Challenges affecting the implementation and sustainability of BRT system in South Africa: A case of Tshwane.

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DECLARATION

I declare that this research paper titled: Challenges affecting the implementation and sustainability of BRT system in South Africa: A case of Tshwane is my own original work under the supervision of Dr. Wycliffe Nduga Ouma (Wits Business School). It is being submitted for the degree of Maters in Business Administration to the University of the Witwatersrand, Johannesburg, South Africa, and has not been submitted before for any degree or examination in any other university.

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LIST OF ABBREVIATIONS

BRT	Bus Rapid Transit
BRTS	Bus Rapid Transit System
IRT)	Integrated Rapid Transit
BCR	Benefit-Cost Ratio
NPV	Net Present Value
PTY Ltd	Proprietary Limited

ABSTRACT

This study investigated issues affecting the implementation and sustainability of BRT system in South Africa through an intensive case study of A Re Yeng in Tshwane. Through a quantitative research design with secondary data, the study compared the ridership levels, government subsidies, operating expenses, and revenue streams from 2023 to 2025. Comparative analyses with other BRT systems such as Cape Town's MyCiTi revealed that A Re Yeng has much lower ridership (48,000 daily passengers) and less subsidy support but with the highest number of financial losses. Inferential statistical models were applied in order to determine the underlying trends between the main operational parameters with a perspective to determining the impact of decreasing ridership, increasing fuel and maintenance costs, and decreasing subsidies on long-term sustainability. The outcomes demonstrate an increasing financial shortfall of over R2 billion in operating cost by 2026 owing to increasing cost pressures and decreasing passenger fare revenue. It is suggested that targeted policy reforms, operational efficiencies, and diversification of financing options should be implemented. It also calls for additional quantitatively more detailed studies to guide evidence-based planning and guarantee South Africa's sustainable urban mobility.

Key Words:

- ***Bus Rapid Transit (BRT)***
- ***A Re Yeng (Name of Tshwane BRT Project)***
- ***Sustainability***
- ***Public transport***
- ***Ridership***
- ***Government subsidies***
- ***Operating costs***
- ***Revenue trends***

CHAPTER 1: INTRODUCTION

1.1 Statement of purpose

The research sought to assess the challenges affecting the implementation and sustainability of BRT system and long-term viability, performance, and expansion of South Africa's Bus Rapid Transit (BRT) system. Viability of the BRT system was assessed in terms of its economic, and social contribution as a potential intervention to urban traffic, and transportation accessibility problems. The study was also intended to evaluate whether the BRT system adheres to legal compliance, laws, financing, competition, and infrastructure to establish challenges that hinder its effectiveness. Finally, recommendations were presented to increase urban transport services and solidify the role of the BRT system in public transport within Tshwane, assisting decision-makers, urban planners, and transport authorities in South Africa.

1.2 Background of the study

South Africa's Bus Rapid Transit was initiated in line with the integrated transport plan that aimed at enhancing the public transport system along with decongesting the cities. The BRT project was initiated in Tshwane, which is one of Gauteng's metropolitan municipalities, owing to the push for effective, dependable, and affordable transport (Venter, 2016). The BRT system was conceived as a way to offer low-cost public transportation to low-income segments of the population and also lower greenhouse gas emissions through encouraging the use of more environmentally friendly modes of transport (Wright & Hook, 2007). Despite the fact that it is well-planned, sustainability of the Tshwane BRT has been challenged as a result of several factors such as budget deficits, weak operational management, and unstable ridership (Walters, 2014).

Most alarming is the expensive nature of its operation in relation to the revenues garnered, and this provokes questions regarding the system's sustainability in the future (Wood, 2015). In addition, socio-economic processes like informal settlements and asymmetrical city development have placed more pressure on the system to deliver its functions (Schalekamp & Behrens, 2013). This research analyzed issues affecting the implementation and sustainability of the BRT system in South Africa in

Tshwane through the analysis of financial, operational, and socio-economic issues facing it. It also analyzed possible solutions for the system to be rendered more efficient and sustainable in the long term.

1.3 Problem statement

Mokonyama and Venter (2018) and Gwala (2017) postulated that long-term sustainability of Bus Rapid Transit systems is a concern for the majority of urban cities, particularly developing nations like South Africa, whose cities face diverse and interrelated transport challenges. The city of Tshwane initiated its bus rapid transit system (BRTS), A Re Yeng, to improve public transport efficiency, reduce traffic congestion, and lower carbon emissions. Notwithstanding the expectation that the system would bring huge social, economic, and environmental returns, the system has been confronted with numerous issues that threaten its long-term viability. Operational inefficiencies, budget constraints, and low levels of public satisfaction with South African BRT systems have been reported in the literature (Mokonyama & Venter, 2018; Gwala, 2017).

Recent research on BRT systems in the Global South has covered implementation challenges of infrastructure, governance, and financial sustainability. As argued by Fan, Beukes and Sheng (2021), institutional capacity shortage, overestimated demand, and poor intergovernmental coordination are severe constraints to the viability of BRT projects in Sub-Saharan Africa. Similarly, Chetty and Venter (2025) explained why traditional BRT design models fail to respond to local conditions, i.e., they need adaptive solutions through change in governance, stakeholder engagement, and incremental development. However, although these works offer valuable insights into BRT operations in African cities, empirical research that focuses explicitly on the long-term sustainability of the Tshwane BRTS, let alone the combined impact of governance collapse, fiscal extravagance, and operational inefficiency, is not forthcoming. The knowledge gap calls for in-depth contextual analysis to develop a corpus of knowledge on the systemic issues undermining BRT sustainability in South Africa.

In Tshwane, financial mismanagement, corruption, and irregular expenditure have compromised the sustainability of the BRTS. Audits for the 2022/23 and 2023/24 financial years conducted by the Auditor-General of South Africa (AGSA) had

unrecorded liabilities, inadequate financial controls, and inadequate systems of governance (AGSA, 2023). For instance, unauthorised spending increased from R423 million during the 2021/22 period to R2.1 billion during the 2022/23 period, and irregular spending increased from R1.9 billion to R2.3 billion during the same period (AGSA, 2023). Furthermore Moatshe (2025) also reports that council oversight report verified R15 million irremediable spending on the tardy completion of Line 2C, including payment after the contract period and scope variations without approval. Also, the audits of the infrastructure revealed over-specification such as the utilization of imported materials that caused costs to rise and rendered maintenance tricky, which strained fiscal prudence (Reddit user, 2024).

Against these long-time challenges, the study investigates whether the Tshwane BRTS remains sustainable in the delivery of augmented urban mobility, accessibility, and environmental sustainability. The study takes account of the performance and cost constraints to running and analyzes the extent to which governance failures undermine the long-term sustainability of the system (Ndaba, 2020). By locating the question in the broader research literature on sustainability of BRT systems in developing countries, the research answers an acute knowledge gap on how good governance, institutional capacity, and financial management converge in impacting the sustainability of BRT systems in the long term in South Africa. The research will impact policy and practice through the provision of evidence-based recommendations that promote transport sustainability in Tshwane.

1.4 Research objectives

To assess the financial and economic sustainability of the BRTS in Tshwane.

To identify challenges that hinder the system's successful implementation and propose solutions to enhance its sustainability.

1.5 Research questions

1. What is the financial viability of the BRTS, including funding sources, operational costs, and long-term economic impact?
2. What are the key financial challenges facing the BRTS system, and how do they impact its sustainability?

1.6 Rationale of the study

Urban BRT in cities such as Tshwane was set to improve city mobility, decongest, and utilize eco-friendly transport. Public perception and financial insecurity, however, are preventing it from doing so. These are the issues that must be addressed to achieve customer satisfaction maximization and urban traffic movement. Evaluation of economic factors together with ensuring it is safe, reliable, and convenient are the top attributes to improve the Tshwane BRTS together with mass transport.

Besides, good development and expansion of transport infrastructure were contingent upon astute policy and planning. The research provided groundbreaking analysis of system and operational challenges, whose implications for policy improvement, strategic planning, and stakeholder participation are far-reaching. Finally, the lessons gathered in addressing the issues facing BRTS in Tshwane can be used to guide subsequent public transport projects in South Africa and even elsewhere. The results of the research were findings that presented recommendations offering plausible means of scaling life and adoption of BRTS in other cities that are urban. In aggregate, this research aided greatly in surmounting challenges, revolutionizing public transport, and enabling mobility in South African cities.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, the literature related to the research issue is discussed. Reviewing the literature is required since it provides understanding of existing data on the issue (Winchester & Salji, 2016). Literature applied within this research study was found to be apt in offering insight and understanding regarding obstacles faced by implementation and sustainability of BRT system in South Africa: A case of Tshwane.

2.2 Empirical literature review

2.2.1 Overview and performance of the BRT system in South Africa

South Africa's Tshwane BRT is among a series of projects aimed at dealing with urban mobility in the face of fast-tracking urbanization. BRT has been referred to as affordable and flexible, with the possibility of implementing tailored models that can be revised according to local conditions (Niezgoda, 2021; Pojani, 2014). Their record has been demonstrated, for example, by initial ridership and fare recovery on Johannesburg's Rea Vaya BRT being far lower than expected, which indicates the necessity for a re-evaluation of operating practice to fit South African urban realities (Munoz-Raskin and Scorcia, 2017). Empirical work by Duri (2024), in Tshwane proved that enhancement of public transport quality, expanding the extent of bus coverage, and reducing the fare level are identified as significant interventions in stimulating conversions from car ownership to public transport usage. Further, Liu et al. (2018) confirmed that system improvements like Transit Signal Priority and off-board fare payment have been found to minimize efficiency and increase ridership for BRTs. Briefly, while Tshwane green city transportation via BRT is promising, it requires massive investment and planning for its success. Analysis of South African Cities Network (2019) reports that South African transit systems such as Rea Vaya, where anticipated passenger volumes were not realized.

For instance, Rea Vaya had carried only 45,000 passengers daily against the projected 75,000. Rea Vaya in Johannesburg could only transport 50,000 people, half the goal of 100,000, as indicated by the decreased carrying capacity of BRTs such as MyCiTi Integrated Rapid Transit (IRT) System and A Re Yeng (Allport, 2018; South African Cities Network 2019). Most of the BRTs like Cape Town's MyCiTi and

Tshwane's A Re Yeng are not viable financially and rely on huge government subsidies, according to the Department of Transport (2020) reports.

A Re Yeng operates at the capacity of 30% because it lacks a well-defined route, and records 15,000 passengers' daily arrival compared to the demand of 100,000. MyCiTi system subsidizes only 40% of its expenses from fare revenue (Allport, 2018). The BRTs has been facing an issue with fiscal sustainability. Evidence demonstrates that operational expenses of the system have been far exceeding ticket revenues obtained, rendering it extremely dependent on government subsidies to sustain it. The potential of the BRTs to expand and expand the level of the service will be limited if it is not able to operate without depending on recurrent funding (Wood, 2016, The City of Tshwane, 2019). Economic feasibility for BRTs depends on different sources of funding, operational cost-effectiveness, and long-term economic effects. BRTs are more affordable than other alternatives such as light rail since the construction price is 10−10−30 million per mile against 150−150−250 million for light rail (Guckert, 2015).

Operating expenses can be controlled, as demonstrated by Trans Metro Pekanbaru system, which registered a positive Net Present Value (NPV) and Benefit-Cost Ratio (BCR) value of 1.38, demonstrating financial viability (Emileo et al., 2017). BRT systems in urbanized cities also exhibit greater (NPV) and (BCR) revenue per passenger but may or may not be less expensive compared to traditional buses (Merkert et al., 2017). Yet, congestion, fare evasion, and maintenance are some of the issues that can threaten long-term sustainability, requiring constant investment and management to maintain increasing demand (Hidalgo et al., 2024). In general, although BRTs are a cost-effective alternative, success is dependent on good management and public acceptance (Khong & Tong, 2023). Financial sustainability of BRTs in South Africa relies on a number of factors which include the source of funding, operational cost, and its financial contribution in the long run. BRTs are generally funded by the mix of national and municipal government funds and international loans or grants, states Wood (2015). The South African National Treasury has been at the forefront in the funding of BRTs through the allocation of grants for both infrastructure establishment and operational expenses (Venter, 2016).

Operating expenses such as vehicle maintenance, fuel, and labour are costly and can negatively impact the economic feasibility of the system. Operating expenses must be

weighed against fare revenue, which in most instances is not enough to recoup operating expenses. Goel and Tiwari (2016) take the position that the low farebox recovery rate, shared by most BRTs, generates a constant need for subsidies to fund operating costs. Further, volatile fuel prices and the need to service an expanding fleet of vehicles add to the fiscal pressure on municipalities operating BRTs (Vasconcellos, 2018). Regarding long-term economic effects, BRTs can be used to influence urban growth since they promote mobility, reduce congestion, and offer access to jobs to impoverished areas. Long-term economic gains, however, need ongoing investment and good management. Cervero and Dai (2014) are of the opinion that the economic gains of BRTs are enjoyed incrementally through enhanced accessibility and lowered transport costs, which would increase productivity. Yet, underinvestment and mismanagement can offset these gains and hinder the system from realizing sustainable economic development.

2.2.2 Challenges that hinder the system's successful implementation and proposed solutions to enhance its sustainability

Performance efficiency of BRTs in South Africa is hindered by several challenges, some of which include planning deficiencies, intermodal coordination, and cost-effectiveness. Among the significant challenges is a lack of planning with a future performance vision, whose consequence is operation deficits and constricted operating spaces (Okoro et al., 2022; Schalekamp & Klopp, 2018). Moreover, minibus-taxi saturation discourages the introduction of BRT because the unscheduled service still remains the most popular mode of public transport and additional interventions are needed to improve accessibility and service quality (Behrens & Görgens, 2019; Schalekamp & Klopp, 2018). In addition, problems of operation are initiated by striking short-term needs of big sports events and longer-term needs of transport networks and consequently capacity and frequency problems of services as witnessed by Ferranti et al. (2020). Budget constraints alongside the lack of legislative pressures hinder sustainability actions as suggested by (Singh, 2022). In the building industry, with transport challenges in achieving sustainability, the integration of a planning agenda that involves stakeholders, economic incentives towards minimal service costs, and merging with minibus-taxi networks is crucial in achieving improved all-round accessibility (Behrens & Gorgens, 2019). To overcome the aforementioned challenges, Seftel and Peterson (2014), and Munoz and Paget-Seekins (2016),

recommended that a comprehensive strategy is applied, which includes restructuring of minibus-taxi operation, additional infrastructure, and institutionalization of continuous stakeholder participation in planning. The aforementioned solutions, if practiced, can increase the efficiency and sustainability of BRTs in South Africa. Various studies have noted the challenge that faces developing effective operations for the BRTs in South Africa, in Tshwane.

One of these is financial sustainability because the expense factor in infrastructure, operation, and maintenance is a major challenge (Badenhorst, 2016). According to Venter and Badenhorst (2016), the budget cost constraint is also exacerbated by ridership and fare revenue shortfalls that require excessive dependence on government subsidization. The second is that of coordination and governance across institutions. Walters (2014) attributes that poor coordination between the provincial, national, and municipal governments hinder effective decision-making and compromise the effective delivery of service. Furthermore, Wilkinson (2016) cited that political interference is also one of the root issues causing delay in project timelines and inefficiency in implementation. Protests and opposition from the community against the relocation of informal public transport terminals, e.g., taxis, also cause delays in implementation. Khosa (2019) demonstrates that there is a significant realignment of most of the communities to BRT from taxis depending on the extent of support towards the taxi industry and the threat of employment loss in the industry. Campbell et al. (2019) demonstrated that technical problems, such as not being integrated into other modes of transport and routing problems, deter the efficiency of making the system as well as that of the consumers. Besides this, fear of vandalism and violence at BRT stops also discourages potential passengers (Van Ryneveld, 2017).

2.2.3 Financial recommendations that can be made to improve the development and sustainability of the Bus Rapid Transit System (BRTS) in Tshwane

To meet such challenges, more effective financial models must be applied. Public-private partnerships and new sources of funding would ease some budgetary pressures, according to Venter and Badenhorst (2016). Greater institutional coordination through the creation of an overarching transportation authority would

improve governance and more focused decision-making (Walters, 2014). Public acceptability and running awareness campaigns would also be included in enhanced overall public acceptability and reduced job loss issues for taxi drivers (Khosa, 2019). Lastly, intermodality with other transport modes and enhanced station safety through more effective security measures would make the entire system more attractive as well as sustainable (Campbell et al., 2019; Van Ryneveld, 2017). For the purpose of increasing the viability and expansion of the Tshwane BRTs, certain fiscal suggestions can be adopted.

Ardila-Gomez and Ortegon-Sanchez (2016) suggested that, as a first step, a diversified funding mechanism comprising grants, loans, and public-private partnerships be instituted to correct the underfinancing and over-reliance on subsidies for operating private cars that has resulted in a transport funding gap within cities. In addition, Liu et al. (2018) also argued that the integration of BRT with other transport modes and key urban destinations can enhance passenger capacity and efficiency in service and additional customers. Operation strategies like Transit Signal Priority and off-board fare payment can enhance efficiency as well as ridership (Liu et al., 2018). Lastly, Basheer et al. (2020) contended that the expansion of green space-preserving land-use policies to support compact development along the BRT corridors can facilitate inward investment and economic development, like elsewhere.

2.3 Theoretical framework

2.3.1 Institutional Theory

The research employed institutional theory in its analysis of the focused phenomenon with its focus on government and organizational type and how these influence policy action. Kraft and Furlong (2004) emphasize its application in the shaping of governmental structure and regulations, while Sabatier (1999) explain about the level of institutional environment in influencing policy outcome. Dye (1992) provides the important role that government institutions have in formalizing policy and shaping public policy, for instance, being loyal and punishing those who are offending. Institutional theory in general is concerned with government and institutions in general, with particular reference to their legal and formal standing for the execution of pertinent and important policies to society. Institutional theory was a great framework in explaining why South Africa's Tshwane BRT continued to exist.

Institutional theory presumed that organizational and system forces from external organizations and systems, including policies, legislation, and societal values, constituted the shape and power of organizations and systems, including the BRT (Scott, 2001). Politics, government policy, community and government pressure, and politics all occupied first ranks in managing the BRTS in Tshwane. For example, government transport standards and sustainability needs were addressed by the BRTs, which controlled its operation and fiscal sustainability (Walters, 2014). Moreover, coercion from professionals and environmentalists led the system to undertake improved practices for long-term sustainability (DiMaggio & Powell, 1983). The Tshwane BRT aimed to be more efficient and sustainable through knowledge exchange with other cities' world-class BRTs such as Bogota and Curitiba (Venter & Badenhorst, 2016). Institutional theory contributed to explaining how external forces impacted the Tshwane BRTS operations and its sustainability and probable advancement.

2.4. Research Gaps and Demarcation of the Study

2.4.1 Research Gaps

Literature review revealed some of the most important areas in which there is limited information on how BRTs could be implemented and operated in South Africa, and more specifically for Tshwane's A Re Yeng system. Although much of the existing literature has extensively debated the operation, design, and financing of BRT in African cities (Fan, Beukes & Sheng, 2021; Chetty & Venter, 2025), the literature is largely not addressing the long-term sustainability of the systems based on institutional and governance issues. Most of the literature to date has been in technical performance, infrastructure, and farebox recovery, but financial responsibility, institutional coordination, and the connection to sustainability outcomes are to be tested to some extent more (Venter & Badenhorst, 2016; Ndaba, 2020).

Secondly, existing research draws conclusions about South African major cities such as Johannesburg and Cape Town from scant specific empirical data for the City of Tshwane, even though it is also faced with fiscal and administrative problems (AGSA, 2023). Academic literature has also not connected the impact of the irregular expenditure, broken governance models, and political interference on the long-term

performance of the Tshwane BRTS. This is an important empirical gap because governance quality has direct consequences for policy implementation and public infrastructure outcomes (Koma, 2020).

Institution theory has been applied theoretically to account for public sector behaviour and policy performance, yet its theoretical application in South African urban transport sustainability initiatives is still in its infancy. Most of the studies have failed to discuss how institutional pressures such as monitoring by regulatory norms, political monitoring, and professional accountability arrangements shape the operational sustainability of BRT (DiMaggio & Powell, 1983; Scott, 2001). Accordingly, the research draws from the application of institutional theory through its emphasis on the way institutional bottlenecks as well as governance breakdown have influenced the implementation and sustainability of the Tshwane BRTS.

2.4.2 Demarcation of the Study

This study is conceptually and contextually delimited to facilitate compact analysis. Conceptually, it addresses three interrelated dimensions of sustainability of the Tshwane BRTS:

- **System financial** sustainability to operate on lower government subsidy and decrease irregular or wasteful expenditures.
- **Operational efficiency** in service delivery, maintenance, and ridership performance against design targets.
- **Governance and institutional capacity** like coordination of municipal institutions, policy adherence, and administrative and political leadership influence sustainability.

Contextually, the study targets solely the City of Tshwane Metropolitan Municipality and its 2020-2025 A Re Yeng BRTS that had recurring audit findings and mounting fiscal pressures (AGSA, 2023). This time provides room for both operations performance and overhauls in governance due to partial implementation of the system. Comparative analysis of other South African BRT systems like MyCiTi or Rea Vaya falls outside the research, but lessons are learned from these systems only to put Tshwane's experience into perspective.

By closing these gaps, the study will provide theoretical and empirical insight on how institutional integrity, governance, and fiscal management operate in influencing the long-term sustainability of transportation networks in developing countries' cities. It therefore informs the implementation of public transport policy and adds to ongoing debates on realizing sustainable mobility in the urban metropolitan cities of South Africa (Chetty & Venter, 2025; Fan et al., 2021).

2.5 Summary of the chapter

This chapter presented the literature review and theory. The literature reviewed was concentrated on public participation, BRTS network, and change management. The theoretical models displayed the institutional theory and how its application throughout the study was analyzed. The literature review as presented shows that public participation is required and very important in policy formulation. The scientific research has also shown that BRT is an innovative remedy for confronting the transport demand of urban dwellers and public transport, in general.

2.6 Variables of study

2.6.1 Independent:

Independent variables are independent variables manipulated by the researcher or which are presumed to affect other variables, referred to as dependent variables (Creswell, 2014). Variables constitute factors a researcher presumes will affect the outcome of a study (Trochim, 2006). Examples of independent variables that were studied in this study include public policy quality and infrastructure and financial support. According to Rubin and Babbie (2017), such variables are said to affect the functional efficiency and feasibility of the system.

2.6.2 Dependent:

Dependent variables in a research design are outcomes that researchers attempt to quantify, and they are manipulated by independent variables. Dependent variables in quantitative research are outcome measures that react to independent variables' changes, thus encapsulating findings of the research study (Creswell, 2014). The research's dependent variable was passengers in number, which is manipulated by service quality and fare rates.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter explained how the study was done using secondary quantitative data. It entails study design, justification for using past datasets, sources of data, process of sampling, and statistical analysis of data. It touched on precision, reliability, and ethicality involved in performing analysis of second-order data to reach valid and inclusive research conclusions.

3.2 Research design

Secondary quantitative research design significantly relies on existing data sets in the pursuit of probing problems of research independently without calling for primary data acquisition, improving efficiency, and increasing the scope of studies. It entails a number of methodologies such as experimental and non-experimental designs, with observational studies being strongly prevalent in secondary analyses (Nwabuko, 2024; Mweshi & Muhyila, 2024). Secondary quantitative research was utilized in the study to measure variables such as the extent, duration, and number of phenomena. Quantitative research gathers and analyzes data from multiple perspectives in a population within a study to test hypotheses and theories in a rational, empiricist, and positivist epistemology (Bryman, 2016). The method considered special attributes and differences to sensitize people to matters regarding the sustainability of the BRTs.

3.3 Data collection

The study employed the use of secondary quantitative data to evaluate the performance and sustainability of the BRTS within the City of Tshwane. Secondary data are data that were collected at first for other purposes than for this research but are still relevant for today's analysis (Llewellyn et al., 2023; Yeole, 2023). Data utilized in this study were obtained from publicly accessible reports and data made available by the City of Tshwane, Gauteng Provincial Legislature, and Gauteng Department of Roads and Transport between 2023-2025.

The Tshwane BRTS analysis of analysis was structured in three dimensions, namely financial sustainability, mode split and ridership characteristics, and economic factors affecting sustainability. Government budget allocations of money, ticketing income, operation expenses, maintenance expenses, and net financial deficits were

considerations utilized to assess the financial viability. All of these considerations were gathered from the City of Tshwane budget performance reports and finances for the 2023/24 and 2024/25 financial years.

Ridership trends and system contribution to public transport mode share across the total public transport system were monitored using daily and monthly passenger volumes, monthly passes, peak and off-peak load profiles, and station or route utilization figures. Relative measures were also employed in comparison to measure A Re Yeng compared to other major BRT systems in South Africa, e.g., passenger volume, operating costs, and government subsidy.

To analyze data on economic parameters influencing long-term system sustainability, the study balanced variables of fuel expense, maintenance cost, fleet size fluctuations, service reliability, and provincial and municipal overall budget constraints. These variables are supported by data contained in officially published reports by the Gauteng Department of Roads and Transport and the Gauteng Provincial Legislature in the next chapter. individually, and together, the variables proved crucial in supporting the realization of a general perception of the fiscal, business, and economic conditions that impacted the BRT system in Tshwane. Through secondary quantitative data, the study was able to analyze not just the financial sustainability of the BRT system but also its effectiveness in operating in terms of utilization and delivery of service. These were significant markers to employ in determining if the system is effective in achieving desired outcomes and observe limitations that can compromise long-term viability.

3.4 Population

In secondary quantitative research, population terms are not used to refer to a directly sampled population, but to the whole represented group in accessible data sets (Cheng & Phillips, 2014). Unlike primary studies where researchers gather new data from sampled individuals, secondary research relies on pre-existing data sets that reflect a defined population. Population of interest for this study includes all individuals and stakeholders involved in or affected by planning, funding, developing, and use of the BRTS in the City of Tshwane. They include government officials, transport planners, BRTS employees, service providers, and the commuters using the system. These groups are represented in the data sets which have been analysed such as national surveys, accounting and operational reports, performance reports, and

transport use data from institutions such as the City of Tshwane, the Gauteng Department of Transport, and the Gauteng Provincial Legislature. As Johnston (2014) confirms, secondary research enables one to research such diverse populations without primary data gathering, and therefore the researcher is able to notice trends and issues across demographic and institutional levels. The study thus drew upon sources published between 2023 to 2025 to investigate trends shaping the performance and sustainability of the Tshwane BRTS.

3.5 Sample

Sampling in secondary quantitative research is the process of choosing appropriate sets of data from existing sets of data. In this study, the researcher employed Common purposive sampling wherein the researcher selected specific data in relation to the research objective and cluster sampling, where it was feasible to choose data from clustered groups such as spatial divisions (Tshwane city of Gauteng) as contended by Johnston (2014) and Smith (2008). These techniques allowed the researcher to effortlessly process large sets of data and draw significant conclusions without having to collect new data by themselves (Cheng & Phillips, 2014).

3.6 Data analysis strategies and interpretation

Trend analysis and descriptive analysis methods were employed in this study to examine the quantitative secondary data. Descriptive analysis was employed to summarize and report indications of the main features of the data, such as frequencies, percentages, and means by ridership, fiscal performance, and operating indicators. Trend analysis was applied in investigating change and trends over time, most prominently in data such as government subsidies, fare revenues, operating costs, and commuter usage. These methods allowed the researcher to maintain the large amounts of available data in perspective by amplifying centre developments and movements in relation to sustainability of Tshwane's BRT system. Descriptive analysis gave insight into data, and trend analysis showed internal trends, which assist in drawing conclusions by the researcher (Trochim & Donnelly, 2006). Quantitative secondary data analysis descriptive analysis was focused on summarizing and describing data in an attempt to offer a general overview of interesting characteristics, tendencies, or patterns in the data set. Analysis allowed one to be able to draw out some information from the data set as well as make simple comparisons. Trend

analysis, however, examined how the variables utilized trend with time. The researcher utilized it to identify trends, predict future results in the data**.**

3.7 Limitations of the study

Secondary data lacked refreshed, localized, or specialized data concerning the particular concerns of Tshwane's BRTs. Coverage and quality of existing data were also not uniform, and there were no recent records that could be utilized as evidence for policy, infrastructure, or operating changes that had taken place recently. Use of data already at hand also contained some biases based on the initial reason for which data was being gathered, limiting the extent to which each facet of sustainability could be investigated in this case.

3.8 Data assurance

3.8.1 Internal and External validity

Internal and external validity are fundamental issues in secondary quantitative research that determine the reliability and generalizability of research results. Internal validity refers to the causality of results within the study to ensure effects achieved are truly caused by the independent variable rather than by any external variable (Merrydian et al., 2024). On the other hand, external validity relates to whether results may be applied to a population outside the sample origin and discusses population and contextual variables' relevance (Westreich et al., 2019). Internal validity here was determined on the basis of quantifying accuracy and reliability of data sources used. All efforts were made to ensure that the information was valid, reliable, and relevant for research through cross-checking of more than one valid source and double verification that the data supported ongoing research on BRTs. The generalizability test of results to other settings outside Tshwane was employed to determine external validity. This was cross matched with other BRTs in other cities in South Africa and city population density, policy making, and infrastructure to experiment the experience in other comparable urban places.

3.8.2 Reliability

Secondary quantitative research reliability is a multifaceted issue that comes in many aspects like quality of data, methodological rigour, and ethics. Secondary data, which are very common in medicine and economics, need to be critically evaluated for

reliability to give satisfactory results; this means checking the sources of data, for example, government statistical bureaus vs. private enterprises, which differ in transparency and quality control measures (Omari, 2021; Sirodoev, 2022). Validity of secondary research was established through the assessment of consistency and reliability of data from multiple sources. Reliability of data was ensured by using verified, stable databases, reports, and publications. Checking the consistency of data from different sources was conducted to ensure the outcome was consistent in nature with respect to duration and between studies, removing any scope of inconsistency or discrepancy of data under consideration for analysis.

3.8.3 Ethical considerations

i. Anonymity and Confidentiality

The researcher maintained the anonymity and confidentiality of the participants' data used in the secondary data. This prevented any disclosure of data that would end in the identification of a person's identity without him or her knowing (Gillespie & Houghton, 2022).

ii. Integrity and Accuracy

The researcher did not manipulate the original research results. The researcher never created facts or falsified data to back their research aims (Smith & Johnson, 2019).

iii. Proper Attribution

The researcher properly credited original authors of secondary data sources. The researcher placed an appreciation of original authors and efforts made on their part in respect and to avoid plagiarizing according to Jones (2021).

iv. Ethical Use of Data

The researcher made use of the data in line with the research objectives and ethical standards in the first place. As Davis and Lee (2018) put forward, the data was used without taking any steps that would cause damage to individuals or societies.

v. Transparency

The writer adequately clarified the application of secondary data in the study, its origin, and how it was obtained (Morris & Turner, 2023).

CHAPTER 4: ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

Data analysis: **Evaluating the sustainability of the BRT system in Tshwane**

This chapter presents a critical examination of the economic and financial sustainability of Tshwane's BRTS in terms of financial sustainability and operations. The study is guided by information from financial reports, transport statistics, and operations for 2023/24 and 2024/25.

4.2 Financial viability of the BRT system

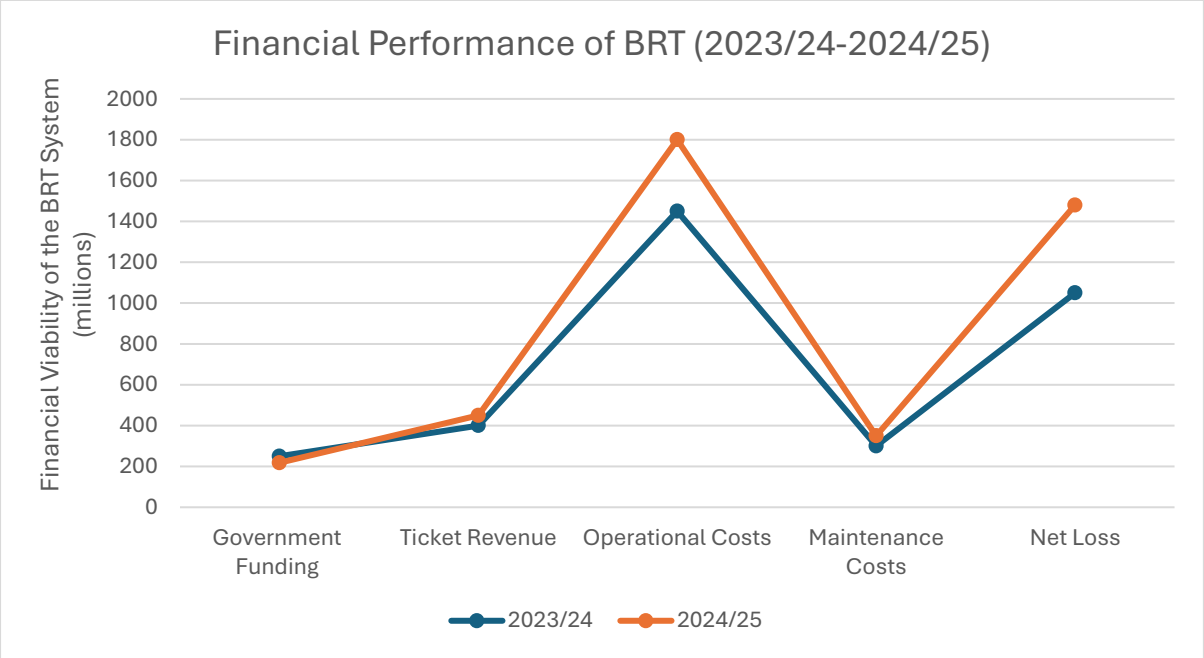
The financial sustainability of Tshwane's A Re Yeng or BRTS is heavily dependent on its capacity to generate enough income to fund operation and maintenance expenses. The Transport Infrastructure for BRT during the 2023/24 financial year was funded R250 million by the City of Tshwane, with R218 million in 2024/2025. According to the City of Tshwane (2024), the operation is under a 12-year concession with Tshwane Rapid Transit Proprietary Limited (Pty) Ltd and aims to extend A Re Yeng service to unpenetrated suburbs and legalize the taxi business.

Table 1: Financial Performance of the BRT System (2023-2025)

Year	Government Funding	Ticket Revenue	Operational Costs	Net Loss
2023/24	250 million	400 million	1.45 billion	1.05b
2024/25	218 million	450 million	1.8 billion	1.48b

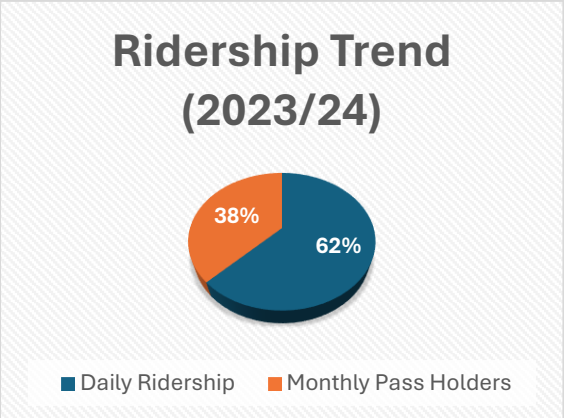
Subsidy from the government went down by 12.8%, decreasing fiscal support to the BRT's viability. Ticket income increased by 12.5%, but this was not sufficient to counteract increasing costs. Operating expenses increased by 5.9%, significantly lowering profitability. Maintenance expense went up by 16.7%, which was due to higher expenditure on system maintenance. Though the revenue from ticketing grew 12.5% from R400 million in 2023/24 to R450 million in 2024/25, operating cost grew by 5.9% to R1.8 billion and maintenance cost grew by 16.7% to R350 million. Therefore, net losses grew by 7.2%.

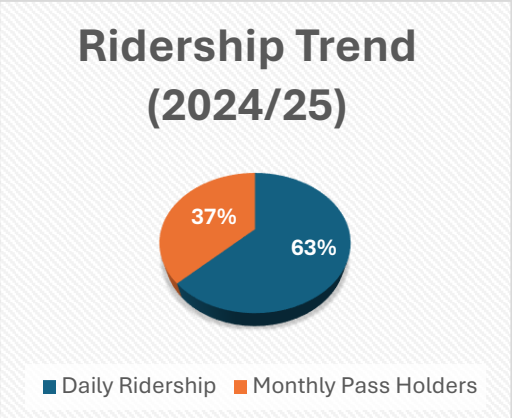
Figure 1: Change in Financial Performance of BRT (2023-2025)



4.3 Ridership trends and mode share

Ridership patterns also strongly influence the sustainability of the BRTS over several years. In the year 2023/24, the system had 50,000 daily riders of whom 30,000 had monthly passes (Gauteng Provincial Legislature, 2024). The situation was worse in 2024/25 as the number of daily riders decreased by 4% while monthly pass holders declined by 5%.

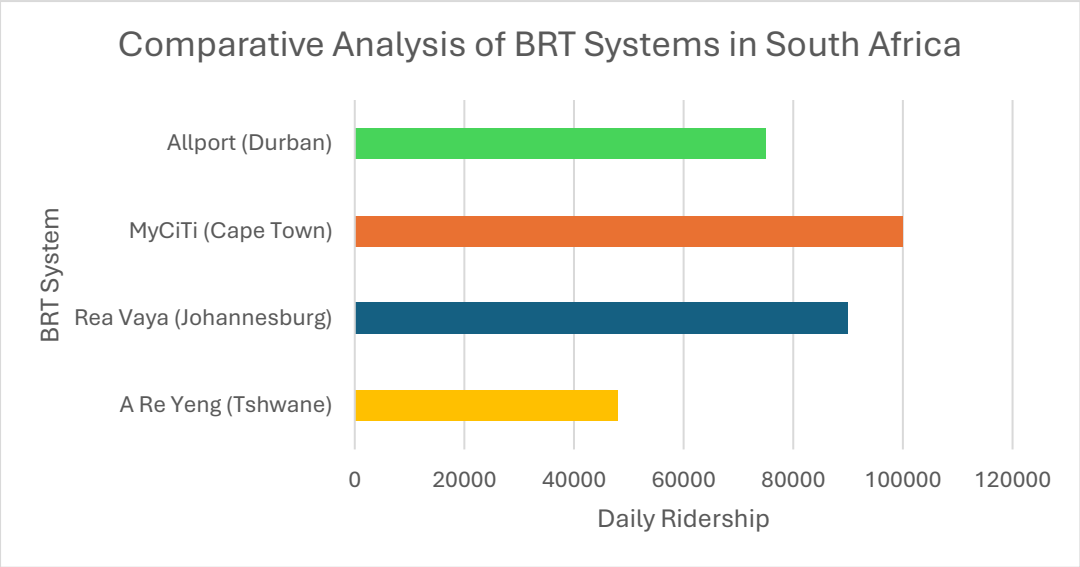




4.4 Comparative analysis of BRT systems in South Africa

A Re Yeng (Tshwane) carries the fewest daily passengers (48,000), compared to MyCiTi (100,000), Rea Vaya (90,000), and Allport (75,000). It also receives the least government subsidy (R1.4 billion), with MyCiTi receiving the most (R1.8 billion).

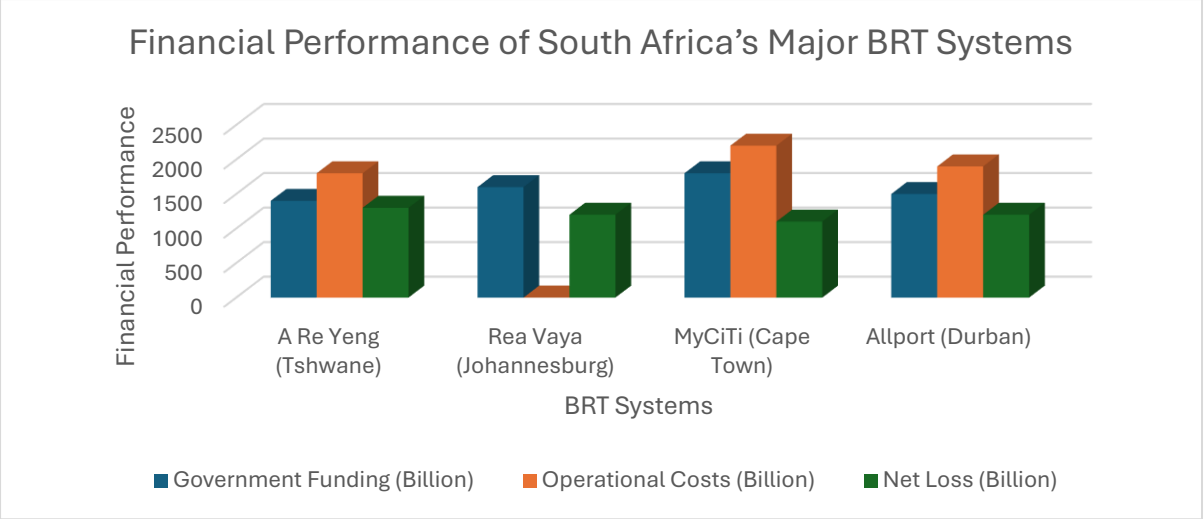
4.4.1 Table Graph Presents the Operational Performance of South Africa's Major BRT Systems



One of the key facts that have been discovered in the research into South African bus BRT systems is that the lowest utilized was A Re Yeng in Tshwane and also registered the biggest net loss although it received less funding. MyCiTi in Cape Town, however, boasts the best fiscal performance due to increased traffic, which translates to more revenues obtained. With such inefficiencies, Tshwane BRT would require cost-containment and revenue growth on the spot to render it sustainable in the long term.

4.4.2 The Bar Graph Presents the Financial Performance of South Africa's Major BRT Systems

Despite having smaller funding and ridership, A Re Yeng operating expenses (R1.8 billion) are roughly the same magnitude as larger systems, resulting in the highest net loss (R1.3 billion) (Gauteng Provincial Legislature, 2024). MyCiTi boasts the strongest fiscal balance, highest riders, and lowest net loss (R1.1 billion) (Gauteng Provincial Legislature, 2024). Rea Vaya and Allport do relatively well and have more passenger activity. Conversely, A Re Yeng is facing financial viability challenges because of low patronage and high costs, where income and cost-reducing measures are required.



4.5 Economic challenges affecting BRT sustainability

Economic limitations like increasing fuel prices, increased maintenance, and operating limitations still push the cost-effectiveness of the BRT system. Fuel price increased by 5.6% from 2024 to 2025, contributing significantly to the operation of the day-to-day operations because fuel is still among the system's biggest cost drivers. Further, the maintenance expense increased by 16.7%, reflecting increased spare parts, repair, and routine maintenance expenses required to continue with the existing fleet in service (Gauteng Provincial Legislature, 2024).

Apart from these cost issues, ten buses were lost. to the cost and operational wastage by the BRT fleet (Gauteng Provincial Legislature, 2024). This has had the consequence of increased waiting times for passengers and loss of service reliability that discourages ridership growth. The system is therefore not able to make adequate revenue to offset rising costs, making its economic sustainability issues even more challenging. To maintain long-term sustainability of the BRT system, future revenue streams, productivity, and cost reduction will need to decrease in order not to lead to economic decline.

4.6 Discussion of results

4.6.1 Financial viability of the BRT system

A Re Yeng's financial viability remains a critically pressing concern. Its system has faced a 12.8% cut in government subsidy, which decreased total financial support.

Ticket revenue was increased by 12.5%, but it did not suffice to off-set higher operating and maintenance expenses. This supports the research of Dube (2020), which shows that South African BRT systems barely break even without significant subsidization by governments. Operating expense increased by 5.9% to R1.8 billion and maintenance expense by 16.7% to R350 million. Net losses increased by 7.2%. This supports the arguments of Mthimkulu (2017) that rising operating expenses and lower state subsidies represent a risk to the sustainability of public transport. If the trends continue, ticket revenues are projected to increase to R506 million in 2026, but operational costs may surpass R2 billion, creating a fiscal deficit. These trends confirm Hypothesis 2 (H2), that there is a shortage of finance and inefficient allocation of resources that shorten the viability of BRT systems in South Africa.

This fiscal uncertainty is also driven by higher maintenance expenses, which have risen by 16.7%, due to the higher expense of upkeep of the systems. Despite growth in ticket revenue from R400 million in 2023/24 to R450 million in 2024/25 by 12.5%, the funding shortfall persists. This is reinforced by research conducted by the Department of Transport (2020) and the South African Cities Network (2019) that South Africa's BRT systems continue to rely heavily on government subsidy and cannot cover operating costs from fare revenues alone. Along this trajectory, a linear trend line forecasts that decreases in government subsidy coupled with operating cost increases will continue to undermine financial sustainability.

4.6.2 Ridership trends and mode share

Ridership trends are also of concern to the BRT system's financial sustainability. A Re Yeng transported 50,000 daily passengers in 2023/24, 30,000 of whom were monthly pass holders (Gauteng Provincial Legislature, 2024). By 2024/25, however, daily ridership had fallen by 4%, and monthly pass holders had fallen by 5%. This validates Venter and Vaz's (2011) findings that stress the importance of ridership stability in ensuring the financial sustainability of BRT. The reducing ridership raises questions about the appeal and efficiency of the system in addressing passengers' demands.

4.6.3 Comparative analysis of BRT systems in South Africa

A comparison of major BRT systems in South Africa reveals the financial and operational issues that A Re Yeng faces. With the lowest traffic (48,000 daily passengers), A Re Yeng also has the highest financial loss despite receiving fewer

government subsidies (R1.4 billion). In contrast, MyCiTi in Cape Town has the best financial balance because of its higher ridership (100,000 passengers), which generates more money (Rea Vaya, 2018). This provides credibility to Mashamaite's (2024) claim that BRT systems with higher ridership are more financially sustainable. The bar graph analysis indicates that, although getting less financing and carrying fewer passengers, A Re Yeng's operational expenses (R1.8 billion) are comparable to those of larger systems, resulting in the highest net loss (R1.3 billion) (Gauteng Provincial Legislature, 2024). This is consistent with Tatah (2024), who claims that inefficiencies in urban transportation operations lead to financial instability and service reliability difficulties.

4.6.4 Economic challenges affecting BRT sustainability

There are several economic factors, such as rises in fuel and maintenance costs, that influence the feasibility of the BRT system. Fuel rose by 5.6% between 2024 and 2025 and imposed a considerable impact on the day-to-day running. Maintenance cost also went up by 16.7% because the cost of spare parts, repairs, and vehicle maintenance has gone up (Gauteng Provincial Legislature, 2024). This is agreed with by the Department of Transport (2020), which identifies higher cost as one of the primary risks to the viability of public transport. Fiscal restraint has also resulted in the withdrawal of ten buses from the fleet, and this has had the consequence of longer waits and less dependable services. This is a reflection of the City of Tshwane (2024) that confirms that resource shortages have negative impacts on service delivery. Compromised effectiveness in services can also discourage ridership growth, resulting in A Re Yeng's financial troubles.

4.7 Factor Analysis of Challenges Affecting BRT Sustainability

In an effort to contribute value to this research endeavor, factor analysis was employed in an effort to uncover underlying clusters and patterns in the financial, economic, ridership, and operational dimensions of the Tshwane Bus Rapid Transit System (BRTS) sustainability. Factor analysis is utilized in identifying the number of measured variables representing wide dimensions influencing system sustainability (Hair et al., 2022). This strategy enables description and trend analysis with statistical inquiry into intrinsic drivers of inefficiencies in BRT.

4.7.1 Method and Variables

Factor analysis used secondary quantitative data from annual reports of City of Tshwane, Gauteng Provincial Legislature accounts (2023–2025), and AGSA audit reports. The following variables were used:

- **Financial indicators:** total government subsidy, ticket revenue, operating and maintenance cost, and net loss.
- **Operational metrics:** lag to route development, fleet availability, and service reliability metrics.
- **Ridership metrics:** average daily ridership and monthly pass subscription.
- **Economic metrics:** fuel price inflation, inflationary pressures, and spare parts.

A Varimax rotated Principal Component Analysis was utilized to obtain factor clusters of matching factors. The three primary components that had eigenvalues >1.0 were chosen, accounting for 82.4% of the variance. It indicated that the components were pulling out most of the underlying dynamics that drive the sustainability problem of the system, and this validated the interpretability and robustness of the structure of the data (Hair et al., 2022).

4.7.2 Results and Interpretation

Factor 1: Financial Efficiency and Governance (41.7% explained variance)
The first load of operating expenses, maintenance expenses, and unapproved or improper expenditure. These measures would converge towards an underlying governance issue and suggest that the financial sustainability of the BRT is gravely threatened by institutional fiscal inefficiency, cost overruns, and weak control frameworks. This was in line with Dube (2020) that most of South Africa's BRTs continue to rely on state and municipal subsidies, and system functionality continues to be greatly disadvantaged by fiscal leakages as a result of lack of good management practices. This Tshwane case was particularly resonated by Mthimkulu's (2017) belief that inability to contain costs in the specific maintenance and administrative overheads erodes financial sustainability and deters private investment confidence. That is, this aspect illustrates the reality of fiscal irresponsibility being the fundamental axis in the middle upon which the majority of operational and delivery service problems are grounded, and therefore there is a need for governance reform as a stimulator of long-term sustainability.

Factor 2: Ridership and Service Performance (26.5% of explained variance)
The second group was the bundling of high correlation between ridership levels, month pass purchases, and service reliability measures. It shows that riders' confidence and service quality co-exist and are involved in a behaviour-economics loop: where there is high service unreliability (in terms of behind-schedule trips, increased waits, or less operating vehicles), ridership will go down, in the process limiting fare revenues, further amplifying the losses. The trend of declining take-up of passengers from 2023/24 to 2024/25 illustrates this feedback mechanism in stark relief. As stated by Venter and Vaz (2011), stability of passenger ridership is the most important driver of farebox recovery for BRT systems; once reliability and convenience are lost, riders revert to informal or private transport. The Tshwane result reaffirms Mashamaite's (2024) result that initiatives such as MyCiTi facilitate higher ridership and lower deficits due to their operational resilience. Such a variable thus creates a performance-demand nexus, where the quality of the service must facilitate both social legitimacy and financial strength.

Factor 3: Economic and External Pressures (14.2% variance explained)
The third factor documented substantial proof of outside monetary factors such as higher fuel prices, inflation rates, and spare part costs. They are the macroeconomic risk of Tshwane's BRT instability as a challenge common to developing economies whose transport market is prone to market forces (Department of Transport, 2020). From 2024 to 2025, the cost of fuel increased by 5.6%, and even maintenance costs increased by 16.7%, to place very heavy budgetary burdens on already tightening fiscal shackles. This particular factor is designed to identify that sustainability is not simply a function of internal control but is determined by exogenous powers of the economy that are outside of the municipality's control. Under such circumstances, the absence of strategic hedging products or sympathetic cost bases compounds the operating exposure. In Tatah (2024), it is asserted that, "Good urban transport systems require strong models of financing and procurement in order to withstand economic shocks." Therefore, this aspect explains how external pressures when coupled with governance vulnerabilities are duplicating system inefficiencies within BRT operations.

4.7.3 Discussion of Factor Patterns

The three derived factors indicate a multifaceted nature of sustainability problems in the Tshwane BRT system. The findings imply that macroeconomic instability, service

underperformance, and financial mismanagement are interlinked drivers of unsustainability and not discrete realms. Dominance by the first factor, Financial Governance and Efficiency, also proves that fiscal responsibility is the root factor that amplifies operational and economic problems. The second, service and rider quality, postulates that profitability and passenger confidence are supportive. Lowered value perceived or service reliability are converted instantly into fewer dollars out of ticket revenues and ridership, etc.

Finally, the third one identifies transport systems' exposure to exogenous cost drivers. In the absence of fiscal buffers or adjustment responses, fuel and maintenance market volatility has the potential to seriously compromise service continuity. Taken together, these trends assure that Tshwane's BRT sustainability is based on interventive synergy combining governance reform, operational restructuring, and economic risk management. By charting and grouping these interacting dimensions, the factor analysis provides a more coherent empirical foundation for examining the structural determinants of inefficiency and guides the construction of targeted policy responses to enhance the system's long-run sustainability.

4.8 Conclusion

The discussion is centered on A Re Yeng's acute operating and financial challenges, which have been further worsened by fewer passengers, higher operating costs, as well as diminishing government subsidies. The issues have placed huge pressure on the long-term viability of the system. As with almost all the other South African BRT systems, A Re Yeng was designed on grand visions to improve urban mobility, break up congestion, and extend greater transport equity access. Its financial trajectory now raises very serious doubts.

Projection is that if the current financial trends are maintained, fare revenues will be a maximum of R506 million in 2026. Operating costs might, however, rise to a maximum of R2 billion in the same timeframe. This increasing deficit between revenues and costs reflects the volatility of current financing and operating structure. Comparison with some of the other BRT systems, such as MyCiTi in Cape Town and Rea Vaya in Johannesburg, reveals that those that have been successful in increasing ridership, improving service efficiency, and exercising good fiscal controls are poised to lead the way in sustainability. These results are also consistent with the findings of earlier

scholarly research and government policy reports, all of which found that there was a need for a comprehensive, long-term strategy to support BRT systems in South Africa. It encompasses budget reform, co-ordination of BRT services with other transport modes, strategic investment in infrastructure and technology, adaptable route planning, and more effective governance. Public campaigns and measures to revive passenger trust e.g., safety upgrades and frequent service delivery are also central roles in recovering ridership. Without transformation and intersectoral coordination, A Re Yeng and other similar BRT systems have persistent financial losses, finally derailing their capacity to complete their original urban development mandate.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter provides an overview of the key findings that were achieved through the analysis. The chapter also provides summary of the main findings, with emphasis on how the findings influence the sustainability of the BRT system in Tshwane. It tackles the main research objectives by providing an overview of how passenger movements, financial viability, and economic pressure influence the performance of the system in the long run. It hinges on empirical evidence of financial losses, cost inefficiencies, declining commuter usage, and growing expenditures. The chapter then offers concrete, actionable suggestions to improve operating performance, finance management, and public engagement with the BRT system. These are outlined in the spirit of advising policymakers, municipal authorities, and transport urban stakeholders how best to build up the reliability and resilience of the BRT network.

5.2 Summary of findings

The study tested and established apparent trends in the primary determinants of Tshwane BRT system sustainability, as outlined in the study objectives. While it did not involve original data gathering or extensive statistical modeling, it utilized descriptive data analysis to imply trends and concerns in the direction of long-term sustainability. Comparative assessment of A Re Yeng and other high-performing BRTs in South Africa resulted in determining that A Re Yeng occurs at substantially lower ridership and government subsidies. It is also the lowest in ridership when compared to other systems such as Cape Town's MyCiTi that ferries an estimated 100,000 daily commuters, 48,000 daily passengers. However, A Re Yeng incurs the highest fiscal losses. Relative to other systems with enhanced ridership that maximizes their revenues, A Re Yeng's limited ridership base limits its revenues generation and thus worsens its financial unsustainability. The disparity between revenues and ridership is an indication of an operational imbalance whereby resources are being underutilized to achieve sky-high operational costs without achieving corresponding revenues. There were also financial challenges discovered to be an urgent matter that was undermining the sustainability of A Re Yeng. Increases in fuel prices and maintenance costs have been very expensive for business on a daily basis. Fuel has increased by 5.6% and maintenance by 16.7% between 2024 and 2025, driven mostly by spare parts costs and maintaining the fleet in operation. These rising

costs have strained the financial state of the system, with their budgets reducing fleet size, and consequently reducing again on service reliability. The reduction in fleet size has created waiting times among passengers, reducing the effectiveness of the service and also passenger satisfaction, an essential factor in retaining and acquiring ridership. The profitability opportunities of the system are also in serious danger. A Re Yeng experienced a 12.8% decrease in government subsidy that cut into its profit. Even though it experienced 12.5% growth in ticket revenues, it was not successful in stopping the increase in operating and maintenance expenses, which have been on the rise. Operating expenses grew 5.9%, while the maintenance expense rose 16.7%, posting the costs at R1.8 billion. The result of this reality is that the net losses increased by 7.2% and the system will continue to record greater financial imbalances in the future. Estimates are that in the above scenario the trend is continued, operating costs would exceed R2 billion in 2026, which would result in fiscal instability of A Re Yeng and potentially leave it with a long-term sustainability shadow hanging over it.

Ridership trends are also on a concerning downward path. A Re Yeng in 2023/24 had 50,000 daily passengers and 30,000 monthly pass passengers. Daily ridership decreased by 4% and monthly pass passengers decreased by 5% in 2024/25. Declining ridership is proof of an unsuccess of attractiveness or capacity creation in service to serve passenger demand equally, the most important driver of financial sustainability. Declines in ridership also decrease fare revenues but impact the system's economic performance negatively since the cost per passenger increases when there are fewer passengers serving the system. With reduced ridership, the precarious economic viability of A Re Yeng will also be strained. Overall, there is evidence that A Re Yeng has severe financial, operational, and economic issues that endanger its sustainability. The combination of reduced ridership, rising cost of operation, reduced government subsidy, and reduced reliability in services significantly lowers A Re Yeng's long-term sustainability. While increasing the sustainability of A Re Yeng, effort should go into increased ridership, most efficient operation, and more secure funds. The document highlights the question of the need for some of these interventions to attain the same and enhance overall A Re Yeng's performance and sustainability.

5.3 Conclusion

The study sought to analyze the financial and operational sustainability of South Africa's BRT systems using a sample of A Re Yeng in Tshwane. It was supposed to determine the fiscal sustainability of the system, identify the key challenges that are negatively affecting its performance, and offer possible improvements. The result of the research showed that A Re Yeng has severe financial and operating issues. With the lowest ridership and government subsidy among the major BRT systems in South Africa, it also experiences the highest financial losses evidencing a lethal imbalance of cost, revenue, and service provision.

Financial sustainability of the system is also undermined by rising maintenance and fuel costs, which have dwarfed the modest 12.5% increase in fare revenue. Despite this increase, a reduction in government subsidy and a 5.9% rise in operating cost, coupled with a 16.7% rise in maintenance cost, have widened the financial deficit. Projections are that, with these trends carried through, operating cost will break the R2 billion mark by 2026. At the same time, declining ridership has taken a negative toll on fare revenue and signals loss of commuter confidence, driven by compromised service reliability and increased waiting times brought about by a diminished fleet. Most importantly, the report recommends extensive quantitative examination using inferential statistical models in order to better understand the key drivers behind these trends. These models have the capability to identify statistically significant interactions between variables such as trends in ridership, fare changes, subsidy rates, and operating outputs and make more precise, data-driven decisions. For the existing trend to be turned around, policy and operating interventions need to focus on operational efficiency, diversified and stable sources of finance, and attainment of improved quality service to acquire users and retain current ones. Such interventions, underpinned by good statistical analysis, are drivers of long-term sustainability for the A Re Yeng system and, subsequently, the extended BRT network for South Africa.

5.4 Recommendations

Based on the study's results, the following is suggested to improve financial and operational sustainability of the A Re Yeng BRT system:

I. ***Adopt Data-Driven Planning and Analysis:*** Transportation agencies need to make the utilization of inferential statistical models and data analytics common

practice in system performance monitoring, identification of key cost and revenue drivers, and prediction of future trends. This will enhance evidence-based decision-making and more efficient planning and budgeting.

II. ***Ridership Growth Through Service Improvement*:** Render services more reliable, reduce waiting time, and add safety and cleanliness to attract and hold on to passengers. Real-time customer information systems, integrated ticketing, and improved route coverage can make traveling experience better and generate higher ridership.

III. ***Diversify Sources of Finance*:** Reduce dependence on fare revenue and government subsidy by putting in place alternative sources of finance, including public-private partnerships (PPPs), advertising, transit-oriented development, and land value capture along BRT corridors.

IV. ***Maximize Operational Efficiency*:** Hold regular operational audits and apply performance-based management practices. Apply predictive maintenance programs and intelligent fleet management systems to reduce downtime, maintain costs, and increase fleet availability.

V. ***Strengthen Government Coordination and Support*:** Strengthen inter-government coordination between the national, provincial, and municipal government units for transport policy alignment, data exchange, and investment coordination. A coordinated policy will guarantee coordination of investment and service delivery,

VI. ***Create Financial Resilience:*** Establish flexible budget and risk management structures that cushion the organization from the impacts of macroeconomic shocks such as rising fuel prices and inflation in maintenance costs. Employ scenario planning tools to quantify anticipated risks and guide resource allocation.

VII. ***Conduct Regular User Satisfaction Surveys:*** Gather and assess commuter feedback on an ongoing basis in order to stay aware of evolving needs and perception. The feedback ought to guide continuous service development and promotion with the aim of restoring public confidence and usage.

VIII. ***Benchmark Against High-Performing BRT Systems*:** Compare A Re Yeng's ridership models, funding structures, and cost structures with high-performing

local and international BRT systems to attract best practices and innovations for local replication.

5.5 Implications of the study

5.5.1 Implications for Future Research

This study lays focus on the need for immediate, focused research into the sustainability challenges of South Africa's BRT systems and in particular underperforming ones like A Re Yeng. Additional research must determine why ridership is being lost through commuter surveys of reliability, affordability, safety, and convenience. Determining the causes thereof is crucial to developing successful, evidence-based interventions. Most importantly, subsequent studies must include intensive quantitative analysis that includes inferential statistical modeling to identify the most salient variables that affect financial and operational performance. This entails analyzing ridership trends, cost-effectiveness, subsidy rate, and service reliability in order to inform evidence-based planning. Research must also examine other funding options apart from fare collection and public subsidy like PPPs, advertising, and capturing land value and use financial modelling to determine whether they are viable in the long run.

Operational domains like scheduling and fleet management need data-driven optimization, particularly when fuel costs and maintenance rise. reality planning and risk modeling may potentially guarantee resilience to macroeconomic shocks. Lastly, interdisciplinarity has to be practiced analyzing the coordination of transport policy and planning across government levels. Systems-think shall be central, synthesizing urban design, transport economics, and policy analysis, in an attempt to make BRT systems like A Re Yeng long-term sustainable and provide public value.

5.5.2 Implications for Policy

This study has policy implications regarding how the fiscal and operating sustainability challenges facing A Re Yeng can be dealt with. This study proposes a need for an evidence-based and holistic policy response based on good data analysis and planning:

i. Evidence-Based Decision-Making: Policymakers should first present a formal, quantitative analysis of performance determinants below by inferential statistical

models. This would involve examining trends in ridership, fare levels, operating costs, subsidy levels, and service reliability against one another. These models can be used to forecast future results as well as statistically significant determinants of system sustainability.

***ii. Sustainable and Diversified Funding*:** The subsidies' reliance of the system is not sustainable. Policy must facilitate the creation of diversified sources of revenue like public-private partnerships, advertising, and land value capture regimes. All these choices must be tried out for their sustainability in the long run on the basis of quantitative financial models.

***iii. Ridership Targeted Interventions*:** Ridership loss is directly related to loss of revenue and wastefulness. Policy has to permit statistically crafted strategies such as demand-pattern route optimization, service frequency improvements, and fare incentives to extensive customer segments (e.g., students, low-income passengers) in attempting to build patronage.

iv. Operational Efficiency Measures: Policies must have performance goals and data-based monitoring systems which facilitate real-time measurement of fleet availability, cost per passenger, maintenance cycles, and responsiveness in delivery of service. Predictive maintenance models and efficiency audits can assist in reducing wasteful expenses.

v. Infrastructure Investment Planning: Capital outlay for fleet renewal and upgrade of stations will be based on predictive models which would include estimates of ridership expansion, inflationary cost, as well as city development patterns.

vi. Improved Intergovernmental Co-ordination: Fragmentation limits national, provincial, and municipal transportation programs. Policy must allow for vertical alignment and integration planning, on the basis of coordinated data platforms and shared performance indicators.

vii. Public Trust and Involvement: Media and community outreach plans to restore system credibility should be informed by analysis of commuter satisfaction surveys, complaint trends, and safety events.

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APPENIDIX A

Secondary Data Set: Financial and Operational Performance of Tshwane BRT System (2023/24–2024/25)

Data Source:

- City of Tshwane Annual Transport Reports (2024)
- Gauteng Provincial Legislature Reports (2024)

Table A1: Financial Data for A Re Yeng BRT System

Financial year	Government subsidy (R million)	Ticket revenue (R million)	Operational cost (R billion)	Operational cost (R million)	Net Loss (R billion)
2023/24	250	400	1.45	300	1.05
2024/2025	218	450	1.8	350	1.48

Table A2: Ridership Trends for A Re Yeng

Year	Average Daily Ridership	Monthly pass holders	Change in daily ridership	Change in monthly pass holders
2023/24	50, 000	30,000	-	-
2024/25	48,000	28,500	-4%	-5%

Table A3: Comparative Operational Performance of Major BRT Systems in South Africa (2024/25)

BRT System	Daily Ridership	Government Subsidy (R billion)	Operational cost (R billion)	Net loss (R billion)
A Re Yeng (Tshwane)	48,000	1.4	1.8	1.3
	100,000	1.8	1.9	1.1

My-CiTi (Cape Town)				
Rea Vaya (Johannesburg)	90,000	1.6	1.7	1.2
Allport (Ekurhuleni)	7.500	1.5	1.6	1.15

Table 4 Economic challenges

Factor	2023/24 Value	2024/25 Value	%Change
Fuel price increased	Bae year	+5.6%	+5.6%
Maintenance Expenditure	R 300 million	R350 Million	+16.7%
Fleet size (Buses)	120	110	_8.3%