Investigating the effects of challenges faced by the railway network on social, economy and developing railway recovery strategies

by

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DECLARATION

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Abstract

The passenger rail system in South Africa's is exposed to a myriad of challenges that include theft of infrastructure, vandalism, and aging infrastructure. The study examines railway network challenges of state-owned enterprises in the City of Cape Town central line recovery experienced by the Passenger Rail Agency of South Africa (PRASA) in rehabilitating the Cape Town Central Line within the Western Cape Province. A qualitative research approach was employed to collect data through in-depth interviews with 16 key participants to solicit inputs and perceptions from different stakeholders, including commuters, government representatives, community leaders, and PRASA personnel. Three key findings were revealed, firstly, common factors such as inadequate security measures, informal settlements along railway reserves posed security threats, governance problems, and financial limitations. These factors contributed to frequent service interruptions, decreased safety, and a declining preference and commuter experience. Secondly, overcoming these challenges required financial diversification through public-private partnerships, community involvement, improved security, and governance reforms. Thirdly, legal and regulatory frameworks, such as the National Rail Policy and the National Development Plan (NDP), supported PRASA's recovery goals. Interagency cooperation, financial responsibility, and community involvement were deemed necessary to utilize these frameworks effectively to ensure sustainable solutions. The study hopes to contribute to how PRASA could increase its investments in service dependability, boost commuter satisfaction, and support South Africa's broader public transport objectives through making significant improvements in their governance and infrastructure restorations. The study will inform policymakers, transportation authorities, and other stakeholders within PRASA and government counterparts working to build robust and equitable public transportation network.

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Chapter 1: Introduction

1.1 Introduction

The Passenger Rail Agency of South Africa (PRASA) operates one of the most essential commuter trains, the Cape Town Central Line located in the Western Cape Province. PRASA oversees the entire passenger rail services throughout South Africa. Tucho (2022) highlights that the Cape Town Central Line offers an important mode of transport for thousands of daily commuters, particularly those from low-income regions who depend on accessible and reasonably priced public transportation to get to their jobs, schools, and other necessities, this route connects several suburbs. Formerly, the central line has been vital to promoting urban mobility, easing traffic, and encouraging Cape Town's socioeconomic stability for the working class and low-income workers.

However, infrastructure, financial, and social issues had caused significant operational setbacks for the line in recent years (Evans, 2022). During the beginning of the Covid 19 pandemic and implementation of the lockdown regulations in 2020, the central line's operating effectiveness and commuter safety were severely impacted (Evans, 2022). The South African government suspended the operations of the passenger train, and this resulted in extensive theft of infrastructure, extreme vandalism, and massive encroachment from informal settlements (Evans, 2022).

Due to these problems, commuters were compelled to use buses or taxis, which were typically more expensive than the passenger rail. They had to deal with longer journey times, crowded alternative transportation, and higher taxi fares imposed by the minibus industry (Venter, Mahendra, & Hidalgo, 2020). Notably, the central line outages brought attention to PRASA's extensive problems, including insufficient finance, security threats, and governance issues. This impacted negatively on the organization's capacity to deliver dependable and secure rail services throughout its network (Kheyroddin & Ghaderi, 2022).

There is extensive research in the field of transport that has extensively documented the value of public transportation, particularly in metropolitan environments. Kheyroddin & Ghaderi (2022) argued that rail travel is identified to be typically more ecologically friendly and energy-efficient than road-based transportation and helped ease traffic congestion in cities. The efficient functioning of commuter rail lines, such as the central line, is crucial for social inclusion and economic progress in South Africa, where many urban dwellers rely on public transportation to access economic opportunities (Toth, Padayachee, Mahlatji & Vilakazi, 2022).

The main goal of this study was to understand the various obstacles to the central line's revival, such as budgetary restraints, infrastructure deterioration, and sociopolitical problems about informal settlements along railway reserves. Regrettable, these challenges have impacted the economy, social issues and full recovery of the central line. By examining these problems, the study attempted to developing effective railway recovery strategies especially in the Cape Town Central line, thereby rebuilding public confidence in PRASA's capacity to offer necessary railway service. Additionally, by providing insights that could be applied to comparable issues in other South African towns or emerging cities across the globe, the study hopes to improve on expanding body of knowledge on the resilience of the urban rail system and its recovery (Creswell & Poth, 2018).

1.2 Motivation of the Study

The study was encouraged by the importance of the Cape town central line in promoting regional mobility and the socioeconomic well-being of Cape Town's citizens, especially those from low-income neighbourhoods who depend on reasonably priced public transportation. Public transportation networks like the train were crucial for getting people to areas of economic activity, places of employment, schools, and medical facilities, particularly in cities with long commutes. Teffo, Earl & Zuidgeest (2019) mentioned that private transportation was expensive and out of reach for many disdvantaged groups. For everyday commuters, rail travel was frequently the most accessible and economical option. The central line, a vital component of PRASA's network, has long provided services to thousands of individuals that relied on it for their livelihood (Blumenfeld, Wemakor, Azzouz & Roberts, 2019; Ecofin Agency, 2025).

Many commuters were forced to look for alternate, frequently more costly, and unpredictable modes of transportation due to central line interruptions. Buses and minibus taxis were increasingly being used as alternatives, which increased travel expenses for low-income households, exacerbated socioeconomic disparities, and put further strain on Cape Town's road system (Teffo et al., 2019). Geels (2022) asserted that the everyday lives of commuters were impacted by the central line's failure to be restored. It restricted Cape Town's broader economic potential since dependable public transportation was critical to productivity and economic expansion (Geels, 2022). The pressing need to understand and resolve these issues assisted in building a robust and effective transportation system in Cape Town. The reopening of the central line was a meaningful community engagement exercise, which was essential to identifying key issues and finding appropriate solutions (Voice of the Cape, 2025).

The central line's high rates of vandalism and infrastructure theft indicated a more significant societal crisis, where problems like unemployment, poverty, and a lack of security led to circumstances that deteriorated public assets (Blumenfeld et al., 2019). PRASA needed help in re-establishing the line, including financial and technical barriers and social, political, and governance interventions. The enduring character of these issues necessitated creative fixes and calculated actions that considered the socioeconomic factors at work additional to repairing infrastructure. Such challenges offer workable, community-based solutions that promoted the central line to recover sustainably (Bešinović, 2020).

The potential to advance scholarly understanding of South Africa's urban planning, infrastructure recovery, and public transportation resilience served as additional motivation. Kheyroddin & Ghaderi (2022) noted that there was sufficient evidence of the value of rail systems in urban environments that needed to know about how urban rail lines recovered in underprivileged countries with limited resources and security. Information that guided comparable recovery initiatives in other South African cities needed to be explored. Practical conclusions drawn from this study hoped to stimulate policymakers, urban planners, and transportation authorities to create inclusive and sustainable transportation options for underserved populations.

1.3 Focus of the Study

The main objective was to pinpoint and examine the difficulties PRASA is having in rehabilitating and reopening the Cape Town central line. It looks at issues with PRASA's governance, financial constraints, theft, vandalism, and informal settlements on railroad reserves. The analysis also considered how the line's recovery affected the communities that depended on it on a more significant socioeconomic level. The study aimed to gather a thorough understanding of these issues and offered workable solutions through interviews with PRASA personnel, government representatives, community leaders, and commuters. The focus of the study was in line with a larger objective of improving the resilience of public transportation in South African cities.

1.4 Problem Statement

One of Cape Town's most important transit hubs, the Cape Town central line operated by the Metrorail which is part of the Passenger Rail Agency of South Africa (PRASA) and serves thousands of locals daily with vital commuter services. Scheba, Turok & Visagie (2021) argued that since 2020, the route experienced protracted disruptions brought by several problems, which caused substantial socioeconomic impacts on the towns it served, decreased service reliability, and jeopardized commuter safety.

The socioeconomic circumstances of Cape Town, where many citizens mainly depended on reasonably priced rail transportation to work, school, and other necessary services, further exacerbated the issue (Blumenfeld et al., 2019). Thus, the impacted communities and Cape Town's overall economic stability and transportation environment were severely impacted by the central line's ongoing deterioration and slow rehabilitation.

The leading cause of the issue was widespread railway infrastructure theft and vandalism, which caused vital systems, including electrical wiring, rails, and signalling, to collapse. Scheba et al. (2021) noted that these problems were not unique, but were caused by more extensive socioeconomic variables, including high unemployment rates and poverty in the neighbourhoods along the railroad line. Due to insufficient finance and security resources, PRASA's limited ability to prevent or mitigate such occurrences exacerbated widespread vandalism, frequently blamed for socioeconomic misery and exposure to risks. Additionally, these problems were worsened by the COVID-19 pandemic's reduction in security forces, which left the infrastructure more susceptible to theft and damage (Mugari & Obioha, 2024). Due to a lack of a robust infrastructure maintenance plan, PRASA was unable to adequately handle these issues, which resulted in vandalism and outpaced recovery attempts.

The invasion of railway reserves by informal settlements further complicated matters. Parts of the central line observed an increase in informal housing in recent years, which made it difficult for PRASA to maintain and access infrastructure. Kamalipour & Dovey (2019) noted that these settlements made recovery and maintenance efforts more difficult and provided serious safety threats to the local population. Efforts to resolve this issue were hampered by sociopolitical issues since moving residents necessitated delicate involvement with the impacted communities and coordination with local and federal government agencies. The line's rehabilitation was further hampered by the lack of progress in developing long-term plans for managing or relocating informal settlements despite the efforts PRASA and local government organizations.

Another notable obstacle was money. PRASA's ability to perform necessary repairs, security improvements, and infrastructure upgrades was hampered by severe budget cuts and funding constraints. Sibeko & Isaacs (2019) highlighted that the organization's dependence on state funding restricted its capacity to react quickly and efficiently to new problems, and the expenses of securing and repairing damaged infrastructure were substantial. According to PRASA (2021), without sufficient funding, the entity could not put in place thorough security measures, which created a vicious cycle whereby partial repairs were undone by more vandalism, ultimately impeding recovery efforts. Thereby the core problem of the research study is to examine railway network challenges of state-owned enterprises in the City of Cape Town central line recovery experienced by the Passenger Rail Agency of South Africa (PRASA) in rehabilitating the Cape Town Central Line within the Western Cape Province. The study will contribute to PRASA’s in establishing possible recovery strategies that will benefit the economy and its society at large. Functional railway lines are essential for a thriving economy and with commuters having access to affordable transportation.

1.5 Research Aim and Objectives

1.5.1 Aim

The study aimed at investigating the effects of challenges faced by the railway network on the social, economy and developing railway recovery strategies within the Cape Town Central line.

1.5.2 Primary Objectives

- To assess the perceptions of affected stakeholders on the challenges faced by PRASA's Cape Town central line recovery.
- To investigate the impacts of infrastructure theft and vandalism on the railway line.
- To explore the impact of the informal settlements on the railway reserves on the recovery process.
- To examine the role of corruption and project management issues in the recovery process.

1.6 Research Questions

- What were the main challenges facing the recovery of PRASA's Cape Town central line?
- How has infrastructure theft and vandalism impacted the recovery of the railway line, and what were the underlying causes of these issues?
- What was the impact of informal settlements on railway reserves on the recovery process, and how could this challenge be addressed?
- How did corruption and project management issues hinder the recovery process, and what measures could be taken to mitigate these challenges?

1.7 Theoretical objectives

- To review the legislative and policy framework for railway management in South Africa.
- To analyse the key challenges facing the railway network of state-owned enterprise.
- To review the effects of key challenges on social impacts, economic impacts and recovery process of rail network.

1.8 Significance of the Study

This study was valuable because it examined the intricate issues preventing PRASA's Cape Town central line from recovering. The Cape Town central line was an essential transportation link for thousands of Cape Town citizens, especially those from low-income neighbourhoods. PRASA and politicians could be able to address these obstacles if they were better informed on governance challenges related to infrastructure theft, vandalism, informal settlements, and financial constraints. The findings of this study intended to aid in the creation of a transport network that was sustainable, equitable, and robust.

Furthermore, this study added to the body of scholarly research on public transportation recovery in emerging urban environments through providing valuable suggestions that would guide comparable recovery initiatives in other areas. By concentrating on restoring the central line, this study hoped to advance solutions that improved equity, accessibility, and public infrastructure trust, often benefiting commuters in Cape Town and its larger socioeconomic landscape within the context of South Africa.

1.9 Scope and Limitations

The study examined problems such as infrastructure theft, informal settlements, budgetary limitations, and governance inefficiencies. It also focuses on the difficulties facing the recovery of the Cape Town central line. The study gathered opinions and perceptions from a small, purposefully chosen sample of 16 participants, comprising of commuters, government officials, community leaders, and PRASA officials. This intended to provide a thorough picture of the recovery process. The study was constrained by its small sample size, geographic focus on Cape Town, and dependence on qualitative data, all of which raised the possibility of subjective bias.

Furthermore, the potential for long-term monitoring was limited by time constraints, which limited our understanding of the dynamics of continuous recovery. Due to such restrictions, the results were unique to the Cape Town setting and could only be partially transferable to other areas, even though they provided insightful information. Figure 1.1 represented the Cape Town region's central line (purple line).

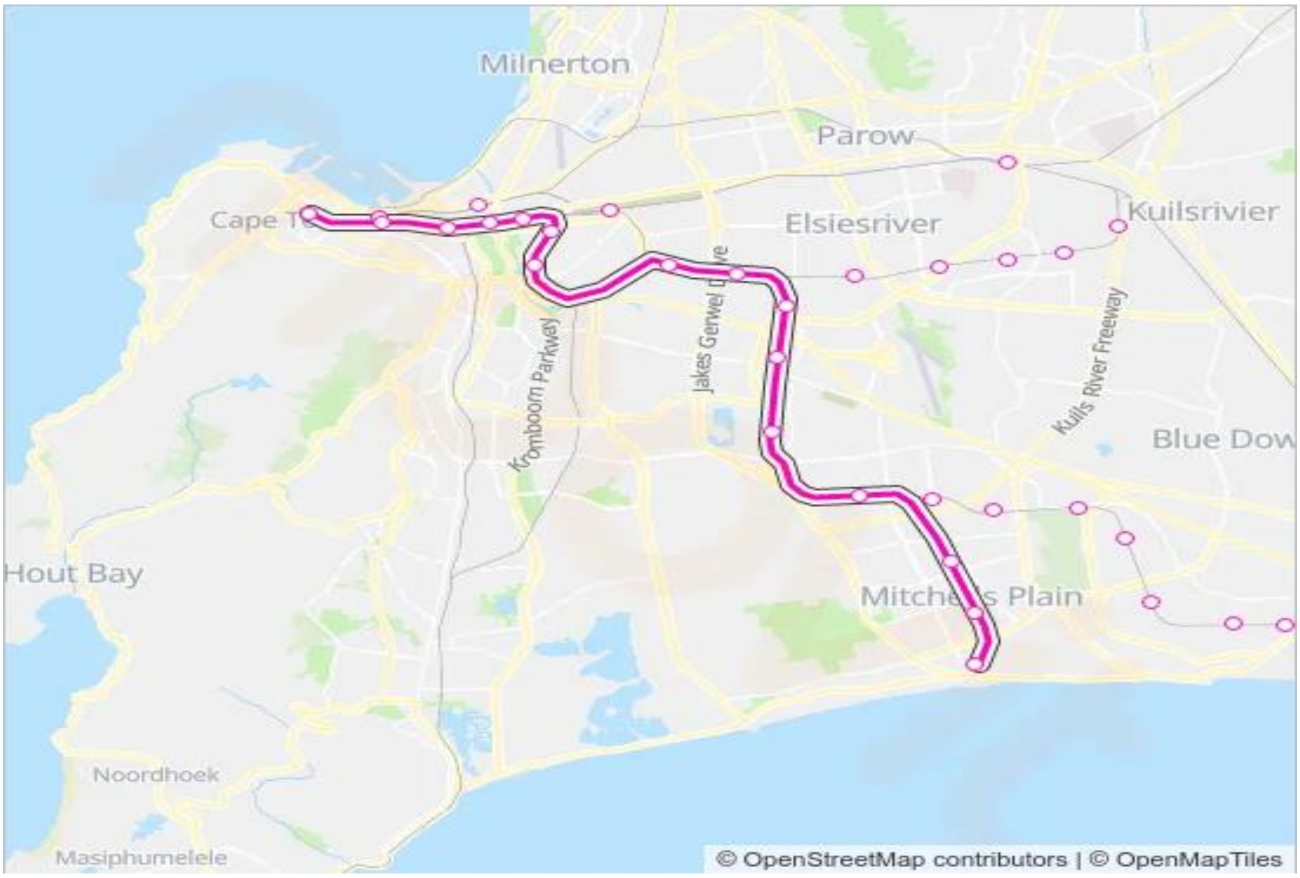

Figure 1.1: Metrorail Western Cape central line train line map (Western Cape Central Line, 2024).

1.10 Chapter Outline

Chapter 1: Introduction

Chapter 1 introduced the background and context of the study, outlining the study topic, research problem, objectives, questions, and motivation for the study. It also discussed the research's scope and limitations.

Chapter 2: Literature Review

The literature review explored recent scholarly work and discussions on railway recovery in South Africa and similar contexts. It provided an overview of the factors impacting railway infrastructure, such as infrastructure theft, vandalism, financial constraints, governance issues, and socio-economic factors, including the role of informal settlements on railway reserves. The chapter also examined existing strategies and frameworks for public transport resilience and recovery, focusing on

PRASA's challenges in restoring the central line. Relevant legislation and policies surrounding public transport in South Africa were reviewed to provide a foundation for the study's analysis.

Chapter 3: Research Methodology

Chapter 3 detailed the research design and methodology that guided data collection from participants, including PRASA officials, government representatives, community leaders, and commuters. This chapter outlined the sampling procedures, data collection instruments, and analysis methods used to understand the challenges and potential solutions for railway recovery in the Cape Town central line context.

Chapter 4: Findings and Discussion

This chapter presented the findings and discussed s them in depth concerning the research objectives and questions. The chapter drew connections to the literature reviewed in Chapter 2, comparing the findings with existing studies and frameworks on public transport recovery. The findings were discussed thematically, highlighting perceptions into the barriers and opportunities involved in recovering the central line.

Chapter 5: Conclusion and Recommendations

Chapter 5 provided the conclusions and recommendations derived from the research. It summarized the main findings for each research question and discussed their implications for railway recovery efforts in Cape Town. Based on these conclusions, the chapter offered recommendations for PRASA and policymakers on strategies to overcome challenges in railway recovery, particularly in the context of the central line. The study's limitations and suggestions for further research to explore railway infrastructure resilience and public transport sustainability were also addressed.

1.11 Summary

The chapter provided an overview and background of the study on PRASA's Cape Town central line recovery. The study's problem statement, research goals, and guiding questions were laid out and discussed. The rationale behind conducting this study was articulated, with an emphasis of how it advanced our understanding of the resilience and recovery of railway infrastructure. A concise summary of each chapter's structure was supplied to set the scene for the rest of the research study. The following chapter reviewed pertinent literature to examine important railway recovery issues, including the study's theoretical framework. The next chapter provides a deep dive into the literature review to justify the study, provide a comprehensive overview of existing literature, and to understand identify gaps and contribute to the body of knowledge.

Chapter 2: Literature Review

2.1 Introduction

The first chapter provided the purpose and context of the study and explored the challenges face by the Passenger Railway Agency of South. The literature reviewed provided a comprehensive overview of the challenges and strategies for recovering the Cape Town central line, a crucial part of South Africa's railway network managed by the Passenger Rail Agency of South Africa (PRASA). The Central Line served as a primary mode of transport for thousands of Cape Town's residents, especially those from low-income communities who relied on affordable public transport for their daily commute (Aivinhenyo, 2019). Mavundla, (2019) noted that over the past few years, the line faced severe disruptions due to various socio-economic and operational challenges, that included infrastructure theft and vandalism, financial constraints, informal settlements on railway reserves, and governance issues within PRASA.

The thesis examined the academic literature and empirical studies that surrounded these issues, aiming to contextualize the challenges that affected the central line within a broader framework of railway resilience and public infrastructure recovery. Key focus areas included infrastructure degradation, socio-economic impacts on communities, the role of policy and legislation, and international case studies of similar railway recovery efforts. By exploring these themes, the literature review provided perceptions into the multi-dimensional factors that contributed to the railway recovery complexities in developing countries, particularly South Africa.

The thesis defined railway recovery and its importance within public transportation systems, then analysed the socioeconomic benefits of resilient railway infrastructure. Moreover, it discussed the primary challenges that hindered recovery efforts, such as vandalism, budget limitations, governance issues, and informal settlements. The review also examined policy frameworks relevant to railway management in South Africa and explored international case studies of railway resilience to identify potential strategies for adequate recovery. The foundation for understanding the Cape Town central line's challenges was central to the study. It supported the development of a framework for addressing these issues, contributing to a sustainable and resilient railway system for Cape Town and South Africa.

2.2 Coping Theory

According to Chowdhury (2019) the coping theory is defined as an exploration of how individuals manage stressful situations. This includes the use of a widespread of problem emotion focused strategies. The theory also highlights that effective coping strategies enhance resilience, adaptability, and psychological well-being, enabling individuals to navigate life's challenges constructively (Chowdhury, 2019). Ozcan, Bezgin and Ozden (2023) argued that railway networks are a major transit infrastructure connecting a country's transportation network. They are also a backbone for transport of goods to proximate ports, commuter transportation for workers and school children and play a crucial role in economic growth (Ozcan, Bezgin and Ozden, 2023). The coping theory was applied in the study to determine and explore how PRASA plans to overcome the challenges it faced in restoring the railway network with a particular focus on Cape Town Line.

2.3 The Legislative and Policy Framework for Railway Management in South Africa

A comprehensive legislative and policy framework governed South Africa's railway infrastructure's operations, management, and recovery. These frameworks guided issues ranging from safety, financial accountability, and governance to land use, community engagement, and sustainability. Understanding this framework was critical to evaluating PRASA's challenges and opportunities in restoring the Cape Town central line. This section explored the critical legislation and policies relevant to South Africa's rail sector and their implications for the recovery and sustainability of PRASA's services (Sakanga, Mwanaumo & Thwala, 2020).

2.3.1 Railway Safety Regulation Act, no. 16 of 2002

The Railway Safety Regulation Act provides for the legislative framework for the establishment of a Railway Safety Regulator. The Act further details the objectives, regulatory functions, management, safety standards and regulatory practices for the protection of persons, property and the environment. The Act creates an independent regulator with the power to enforce safety regulations and aims to safeguard all involved in railway operations and the environment (Republic of South Africa, 2002; Department of Transport, 2024).

The Railway Safety Regulator Act established the Railway Safety Regulator (RSR), an independent body responsible for ensuring safety in railway operations (RSR, 2023). This Act was particularly relevant to PRASA's central line recovery as it mandated strict compliance with safety standards, such as regular inspections, safety audits, and risk assessments. The Act allowed the RSR to issue safety permits, which PRASA needed to maintain and operate. However, frequent theft and vandalism, coupled with limited security funding, impacted PRASA's ability to meet these safety requirements, posing challenges to the central line's consistent operation (Ryseck & Behrens, 2022).

2.3.1.1 Implications for railway recovery on the Cape Town central route

The legislative and policy framework for railway management in South Africa outlined PRASA's responsibilities, safety standards, financial accountability requirements, and sustainable land use guidelines. However, while these frameworks support PRASA's mandate, implementation challenges, financial constraints, and coordination issues with local authorities hindered practical recovery efforts on the central line.

Strengthening compliance with these legislative mandates and integrating policy recommendations from the National Rail Policy helped PRASA navigate its recovery challenges. Addressing governance issues within PRASA and enhancing collaboration with municipal authorities further streamlined efforts to address informal settlements, improve safety, and ensure sustainable railway infrastructure. By aligning PRASA's strategies with these legislative and policy frameworks, South Africa worked towards building more resilient, sustainable rail network that better served its urban populations (Deel-Smith, 2022).

2.3.2 National Development Strategy and Institutional Support

South Africa's National Development Plan (NDP), led by the Department of Transport, establishes a long-term vision for developing sustainable, inclusive transportation infrastructure. The NDP is instrumental in guiding efforts to address the transport sector's social, economic, and environmental challenges, with specific focus areas that include railway recovery and enhancement (Deel-Smith, 2022).

2.3.2.1 National Development Plan (NDP) and Railway Recovery

According to the National Planning Commission (National Development Plan, 2011) South Africa's National Development Plan (NDP) acknowledged the decline in both freight and commuter rail services. It further emphasized the need for infrastructure investments, including rehabilitation of railway networks to boost economic growth and achieve development goals. Moreover, the NDP seeks to enhance efficient and reliable public transportation, including rail networks, and accessibility and reduce reliance on private vehicles.

The NDP identified rail as a cornerstone of South Africa's public transport system, calling for substantial investments to modernize and expand railway networks to meet growing urban demand and support economic development (Marquette & Peiffer, 2022). It highlighted the importance of efficient public transportation in reducing road congestion, lowering emissions, and improving access to economic opportunities, particularly for low-income communities (South Africa, 2012). The NDP's objectives were critical for the Cape Town central line, as improved railway services addressed current commuting challenges, reduced socio-economic disparities, and supported sustainable urban growth (Blumenfeld et al., 2019).

The NDP also prioritized safety, affordability, and integration within the transport system, directing PRASA and the Department of Transport to collaborate in achieving these goals. This vision aligned with the *National Rail Policy White Paper (Department of Transport, 2022)*, emphasizing infrastructure upgrades, technological integration, and public-private partnerships to enhance the rail sector's sustainability and resilience (Department of Transport, 2023).

2.3.2.2 Department of Transport role and policy support

According to Railway Africa (2025), the Department of Transport (DoT) has embarked on a drive for modernizing and refurbishing the commuter rail network, including the Mabopane Line in Tshwane and the Central Line in Cape Town. The focus is to expand the national rural and municipal road rehabilitation and maintenance programme using labour intensive methods and implementation of strategic infrastructure projects through the approval of credit enhancing instruments, provision of bulk infrastructure, and speedy processing of water use licenses, environmental impact assessments and township establishment (Railway Africa, 2025). Moreover, the DoT aims to adapt the infrastructure procurement framework to enable public-private partnerships and unlock financing to support rehabilitation of railway and transport infrastructure.

The transport department implemented the NDP’s transport-related goals through policy oversight, regulatory enforcement, and strategic planning. The department was pivotal in coordinating infrastructure investments, setting safety standards, and supporting PRASA’s efforts to modernize railway infrastructure (Department of Transport, 2023). Under the National Land Transport Act and the Railway Safety Regulator Act, the department enforced safety and operational standards to ensure that PRASA’s services aligned with national objectives of safe and efficient public transportation (RSR, 2023)

The department’s support was crucial in securing funding for large-scale projects under the NDP, such as restoring the Cape Town central line. By prioritizing projects aligned with the NDP, the transport department allocated resources toward expanding rail infrastructure, improving service quality, and promoting accessible public transport options (Treasury, 2023). Additionally, through the *Infrastructure Development Act*, the department helped designate Strategic Integrated Projects (SIPs) that expedited rail project approvals and fast-track development, enabling PRASA to overcome bureaucratic delays (Malongwe, 2018).

2.3.2.3 Implications for Railway Recovery

The National Development Plan and the Department of Transport's policies and strategic oversight formed a vital support system for PRASA's efforts to recover and enhance the Cape Town central line. The NDP's emphasis on integrated, accessible, and sustainable transport aligned with PRASA's mandate to provide reliable, affordable rail services to alleviate urban transport challenges and support economic inclusion. However, achieving these objectives required continued interdepartmental coordination, adequate funding, and effective governance reforms within PRASA to realize the vision of a modern, resilient rail network.

By aligning PRASA's recovery strategies with the NDP's long-term objectives and leveraging the Department of Transport's support, South Africa worked towards a cohesive transport system that met the needs of both commuters and the broader economy (Tucho, 2022).

2.4 The Key Challenges Facing the Railway Network hindering the Railway Recovery Process

Railway recovery, particularly in developing countries like South Africa, was hindered by multiple interrelated challenges. PRASA's Cape Town central line challenges included infrastructure theft and vandalism, financial constraints, informal settlements along railway reserves, and governance and organizational issues within PRASA. Each factor exacerbated the difficulties in restoring efficient, reliable, safe railway services. This section explored these critical challenges in detail, drawing on existing literature to understand their causes, effects, and implications for railway recovery.

2.4.1 Infrastructure Theft and Vandalism

Ramuhulu & Chiranga (2018) affirmed that infrastructure theft and vandalism were some of the most pressing challenges that affected the recovery and sustainability of South Africa's railway systems, especially in urban areas where rail infrastructure was easily accessible and often inadequately protected. These activities, primarily involved the theft of copper cables, rail tracks, and signalling equipment, which had devastating effects on railway operations, thus resulting in service disruptions, increased maintenance costs, and significant safety hazards (Ramuhulu & Chiranga, 2018). In the context of PRASA's Cape Town central line, infrastructure theft and vandalism contributed to service instability and prolonged closure of critical sections of the line, which negatively impacted commuters who depended on affordable public transport (Gregson-Green, 2018).

2.4.1.1 Causes and Motives Behind Infrastructure Theft and Vandalism

The underlying causes of infrastructure theft and vandalism in South Africa's rail sector were complex and multi-dimensional, often linked to socio-economic conditions such as high unemployment, poverty, and inequality. Many individuals involved in theft and vandalism perceived these activities as a means of economic survival in a context where legitimate employment opportunities were scarce (Ikejemba & Schuur, 2018). The high demand for copper and metal on the black market further incentivized theft, as copper cables stolen from railway systems were quickly sold to scrap metal dealers at substantial prices. This illegal trade in stolen metal grew into a lucrative business, with the transport and energy sectors suffering billions of rand in losses annually (Peters, 2023).

Mmakwena (2022) highlighted that it was evident that copper theft escalated due to weak regulatory measures, insufficient law enforcement, and gaps in the criminal justice system linked to poor conviction of offenders (Mmakwena, 2022). Although the South African government-imposed regulations on the scrap metal industry, enforcement remained a challenge as illicit trade continued domestically and internationally. For example, stolen copper was often smuggled out of the country through informal channels, which made it difficult for law enforcement agencies to trace and penalize offenders (Samkezi, 2021). The profitability of stolen infrastructure components and limited economic opportunities made copper theft a persistent and pervasive problem in South Africa's rail sector (Hlatshwayo, 2022).

2.4.1.2 Impact on Railway Operations and Safety

Janowiec and Kula (2023) mentioned that the impact of infrastructure theft and vandalism on railway operations profoundly affected the reliability and efficiency of services and the safety of commuters and railway employees. When key components such as signalling cables or electrical wiring were stolen or damaged, train services were forced to operate at reduced speeds or, in some cases, altogether halt (Janowiec & Kula, 2023). This significantly reduced the capacity of the railway system to meet commuter demand, resulting in overcrowded trains, delays, and cancellations that disrupted the daily lives of passengers who relied on affordable rail services to commute to work, school, and other essential destinations (Bešinović, 2020).

The financial cost associated with these disruptions was another critical factor. PRASA, already limited by financial constraints, allocated a significant portion of its budget on infrastructure repairs and replacements, diverting resources from other essential improvements and maintenance needs. According to the PRASA Annual Report (2021), infrastructure theft had cost the agency billions of rand over recent years, contributing to service delays, rising operational costs, and a diminished capacity to restore reliable services on routes like the central line (PRASA, 2021). This financial burden exacerbated railway recovery challenges, creating cycle where limited funds hindered comprehensive repairs, and made infrastructure vulnerable to recurring theft and vandalism (de-Charmoy, 2020).

2.4.1.3 Security Challenges and Limitations

Efforts to secure railway infrastructure face significant obstacles, primarily due to the extensive geographic scope of South Africa's rail networks and PRASA's limited capacity to deploy adequate security measures. According to the South African Police Masuku & Motlalekgosi (2022) revealed that protecting rail infrastructure across thousands of kilometres was challenge, especially in remote or high-crime areas with frequent theft. Law enforcement presence was minimal (Masuku & Motlalekgosi, 2022). PRASA had attempted various security interventions, including deploying security personnel, installing CCTV cameras, and fencing along railway lines. However, these measures proved to be insufficient against the scale and persistence of theft and vandalism (Kuzbetsov, Artur & Szulc, 2023).

Moreover, budget limitations further restrict PRASA's ability to enhance security. With limited resources, PRASA was unable to consistently fund advanced security technologies, such as alarm systems or real-time monitoring solutions that detected and deterred theft more effectively (Venter et al., 2020). Security personnel, while crucial, were often outnumbered and unable to patrol the full extent of the rail network, leaving large sections vulnerable to theft. According to Bešinović (2020), PRASA's reliance on outsourced security services introduced accountability issues, as private security providers did not adhere to the same standards and protocols required for adequate infrastructure protection.

2.4.1.4 Social Implications and Community Involvement

The prevalence of infrastructure theft and vandalism was also a symptom of deeper social issues within communities adjacent to railway lines (Geels, 2020). In many cases, individuals involved in theft and vandalism emanated from impoverished backgrounds, and the lack of local economic opportunities contributed to a sense of disenfranchisement, leading to destructive actions against public assets (Kuzbetsov et al., 2023). Engaging local communities as stakeholders in railway security was observed as a promising approach to reducing vandalism (Geels, 2020). Studies suggested that community-based programs, educated residents about the importance of rail infrastructure and involved them in security efforts, that fostered a sense of collective ownership and responsibility (Geels, 2022).

International examples, such as community engagement initiatives in India's railway security efforts, demonstrated that partnerships between rail agencies and local communities reduced vandalism and created a safer environment for railway operations (Dipanjan Nag, Goswami & Bharule, 2019). Implementing similar initiatives in South Africa presented opportunities for PRASA to address infrastructure theft through collaborating with residents in high-risk areas. Community involvement transformed public perceptions of rail infrastructure, shifting it from being perceived as an external resource to a valuable community asset (Bešinović, 2020).

2.4.1.5 Policy and Legal Responses to Curb Theft

Legal and policy measures to combat infrastructure theft and vandalism in South Africa included tighter regulations on the scrap metal industry, increased offender penalties, and collaborations between PRASA, law enforcement, and municipal authorities (Janowiec & Kula, 2023). Despite these efforts, enforcement remained a significant challenge, as the criminal networks involved in copper theft were well-organized and complex to dismantle. Additionally, prosecuting offenders proved difficult due to gaps in the criminal justice system, with many cases delayed or dismissed due to insufficient evidence or procedural challenges (Janowiec & Kula, 2023).

There was a need for coordinated legislative action that strengthened existing regulations on the scrap metal trade and enhances penalties for infrastructure theft to address these issues (Dipanjan Nag et al., 2019). Furthermore, strengthening collaboration between PRASA, the South African Police Service, and judicial authorities was essential to create effective deterrent and streamline the prosecution of offenders (Dipanjan Nag et al., 2019). According to Gregson-Green (2018), public awareness campaigns altered the attitudes and perceptions toward railway infrastructure, raised awareness about theft and vandalism's societal and economic impacts, and fostered public support for stronger legal protections.

2.4.2 Financial Constraints and Budget Limitations

According to Kriel (2022), financial constraints were a critical challenge that faced South Africa’s railway infrastructure recovery, particularly for the Passenger Rail Agency of South Africa (PRASA) in its efforts to restore the Cape Town central line (Kriel, 2022). Adequate funding was essential for infrastructure maintenance, security enhancements, and comprehensive recovery operations. However, PRASA faced significant budget limitations due to restricted government funding, inefficiencies in financial management, and broader economic constraints within the country. These financial challenges impacted PRASA’s ability to respond effectively to infrastructure degradation, theft, and vandalism, further complicating the complex task of restoring and maintaining reliable rail services (Kriel, 2022).

2.4.2.1 Government Funding Constraints

PRASA relied heavily on government funding to support its operations as a state-owned entity, with limited revenue generated from ticket sales and other sources (PRASA, 2021). However, South Africa's government faced fiscal challenges in recent years, primarily due to slow economic growth, high unemployment, and increasing demands on public resources (Thokoa, Nadioo & Tessie, 2020). These financial pressures constrained budgets for state-owned enterprises, including PRASA, and limited the government's capacity to provide sufficient funding for railway infrastructure (PRASA, 2021).

The inadequate allocation of funds directly impacted PRASA's ability to maintain infrastructure and address the escalating issues of theft and vandalism on the central line (PRASA, 2021). According to PRASA's 2021 Annual Report, financial constraints delayed crucial repairs and upgrades, leading to further degradation of railway assets and increased operational costs. The limited budget hindered PRASA's efforts to improve security along the central line, leaving critical sections of the rail network vulnerable to repeated theft and damage (Nyeadi, 2018).

2.4.2.2 Cost Implications of Infrastructure Repairs and Security Enhancements

Villa (2023) observed that the cost of repairing vandalized and stolen infrastructure was substantial, burdening PRASA's already limited resources. Each cable theft incident, track damage, or facility vandalism required significant funds for repairs or replacements. For example, replacing copper cables, installing new security measures, and restoring signalling equipment was expensive and a time-consuming process that required substantial financial investments (Nyeadi, 2018). PRASA's inability to maintain a consistent budget for these essential activities resulted in a vicious cycle where limited financial resources lead to inadequate repairs, making infrastructure vulnerable to further theft and damage (Villa, 2023).

Furthermore, the financial strain extended beyond repairs, including the cost of deploying security personnel and surveillance systems across the rail network (PRASA, 2021). The high cost of security technologies, such as CCTV systems, fencing, and real-time monitoring solutions, often exceeded PRASA's budget capacity, limiting the agency's ability to secure the infrastructure effectively (Kuzbetsov et al., 2023). Moreover, security personnel, though necessary, also added to ongoing operational costs that PRASA struggled to sustain. As a result, the financial burden of theft and vandalism became cyclical, further exacerbating the challenges of railway recovery (Strauss, 2019).

2.4.2.3 Inefficiencies and Financial Mismanagement

In addition to external financial constraints, PRASA faced internal inefficiencies and financial mismanagement, further strained its resources. Over the years, PRASA was plagued by corruption, wasteful expenditure, and poor financial oversight, which hindered its capacity to utilize available funds effectively. Allegations of financial mismanagement within PRASA led to public mistrust and reduced investor confidence, complicating efforts to secure additional funding through alternative channels such as loans or partnerships (Sithomola & Maluleke, 2024)

The Auditor-General’s Report (2024) on PRASA highlighted significant inefficiencies, including unspent budgets and delayed procurement processes, which contributed to the underutilization of allocated funds for critical infrastructure projects (Auditor-General, 2024). These inefficiencies directly impacted PRASA’s recovery efforts, as security, repairs, and maintenance funds were often delayed or misallocated. Financial mismanagement within PRASA hampered its recovery efforts and limited its ability to attract external investment and potential partnerships that provided additional resources for infrastructure upgrades and recovery operations (Nyeadi, 2018).

2.4.2.4 Limited Opportunities for Alternative Funding

In many countries, public transport agencies supplemented government funding with alternative sources, such as public-private partnerships (PPPs), donor funding, or commercial revenue streams. However, PRASA faced challenges of leveraging such options due to regulatory restrictions, limited investor interest, and concerns about governance and accountability (PRASA, 2021). Public-private partnerships, for example, proved beneficial in other regions, where private investment has supported infrastructure improvements, technology upgrades, and maintenance operations. However, in South Africa, the regulatory and institutional environment has made it difficult for PRASA to attract private sector participation effectively (PRASA, 2021).

International examples showed that private sector involvement brought valuable expertise and financial resources to infrastructure recovery. For instance, Brazil successfully implemented PPPs in its rail sector, which provided funding and technical expertise to support rail expansion and modernization (Kriel, 2022). Adopting a similar approach potentially helped PRASA secure the resources it needed for comprehensive recovery. However, governance, transparency, and financial accountability would be addressed to attract private investment and build long-term partnerships (Dipanjan Nag et al., 2019).

2.4.3 Governance and Organizational Challenges

Governance and organizational issues within the Passenger Rail Agency of South Africa (PRASA) posed significant obstacles to the recovery of the Cape Town central line and the broader rail network. PRASA faced ongoing challenges related to corruption, mismanagement, lack of accountability, and inefficiencies, which hindered its ability to deliver reliable and effective rail services (Mavundla, 2019). These governance issues exacerbated other challenges, such as financial constraints and infrastructure theft, by impeding the organization’s capacity to respond proactively and efficiently to operational and strategic needs. In particular, the instability within PRASA’s leadership and the lack of coherent management practices significantly slowed recovery efforts on the central line, preventing PRASA from effectively utilizing resources and coordinating with other stakeholders to address critical infrastructure issues (Auditor-General, 2024).

2.4.3.1 Corruption and Financial Mismanagement

Corruption has widely reported as a pervasive issue within PRASA, leading to misallocating funds and undermining public trust. Over the years, allegations of corrupt practices, including procurement fraud, tainted PRASA’s reputation, eroded public confidence, and hindered organizational effectiveness (Makoti & Odeku, 2024). According to Villa (2023), corruption within state-owned enterprises like PRASA drained resources and diverted funds away from essential projects, impeding infrastructure recovery. This misuse of funds left PRASA unable to invest adequately in maintenance, security, and technology upgrades necessary for efficient railway recovery and sustainability.

The Public Protector’s report on PRASA revealed that billions of rand were misappropriated through inflated contracts and irregular expenditure, further intensifying the financial challenges faced by the organization (Makoti & Odeku, 2024). As a result, funds that were allocated toward critical recovery projects on the central line were lost, delaying the restoration of safe and reliable services. Furthermore, financial mismanagement led to poor budget oversight and inefficient allocation of resources, hindering PRASA’s ability to plan effectively for infrastructure recovery and maintenance (Auditor-General, 2024).

2.4.3.2 Leadership Instability and Lack of Accountability

PRASA has experienced frequent changes in its executive leadership, leading to instability and lack of continuity in its governance structures. This leadership turnover resulted in a lack of strategic direction and weakened accountability within the organization, contributing to operational inefficiencies and inconsistent policy implementation (PRASA, 2021). According to the South African Department of Transport, PRASA saw multiple board reshuffles and leadership changes over the past decade, with each new administration implementing its agenda, often disregarding previous recovery efforts and strategic initiatives (Hlatshwayo, 2022)

The lack of stable leadership affected decision-making processes and limited PRASA's ability to establish and follow through on long-term recovery plans. Frequent leadership changes created a culture of short-term focus, where executives were incentivized to pursue visible, quick fixes rather than sustainable, long-term solutions for railway recovery (Villa, 2023). This lack of continuity impeded PRASA's capacity to effectively address issues on the central line, as each new executive team often changed priorities, leaving critical recovery projects unfinished or delayed (Blumenfeld et al., 2019).

2.4.3.3 Ineffective Project Management and Operational Inefficiencies

PRASA's internal management structures has been criticized for inefficiency, particularly in project management. PRASA repeatedly failed to complete critical infrastructure projects on time and within budget due to ineffective project planning, oversight, and resource allocation (Auditor-General, 2024). This inefficiency directly impacted the central line's recovery, as delays and cost overruns prevented the timely implementation of necessary repairs, upgrades, and security measures.

One of the significant operational inefficiencies within PRASA was the need for standardized processes and transparent accountability mechanisms for project execution. This lack of structure led to misaligned priorities, where urgent recovery projects were delayed in favour of other less critical initiatives. Venter (2019) argued that the absence of clear accountability structures within PRASA resulted in delayed decision-making, ineffective supervision, and a lack of responsibility when projects failed to meet their objectives. For instance, incomplete maintenance work and delayed infrastructure upgrades were frequent issues that reduced service quality and eroded public confidence in PRASA's ability to manage rail infrastructure effectively (Dipanjan Nag et al., 2019).

2.4.3.4 Lack of Stakeholder Coordination and Community Engagement

Effective railway recovery required coordinated efforts across multiple stakeholders, including PRASA, local government, law enforcement, and the communities the railway serves. However, PRASA struggled to establish collaborative relationships with key stakeholders, leading to fragmented and poorly coordinated recovery efforts. For instance, the issue of informal settlements along the central line required a joint approach involving PRASA, municipal authorities, and housing departments to address both the infrastructural and socio-economic aspects of the problem. However, weak inter-agency collaboration prevented a unified response, resulting in stalled recovery projects and persistent safety risks for residents and commuters (Mnukwa, 2020).

Additionally, PRASA has been criticized for lacking engagement with local communities, contributing to a disconnect between the organization and the public it serves. Research suggested that community engagement was critical in reducing infrastructure theft and vandalism, as residents who felt connected to railway infrastructure were more likely to support its preservation (Mavundla, 2019). However, PRASA's limited community engagement efforts made it challenging to foster public ownership of the railway system, leading to a lack of cooperation from residents and an increased incidence of theft and vandalism (PRASA, 2021).

2.4.3.5 Governance Reforms and Potential Solutions

Addressing the governance and organizational challenges within PRASA required a comprehensive reform strategy that prioritizes transparency, accountability, and efficiency. One approach was establishing more robust governance frameworks within PRASA, including more explicit accountability structures for executive leadership and project management teams. Enhanced oversight mechanisms, such as independent audits and performance evaluations, helped monitor and assess the effectiveness of PRASA's recovery efforts, ensuring that funds were used appropriately and projects were completed on time (Auditor-General, 2024).

Anti-corruption initiatives, including stricter procurement processes and improved financial oversight, were also essential to curbing misuse of resources within PRASA. Implementing a robust anti-corruption framework could enhanced public confidence in the agency's management practices and attracted additional funding sources by demonstrating a commitment to ethical governance (Dipanjan Nag et al., 2019). According to Kohler & Dimancesco (2020), implementing transparent procurement practices and fostering a culture of accountability within public institutions were vital strategies for reducing corruption and improving service delivery.

To address leadership instability, the government established fixed-term appointments for PRASA's executive team and board members, providing stability and continuity in management. Fixed terms helped reduce leadership turnover, allowing executives to focus on implementing long-term strategic goals and recovery plans (Hlatshwayo, 2022). In addition, adopting a participatory approach to community engagement helped PRASA foster a sense of public ownership over railway infrastructure, which in turn reduced vandalism and encourage community support for recovery efforts (Kohler & Dimancesco, 2020).

2.4.4 Corruption

Corruption has been pervasive in South Africa's public sector, particularly within state-owned enterprises (SOEs) like PRASA. Corruption undermined governance, wasted resources, and eroded public confidence, severely impacting railway recovery efforts and the broader functionality of PRASA's services. Systemic corruption within PRASA led to financial mismanagement, resource misallocation, and operational inefficiencies that hindered the restoration and maintenance of critical railway infrastructure, such as the Cape Town central line (Kohler & Dimancesco, 2020). The effects of corruption were evident in multiple aspects of PRASA's operations, from inflated contracts and procurement fraud to weakened financial oversight, making corruption a critical barrier to the recovery and sustainability of South Africa's rail systems (Enwereji & Uwizeyimana, 2019).

2.4.4.1 Impact of Corruption on Railway Recovery

Corruption substantially impacted PRASA's ability to recover and maintain critical infrastructure effectively. Funds that were allocated to essential recovery activities, such as security upgrades, infrastructure repairs, and maintenance, were frequently lost to corrupt practices, leaving PRASA under-resourced and unable to meet its operational needs (Auditor-General, 2024). For instance, the resources lost through corrupt procurement contracts would be invested in securing rail tracks against theft and vandalism, addressing informal settlements along railway reserves, or ensuring that necessary repairs were carried out promptly.

The financial mismanagement from corruption also created inefficiencies in project implementation, leading to delays, cost overruns, and substandard work. According to Sithomola and Maluleke (2019), corruption often resulted in incomplete or poor-quality infrastructure projects that failed to meet safety and operational standards. This outcome mainly damaged the central line, where compromised infrastructure exacerbated service disruptions and created safety hazards for commuters. Furthermore, the need to repeatedly fix corrupted projects drained PRASA's budget, creating a cycle where financial resources were continuously wasted on rectifying the effects of corruption rather than progressing toward sustainable recovery (Mkhabele, 2018).

2.4.4.2 Regulatory and Institutional Responses to Combat Corruption

Addressing corruption within PRASA required a many-sided approach involving stringent regulatory measures, improved oversight, and a commitment to transparency and accountability. The South African government has addressed corruption in state-owned enterprises by implementing anti-corruption policies, stricter procurement regulations, and regular audits by entities like the Auditor-General's Office (Thokoa et al., 2020). In addition, the Special Investigating Unit (SIU) was tasked with probing fraud cases within PRASA, aiming to hold officials accountable and recover funds lost to corruption (Auditor-General, 2024).

2.4.4.3 Lessons from International Examples

International case studies indicated that successful anti-corruption strategies in public transport agencies relied on a combination of regulatory frameworks, organizational transparency, and public accountability. For example, the anti-corruption initiatives implemented in Brazil's transport sector, such as rigorous procurement practices and public reporting requirements, helped reduce corruption and improve service delivery (Villa, 2023).

2.5 Effects of Key Challenges on Social and Economic Impacts, and Recovery Process

2.5.1 Socio-Economic Impacts of Railway Service Disruptions

The disruptions in railway services on PRASA's Cape Town central line have profound socio-economic implications for the communities reliant on affordable and reliable public transport. As the railway service falters due to infrastructure theft, financial limitations, informal settlements, and governance challenges, the impact extended beyond transportation, affecting economic productivity, social mobility, and the environment. These disruptions exacerbated inequalities by limiting access to affordable transport, increasing the cost of commuting, and contributing to broader economic inefficiencies (Mugari & Obioha, 2024).

2.5.1.1 Social Impacts on Society

The social impacts of railway service disruptions were particularly severe for vulnerable and marginalized communities. Many individuals in these communities depend on affordable rail services to access essential services, including healthcare, education, and employment opportunities. When these services were disrupted, access to essential services became challenging, disproportionately affecting low-income households and increasing social inequality (Dipanjan Nag et al., 2019). As affordable public transport becomes less accessible, some commuters had to forgo opportunities for education or employment, further entrenching cycles of poverty and inequality.

2.5.1.2 Informal Settlements on Railway Reserves

The presence of informal settlements on railway reserves became a critical challenge in South Africa’s railway recovery efforts, particularly for PRASA’s Cape Town central line. Informal settlements, consisting of makeshift housing built by residents that lacked access to affordable formal housing, grew significantly in recent years due to urbanization, poverty, and housing shortages (Mathiba, 2019). These settlements were often located on or near railway infrastructure, creating multiple safety risks, operational challenges, and social complexities that complicated the recovery and maintenance of railway lines. In the case of the central line, informal settlements obstructed critical infrastructure, prevented maintenance work, and exacerbated safety risks for residents and commuters (Kaalipour & Dovey, 2019). This made it increasingly difficult for PRASA to restore reliable services (Kamalipour & Dovey, 2019).

2.5.1.2.1 Socio-Economic Drivers of Informal Settlements

Various socio-economic factors, including rapid urbanization, unemployment, and the lack of affordable housing, drove the proliferation of informal settlements along railway lines. According to Kamalipour (2019), South Africa’s cities experienced significant population growth as individuals migrate from rural areas for better employment opportunities. However, urban centres such as Cape Town struggled to keep up with the demand for affordable housing, forcing many low-income individuals and families to settle informally on available land, including railway reserves (Brandau, 2021). The residents of these settlements were often among the most vulnerable populations, with limited economic means, few formal employment opportunities, and inadequate access to public services (Brandau, 2021).

For individuals living in informal settlements, proximity to railway infrastructure provided access to public transport, reduced travel costs and access to job opportunities in urban areas (Mathiba, 2019). However, this proximity posed significant risks, as informal settlements were not designed to accommodate railway operations' infrastructure and safety needs. The lack of access to formal housing in Cape Town reflected broader issues within South Africa’s housing policy and urban planning strategies, where government efforts to address housing shortages did not meet the needs of low-income populations (Mathiba, 2019).

2.5.1.2.2 Safety Risks and Operational Challenges

Informal settlements on railway reserves presented severe safety risks for residents living near the tracks and railway operations. Ngwenya (2022) highlights that the informal nature of these settlements often meant minimal safety measures were in place, leaving residents exposed to the dangers of passing trains and electrical infrastructure (Ngwenya, 2022). Incidents of accidental injuries and fatalities among residents were common, mainly where children played near active railway lines and where adults used the tracks as shortcuts to other areas (Brandau, 2021). PRASA faced additional challenges in ensuring commuter safety when informal settlements encroach on the railway line, as unauthorized access points and informal crossings increase the likelihood of accidents (Brandau, 2021).

The encroachment of informal settlements also restricted PRASA's ability to access, repair, and maintain railway infrastructure. According to Ngwenya (2022), maintenance teams often struggled to perform essential repairs and inspections on tracks, signalling equipment, and electrical wiring when settlements obstruct these areas. This access issue delayed maintenance efforts, leading to further deterioration of the infrastructure and increasing the likelihood of service disruptions (Ngwenya, 2022). As PRASA grappled with limited financial and operational resources, the additional burden of navigating informal settlements further complicated its ability to restore and maintain reliable services on the central line (PRASA, 2021).

2.5.1.2.3 Impacts on Infrastructure and Service Delivery

The presence of informal settlements on railway reserves had direct implications for infrastructure resilience and service delivery (Masiya, Davids & Mangai, 2019). Encroachments by informal settlements expose railway infrastructure to damage and degradation, as structures and pathways built by residents interfered with tracks and signalling systems. In addition, waste generated by these communities, coupled with inadequate sanitation and drainage facilities, led to pollution and erosion along the tracks, exacerbating wear and tear on the railway infrastructure (Masiya, Davids & Mangai, 2019).

Moreover, the informal settlements contributed to service delivery challenges for PRASA, as housing structures on railway reserves limited train speed and forced operators to adopt more cautious approaches in these areas. This results in delays, reduced service efficiency, and increased operational costs. Kamalipour (2019) argued that informal settlements disrupted rail scheduling and impacted service reliability, negatively affecting commuters who relied on timely and accessible public transport. The accumulation of these issues created a complex environment that made it challenging for PRASA to fulfil its mandate of providing safe, efficient, and reliable rail services (Kalalipour, 2019).

2.5.1.2.4 Policy and Legislative Gaps

Addressing the issue of informal settlements on railway reserves required a coordinated policy response that involved multiple government agencies, including PRASA, local municipalities, and the Department of Human Settlements. However, existing housing and land-use policies in South Africa struggled to effectively manage the growth of informal settlements near critical infrastructure, revealing gaps in policy implementation and inter-agency collaboration (Lubasi, 2018). For example, while South Africa's National Land Transport Act and other regulatory frameworks mandate PRASA to secure railway reserves, these policies often lacked the enforcement mechanisms necessary to prevent encroachments or support the relocation of residents (Strauss, 2019).

In cases where relocation initiatives were attempted, resistance from residents and logistical challenges stalled progress. According to Lubasi (2018), many residents were unwilling to relocate due to a lack of alternative housing options and a deep-seated mistrust of government promises regarding resettlement. This lack of viable relocation options was a critical policy gap limiting PRASA's ability to address encroachment on railway reserves effectively. Poor coordination between PRASA and municipal authorities hindered efforts to monitor and prevent new encroachments, as responsibilities were often divided between government entities with limited cooperation (PRASA, 2021).

2.5.1.3 Environmental Impacts of Rail Service Disruptions

The environmental impacts of railway service disruptions were equally concerning. Rail transport was considered a more sustainable mode of public transportation due to its lower greenhouse gas emissions per passenger compared to road-based modes such as buses, taxis, and private cars (Ghaemi, Zilko, Yan, Cats, Kurowicka & Goverde, 2018). When rail services on the central line were disrupted, many commuters were forced to switch to road transport, leading to increased traffic congestion and higher carbon emissions. These shifts undermined Cape Town's environmental sustainability goals and contributed to poor air quality, posing health risks to the city's residents (Madonsela, 2019).

2.5.2 Economic Impact of Railway Service Disruptions

The financial limitations PRASA faced affected the agency's operational capacity and had broader socio-economic implications. Limited funding for railway recovery reduced service reliability, affecting commuters who depend on affordable public transport. As the central line continued to experience disruptions and delays due to vandalism and inadequate repairs, many commuters were forced to seek alternative, often more expensive, modes of transport, increasing their financial burden (Sithomola & Maluleke, 2024). Malongwe (2018) noted that this additional cost impacted low-income households the most, as limited access to affordable rail services contributed to rising transport expenses and further entrenched socio-economic inequalities (Malongwe, 2018).

2.6 Recovery Process Impacts of Railway Service Disruptions

2.6.1 Definition of Railway Recovery

According to Maboa (2019), railway recovery can be defined as restoring railway infrastructure's functionality, safety, and reliability following disruptions due to various factors, including natural degradation, vandalism, or socio-economic pressures (Maboa, 2019). Recovery entailed a comprehensive approach addressing physical restoration and systemic improvements to ensure long-term resilience. In PRASA’s Cape Town central line context, railway recovery went beyond merely repairing tracks and stations. Mavundla (2019) asserted that railway recovery addressed the underlying social, economic, and governance challenges that have contributed to repeated disruptions (Mavundla, 2019). Additionally, railway recovery aimed to restore service to a state that effectively met the needs of the commuter population, ensuring affordable and accessible public transport, particularly for low-income communities in Cape Town.

2.6.2 Factors Impacting Railway Recovery

Several interrelated factors impacted the railway recovery, especially in developing countries where public transport systems faced unique challenges. In South Africa, infrastructure theft, financial constraints, inadequate governance, and socio-political pressures were vital factors influencing recovery (Maboa, 2019). Infrastructure theft and vandalism were particularly prevalent, driven by high unemployment rates and socio-economic challenges. Kheyroddin & Ghaderi (2022) agreed that such activities damaged the railway and led to safety risks and service delays, making a recovery costly and complex (Kheyroddin & Ghaderi, 2022).

Hlatshwayo (2022) also noted that financial limitations further complicated the process, as funding for railway repairs and upgrades was often constrained, impacting PRASA’s ability to implement comprehensive recovery measures (Hlatshwayo, 2022). Additionally, informal settlements on railway reserves added another layer of complexity to recovery efforts. These settlements, often established by low-income residents needing housing, made it difficult for PRASA to access and maintain infrastructure safely (Kamalipour & Dovey, 2019). Mnukwa (2020) stated that governance issues within PRASA, including management inefficiencies and allegations of corruption, posed significant barriers to railway recovery through undermining project planning and execution (Mnukwa, 2020).

2.6.3 Railway Recovery in Global Context

Globally, railway recovery and resilience efforts varied widely, influenced by differing economic resources, governance structures, and social conditions. In developed countries, railway systems often benefited from advanced security measures, regular maintenance, and sufficient funding, enabling swift recovery from disruptions (Bešinović, 2020). Contrary, railway recovery in developing regions faced numerous challenges related to resource limitations and socio-economic pressures. Lubasi (2018) highlighted that case studies from countries such as India, Brazil, and Kenya demonstrated that issues like theft, informal settlements, and limited budgets were common in urban rail systems serving low-income communities (Lubasi, 2018). These countries adopted various strategies to tackle these issues. These included public-private partnerships, community engagement initiatives, and technology-driven solutions to improve security and efficiency (Kriel, 2022).

Examining international cases provided valuable lessons for PRASA and the recovery of the Cape Town central line. For example, India's experience with community engagement in railway security illustrated that involving local communities reduced vandalism and theft by fostering a sense of community ownership and responsibility. Similarly, Scheba et al. (2021) noted that Brazil’s efforts in forming public-private partnerships to boost infrastructure funding helped to mitigate financial limitations (Scheba et al., 2021).

2.6.4 Railway Recovery in South African Context

In South Africa, railway recovery efforts were challenged by socio-economic and operational issues that negatively impacted PRASA’s ability to maintain and restore critical infrastructure like the Cape Town central line. Deel-Smith (2022) noted that the rail sector in South Africa had been under strain due to years of inadequate investment, aging infrastructure, and a shortage of skilled personnel (Deel-Smith, 2022). Infrastructure theft and vandalism, fuelled by unemployment and poverty, exacerbated the deterioration of railway services, leaving lines like the central line vulnerable to frequent disruptions (IOL, 2023). Moreover, Mugari and Obioha (2024) concluded that reduced security personnel during the COVID-19 pandemic further exposed these vulnerabilities, making infrastructure more accessible to theft and vandalism (Mugari & Obioha, 2024).

Policy and regulatory frameworks in South Africa, such as the National Land Transport Act and PRASA's mandate, outlined responsibilities for managing and securing railway infrastructure. However, PRASA faced governance and accountability challenges that hindered its capacity to fulfil its mandate effectively (Deel-Smith, 2022). Kamalipour & Dovey (2019) mentioned that corruption allegations, inefficiencies, and lack of coordination between PRASA and local municipalities further complicated efforts to address issues like informal settlements along railway reserves (Kamalipour & Dovey, 2019).

Despite these challenges, the South African government recognized the importance of revitalizing public transport systems and allocated funds for railway upgrades and infrastructure security. Nonetheless, the gap between policy goals and implementation remained a significant obstacle to effective recovery. In particular, the Cape Town central line's recovery required technical and financial solutions and coordinated efforts involving community engagement and inter-departmental collaboration to address the socio-political factors impeding recovery (PRASA, 2021).

2.6.5 Key Challenges Facing Railway Recovery

Railway recovery, particularly in developing countries like South Africa, was hindered by multiple interrelated challenges. PRASA's Cape Town central line challenges included infrastructure theft and vandalism, financial constraints, informal settlements along railway reserves, and governance and organizational issues within PRASA. Each factor exacerbated the difficulties in restoring efficient, reliable, safe railway services. This section explored these critical challenges in detail, drawing on existing literature to understand their causes, effects, and implications for railway recovery.

2.7 Strategies for Railway Recovery and Resilience

The challenges facing PRASA's Cape Town central line and the broader South African rail network required a many-sided approach to recovery. Addressing infrastructure theft, financial constraints, informal settlements, governance challenges, and corruption was essential to restore reliable rail services and build long-term resilience. This section explored a range of strategies to support railway recovery and enhance the resilience of South Africa's rail infrastructure. These strategies include improved infrastructure maintenance, community engagement, sustainable funding models, governance reforms, and technology adoption.

2.7.1 Infrastructure Maintenance and Security Enhancements

Effective and regular maintenance of railway infrastructure was a cornerstone of railway recovery and resilience. Proper maintenance reduced the risk of accidents, prolonged the life of rail assets, and ensured a safe and reliable service for commuters. However, maintaining infrastructure in an environment plagued by theft and vandalism presented unique challenges. One potential solution was to enhance security measures along the railway lines, which helped prevent the theft of critical components, such as copper cables, and reduced the incidence of vandalism (Ramuhulu & Chiranga, 2018).

Security improvements included the installation of CCTV cameras, motion sensors, and fencing around vulnerable sections of the railway network. For example, anti-theft technology, such as tamper-resistant materials and sensors, proved effective in countries like the United Kingdom, where measures have significantly reduced copper theft on railways (Ambrogio, Filice, Longo & Padovano, 2022). PRASA considered similar investments in high-risk areas along the central line to deter theft and safeguard infrastructure.

2.7.2 Community Engagement and Resettlement Initiatives

Addressing the challenge of informal settlements on railway reserves required a many-sided approach that balanced infrastructure recovery needs with the socio-economic realities of residents. Kim, Newman & Jiang, 2020 stated that community engagement was essential to any potential solution involving residents in discussions about railway safety, relocation, and infrastructure needs fostered cooperation and mutual understanding. International examples, such as India's community engagement initiatives in railway safety, have shown that collaborative approaches reduced risks while improving relationships between rail authorities and local communities (Kim, Newman & Jiang, 2020).

Relocation efforts, while challenging, were essential for long-term solutions. Successful resettlement initiatives provided affordable, accessible housing alternatives close to transportation networks and job opportunities. Ensuring residents maintained their livelihoods was critical to gaining cooperation and reducing relocation resistance (Lin & Lin, 2020). This may involve partnerships with local government and housing authorities to prioritize relocation initiatives and incentivize residents to move to safer, formal housing (Lin & Lin, 2020).

Railway service disruptions on the central line had significant economic consequences for individuals and the broader economy. Many commuters, especially those from low-income communities, relied on the central line as an affordable means of transport to reach workplaces, educational institutions, and essential services in Cape Town.

When service was disrupted, these individuals faced increased transportation costs as they were forced to use more expensive modes, such as minibus taxis, which costed several times more than train fares (Enwereji & Uwizeyimana, 2019). This increased cost reduced disposable income for low-income households, exacerbating poverty and limiting economic opportunities (Havenga, Simpson, Swarts & Witthoft ., 2021)

Furthermore, disruptions in public transport negatively impacted workforce productivity. Delays, cancellations, and unreliable service affected workers' ability to reach their workplaces on time, leading to job losses, reduced work hours, and lost wages (Ambrogio, Filice, Longo & Padovano, 2022). These disruptions resulted in lower productivity and increased business operational costs, particularly in sectors where employees relied heavily on public transportation. The ripple effect of delayed commuter services strained Cape Town's Road infrastructure, increased congestion and travel time for other affected road users (Havenga et al., 2021). These economic impacts hindered the region's economic growth and reduce its productivity.

Community engagement was essential for building public support for railway recovery and reducing infrastructure theft and vandalism. When communities understood the value of railway services and felt a sense of ownership over the infrastructure, they were more likely to protect and support these assets (Blumenfeld et al., 2019). PRASA benefited from fostering more robust relationships with local communities, particularly those residing near railway lines, through involving them in recovery efforts and encouraging them to report suspicious activities.

Villa (2023) mentioned that international examples, such as India's community-based railway safety programs, demonstrated that involving residents in protecting railway infrastructure substantially reduced theft and vandalism (Villa, 2023). In South Africa, PRASA implemented community outreach programs to educate residents about the importance of railway infrastructure, raised awareness about the costs of theft and vandalism, and promoted community-led patrol initiatives.

For informal settlements on railway reserves, resettlement initiatives prioritizing affected residents' well-being and housing needs were critical. Working closely with local municipalities and the Department of Human Settlements, PRASA facilitated resettlement programs that provided residents with affordable and safe housing alternatives. According to Brandau (2021), successful resettlement required adequate support services, clear communication with residents, and the provision of amenities in new housing areas. This approach ensured that residents benefited from improved living conditions while freeing up railway reserves for maintenance and security.

2.7.3 Sustainable Funding Models and Public-Private Partnerships

To address PRASA's financial constraints, sustainable funding models and public-private partnerships (PPPs) offered viable options for supplementing government funding and ensuring continuous investment in railway infrastructure. Public-private partnerships allowed PRASA to leverage private sector resources, expertise, and technology, reducing the financial burden on the government while enhancing operational efficiency. In Brazil, for example, PPPs in the railway sector allowed the private sector to participate in infrastructure financing and management, resulting in improved rail services and increased investment (Khan, 2022).

2.7.4 Governance Reforms and Anti-Corruption Measures

Strengthening governance within PRASA was essential for improving operational efficiency and ensuring that resources were used effectively for railway recovery. Governance reforms enhanced transparency, accountability, and decision-making processes, addressing the root causes of financial mismanagement and corruption (Marquette & Peiffer, 2022). One approach was establishing independent oversight bodies to monitor PRASA's financial activities, ensuring compliance with ethical standards and minimizing opportunities for corrupt practices (Auditor-General, 2024). Adopting anti-corruption measures, such as stricter procurement controls and whistleblower protections, was also critical for fostering a culture of accountability within PRASA. For example, creating a transparent procurement system that published all tenders, and contract awards reduced corruption by providing public visibility into PRASA's operations. Additionally, PRASA established internal compliance units to review and investigate irregularities, with clear penalties for employees and contractors found guilty of unethical behaviour (Lekubu, 2019).

Governance reforms addressed leadership instability and improved PRASA's project management capabilities. By implementing fixed-term contracts for senior executives and establishing standardized project management frameworks, PRASA promoted stability within its leadership and enhanced the efficiency of its recovery projects (de-Charmoy, 2020).

2.7.5 Adoption of Technological Innovations

Investing in technological solutions helped PRASA improve service reliability, optimize resource allocation, and enhance security. Innovations in surveillance technology, such as CCTV cameras, remote monitoring, and intrusion detection systems, significantly enhanced security along the central line, reducing theft and vandalism incidents (Unhelkar, Joshi & Prasad, 2022). Real-time monitoring systems enabled

PRASA to detect unauthorized activities and respond promptly to incidents, ensuring a safer environment for infrastructure and passengers.

Additionally, digital ticketing systems streamlined revenue collection, reduced fare evasion, and improved the commuter experience. Digital ticketing was widely used in public transportation systems globally, as it facilitated efficient fare collection and minimized revenue loss (Owusu-Agyemang, Simons, Henning & Marshall, 2024). Implementing a similar system in South Africa improved revenue and offered valuable data insights into commuter patterns, allowing PRASA to plan and allocate resources more effectively.

Big data analytics and predictive maintenance technologies were required in other areas where technological innovations supported PRASA's recovery and resilience efforts. Using data analytics to monitor asset health, PRASA predicted equipment failures and optimized maintenance schedules, preventing costly breakdowns and minimizing service disruptions (Kavitha & Senbagavalli, 2023). These technologies improved efficiency, extend asset lifespan, and reduced long-term maintenance costs, making them valuable tools in a resource-constrained environment.

2.8 Summary

The chapter examined literature related to the themes and challenges of railway recovery. Key terms, including railway recovery, infrastructure resilience, and governance, were explored within global and local contexts, drawing insights from various authors. The review outlined the financial, socio-economic, and governance-related challenges faced by PRASA, including vandalism, financial mismanagement, informal settlements, and the legal and policy frameworks governing railway operations in South Africa. The literature review further explored potential strategies for mitigating these challenges, including public-private partnerships, governance reforms, and community engagement. Additionally, theoretical concepts such as coping theory, infrastructure resilience, sustainable public transport, and institutional governance were discussed. The next chapter focuses on the methodology and research approach that this study adopted.

Chapter 3: Research Methodology

3.1 Introduction

Chapter 3 provides the research methodology that provides guidance of the study from chapter one until the last chapter through several research methodological tools.

3.2 Research questions

- What were the main challenges facing the recovery of PRASA's Cape Town central line?
- How has infrastructure theft and vandalism impacted the recovery of the railway line, and what were the underlying causes of these issues?
- What was the impact of informal settlements on railway reserves on the recovery process, and how could this challenge be addressed?
- How did corruption and project management issues hinder the recovery process, and what measures could be taken to mitigate these challenges?

3.3 Research Approaches

The qualitative approach suits this study because it enables the researcher to understand the personal, institutional, and socio-economic factors influencing the central line’s recovery. Qualitative methods allow participants to express their views openly, providing rich, descriptive data that reveals underlying motivations, concerns, and potential solutions from their unique perspectives. This approach was instrumental in developing a comprehensive understanding of infrastructure challenges, security concerns, financial constraints, and community impact, which were not fully captured through quantitative measures alone (Jgehman et al., 2018).

3.4 Research Design

The study adopted a qualitative research design chosen for its ability to provide an in-depth, context-specific exploration of the complex issues surrounding the recovery of PRASA’s Cape Town central line. The case study approach was ideal for examining a single, bounded system like the Central Line. It allowed for a focused analysis of this context's unique challenges and dynamics (Jgehman, Glaser, Eisenhardt, Gioia, Langley & Corley, 2018). According to Arifin (2018), using qualitative methods, the research captured the diverse and nuanced perspectives of different stakeholder groups, offering insights beyond numerical data and delving into the lived experiences, opinions, and attitudes of those affected by the recovery process.

3.4.1 Case Study Design

The case study design allowed for a holistic examination of the Central Line within its real-world setting, capturing the interdependencies between the various elements involved in the recovery process. This design was chosen because it enabled the researcher to focus on specific events, actions, and decisions made by PRASA and other stakeholders, as well as how these impact the overall progress of the recovery. By concentrating on this single case, the study uncovered deep insights into the causes, effects, and perceptions of the challenges surrounding the central line, contributing valuable context-specific findings to railway recovery and infrastructure management (Priya, 2021).

The population size included soliciting perceptions from a random sample of affected stakeholders, deduced from some of the 880 families along the Cape Town central railway line, which were relocated by the City of Cape Town, government officials, ward councillors from wards along the Cape Town central line, PRASA employees in the Cape Town region, managers in the transport department, and commuters. The central line was not functioning fully during and after COVID-19; hence, very few commuters utilized the rail services in the area during data collection. The entity experienced operational issues that resulted in the line not operating after covid19. Additionally, PRASA lost many employees after the COVID-19 pandemic. Therefore, perceptions were mainly solicited from key affected stakeholders in government, resulting in only gathering information from a limited population size.

3.4 Sampling Design

3.5.1 Target Population/ Sample of the Study

The study was conducted in Cape Town, South Africa, specifically focusing on the central line, one of the region's most vital commuter railway lines, serving thousands of residents daily. The line’s recovery was crucial for enhancing regional mobility and supporting local economic activities. However, infrastructure degradation, theft, and informal settlements on railway reserves hindered progress. This setting provided a rich context for examining the challenges of urban railway recovery, as it reflected the socio-economic conditions of surrounding communities and the operational challenges faced by PRASA.

The population of this study included all individuals and entities involved in or affected by the recovery of the Cape Town central line. Given the scope of the study, a purposive sampling technique was used to select participants who could provide relevant insights based on their roles and experiences. The study employed a qualitative research approach, prioritizing depth of understanding over statistical generalizability.

3.5.2 Sample Frame

A sample size of 16 participants was chosen based on data saturation, ensuring no new themes or insights emerged after data collection. Participants were selected through purposive sampling, targeting key stakeholders representing diverse yet relevant perspectives within the broader population. Although the sample was small relative to identifying key participants from the affected parties, qualitative studies relied on the richness of data rather than its quantity, allowing for a comprehensive exploration of the research problem. Similar sample sizes have been effectively used in comparable qualitative studies, as supported by the literature (Vasileiou, Barnett, Thorpe & Young, 2018).

3.5.3 Sampling Method (Purposive Sampling)

This study employed a purposive sampling method to select participants, which ensured the inclusion of individuals with direct knowledge, experience, or involvement in the central line recovery. Purposive sampling was particularly suitable for qualitative research, where the aim was to gather in-depth insights from those with specific expertise or experience related to the research topic (Ames, Glenton & Lewin, 2019). Employees in PRASA officials were selected based on experience and involvement with the central line. Management and technical employees were suitable for gathering all relevant information.

Purposive sampling was chosen for this research because it prioritizes the selection of participants who can provide rich, context-specific information relevant to the study's objectives. Given the many-sided nature of the central line recovery process, including challenges in infrastructure, security, governance, and community impact, it was critical to select individuals who could speak to these varied issues (Jgehman et al., 2018). Focusing on key individuals directly affected by or responsible for different aspects of the recovery facilitates a comprehensive understanding of the factors influencing the process.

Years of experience were also considered. In terms of commuters, they were selected based on race, gender, and purpose of commuting, which was mainly for work and school. Ward councillors were selected from larger communities based on their years in the positions and knowledge of the area and community. For government officials, one manager was selected from the Department of Transport due to years of experience and direct involvement with PRASA, and one manager from the City of Cape Town was also selected based on involvement with PRASA and many years of experience.

3.5.3.1 Selection Criteria

The following criteria were applied to ensure each group was well-represented:

Direct Involvement or Impact: Participants were selected based on their direct involvement in or knowledge of the central line's recovery process. For instance, PRASA officials in decision-making or operational roles and government officials overseeing transport policies were prioritized (Dipanjan Nag et al., 2019). Diversity within Groups: In groups such as commuters and community leaders, individuals of different ages, genders, and socio-economic backgrounds were included to ensure diverse experiences and viewpoints. Willingness to Participate: Participants were also selected based on their willingness to engage in semi-structured interviews, facilitating an open exchange of insights.

3.5.4 Sample size

The sample size comprised 16 participants categorized into four groups:

- Five PRASA Officials: Key figures responsible for the recovery process's technical, operational, and strategic aspects.
- Two Government Officials: Representatives from relevant government departments, including transport and human settlements, oversee regulatory and policy aspects.
- Two Community Leaders: Local ward councillors and community representatives who understood the impacts of the railway recovery on residents.
- Seven Commuters: Regular users of the central line who experienced the disruptions firsthand and provided insights into the commuter perspective

3.5.5 Data Collection

The primary data collection method was semi-structured interviews with a purposive sample of 16 participants, representing PRASA officials, government representatives, community leaders, and commuters. Semi-structured interviews were chosen for their flexibility, allowing the researcher to guide the conversation around critical topics while providing space for participants to express their thoughts and experiences in their own words (Jgehman et al., 2018). This approach facilitated an in-depth understanding of the complex and multifaceted issues surrounding the recovery of PRASA's Cape Town central line.

3.5.5.1 Interview Process

Semi-structured interviews were conducted with a purposive sample of 16 participants to collect data, including PRASA officials, government representatives, community leaders, and commuters. Semi-structured interviews were chosen for their flexibility, allowing the researcher to guide the discussion with pre-determined questions while exploring new themes as they emerged during conversations. This approach allowed participants to discuss their experiences and views in detail, offering personal and contextually relevant insights.

The interview questions were designed to address the study's primary objectives and research questions, thus focusing on themes such as the challenges of infrastructure recovery, the effects of theft and vandalism, the impact of informal settlements, governance, and project management issues, and proposed solutions for sustainable recovery. Each interview was conducted in person or via virtual platforms, depending on participant availability and logistical considerations, ensuring a comfortable and accessible environment for participants to share their perspectives.

3.5.5.2 Audio Recording and Transcribing

With participants' consent, all interviews were audio-recorded to ensure accuracy in data capture. Audio recordings allowed the researcher to focus entirely on the conversation without being distracted by notetaking, enabling a more fluid and engaging interaction with each participant (Rutakumwa, Mugisha, Bernays, Kabunga, Tumwekwase, Mbonye & Seeley, 2020). After each interview, the recordings were transcribed verbatim to facilitate a thorough and precise analysis. Transcription provided a written record of the data, which was essential for coding and identifying recurring themes.

3.5.5.3 Field Notes

In addition to audio recordings, field notes were taken during each interview to document immediate observations, non-verbal cues, and initial impressions. Field notes provided additional context to the responses, helping to capture subtleties such as tone, pauses, or gestures that could enrich the data analysis process. These notes complemented the transcriptions, providing a fuller picture of the participant's responses and allowing the researcher to capture observations that may not be evident in the audio recordings alone (Phillippi & Lauderdale, 2018).

3.5.5.4 Data Management and Security

All interview data, including audio recordings, transcriptions, and field notes, were securely stored in a password-protected digital folder accessible only to the researcher. This measure was taken to protect participants' confidentiality and ensure data security. The researcher followed ethical guidelines to handle and store sensitive information in compliance with data protection and privacy regulations.

3.5.5.5 Data Collection Timeline

Data collection took place over approximately one month. This timeframe allowed sufficient time to schedule and conduct interviews with all selected participants, including follow-ups where necessary. The structured yet flexible timeline ensured that each interview could be conducted thoroughly and attentively while allowing preliminary analysis between interviews to identify emerging themes or areas requiring further exploration in subsequent discussions.

In summary, the data collection process involved carefully structured semi-structured interviews, complemented by audio recording, transcription, and field notes to capture a rich set of qualitative data. These methods ensured a detailed, context-sensitive understanding of the perspectives of PRASA officials, government representatives, community leaders, and commuters, providing a solid foundation for the thematic analysis presented in Chapter 4.

3.6 Research Instrument

In this study, semi-structured interviews served as the primary research instrument. Semi-structured interviews were selected because they provide a flexible yet structured approach to data collection, enabling the researcher to explore critical topics while allowing participants to elaborate on their unique perspectives. This flexibility was essential for capturing the diverse views of PRASA officials, government representatives, community leaders, and commuters, each of whom brought a distinct set of experiences and insights relevant to the recovery of the central line.

3.6.1 Interview guide development

An interview guide was developed to ensure consistency across interviews while allowing for in-depth exploration of themes as they emerged. The guide included open-ended questions designed to align with the study's objectives, focusing on areas such as:

- The main challenges and obstacles hindering the recovery process.
- The impact of infrastructure issues, theft, and vandalism on railway operations.
- The socio-economic effects of the central line's recovery on local communities.
- Governance, project management, and resource allocation within PRASA.
- Possible solutions and recommendations for sustainable recovery.

The questions were crafted to encourage participants to reflect on their experiences and views, allowing the researcher to gather detailed, descriptive data to inform a nuanced understanding of the recovery process. Additionally, follow-up questions were prepared to probe further into specific topics as needed, depending on the participant's responses.

3.6.2 Piloting the Interview

To refine the interview guide and ensure clarity, a pilot interview was conducted with a volunteer with relevant experience in public infrastructure management. This pilot test helped identify ambiguous or leading questions, allowing adjustments to enhance the instrument's effectiveness. Feedback from the pilot interview indicated that the questions were clear and relevant, and minor adjustments were made to improve flow and phrasing.

3.6.3 Data Collection Process

During data collection, the interview guide was a flexible framework, allowing the researcher to adapt questions based on each participant's role and expertise. For example, PRASA officials were asked questions about operational and strategic aspects. At the same time, commuters were encouraged to discuss how service disruptions impacted their daily routines and quality of life. This tailored approach ensured that the interview instrument remained relevant to each participant group, providing data that reflected individual and group perspectives on the recovery of the central line.

3.7 Reliability and Validity

Several strategies were implemented to enhance the reliability and validity of the data collected (Mosbah, 2024):

- Consistency Across Interviews: All participants were asked the same core questions to maintain consistency while allowing follow-up questions specific to everyone's experiences.
- Member Checking: After interviews were transcribed, participants were allowed to review and confirm their responses, ensuring accuracy and allowing them to clarify any points if necessary.
- Peer Review: The interview guide was reviewed by colleagues and advisors familiar with qualitative research and railway infrastructure recovery, who provided feedback to ensure that the questions were unbiased and aligned with the research objectives.

The semi-structured interview guide was a carefully designed research instrument facilitating rich, in-depth data collection. Its flexible design and strategies to ensure reliability and validity made it an effective tool for capturing the complex, many-sided perspectives on PRASA's central line recovery.

Ensuring reliability and validity was crucial in qualitative research, as it enhanced the credibility and trustworthiness of the findings. This study employed several strategies to maintain reliability and validity throughout the research process, from data collection to analysis (Mosbah, 2024).

Reliability in qualitative research referred to the consistency and dependability of the research findings (Coleman, 2022). The following strategies were implemented to enhance reliability in this study (Rezapour Nasrabad, 2018).

Firstly, consistency in data collection procedures involved a semi-structured interview guide was used to ensure that each participant was asked similar core questions. This consistency minimized variations in data collection and ensured that responses addressed the study's main themes while allowing for flexibility to explore unique insights from each participant. Secondly, detailed documentation and audit trail which entailed the research process was carefully documented, including interview procedures, data coding steps, and theme development. An audit trail was maintained to provide a clear record of all methodological decisions, allowing future researchers to understand and replicate the study's approach if necessary.

Thirdly, the use of NVivo Software for systematic coding entailed organizing and coding the data, which helped to maintain a consistent coding process. By having a systematic approach to categorizing and analysing the data, the reliability of the findings was enhanced, as the software helped to identify recurring patterns and themes across all interviews. Lastly, peer review entailed academic peers familiar with qualitative research methods reviewed the data analysis process, including coding and theme identification. This peer review provided additional scrutiny, helping to ensure that the coding was consistent and that the themes accurately reflected the data. Validity in qualitative research referred to the accuracy and truthfulness of the findings, ensuring that they reflect the actual experiences and views of the participants (Rezapour Nasrabad, 2018). The following strategies were implemented to enhance validity:

Member Checking: Member-checking was conducted to ensure that the findings accurately represented participants' views. Participants were provided summaries of their interview transcripts or themes derived from the data, allowing them to confirm or clarify their statements. This practice helped validate the data's accuracy and reduced the possibility of misinterpretation (Hayashi, Abib & Hoppen, 2019). Reflexivity: The researcher practiced reflexivity by keeping a reflective journal throughout the research process. Reflexivity involved documenting personal biases, assumptions, or influences that could impact data collection or analysis. By being aware of these factors, the researcher could objectively approach the data and ensure that findings were derived from the participants' perspectives rather than personal assumptions (Hayashi et al., 2019). Peer Debriefing: The researcher conducted regular debriefing sessions with colleagues and academic supervisors to discuss the research process, data analysis, and emerging themes. These discussions helped to challenge and refine interpretations, providing an external check on the validity of the findings (Rose & Johnson, 2020).

3.8 Data Analysis

The data collected through interviews were analysed using thematic analysis, which allows the researcher to identify, organize, and interpret recurring themes within the data (Lochmiller, 2021). NVivo software was employed to aid in organizing and coding data, enabling the researcher to systematically examine patterns and relationships across different participant responses. Key themes emerged around infrastructure degradation, financial constraints, security issues, community impact, and project management, each contributing to a deeper understanding of the factors affecting the recovery process. The thematic analysis also enabled the researcher to draw connections between different stakeholder perspectives, highlighting common concerns and unique viewpoints.

3.8.1 Stages of Thematic Analysis

The thematic analysis process followed six steps, as recommended by (Allsop, Chelladurai, Kimball, Marks & Hendricks, 2022):

Firstly, data familiarization which involved the analysis began with thoroughly reviewing the interview transcripts and field notes. The researcher read each transcript multiple times to fully immerse in the data, making initial observations and noting potential patterns or recurring points. This familiarization phase was essential for understanding the nuances in participants' responses. Secondly, generating initial codes: After familiarization, initial codes were generated by systematically examining each transcript and identifying relevant words, phrases, or segments related to the research questions. Codes were developed to capture key ideas, issues, or sentiments expressed by participants, with attention to specific topics such as infrastructure challenges, governance, and the socio-economic impact on communities. NVivo software was used to facilitate this coding process, organizing the data and helping to ensure a systematic approach to analysis.

Thirdly, searching for themes: Once all data had been coded, the researcher grouped related codes to identify broader themes. For instance, codes related to security concerns, theft, and vandalism were grouped under the theme “Security and Safety Challenges.” This process involved organizing codes into categories that reflected the overarching patterns in participants’ responses and aligning these with the study’s objectives. Fourthly, reviewing themes: In this stage, themes were reviewed to ensure that they accurately represented the data and were distinct. It involved cross-referencing themes with the original transcripts to verify that they captured the essence of participants' insights without overlap. Adjustments were made as necessary, merging similar themes or separating larger ones into sub-themes for greater clarity. This stage helped refine the themes, ensuring they were meaningful and coherent.

Fifthly, defining and naming themes: Each theme was carefully defined and named to concisely and descriptively capture its core meaning. For example, a theme named “Financial and Resource Constraints” was used to encompass issues related to funding shortages, budget limitations, and resource allocation challenges. Precise definitions for each theme helped to maintain consistency and provided a structured basis for interpreting the findings. Lastly, producing the Report: The final stage involved organizing the themes into a coherent narrative, presented in Chapter 4. Each theme was described in detail, with supporting quotes from participants to illustrate key points and provide evidence. This narrative aimed to convey a comprehensive understanding of the diverse perspectives on the central line recovery, highlighting the main challenges and potential solutions identified by the stakeholders.

3.8.2 Use of NVIVO Software

According to Allsop (2022), NVivo software supported the data analysis. NVivo facilitated the organization of codes, grouping related codes into themes, and visualizing patterns across the data. Using NVivo ensured that the coding and theme development were systematic, enhancing the reliability of the analysis. This software also allowed the researcher to quickly locate and review specific data segments, making tracking connections between themes easier.

3.9 Elimination of Bias

Various strategies were implemented to minimize bias. Reflexivity was key in reducing potential bias, with the researcher maintaining a reflective journal throughout the study to ensure that findings accurately represented participants' perspectives. This process allowed the researcher to document any personal assumptions or beliefs that might influence data interpretation, thus promoting awareness and minimizing bias in analysis (Lochmiller, 2021). Neutral and open-ended questions in the interview guide further helped reduce bias.

Participants freely expressed their views by avoiding leading questions, enabling a more genuine reflection of their experiences (Vindrola-Padros & Johnson, 2020). A diverse sample, which included PRASA officials, government representatives, community leaders, and commuters, ensured that multiple perspectives were captured, limiting the possibility of any single viewpoint dominating the study (Haven & Van Grootel, 2019).

Data triangulation was also used to enhance credibility, drawing from multiple stakeholder groups to confirm and cross-check findings. This method helped to ensure that conclusions were supported by evidence from diverse sources, thereby reducing potential bias (Vindrola-Padros & Johnson, 2020). Member checking allowed participants to review and verify their statements, further ensuring accuracy and reducing the possibility of misinterpretation (Lochmiller, 2021).

3.10 Ethical considerations

The study adhered to ethical guidelines to protect participants’ rights and maintain transparency. Before each interview, participants were fully informed of the study’s purpose, their right to withdraw, and the confidentiality measures in place. Written consent was obtained, ensuring that all participants were aware of their involvement and consented to participate willingly (Arifin, 2018). Each participant was assigned a pseudonym, and identifiable information was removed from transcripts to prevent data from being traced back to individuals to maintain confidentiality and anonymity (Fleming & Zegwaard, 2018). Data security was strictly observed, with audio recordings, transcripts, and other materials stored securely in a password-protected digital folder accessible only to the researcher. It protected participants’ information and safeguarded it from unauthorized access.

Participants were also informed of their right to withdraw from the study at any stage without having to justify their decision. It ensured that participation was entirely voluntary and allowed participants to feel secure in their involvement. The study received ethics approval from the relevant academic committee, verifying that it met established ethical standards for research involving human participants. Respect and non-maleficence guided each interview, ensuring that participants were treated sensitively, especially when discussing potentially challenging topics related to the central line’s recovery. The researcher conducted each interview respectfully, creating an environment where participants felt comfortable sharing their views (Wardhono & Lestari, 2023).

3.11 Summary

This chapter has provided a detailed overview of the research methodology used in this study, covering the research design, data collection, and data analysis methods. By adopting a qualitative case study approach, purposive sampling, and semi-structured interviews, the study was able to capture a comprehensive understanding of the challenges and possible solutions for the central line’s recovery. Reliability and validity were enhanced through member checking, data triangulation, and reflexivity, ensuring the findings were credible and trustworthy. The chapter also addressed the study’s limitations, acknowledging constraints related to sample size, geographic focus, and the subjective nature of qualitative analysis. Measures to eliminate bias, such as reflexivity and diverse sampling, were outlined to ensure that the findings accurately represented participants’ perspectives. Ethical considerations, including informed consent, confidentiality, and data security, were rigorously observed to protect participants’ rights and well-being. In summary, the methodological choices made in this study provided a strong foundation for capturing the nuanced perspectives of various stakeholders involved in the recovery of the Cape Town central line. The next chapter presented the findings through a thematic analysis of the data collected, and discussed the study’s implications for policy, practice, and future research.

Chapter 4: Findings and Discussion

4.1 Introduction

This chapter outlined findings and discussed compiled data from detailed interviews conducted with the identified participants: PRASA officials, community leaders, and commuters. The interviews were conducted with five research questions. Themes were identified from the data and presented based on the research objectives. They are discussed in comparison to the literature.

4.2 Sample Profile

The total sample consisted of 16 participants, categorized into four groups: PRASA officials, government officials, community leaders, and commuters. Pseudonyms were used to protect the identity of participants. These groups were carefully selected to represent the diverse perspectives critical to understanding the challenges and opportunities in recovering PRASA's Cape Town central line. The first few interview questions aimed to establish a profile of each participant by gathering information on their roles, gender, years of experience, and their direct involvement with the impact of the central line recovery. PRASA officials provided insights based on their managerial and technical responsibilities, while government officials offered a regulatory and policy perspective. Community leaders shared the concerns and priorities of residents affected by the line's disruption, and commuters provided firsthand accounts of the social and economic impacts on their daily lives. Tables 1 to 5 that follow summarized the key descriptive variables for each participant within their respective groups, highlighting their experience, roles, gender, age, race, and relevance to the recovery process.

4.2.1 Biographical and Geographical Summary Data Analysis

The 16 participants were interviewed. Regarding gender, four (4) females were interviewed, and twelve (12) males were interviewed. Regarding race, two (2) Coloureds, two (1) White, and thirteen (13) black Africans were interviewed. More black Africans ride the train, followed by Coloureds. Whites mostly used the southern line, a route from Cape Town to Simon's Town. The research was focused and limited to the central line mostly utilised by black Africans and the Coloured communities. It was also noted that there was a lack of females in management positions. Both managers in government departments were males. At PRASA, both the regional facility managers were male. The only civil regional engineer was a female. All participants interviewed were based in Cape Town, South Africa.

Table 1: Number of Participants Per Race and Gender.

Race			Gender	
Black	White	Colored	Male	Female
13	1	2	12	4

Table 2: Sample Group 1 – PRASA Officials

Participant	Years of Experience	Gender	Job Title	Involvement in Line Recovery
#1	18	Male	Western Cape Regional Manager	Senior Manager for the region, overseeing all activities
#2	8	Female	Perway/Civil Regional Engineer	Manages civil/perway section of the corridors (rail tracks, sleepers, and platforms)
#3	10	Male	Facilities manager	Manages company's facilities, including electricity, water, and sanitation.
#4	7	Male	Electrical Regional Engineer	Manages electrical section of the corridors (cables and power supplies)
#5	13	Male	Recovery Programme Manager	Manages the recovery program for corridors.

Table 3: Sample group 2 – Government officials

Participant	Years of Experience	Gender	Job title	Department/Section
#1	15	Male	Head of Department	National Department of Transport
#2	11	Male	Manager	City of Cape Town Local Government Department of Transport

Table 4: Sample group 3 – Commuters

Participant	Age	Gender	Race	Reason to commute
#1	31	Male		Work
#2	47	Male		Work
#3	17	Male		School
#4	19	Female		School
#5	33	Male		University
#6	52	Female		Work
#7	49	Female		Work

Table 5: Sample group 4 – Community leaders (ward councillors)

Participant	Job title	Department/ Section
#1	Ward councillor	Khayelitsha
#2	Ward councillor	Phillipi

4.3 Presentation of Data

NVivo software was utilized to systematically analyse the data collected from in-depth interviews with PRASA officials, government officials, community leaders, and commuters. Key themes were identified and visually represented using diagrams to enhance understanding of the findings. As a first step, the source data was reviewed to detect emerging trends and patterns based on participants' responses. Word frequency and text search queries were then conducted to identify commonly used keywords and phrases related to the challenges and proposed solutions for recovering the Cape Town central line. This process provided a foundation for identifying primary themes and sub-themes.

Below is a summary of the word frequency analysis gathered from a Word Cloud displaying frequently mentioned keywords and phrases from the participants:

Figure 4.1: Word Cloud Displaying Frequently Mentioned Keywords (**Source:** Author, 2025).

An interview schedule was utilized to ensure that all participants had the chance to share their perspectives on the same topics. The following sections discuss the themes that emerged from the thematic analysis emanating from the use of NVIVO.

Table 6: Summary of themes and sub-themes informed by participants' responses.

What were the main challenges facing the recovery of PRASA's Cape Town central line?
Theme 1: Main Challenges Facing the Recovery of PRASA's Cape Town Central Line
Sub-Themes Sub-theme 1A: Infrastructure and Maintenance Challenges Sub-theme 1B: Security Concerns and Vulnerability to Theft and Vandalism Sub-theme 1C: Financial and Staffing Constraints Sub-theme 1D: Operational and Safety Issues for Commuters Sub-theme 1E: Policy and Regulatory Barriers
How has infrastructure theft and vandalism impacted the recovery of the railway line, and what were the underlying causes of these issues?
Theme 2: Causes and effects of infrastructure theft and vandalism on railway line
Sub-Themes

Sub-theme 2A: Economic Drivers of Theft and Vandalism Sub-theme 2B: Impact on Service Reliability and Commuter Experience Sub-theme 2C: Operational Setbacks and Delays in Recovery Efforts Sub-theme 2D: Increased Maintenance and Security Costs Sub-theme 2E: Legal and Regulatory Challenges in Enforcement
What was the impact of informal settlements on railway reserves on the recovery process, and how this challenge could be addressed?
Theme 3: Impact of Informal Settlements on Railway Reserves on the Recovery Process
Sub-Themes Sub-theme 3A: Restricted Access to Infrastructure for Maintenance and Recovery Sub-theme 3B: Safety Risks for Residents and Commuters Sub-theme 3C: Social and Economic Drivers of Informal Settlement Expansion Sub-theme 3D: Complexities of Relocation and Resettlement Initiatives Sub-theme 3E: Need for Integrated Planning and Collaborative Solutions
How did corruption and project management issues hinder the recovery process and what measures to be taken to mitigate these challenges?
Theme 4: Corruption and Project Management Issues in the Recovery Process
Sub-Themes Sub-theme 4A: Governance and Accountability Sub-theme 4B: Mismanagement and Resource Allocation Sub-theme 4C: Project Delays and Inefficiencies Sub-theme 4D: Perceived Corruption and Its Impact on Public Trust Sub-theme 4E: Lack of Clear Project Prioritization Framework Sub-theme 4F: Need for External Oversight and Independent Auditing

4.4 Theme one: Main Challenges Facing the Recovery of PRASA's Cape Town Central Line

Participants responses related to the first research objective: to understand the main challenges hindering the recovery of PRASA’s Cape Town central line.

Through the analysis of interviews with PRASA officials, government representatives, community leaders, and commuters, several interconnected challenges emerged, highlighting the complexity of restoring the railway line. These themes included infrastructure and maintenance challenges, security issues tied to theft and vandalism, and financial constraints that affected the prioritization and execution of recovery efforts. Each theme highlighted the structural, operational, and social factors influencing the line’s recovery process.

4.4.1 Sub-theme 1A: Infrastructure and Maintenance Challenges

Most participants highlighted abandoned infrastructure as one of the most key concerns. This was observation was validated by Evans (2022) who argued that the beginning of the Covid 19 pandemic and implementation of the lockdown regulations in 2020 affected the central line's operating effectiveness and commuter safety. He further alluded that the South African government suspended the operations of the passenger train, and this resulted in extensive theft of infrastructure, extreme vandalism, and massive encroachment from informal settlements (Evans, 2022). Some of the perceptions regarding the deteriorating infrastructure included:

> *“I hardly see PRASA maintaining the equipment; government officials don’t work as expected” (Juju).*
>
> *“We lack a proper maintenance plan. We don’t have enough of a workforce and the right skills to get the job done. I also don’t think we prioritize our projects correctly” (Sipho).*
>
> *“We have aging assets, and it looks like the business is not doing justice in attending to those issues, and we have outdated systems and processes” (John).*

One of the most cited challenges was the deteriorated condition of the railway infrastructure, including issues with drainage, rail tracks, and outdated facilities. PRASA officials noted that aging infrastructure, compounded by inadequate and irregular maintenance, left the railway vulnerable to frequent breakdowns and service interruptions. The Facilities Manager mentioned that a lack of maintenance strategy contributed significantly to these challenges, as repairs were often reactionary rather than preventative. Poor coordination with the City of Cape Town on drainage management also exacerbated infrastructure deterioration, according to the Regional Manager.

4.4.2 Sub-theme 1B: Security Concerns and Vulnerability to Theft and Vandalism

Theft and vandalism were the second most notable issues. The results were reflective of the views shared by Blumenfeld et al., (2019) who noted that the central line's high rates of vandalism and infrastructure theft indicated a more significant societal crisis, where problems like unemployment, poverty, and a lack of security led to circumstances that deteriorated public assets. These were some of the comments:

> *"The entity doesn't hire enough people, yet we are unemployed, but we can look after our assets. The security guards don't even carry guns yet are attacked by armed people." – Zwide.*
>
> *"We did our best to deploy security guards strategically but haven't gotten the required help from the SAPS. We need them on board as well. Some of them sit in our sites along the rail reserves yet are not helping." – Mkhize.*
>
> One participant commented: "*Criminals steal cables right in front of us, and the government is doing nothing about it*." *– Jenene.*
>
> *"We build walls with CCTVs and intruders, but community members always find a way to bypass and conduct criminal activities" – Sipho and Mkhize.*
>
> "*The current security measures are insufficient. We need more visible policing, improved lighting, and functional CCTV cameras" – Cde Msomi.*

All participants complained about theft and vandalism. Some of them expressed concern about government corruption. The department was also concerned with the entity's state and mentioned some solutions. A prominent theme was the ongoing problem of theft and vandalism, which PRASA officials and community leaders identified as significant barriers to sustainable recovery. Officials noted that high levels of unemployment and poverty in surrounding areas contribute to the theft of valuable materials, such as copper cables, which disrupt operations and escalate maintenance costs. PRASA executives explained that preventive security measures, like CCTV cameras and anti-theft clamps, have been implemented, yet resource constraints limit these efforts. Community leaders echoed the need for more robust security and stricter penalties for theft, suggesting that a partnership between PRASA, law enforcement, and local communities could help mitigate this issue. Bešinović (2020) shared similar sentiments, highlighting that community involvement transformed public perceptions of rail infrastructure, shifting it from being perceived as an external resource to a valuable community asset (Bešinović, 2020).

4.4.3 Sub-theme 1C: Financial and Staffing Constraints

Budget limitations emerged as a critical challenge across participant groups. PRASA officials, including the Programme Manager, highlighted that budget constraints restricted the scope of recovery and the hiring of sufficient staff to manage the recovery process effectively. Limited funding impeded long-term planning, as funds were often diverted to immediate repairs rather than comprehensive upgrades. Government officials acknowledged that funding constraints at the national and provincial levels impacted their ability to support PRASA's recovery initiatives fully. This finding confirmed the thoughts shared by Kriel (2022), who highlighted that financial constraints were a critical challenge that faced South Africa's railway infrastructure recovery, particularly for the Passenger Rail Agency of South Africa (PRASA). This financial strain delayed essential infrastructure improvements, causing frustration among community leaders and commuters, who expressed dissatisfaction with the slow progress. In addition, Villa (2023) agreed that the cost of repairing vandalized and stolen infrastructure was substantial, burdening PRASA's already limited resources further highlighting that each cable theft incident, track damage, or facility vandalism required significant funds for repairs or replacements, causing serve backlogs in PRASA efforts in addressing the restoration of the line.

One participant from PRASA was worried that this was more political and scoring political gains based on the below comment:

> *"The City of Cape Town does not want to come to the party as they don't want to assist us with drainage systems, which brings concerns about sanitation issues and difficulties working in the area. They wanted to show how PRASA was incompetent, so they took over the railway in the province" - Makhekhe.*
>
> *"Government does not give us enough budget, and that small budget doesn't get to the entity but ends in the wrong hands" – Starblack.*

The Department of Transport provided funding to rehabilitate the entity. This was articulated by some of the participants but with some that raised further concerns.

4.4.4 Sub-theme 1D: Operational and Safety Issues for Commuters

For commuters, service reliability, travel safety, and accessibility emerged as critical concerns. Delayed or infrequent train schedules force commuters to seek alternative, often more expensive, transportation options, impacting their financial well-being and time management. Additionally, commuters voiced concerns over unsafe conditions during peak travel hours due to overcrowding and poorly maintained facilities.

Kamalipour & Dovey (2019) noted that these settlements near the line made recovery and maintenance efforts more difficult and provided serious safety threats to the local population. Moreover, efforts to resolve operational challenges as observed by

Kamalipour & Dovey (2019) were hampered by sociopolitical issues since moving residents necessitated delicate involvement with the impacted communities and coordination with local and federal government agencies, confirming similarities in the perceptions shared by the participants. Community leaders emphasized that the central line's prolonged closure has increased travel costs and limited job opportunities for residents, illustrating the broader social impact of service disruptions.

Some of the participants said:

> *"The train is now very slow, and there's a big-time gab, which means if I miss one train, I'll get another after a very long time" – Xulu and Gxabhashe.*

Findings deduced from engaging with PRASA officials revealed that this was caused by insufficient equipment as the train services were still being tested. Hence, full return to service would take some time after everything had been installed per the design. It was also found that the new trains had a gap between them and the platforms. PRASA personnel had to ensure that people entered and exited the train safely. Also, the new trains were mainly run during off-peak hours, while old trains were run during peak hours.

4.4.5 Sub-theme 1E: Policy and Regulatory Barriers

Government officials pointed out that existing policies, though intended to support railway safety and management, sometimes hindered PRASA's ability to address issues like informal settlements on railway reserves. These settlements presented unique challenges, as PRASA faced legal and logistical barriers to relocating residents near rail tracks. Government representatives stated that although policies such as the National Transport Policy and the Prevention of Illegal Eviction Act were in place, enforcement is inconsistent and often hampered by limited resources.

4.5 Theme 2: Causes and Effects of Infrastructure Theft and Vandalism on Railway Line

This section discusses the themes related to the second research objective: understanding the causes and effects of infrastructure theft and vandalism on PRASA's Cape Town central line. These issues, cited by nearly all participant groups, are critical barriers to the line's recovery and operational stability. Through analysis, themes emerged around economic drivers, community impact, operational setbacks, and increased maintenance costs, each shedding light on the complexity and far-reaching consequences of theft and vandalism on railway recovery efforts.

4.5.1 Sub-theme 2A: Economic Drivers of Theft and Vandalism

One of the most significant underlying causes of infrastructure theft was the economic hardship surrounding communities faced. PRASA officials and government representatives pointed to high unemployment rates and poverty as primary drivers of theft, with residents often targeting valuable railway materials like copper cables and metal components. Blumenfeld et al. (2019) alluded those problems like unemployment, poverty, and a lack of security led to circumstances that deteriorated public assets and linked this to the high rates of vandalism and infrastructure theft that indicated a more significant societal crisis. The Electrical Engineer noted that the economic incentive to steal these materials is heightened by demand in the black market, where stolen metals are quickly sold at scrap yards. Community leaders confirmed that individuals, driven by a lack of economic opportunity, frequently resort to theft as a means of income. This recurring issue underscores the need for targeted socio-economic interventions to alleviate the financial desperation that fuels theft.

One of the participants mentioned: "Government needs to regulate scrap yards in this country, and new technologies must be employed" – Zwide.

4.5.2 Sub-theme 2B: Impact on Service Reliability and Commuter Experience

Theft and vandalism directly impacted the reliability of train services, affecting the daily experiences of commuters who relied on the central line. PRASA officials explained that when cables, tracks, or signalling systems were damaged or stolen, entire line segments were rendered inoperative until repairs were completed. IOL (2023) affirmed that infrastructure theft and vandalism, fuelled by unemployment and poverty, exacerbated the deterioration of railway services, leaving lines like the central line vulnerable to frequent disruptions. These disruptions resulted in delayed or reduced train services, forcing commuters to wait longer for transport or seek alternative, often more costly, options. Commuters expressed frustration with the resulting delays and safety concerns, as unreliable service disrupted their schedules and increases their exposure to unsafe environments when they waited for extended periods Owusu-(Agyemang et al., 2024).

One of the participants commented: "People do these criminal activities, and we stay within our communities, and their parents use these trains daily. The government must do something with drugs in our societies since most of these young men are always on drugs" – Juju.

Another participant mentioned: "Stealing and vandalizing infrastructure creates instability in the system" – Mkhize.

4.5.3 Sub-theme 2C: Operational Setbacks and Delays in Recovery Efforts

The continuous cycle of theft and repair had significantly delayed the recovery timeline of the central line. PRASA's Programme Manager noted that each instance of theft forced the organization to divert funds and resources from planned recovery initiatives to urgent repair needs, resulting in a reactive approach to infrastructure management. Government officials added that theft impacts broader strategic goals, as recovery efforts must frequently be paused or re-prioritized to address the most immediate security breaches and damages. This pattern of reactive management impeded long-term planning, creating a costly cycle that ultimately slows the line's overall recovery.

4.5.4 Sub-theme 2D: Increased Maintenance and Security Costs

PRASA officials and government representatives highlighted the financial toll that theft and vandalism place on maintenance budgets. As the Facilities Manager explained, continuously replacing stolen materials and securing damaged infrastructure significantly drains financial resources that could be allocated to proactive maintenance or service enhancements. PRASA has implemented several preventive measures, such as using less valuable materials like aluminium instead of copper and installing CCTV cameras and anti-vandal clamps. However, these solutions come with high implementation costs and need to be improved in their ability to prevent theft entirely. Government officials acknowledged that funding constraints affect the scope and sustainability of these security measures, emphasizing the need for collaborative support to fund and implement more comprehensive solutions. Mugari and Obioha (2024) outlined similar sentiments and concluded that reduced security personnel during the COVID-19 pandemic further exposed these vulnerabilities, making infrastructure more accessible to theft and vandalism, thus increasing security costs (Mugari & Obioha, 2024).

4.5.5 Sub-theme 2E: Legal and Regulatory Challenges in Enforcement

Another key theme emerging from the discussions with government officials and community leaders was the challenge of enforcing laws to curb theft and vandalism effectively. Although regulations existed to penalize theft, enforcement needed to be more consistent, with many participants noting the need for harsher penalties and stricter controls over the sale of scrap metals. Government officials stated that legislative reviews were underway to strengthen these regulations and discourage theft by imposing fines and restrictions on scrap yard purchases from unauthorized sellers. Community leaders suggested that local law enforcement partnerships and community-based security programs further deterred theft and vandalism, supporting a safer environment around railway infrastructure.

> *"We need to revise our legal and regulatory frameworks and policies to ensure they are still relevant, and that the entity is supported efficiently and operated safely." – Baas.*

This was a statement from one of the participants in the department.

4.6 Theme 3: Impact of Informal Settlements on Railway Reserves on the Recovery Process

The theme examined how informal settlements on railway reserves impact ed the recovery process of PRASA's Cape Town central line. Informal settlements along railway reserves grew significantly, presenting unique challenges for PRASA and other stakeholders regarding accessibility, safety, and resource allocation. In-depth interviews revealed themes around restricted access for maintenance, safety risks for residents and commuters, social and economic pressures driving settlement growth, and the complexities of relocation and resettlement initiatives.

4.6.1 Sub-theme 3A: Restricted Access to Infrastructure for Maintenance and Recovery

PRASA officials cited restricted access to critical infrastructure as the primary obstacle informal settlements posed. According to the Perway Civil Regional Engineer, informal housing on and around the tracks obstructed maintenance teams from performing essential repair work, security installations, and inspections. Kaalipour & Dovey (2019) made a similar observation, mentioning that informal settlements obstructed critical infrastructure, prevented maintenance work, and exacerbated safety risks for residents and commuters. Officials explained that with settlement encroachment limiting access, even routine tasks required additional logistical coordination, which delayed maintenance schedules and slowed down recovery timelines. Government representatives acknowledged these challenges, noting that interdepartmental cooperation with housing authorities and local municipalities was necessary to facilitate safe access to these areas.

4.6.2 Sub-theme 3B: Safety Risks for Residents and Commuters

The proximity of informal settlements to railway tracks presented serious safety risks for residents and commuters. Community leaders and government officials highlighted the heightened risk of accidents, mainly as settlements were often located mere meters from active rail lines. With little to no barriers in place, residents, including children, were vulnerable to injuries from passing trains, electrical hazards, and infrastructure collapses. Additionally, commuters expressed concerns about safety in these areas, as some settlements contributed to overcrowding and created unsafe conditions along station platforms and tracks. Government officials indicated that PRASA's disaster management and emergency response plans included informal settlement provisions, but these measures required reinforcement to ensure resident safety.

4.6.3 Sub-theme 3C: Social and Economic Drivers of Informal Settlement Expansion

The growth of informal settlements along railway reserves reflects broader socio-economic issues, such as poverty, housing shortages, and limited access to affordable services. Despite the associated risks, government officials explained that high urbanization rates and insufficient low-cost housing forced many individuals to seek shelter near railway lines. Community leaders emphasized that the city's lack of affordable housing solutions placed significant pressure on marginalized groups, compelling them to occupy spaces near rail infrastructure. This socio-economic context complicated efforts to enforce policies on encroachment, as relocation initiatives considered residents' financial constraints and housing needs.

Community leaders commented:

> "*The sanitation and service delivery on the informal settlements is a huge challenge, especially as they expand every day and access to these houses can be a big challenge*" – Mazwi.
>
> *"Working with the increasing informal settlements gets more difficult daily." – Zondi.*

4.6.4 Sub-theme 3D: Complexities of Relocation and Resettlement Initiatives

Relocating residents from railway reserves proved to be a challenge for PRASA and government agencies, as logistical, legal, and social factors made resettlement complex. Government officials discussed existing policies and programs, such as the Department of Human Settlements' Informal Settlement Upgrading Programme, which aimed to offer alternative housing and support services to residents in high-risk areas. However, limited funding and land availability constrained these efforts, resulting in slow progress and unmet demands. Community leaders pointed out that past relocation initiatives were met with scepticism, as some residents feared displacement without proper support or adequate housing options. They suggested that relocation efforts prioritized affordable, nearby housing options to ensure residents did not lose access to employment, education, or social services.

One participant from PRASA commented:

> *"This was a new issue we've ever encountered; hence, it was challenging to move people from rail reserves as human settlements and PRASA were not certain of whose responsibility it was" – Mkhize.*

4.6.5 Sub-theme 3E: Need for Integrated Planning and Collaborative Solutions

PRASA officials and government representatives recognized the importance of integrated planning in effectively addressing informal settlements on railway reserves. The Head of the Department of Transport emphasized that sustainable solutions require close coordination between government entities, including the Department of Human Settlements, and local municipalities. This integrated approach allowed for comprehensive relocation plans, infrastructure development, and safety measures that addressed residents' immediate and long-term needs. Community leaders advocated for community engagement and participatory planning, arguing that including residents in decision-making enhanced trust and support for relocation initiatives.

4.7 Theme 4: Corruption and Project Management Issues in the Recovery Process

Exploring the role of corruption and project management challenges in hindered the recovery of PRASA's Cape Town central line. Through interviews with PRASA executives, government officials, and community leaders, several interrelated themes emerged, highlighting issues in governance, resource allocation, project prioritization, and accountability. These findings revealed how inefficiencies, mismanagement, and perceived corruption impacted PRASA's ability to execute an effective recovery strategy, ultimately affecting public trust and organizational credibility.

4.7.1 Sub-theme 4A: Governance and Accountability

A recurring theme across interviews was the challenge of governance and accountability within PRASA. Executives acknowledged historical governance issues that have weakened the organization's credibility and hindered its ability to deliver effective services. Efforts to address these issues included implementing whistleblowing platforms, governance reforms, and a renewed focus on accountability. However, government officials indicated that these measures are often undermined by a lack of transparency and delayed responses to reported issues. Community leaders expressed scepticism about PRASA's commitment to addressing corruption, noting a perceived disconnect between official statements and improvements in service and infrastructure. This lack of trust in governance highlighted the need for consistent, transparent communication and more robust oversight mechanisms.

4.7.2 Sub-theme 4B: Mismanagement and Resource Allocation

Mismanagement of resources emerged as a significant factor affecting the recovery process. PRASA officials explained that the allocation of resources was often constrained by competing priorities, which created challenges in balancing immediate repairs with longer-term investments in infrastructure. For instance, the Programme Manager noted that budget constraints forced PRASA to focus on urgent maintenance needs rather than comprehensive recovery projects. Government officials echoed this, stating that misallocated resources and delays in financial approvals further complicated the line's recovery. Community leaders voiced concerns that mismanagement of funds exacerbated delays, as projects were frequently postponed or scaled down, resulting in inconsistent progress and visible signs of neglect in the rail infrastructure.

4.7.3 Sub-theme 4C: Project Delays and Inefficiencies

Project delays, often attributed to inefficient project management practices, were highlighted by PRASA officials and community leaders as critical obstacles to recovery. PRASA officials admitted that project timelines were frequently extended due to administrative inefficiencies and logistical challenges, such as obtaining necessary approvals and coordinating with external contractors. Additionally, the lack of skilled project managers impacted the organization's ability to meet milestones, with some officials pointing to understaffing and inadequate training as contributing factors. Community leaders criticized these delays, expressing frustration over the lack of progress. They noted that prolonged delays in recovery projects inconvenience commuters and undermine community support for PRASA's initiatives.

4.7.4 Sub-theme 4D: Perceived Corruption and Its Impact on Public Trust

Perceptions of corruption within PRASA emerged as a central theme, affecting both public trust and the willingness of community members to support recovery efforts. Community leaders raised concerns about alleged corruption and resource misappropriation, which eroded confidence in PRASA's ability to manage recovery funds responsibly. Government officials acknowledged these perceptions, noting that even the appearance of corruption was detrimental to organizational credibility, as it fuelled scepticism and resistance among local communities. PRASA executives introduced anti-corruption measures to combat these challenges, including stricter internal audits and reporting mechanisms (Lekubu, 2019). However, community leaders suggested that these measures were insufficient, calling for more proactive oversight by independent bodies to ensure that recovery funds were allocated transparently and used effectively.

4.7.5 Sub-theme 4E: Lack of Clear Project Prioritization Framework

PRASA officials described their approach to prioritizing projects based on safety, infrastructure integrity, and financial feasibility. However, the lack of a structured and transparent project prioritization framework led to inconsistencies in resource distribution and a perceived lack of focus on urgent community needs. Government officials noted that without a clear framework, projects were sometimes re-prioritized due to political or financial pressures, resulting in inefficiencies and missed opportunities for strategic recovery. Community leaders expressed frustration with this approach, citing instances where essential repairs or safety measures were delayed while less critical projects received attention. This lack of a well-defined prioritization process contributed to a perception of mismanagement and a disconnect between PRASA's recovery objectives and the needs of the communities served by the central line.

4.7.6 Sub-theme 4F: Need for External Oversight and Independent Auditing

Government officials and community leaders advocated external oversight of PRASA's recovery efforts in response to concerns about transparency and accountability. Community leaders suggested that independent audits and regular reporting to the public enhanced transparency and provided accountability for resource use and project milestones. Government officials agreed that third-party audits and monitoring mechanisms reinforced public trust and ensure funds were used as intended. PRASA executives acknowledged the potential value of external oversight, noting that independent assessments provided additional credibility to the recovery process and reassured the public of PRASA's commitment to transparency.

4.8 Summary

The chapter presented the findings from interviews conducted with PRASA officials, government representatives, community leaders, and commuters, providing insights into the challenges and potential solutions for the recovery of the Cape Town central line. Each section addressed a specific research objective, revealing themes that offer a comprehensive understanding of the factors influencing the recovery process. Concerning the first objective, challenges such as infrastructure deterioration, security vulnerabilities, financial limitations, commuter safety issues, and policy constraints were highlighted as critical barriers to effective recovery. For the second objective, participants identified economic drivers, service disruptions, and the high costs of ongoing maintenance as significant effects of theft and vandalism, underscoring the need for a multi-pronged approach to address these issues. Almost all the findings are reflective of the sentiments shared scholars studying the subject of railway rehabilitation studies.

Moreover, the findings revealed the impacts of informal settlements on railway reserves in Cape Town, with themes emerging around restricted access, safety risks, socio-economic pressures, and the complexity of relocation efforts. The role of corruption and project management inefficiencies was also examined, and its was found that the need for improved governance, transparent resource allocation, and more effective prioritization of recovery projects was paramount for railway rehabilitation. These themes underscore the multi-dimensional nature of the central line recovery process, pointing to the need for coordinated, transparent, and community-driven efforts. This chapter laid the foundation for the recommendations discussed in the next chapter, outlining actionable strategies to support the sustainable and effective recovery of the central line and improve the quality of service for the communities it serves.

Chapter 5: Conclusions and Recommendations

5.1 Introduction

This chapter synthesized the findings of this study on the challenges and opportunities for the recovery of the Cape Town central line, managed by the Passenger Rail Agency of South Africa (PRASA). Drawing on insights from in-depth interviews with key stakeholders and a review of relevant literature, the chapter outlined actionable recommendations to address infrastructure deterioration, theft and vandalism, project management inefficiencies, budget constraints, and the impact of informal settlements on rail reserves. These recommendations provided PRASA and its partners with practical strategies for achieving the Cape Town central line's sustainable, resilient, and community-supported recovery. By implementing the proposed strategies, PRASA improved operational efficiency, fostered community trust, and secured long-term viability for one of South Africa's critical rail corridors.

5.2 Conclusions

PRASA's Cape Town central line recovery faced significant challenges rooted in infrastructure degradation, theft, vandalism, and the socio-economic conditions surrounding the rail reserves. The study highlighted how complex issues, including project management inefficiencies, budgetary constraints, inadequate stakeholder coordination, and informal settlements, hindered previous recovery efforts. The qualitative insights gathered from interviews with community representatives, Department of Transport officials, and PRASA executives revealed a need for a multifaceted approach to address both technical and social dimensions of rail infrastructure recovery.

The analysis showed that sustainable recovery was achievable if PRASA adopted an integrated strategy that combined enhanced security measures, robust project management practices, transparent funding allocation, and strong community engagement. Additionally, partnerships with governmental departments, particularly for housing and law enforcement, were essential to address external factors impacting the line. By developing a long-term infrastructure maintenance plan and promoting interdepartmental collaboration, PRASA laid the groundwork for a resilient public transportation system that met immediate recovery needs and aligned with South Africa's broader development goals.

Ultimately, the recovery of the Cape Town central line had the potential to improve urban mobility, support economic growth, and contribute to social stability within the Western Cape. This study's recommendations were a blueprint for PRASA to reestablish efficient, secure, and accessible rail services, benefiting the organization and its communities.

The recovery of 31 out of 40 service lines and the restoration of 266 (57%) of 468 stations in Metrorail corridors by the end of March 2024 are two major accomplishments of the Passenger Rail Agency of South Africa (PRASA), which has made great progress in repairing and enhancing the country's passenger rail system. Between 2020–2021 and 2023 – 2024, the number of passengers increased by 294% because of these measures. According to a Western Cape government media statement, PRASA's effectiveness is further demonstrated by the restoration of train services to formerly remote areas, such as Mitchell's Plain, and the decrease in traffic, both of which boost the local economy.

5.2.1 Conclusions regarding the perceptions of affected stakeholders on the challenges faced by PRASA's Cape Town central line recovery.

Implications of Understanding the Impact of Railway Line Recovery on Commuter Experience

The findings revealed that the state of the railway line had significant implications for the commuter experience, affecting accessibility, safety, affordability, and overall reliability. An improved understanding of these impacts helped PRASA prioritize initiatives that enhanced commuter satisfaction and service delivery. As the recovery process advanced, focusing on the commuter perspective would enable PRASA to implement solutions that restored operational efficiency and foster public trust and reliance on the railway system. Addressing these implications contributed to a more assertive, community-centred approach, aligning recovery efforts with commuter expectations and promoting long-term sustainability.

Mitigating the Impact of Railway Service Disruptions on Commuter Experience

Recommendations to address the critical challenges identified in the recovery of PRASA’s Cape Town central line, focused on improving the commuter experience, operational efficiency, and community support. These recommendations provided actionable steps for PRASA and relevant stakeholders to ensure a sustainable and effective recovery process.

5.2.2. Conclusions concerning the impacts of infrastructure theft and vandalism on the railway line.

Enhance Security Measures

Security remained a critical issue, with frequent theft and vandalism disrupting services and increasing maintenance costs. To address this, PRASA needed to do the following:

Firstly, increasing security personnel meant that PRASA needed to employ additional security guards to monitor vulnerable areas, particularly during high-risk times. Secondly, PRASA needed to install advanced surveillance systems through deploying CCTV cameras and sensor-based alarm systems along railway reserves to deter criminal activity and enable real-time monitoring. Lastly, PRASA needed to Engage local communities in security initiatives by implementing community watch programs and incentivizing residents to report suspicious activities. This collaborative approach would foster a sense of local ownership in protecting railway infrastructure.

5.2.3 Conclusions pertaining to the impact of the informal settlements on the railway serves on the recovery process

Engage Communities in Recovery Efforts

Community support was essential for the success of recovery initiatives. Transparent communication and active involvement of residents helped build trust and ensured that recovery efforts aligned with local needs. PRASA needed to:

Hold Regular Public Forums through conducting regular community meetings to update residents on recovery progress, listen to concerns, and address questions. This transparency would potentially build trust and alignment efforts with commuter needs. Moreover, PRASA needed to collaborate with local leaders through Partnering with community leaders, ward councillors, and civil society groups to gain insights into local challenges and secure support for recovery activities.

Secure Sustainable Funding

Sustainable funding was essential to support both immediate and long-term recovery efforts. PRASA needed to consider: Establishing a Dedicated Recovery Fund for the central line recovery to ensure that essential projects had stable financial support. Enwereji & Uwizeyimana, 2019 mnentioned that improving financial accountability within PRASA was potentially perceived to restore public confidence, potentially opening doors for additional funding through government allocations or international loans. Secondly, PRASA needed to leverage Public-Private Partnerships (PPPs) to explore partnerships with private investors to inject capital and share the financial burden while benefiting from private sector expertise in infrastructure management. Lastly, PRASA needed to ensure transparent financial reporting to maintain clear, regular financial reports to ensure transparent expenditures, building public trust and accountability. Kriel (2022) reaffirmed this finding that financial constraints were a critical challenge that faced South Africa's railway infrastructure recovery.

5.2.4 Conclusions concerning the role of corruption and project management issues in the recovery process.

Improved project management is necessary to streamline recovery efforts and avoid delays. Recommended steps included:

- Firstly, implementing a structured project framework to adopt a standardized project management framework with clear milestones, accountability metrics, and regular evaluations. Secondly, PRASA needed to ensure an independent auditing and oversight to engage third-party auditors to monitor project progress and provide impartial assessments of resource allocation and spending, ensuring transparency and accountability. Thirdly, to train and upskill project teams through investing in training for PRASA's project managers and staff to enhance their capacity for efficiently handling complex, large-scale recovery projects.

Address Socio-Economic Factors Related to Informal Settlements

Informal settlements on railway reserves posed accessibility and safety risks. A humane, collaborative approach to relocation and resettlement was needed:

Firstly, partnering with housing authorities to work with the Department of Human Settlements to develop and implement relocation plans that provide affordable and nearby housing options, reducing the encroachment on railway reserves. Secondly, implementing socio-economic support for affected residents through offering job training and employment opportunities, potentially within PRASA's recovery projects, to help address economic challenges and foster community stability.

Implement Integrated Planning for Future Development

Long-term planning was essential for creating a resilient and efficient railway network. PRASA needed to:

Firstly, integrate railway services with other public transport to coordinate with local transit systems to improve accessibility and connectivity, creating seamless commuter experiences. Secondly, modernizing infrastructure for future resilience through investing in infrastructure upgrades, such as signalling and electrification, to enhance service reliability and prevent future disruptions. Lastly, gathering and utilizing commuter feedback through regularly collecting feedback from commuters to identify areas of improvement and ensure that recovery initiatives were aligned with commuter needs and expectations.

5.3 Recommendations

5.3.1 Recommendations based on the perceptions of affected stakeholders on the challenges faced by PRASA's Cape Town central line recovery.

The perceptions drawn from the affected stakeholders interviewed revealed that the challenges in PRASA's Cape Town Central line recovery stem from systemic challenges and inefficiencies, lack of investments in infrastructure rehabilitation and governance. The impact of continuous theft and vandalism is a significant contributor to the challenges, undermining all efforts to speedily restore rail infrastructure. Behavioral change amongst commuters towards concerns about safety, accessibility, and ongoing infrastructure issues persist, particularly among community activists, was another challenge that needs to be overcome.

5.3.2 Recommendations based on the impact of infrastructure theft and vandalism on the railway line.

The study has reaffirmed that theft and vandalism need to be addressed as they significantly undermine efforts to protect and secure railway infrastructure. There is a strong need to invest and strengthen security measures, deploy security infrastructure to track and improve systems to protect railway infrastructure. More measures need to be adopted by PRASA to protect the theft of infrastructure with community also becoming engaged in this process.

5.3.3 Recommendations based on the impact of the informal settlements on the railway reserves on the recovery process

Informal settlements become a breeding growth for infrastructure theft. There is a need for PRASA to prioritize the relocation of informal settlements along its railway line infrastructure, strengthen intergovernmental cooperation, and implement effective measures to prevent future illegal encroachments on railway line.

5.3.4 Recommendations based on the role of corruption and project management issues in the recovery process.

To address the challenges posed by corruption and project management issues, there is a need to strengthen governance structures, introduce whistle blower hotlines for reporting corruption amongst officials and implementing robust monitoring systems. There is also a need to enforce governance principles of transparency and accountability, and to increase community participation in the fight against corruption, theft and vandalism.

5.4 Limitations to The Study

Several limitations to the study were identified. Firstly, in terms of sample size, the study was limited to 16 participants, providing in-depth insights but potentially lacking a broader representation of all commuter groups and stakeholders involved with the central line. Secondly, in terms of geographical focus the research focused specifically on the Cape Town central line, which limited the generalizability of findings to other railway lines within PRASA’s network or other regional contexts. Thirdly, qualitative data constraint meant that the research relied on subjective interpretations, which, despite validation measures like member checking and peer debriefing, reflected individual perspectives rather than universally applicable insights. Fourthly, time constraints related to the time for data collection which restricted the depth of longitudinal insights, as the study captured only a snapshot of participants’ experiences rather than an evolving view over time. Lastly, access to certain stakeholders such as higher-level policymakers and specific community representatives, were not included in the sample, which may have limited the range of perspectives on policy and operational impacts. Moreover, the limitations in this study are pertinent to the current needs of PRASA interventions on the improvements of railway networks in SA and not just in the Cape area of South Africa.

5.5 Suggestions for future studies

5.5.1 Longitudinal Studies on Railway Recovery Efforts

Conducting longitudinal studies provided insights into recovery initiatives' long-term impacts and effectiveness. By tracking progress, challenges, and outcomes at various stages, researchers assessed strategies that were most effective in achieving sustainable recovery and identify any recurring obstacles.

5.5.2 Comparative Analysis Across Railway Lines and Regions

A comparative study involving different railway lines or regions within South Africa could highlighted unique or shared challenges faced by PRASA and other railway operators. This approach identified best practices and adaptable solutions, providing insights that applied beyond the specific context of the Cape Town central line.

5.5.3 Economic Impact of Railway Recovery on Local Communities

Exploring the economic implications of railway recovery for local communities offered a more comprehensive view of its benefits. This included examining how improved railway services contributed to job creation, economic mobility, and access to essential services, helping policymakers and stakeholders better understand the broader social and economic value of effective railway recovery.

5.5.4 Effectiveness of Security Interventions in Mitigating Theft and Vandalism

Security remained a significant challenge, and research focused on evaluating various security interventions determined the most effective methods for protecting railway infrastructure. Studies investigated the impacts of different technologies, community-based security models, and law enforcement collaborations in reducing theft and vandalism.

5.5.5 Community Engagement and Public Perception of Railway Recovery Initiatives

Future studies needed to examine the role of community engagement in the success of recovery initiatives, focusing on public perceptions, levels of community involvement, and the influence of transparent communication. This research would help PRASA and other stakeholders understand how to build stronger community relationships and increase support for railway recovery projects.

5.5.6 Policy and Regulatory Analysis for Improved Railway Management

A detailed analysis of existing policies and regulations affecting railway management, especially those concerning informal settlements and infrastructure protection, highlighted gaps or areas for improvement. By identifying regulatory challenges and potential reforms, future studies needed to support policymakers in creating a more enabling environment for railway recovery and long-term sustainability.

5.5.7 Socio-Economic Factors Influencing Informal Settlement Growth Near Railways

Further research into the socio-economic drivers of informal settlement growth around railway reserves would provide insights for developing effective, equitable relocation and support programs. Understanding these factors needed to inform integrated housing and transportation policies that addressed commuter needs and housing challenges in vulnerable areas.

5.6 Summary

This chapter presented this study's key conclusions, implications, and recommendations for recovering PRASA’s Cape Town Central Line. The findings highlighted the complex challenges PRASA faced in restoring reliable railway services, including infrastructure degradation, security concerns, financial constraints, project management inefficiencies, and socio-economic issues related to informal settlements. Each of these factors affected not only the operational aspects of the railway but also the daily experiences and safety of commuters who relied on this essential service.

The recommendations provided in this chapter focused on actionable steps to address these challenges, emphasizing the importance of enhanced security, active community engagement, sustainable funding, effective project management, and integrated socio-economic solutions. Additionally, a call for long-term planning and strategic partnerships had been made to ensure recovery efforts aligned with commuter needs and future growth demands.

Future research suggestions were also outlined, suggesting areas for further study to deepen the understanding of railway recovery processes and the broader social, economic, and regulatory impacts. These studies would provide valuable insights for PRASA, policymakers, and other stakeholders, helping to inform effective recovery strategies.

In conclusion, this chapter underscored the need for a coordinated, transparent, and community-centred approach to recovering the Cape Town central line. By addressing the identified challenges and implementing the proposed strategies, PRASA needed to improve service reliability, enhance commuter satisfaction, and foster public trust, ultimately contributing to a more resilient and efficient railway network for South Africa.

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Appendices

Appendix 1: Interview Schedule

Geographical and Biographical questions:

1. What is your age?
2. How many years have you worked in the company?
3. How many years have you used the train?
4. What is your race?
5. What is your gender?
6. Tell me about your roles and responsibilities.

PRASA Officials:

1. What are the biggest challenges you face in maintaining the Cape Town Central Line?

2. How do you think infrastructure theft and vandalism affect the railway line's condition?

3. What measures have you taken to address corruption within the organization?

4. How do you prioritize projects and allocate resources for the railway line's recovery?

5. What are your thoughts on the impact of informal settlements on railway reserves?

Community Leaders (Ward Councillors):

1. How do you think the Cape Town Central Line's condition affects the community?

2. What are the biggest challenges your community faces in terms of transportation?

3. How do you think the railway line's recovery could benefit the community?

4. What are your thoughts on the relationship between informal settlements and railway reserves?

5. How can the community contribute to the railway line's recovery?

Commuters:

1. What are your biggest frustrations with using the Cape Town Central Line?

2. How do you think the railway line's condition affects your daily commute?

3. Have you noticed any changes in the railway line's condition over time?

4. How do you think the railway line's recovery could improve your commute?

5. What are your thoughts on the impact of infrastructure theft and vandalism on the railway line?

Stakeholders (Government Officials):

1. What are your interests and concerns regarding the Central Line recovery project?

2. How do you think the project should be managed and implemented?

3. What are the potential risks and opportunities associated with the project?

4. How can stakeholders work together to ensure the project's success?

Appendix 2: Gatekeeper Letter

prasa
PASSENGER RAIL AGENCY OF SOUTH AFRICA

www.prasa.com

Umjantshi House
30 Wolmarans Str.
Braamfontein
Johannesburg
2001

Private Bag X101
Braamfontein, 2107
T +27 11 013 1667

To Whom It May Concern

This letter serves as a confirmation to confirm that, I, Sorin Baltac, Acting CEO at Passenger Rail Agency of South Africa (PRASA) in the Technical division hereby acknowledge and approve the research of Njabulo Thabethe (Student number: 211501576) for the completion of his Master of Business Administration Degree for the title: Investigating the challenges of the railway network of state-owned enterprise: case study of Cape Town central line recovery at the Universityof KwaZulu-Natal.

Please note that the permission is granted on the condition that the data collected shall be confidential and the study findings are submitted to the Passenger Rail Agency of South Africa.

Let me take this opportunity to wish you well in achieving this milestone.

Signature of Designated Authority

[redacted]

S Baltac
Acting CEO (PRASA TECH)

Date: 18.07.2024

Appendix 3: Ethical Clearance Approval

UNIVERSITY OF KWAZULU-NATAL ™
INYUVESI YAKWAZULU-NATALI

05 June 2025

Njabulo Clifford Thabethe (211501576)
Grad School Of Bus & Leadership
Westville Campus

Dear NC Thabethe,

Protocol reference number: HSSREC/00007556/2024
Project title: Investigating the challenges of the railway network of state-owned enterprise: case study of Cape Town central line recovery
Amended title: Investigating the effects of challenges faced by the railway network on social, economy and developing railway recovery strategies
Degree: Masters

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 03 June 2025 has now been approved as follows:

- Change in title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

HSSREC is registered with the South African National Health Research Ethics Council (REC-040414-040).

Best wishes for the successful completion of your research protocol.

Yours faithfully

[redacted]
....
Doctor Shamila Naidoo (Interim Chair)

/nng

Humanities & Social Sciences Research Ethics Committee
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Tel: +27 31 260 8350 / 4557 / 3587
Website: http://research.ukzn.ac.za/Research-Ethics/

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

Appendix 4: Informed Consent Form

English Version

INFORMATION SHEET AND INFORMED CONSENT

To whom it may concern

My name is Njabulo Thabethe, and I am a researcher from the University of KwaZulu-Natal. I am currently conducting a study on the revitalization of the Cape Town Central Line, focusing on the perspectives of PRASA officials, community leaders, and commuters.

You are being invited to participate in this study, which aims to explore the challenges and opportunities of revitalizing the Cape Town Central Line. The study will involve an in-depth interview or focus group discussion, which will be audio-recorded with your consent.

Your participation in this study is entirely voluntary, and you may withdraw at any time without affecting any benefits you are normally entitled to. All information collected will be kept strictly confidential, and your anonymity will be guaranteed.

In the event of any problems or concerns/questions you may contact the researcher at 211501576@stu.ukzn..ac.za or via [redacted] or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001

Durban

4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Please be advised that participation in this research is voluntary. You may withdraw participation at any point. In the event of refusal/withdrawal of participation, you will not incur any penalties or lose any benefits to which you are normally entitled. Should you decide to withdraw, kindly email me at 211501576@stu.ukzn.ac.za as soon as possible so that I have time to source another participant to ensure there is sufficient data for analysis. Should the study be terminated for any reason, your participation will automatically cease.

There is no reimbursement for your participation in the study nor are you expected to incur any costs.

All information, including your personal information, will be kept strictly confidential. All transcripts and recordings of interviews, emails, and any other correspondence will be saved in the secure vault in my OneDrive folder. This is password protected and only my supervisor, Professor Bibi Chummun, and I will have access to the information. Any hard copy documents will be shredded, and electronic copies will be deleted from the OneDrive folder after the required storage time as per the university's policy has lapsed.

Kindly indicate your willingness to participate in the research study by completing and signing the section below.

Yours faithfully

____

Njabulo Thabethe

[redacted]

211501576@stu.ukzn.ac.za

CONSENT

I…………………………………………… (Name) have been informed about the study entitled Investigating the challenges of the railway network of state-owned enterprise: case study of Cape Town central line recovery by Njabulo Thabethe

I understand the purpose and procedures of the study.

I have been given an opportunity to ask questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits to which I usually am entitled to.

If I have any further questions/concerns or queries related to the study, I understand that I may contact the researcher at [redacted] or at 211501576@stu.ukzn.ac.za

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

I hereby provide consent to:

Audio-record my interview YES / NO

______________________ ______________________

Signature of Participant Date

IsiXhosa

IPHEPHA LOLWAZI KUNYE NEMVUME ESAZIWEYO

Kulowo ibhekisele kuye

Igama lam ndinguNjabulo Thabethe, ndingumphandi kwiYunivesithi yakwaZulu-Natal. Kungoku nje ndiqhuba uphononongo lokuvuselelwa koMmandla ombindi weKapa, ndigxile kwiimbono zamagosa e-PRASA, iinkokeli zabahlali, kunye nabakhweli.

Uyamenywa ukuba uthathe inxaxheba kolu phononongo, olujonge ukuphononongа imingeni kunye namathuba okuvuselela uMzila oMbindi waseKapa. Uphononongo luya kubandakanya udliwano-ndlebe olunzulu okanye ingxoxo yeqela ekugxilwe kuyo, eya kurekhodwa ngokuvakalayo ngemvume yakho.

Ukuthatha kwakho inxaxheba kolu phononongo kungokuzithandela ngokupheleleyo, kwaye unokurhoxa nangaliphi na ixesha ngaphandle kokuchaphazela naziphi na izibonelelo oqhele ukuba nelungelo.

Ukuba kukho naziphi na iingxaki okanye iinkxalabo/imibuzo ungaqhagamshelana nomphandi kule nombolo 211501576@stu.ukzn..ac.za okanye ngale nombolo [redacted], okanye iKomiti yase-UKZN yoBuntu neNzululwazi yezeNtlalo, iinkcukacha zoqhagamshelwano ngolu hlobo lulandelayo:

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Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: HSSREC@ukzn.ac.za

Nceda uxelelwe ukuba ukuthatha inxaxheba kolu phando kungokuzithandela. Ungarhoxisa ukuthatha inxaxheba nangaliphi na ixesha. Kwimeko yokwala/ukuyekwa ukuthatha inxaxheba, awuzukufumana izohlwayo okanye uphulukane nazo naziphi na izibonelelo oqhele ukuba nelungelo lokuzifumana. Ukuba uthatha isigqibo sokurhoxa, ndicela undithumelele i-imeyile kule nombolo 211501576@stu.ukzn.ac.za ngokukhawuleza ukuze ndibe nexesha lokufumana omnye umthathi-nxaxheba ukuqinisekisa ukuba kukho idatha eyaneleyo yokuhlalutya. Ukuba uphononongo luyapheliswa ngaso nasiphi na isizathu, ukuthatha kwakho inxaxheba kuya kuphela ngokuzenzekelayo.

Akukho mbuyiselo ngokuthatha kwakho inxaxheba kuphononongo kwaye akulindelekanga ukuba ungene kuzo naziphi na iindleko.

Lonke ulwazi kubandakanywa nolwazi lwakho lobuqu luya kugcinwa luyimfihlo ngokungqongqo. Yonke imibhalo kunye noshicilelo lodliwano-ndlebe, ii-imeyile, kunye nayo nayiphi na enye imbalelwano iya kugcinwa kwindawo ekhuselekileyo kwifolda yam ye-OneDrive. Oku kukhuselwe igama eliyimfihlo kwaye ngumphathi wam kuphela, uNjingalwazi Bibi Chummun, kwaye ndiya kuba nokufikelela kulwazi. Nawaphi na amaxwebhu angamaphepha aya kuculwa, kwaye iikopi ze-elektroniki ziya kucinywa kwifolda ye-OneDrive emva kokuba ixesha lokugcinwa elifunekayo ngokomgaqo-nkqubo weyunivesithi uphelelwe.

Nceda ubonise ukuvuma kwakho ukuthatha inxaxheba kuphononongo lophando ngokugcwalisa kunye nokusayina icandelo elingezantsi.

Owenu othembekile.

____

Njabulo Thabethe

[redacted]

211501576@stu.ukzn.ac.za

IMVUME

Ndi…………………………………………………. (Igama) baziswe malunga nophononongo olunesihloko esithi Ukuphanda imingeni yothungelwano lukaloliwe kushishino lukarhulumente: uphononongo lwendlela yokubuyisela umbindi weKapa nguNjabulo Thabethe.

Ndiyayiqonda injongo kunye neenkqubo zophononongo.

Ndinikwe ithuba lokubuza imibuzo malunga nesi sifundo kwaye ndifumene iimpendulo ezanelisayo.

Ndiyavuma ukuba ukuthatha kwam inxaxheba kolu phononongo kungokuzithandela ngokupheleleyo kwaye ndingarhoxa nangaliphi na ixesha ngaphandle kokuchaphazela naziphi na iibhenefithi endidla ngokuba nelungelo lokuzifumana.

Ukuba ndineminye imibuzo/izinto ezindixhalabisayo okanye imibuzo enxulumene nolu phando, ndiyaqonda ukuba ndingaqhagamshelana nomphandi apha [redacted] okanye apha 211501576@stu.ukzn.ac.za.

Ukuba ndinayo nayiphi na imibuzo okanye iinkxalabo malunga namalungelo am njengomthathi-nxaxheba kuphando, okanye ukuba ndinexhala malunga nomba othile wophando okanye abaphandi ndingaqhagamshelana:

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Email: HSSREC@ukzn.ac.za

Ndinikezela ngemvume ku:

Rekhoda udliwanondlebe lwam EWE / HAYI

_________________________________ ________________

Utyikityo lomhla womthathi-nxaxhebaUmhla