures to help reduce survivorship bias.

To illustrate survivorship bias, it is essential to examine failed transportation projects in Gauteng. The Bus Rapid Transit system, despite some successful routes, has encountered issues like route cancellations, financial struggles, and operational inefficiencies. Although the Gauteng Freeway Improvement Project has enhanced traffic flow on certain major routes, it faces criticism for high toll fees that adversely impact lower-income commuters, raising concerns about its economic and social ramifications. Furthermore, several planned rail extensions and upgrades have experienced delays or cancellations due to funding limitations, technical obstacles, or shifts in political priorities. Boipatong Taxi Rank became a ghost facility due to poor planning and lack of engagement with local taxi associations. These failures underscore the necessity of critically assessing the purported benefits of transport infrastructure projects, considering both achievements and failures to prevent an overly optimistic view. Reports indicate that transportation is a significant source of GHG emissions at global, national, and local levels, and implementing efficient public transport systems is one way to mitigate these emissions (Gopaul, Friedrich, & Stretch, 2019b). Despite early high hopes, these projects faced considerable challenges, revealing the complexities and risks associated with large-scale infrastructure development (Masrom, Abd Rahim, Mohamed, Chen, & Yunus, 2015). To address survivorship bias, a more rigorous and transparent approach to evaluating transportation infrastructure investments is necessary (Fourie & Malan, 2021).

This involves creating independent evaluation bodies, formulating thorough performance metrics, and making data on both successfully and unsuccessfully completed projects accessible to the public. Additionally, project evaluations must consider various factors such as economic, social, environmental, and governance concerns to deliver a comprehensive overview of project impacts. Moreover, safety significantly influences the choice of transportation mode; thus, enhancing service reliability is essential to attract public

transportation users, and improving security measures is crucial for promoting the use of public transportation facilities.

4.7 Conclusion

The analysis presented in this chapter highlights a clear correlation between investments in transport infrastructure and economic growth in Gauteng. The findings demonstrate that strategic allocation of resources to transport projects significantly improves connectivity and productivity, all of which drive economic development. The data reveals consistent trends indicating that regions with higher investments in transport infrastructure experience greater economic activity and socio-economic benefits.

Importantly, the study also accounted for survivorship bias by not limiting the analysis to only successful transport projects. By including examples of underperforming and failed initiatives such as the e-toll system under the Gauteng Freeway Improvement Project and the Boipatong Taxi Rank the research provides a more balanced and realistic assessment of the sector. This approach ensures that conclusions drawn reflect both the opportunities and risks associated with transport infrastructure investment.

These results emphasise the importance of prioritising transport infrastructure as a catalyst for sustainable economic growth, while also highlighting the need for improved planning, stakeholder engagement, and performance monitoring. Collectively, the findings support the case for continued and well-managed investment in this sector to unlock further economic potential in Gauteng

CHAPTER FIVE

RECOMMENDATIONS AND IMPLICATIONS

5.0 Introduction

This chapter focuses on the conclusions and recommendations for stakeholders as per the findings of the study, as well as suggestions for further studies.

5.1 Recommendation

Transport infrastructure investments are crucial for shaping the economy of Gauteng. They impact factors like job creation, urban mobility, and regional competitiveness. There has been an increasing need to modernise transport systems in recent years due to urbanisation pressures, environmental sustainability concerns, and the rise of smart mobility technologies. By using the Multi-Level Perspective (MLP) framework, it becomes apparent that changes at the landscape level, such as economic growth and environmental regulations, create opportunities for niche innovations like autonomous vehicles and smart infrastructure systems to emerge and challenge existing regimes. These changes promise greater efficiency and sustainability and present significant challenges and opportunities for various stakeholders. To ensure successful implementation and to maximise the economic benefits of these investments, strategic recommendations must be tailored to the specific roles and interests of key groups, including policymakers, funders, and commuters. Each group plays a crucial role in shaping the future of Gauteng's transportation landscape.

5.1.1 Policymakers

Policymakers need to be proactive in creating an environment that supports innovation in transportation infrastructure. This involves updating regulatory frameworks to accommodate emerging technologies, such as autonomous vehicles and smart mobility systems, and promoting public-private partnerships (PPPs) that utilise both public resources and private expertise. By aligning regulations with evolving technologies, policymakers can ensure that Gauteng remains competitive while addressing environmental concerns and improving economic efficiency.

5.1.2 Specific Actions

- Implement policies that promote green and smart transport technologies to reduce emissions and congestion.
- Create financial incentives or subsidies for private companies investing in smart mobility and public solutions.
- Facilitate collaboration between local government, academic institutions, and industry to create innovation hubs and test beds for new transport technologies.

5.1.3 Professional and Private Funders

Investors, whether professional or private funders, should prioritise long-term, eco-friendly investments in transportation infrastructure initiatives aligned with wider economic and environmental goals and objectives. This encompasses supporting both extensive public transportation systems and specialised innovations such as electric vehicle charging networks or intelligent traffic management systems. The strategic investment will not only yield financial returns but also contribute to the sustainable long-term practices and resilience of the transport sector, fostering growth in both the regional economy and the broader ecosystem.

5.1.4 Specific Actions

- Prioritise funding for projects with demonstrated economic, environmental, and social benefits, such as reduced carbon emissions, job creation, and urban mobility improvements.
- Collaborate with local government and other stakeholders to ensure alignment between investment strategies and public needs.
- Consider impact investing strategies that focus on measurable societal benefits alongside financial returns.

5.1.5 Commuters

Commuters are crucial in determining the success of transportation infrastructure investments. To ensure that the public supports and uses new systems, it's important to engage with commuters through awareness campaigns, affordable and reliable services, and integrating new technologies into their daily lives. Improving convenience and awareness will encourage

commuters to use public and smart transport options, which will help reduce congestion and pollution while supporting broader economic and social objectives.

5.1.6 Specific Actions

- Enhance the affordability and accessibility of public transport services to attract a large user base.
- Integrate smart mobility, such as real-time route optimisation and digital ticketing systems, to improve commuter experience.
- Launch awareness campaigns on the environmental and economic benefits of using sustainable transport options.

5.2 Suggestion for Further Studies

The long-term economic impacts on autonomous vehicles and smart mobility systems. As niche innovations like autonomous vehicles and smart mobility systems continue to advance, future research should examine their long-term economic effects on employment, traffic congestion, and energy consumption. This involves creating models to explore scenarios where these technologies are widely adopted and evaluating their impact on both formal and informal job markets in Gauteng.

5.2.1 The Contribution of Small and Medium Enterprises (SMEs) to Transport Innovations

It is essential to examine the role of small and medium-sized enterprises (SMEs) in advancing transportation innovation, particularly in specialised markets such as electric vehicle services, mobility-as-a-service (MaaS), and last-mile logistics. Future studies should focus on how government policies and public-private partnerships can better support these businesses to enhance their contributions to the broader transportation sector ecosystem.

5.2.2 Social Equity and Access to Transportation Infrastructure

Future research should focus on analysing how investments in transportation infrastructure affect different social and economic groups. Understanding the impact of infrastructure developments on low-income and underserved communities is essential to ensure that the benefits of new transportation systems are distributed fairly. Studies should also examine the barriers to access and how policies can be designed to make transportation more inclusive.

5.2.3 Environmental Impact of Transport Infrastructure Expansion

A thorough study is needed to explore the environmental effects of transportation expansion infrastructure. This should include an analysis of the lifecycle emissions of various modes of transport. Research could also focus on how emerging technologies, such as green hydrogen or electric buses, can help reduce adverse environmental effects while contributing to the economic growth of Gauteng.

5.2.4 Behavioural Studies on Commuter Adaptation to Technological Changes

Understanding how commuters adapt to new technologies such as real-time route optimisation apps, digital ticketing systems, or autonomous shuttles is key to the success of infrastructure investments. Future research could explore behavioural factors influencing commuter preferences, adoption rates, and resistance to new technologies, providing insights into designing better user-friendly systems.

5.2.5 The impact of global economic trends on local transport infrastructure investments

Transport infrastructure investments do not happen independently. It would be beneficial to explore how global economic trends, such as increasing interest rates, supply chain interruptions, and changes in foreign direct investment, impact Gauteng's local funding and development prospects. This research could offer valuable insights for policymakers and investors when strategising for long-term projects.

Comparative studies between Gauteng and other large metropolitan regions that have successfully implemented transport innovations could provide valuable insights. Learning from best practices in cities like Singapore, Copenhagen, or even in other South African cities could help identify successful strategies and avoid potential pitfalls.

5.3 Comparative Case Analysis

Looking at a comparative analysis of the Gautrain's successful implementation and the protracted development of the Moloto Rail Corridor project, elucidating the critical roles of political commitment, funding models, and institutional coordination in shaping the outcomes

of large-scale infrastructure projects. The Gautrain, a landmark public transport initiative in Gauteng, South Africa, presents a case study in effective project execution, characterised by strong political support, clearly defined governance structures, and significant financial investment enabled through a strategically designed public-private partnership (Du & Gelman, 2018). Conversely, the Moloto Rail Corridor project, designed to tackle the transportation challenges along a high-traffic and high-accident route, has faced significant delays and setbacks, primarily due to fragmented intergovernmental coordination, fluctuating policy priorities, and inadequate funding mechanisms (Mitchell & Walters, 2011).

By juxtaposing these two contrasting projects, this research emphasises that the success of infrastructural endeavours extends beyond mere economic viability, hinging significantly on the strength of institutional support, the alignment of stakeholder interests, and a clear, long-term strategic vision. The differences in outcomes underline that projects aligned with the current regime-level goals are more likely to gain traction and access essential resources. Conversely, those without this alignment, despite clear public demand, may get stuck in drawn-out planning phases. These dynamics highlight the vital role of systemic alignment in effectively developing and implementing transport infrastructure projects.

5.4 Conclusion

This study has explored the multifaceted effects of investments in transportation infrastructure on the economic landscape of Gauteng Province, guided by the Multi-Level Perspective (MLP) framework. By examining data from the Department of Gauteng and Stats SA, alongside policy documents and relevant literature, this research emphasised the essential importance of transportation infrastructure in fostering economic growth and socio-economic development region.

Key findings revealed that strategic investments in the infrastructure of transport, supported by both public and private sectors, have facilitated improvements in mobility, connectivity, and accessibility factors that contribute to increased economic productivity and job creation. Moreover, the analysis underscores the importance of integrating technological innovations, such as autonomous vehicles and smart mobility systems, to meet evolving urbanisation demands and to enhance the sustainability of Gauteng's transport network.

However, the research also identifies several challenges, including funding gaps, policy misalignments, and institutional barriers that may limit the full realisation of infrastructure benefits. Addressing these challenges requires strong partnerships between public and private stakeholders, supportive policy frameworks, and an increased focus on sustainable and inclusive transport solutions.

Ultimately, this study suggests that transport infrastructure can significantly contribute to Gauteng's economic resilience and long-term growth with sustained investment and clear policy direction. Future research might expand on these findings by investigating specific case studies or by analysing the social impacts of transport investments on marginalised communities, thus offering a comprehensive insight into the role of infrastructure in regional development.

Addressing the intricate relationship of political, social, and environmental factors in Gauteng's transport landscape l requires a multifaceted and collaborative approach. Aligning national and regional policies, fostering social and cultural shifts, and prioritising environmental sustainability are crucial in the pursuit of integrated, resilient, and equitable transport solutions for the Gauteng City Region.

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APPENDIX A: Gauteng Province budget (Gauteng Province and Statistic SA)

Period	Gauteng Budget R'bn	Transport Budget R'bn	Transport budget to total budget %	% Change	Spending on infrastructure R'bn	Road and Transport R'bn	% RT to Infrastructure spending	Provincial Revenue R'bn	Motor Vehicle Licences (MVL) R'bn	% MVL to Total Revenue
2006	33.4	1.4	4%	0.0%	4.2	0.6	15%	1.5	0.7	49%
2007	34.5	6.2	18%	330.5%	8.7	4.8	55%	1.8	0.9	53%
2008	40.3	6.5	16%	3.8%	10.9	6.6	60%	2.2	1.2	54%
2009	46.7	7.6	16%	17.8%	11.1	5.9	53%	2.8	1.5	53%
2010	55.3	9.8	18%	29%	12.6	6.7	53%	3.0	1.6	53%
2011	60.9	6.2	10%	-37%	11.3	3.6	32%	2.8	1.6	58%
2012	67.6	6.2	9%	1%	11.7	3.8	33%	3.0	1.8	59%
2013	69.3	4.4	6%	-30%	8.3	1.2	15%	3.4	2.1	62%
2014	77.3	5.2	7%	18%	8.4	1.4	17%	4.0	2.5	64%
2015	87.0	6.7	8%	29%	10.6	2.0	19%	4.3	2.7	64%
2016	97.0	6.5	7%	-3%	13.5	2.3	17%	4.8	3.1	64%
2017	103.4	7.3	7%	13%	13.2	2.3	18%	5.0	3.1	63%
2018	109.6	6.8	6%	-6%	11.2	1.7	15%	5.4	3.4	63%
2019	121.4	7.7	6%	13%	11.0	2.2	20%	6.0	3.8	63%
2020	132.5	7.7	6%	0%	11.2	1.8	16%	6.3	4.0	64%
2021	143.3	8.4	6%	9%	11.4	2.0	18%	7.0	4.5	64%
2022	149.6	8.6	6%	2%	11.4	2.0	18%	7.2	4.6	64%
2023	153.7	8.7	6%	2%	12.3	2.1	17%	7.3	4.7	65%

APPENDIX B: Gauteng Province conditional grant and special projects (Gauteng Province)

Period	Total Conditional Grant R'bn	Conditional Grant Public Transport	transport % of total Conditional grant	Special Projects	Gautrain, Road Safety	Transport to Special project
2006	8.0	2.5	31%	1.6	0.9	59%
2007	8.7	2.7	31%	5.4	4.9	91%
2008	9.6	3.0	31%	5.2	4.9	94%
2009	11.2	3.3	29%	5.6	5.1	92%
2010	13.4	4.0	30%	5.9	5.6	95%
2011	13.7	1.9	14%	6.0	2.5	42%
2012	14.6	2.1	15%	5.5	2.2	40%
2013	15.6	0.6	4%			
2014	15.5	1.7	11%			
2015	16.9	1.8	11%			
2016	17.9	2.0	11%			
2017	18.9	2.0	11%			
2018	20.8	2.2	10%			
2019	21.5	2.3	11%			
2020	23.1	2.4	11%			
2021	25.0	2.7	11%			
2022	26.0	2.9	11%			
2023	26.5	2.7	10%			

APPENDIX C: Gauteng Province gross domestic product (GDP) and Labour data (Statistic SA)

Period	GDP R'tn	GDP Growth rate %	Unemployment rate %	population Age 15-64 :Million	Labour force million	Employed million	Unemployed million	Not economically active million
2006	0.83	6.4%	21.4%	6.9	5.0	3.9	1.1	1.9
2007	0.88	6.0%	20.2%	7.0	5.0	4.0	1.0	2.0
2008	0.92	4.0%	21.6%	7.4	5.4	4.3	1.2	2.0
2009	0.91	-1.4%	23.8%	7.6	5.4	4.1	1.3	2.2
2010	0.94	3.4%	31.7%	8.5	6.4	4.4	2.0	2.1
2011	0.97	3.7%	31.3%	8.7	6.5	4.5	2.0	2.2
2012	1.00	2.8%	29.5%	8.9	6.7	4.7	2.0	2.3
2013	1.44	43.9%	29.7%	9.1	6.8	4.8	2.0	2.3
2014	1.46	1.7%	29.5%	9.3	6.8	4.8	2.0	2.5
2015	1.48	1.2%	31.4%	9.6	7.3	5.0	2.3	2.3
2016	1.50	1.3%	32.8%	9.8	7.4	5.0	2.4	2.3
2017	1.51	1.0%	33.0%	10.0	7.6	5.1	2.5	2.4
2018	1.54	2.0%	34.0%	10.2	7.7	5.1	2.6	2.5
2019	1.55	0.6%	34.7%	10.4	7.8	5.1	2.7	2.6
2020	1.44	-6.9%	39.2%	10.6	7.7	4.7	3.0	2.9
2021	1.51	4.3%	43.4%	10.8	8.1	4.6	3.5	2.7
2022	1.55	2.8%	40.7%	11.0	8.1	4.8	3.3	2.9
2023	1.56	0.6%	33.8%	11.2	7.6	5.0	2.6	3.6