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The Rail Infrastructure and Passenger Experience in Johannesburg

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The Rail Infrastructure and Passenger Experience in Johannesburg

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A research article submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Business Administration

Supervisor:

Dr Joel Marumo Mosenogi

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DECLARATION

I, Javulani Silence Maluleke, declare that this research article is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfillment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name : Javulani Silence Maluleke Signature: 

Signed at Midrand

On the 21 day of February 2023

DEDICATION

This study is in honor of my late mother, my wife, my sons, and my entire family.

ACKNOWLEDGEMENT

I'd like to take this opportunity to thank God for giving me the strength to continue my studies and strive throughout the process. I want to express my gratitude to my supervisor, Dr. Joel Marumo Mosenogi, for all of his guidance and assistance with this endeavor. I further want to express my gratitude to my wife Tlangelani Celeste Maluleke and my sons Dzunisani & Vukona Maluleke for their support and encouragement throughout my academic career.

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ABBREVIATIONS

DBSA	Development Bank of Southern Africa
PMG	Parliamentary Monitoring Group

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ABSTRACT

Rail services has a significant impact on the social and economic development of the South African nation. Efficiency in the rail services is heavily reliant on infrastructural condition but not limited to technological aspects which directly affects passenger experience. The key purpose of the research study was to investigate the rail infrastructure and passenger experience in Johannesburg. The three main objectives were to understand the impact of rail infrastructure and passenger experience, determine the contributing factors to the deterioration of rail infrastructure and determine the impact of poor rail infrastructure on customer experience.

This study makes a significant contribution to the body of knowledge since it sheds light on the management of rail infrastructure and passenger experience, as well as how these factors may be used to acquire an competitive edge. The quantitative research methodology was employed, with an online self-administered survey used to collect primary data and *Qualtrics* as the chosen data instrument. As for the data analysis, descriptive analysis was used.

Once research was concluded; the findings revealed that customer experience was statistically valid and reliable. It was discovered that there was a correlation between vandalism, poor maintenance, and inadequate investment. Last but not least, it was discovered that the reliability of rail infrastructure affects how customers perceive it. Therefore, the conclusion of the study is that smart technology could be utilized to tackle the deterioration and vandalism of rail infrastructure which would be advantageous to win passengers' trust and resurrect it as a preferred method of transportation. The organization under study needs to implement customer retention strategies that could address the problems daily commuters incur and retain existing commuters as well as draw in new commuters.

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Rail services have a significant impact on the social and economic development of many nations and South Africa is not an exception to this. Rail services have the potential to significantly improve the lives of ordinary South African and can further ease the movement of goods across provinces and the African continent. Efficiency in the rail services is heavily reliant on infrastructural condition, which directly affects passenger experience.

The functionality and reliability of the rail infrastructure is imperative because it is the backbone of business and benefits the country's economic expansion as well as offer affordable transportation to the people of South Africa. Deteriorated rail infrastructure will negatively impact passenger experience and may further lead commuters to resort to other modes of transportation.

This research, therefore, aims to investigate the rail infrastructure and passenger experience in Johannesburg. This study is imperative for South Africa because millions of people rely on rail transport to reach all amenities and the functionality of the railway contributes to the economy. By using quantitative approach, this research study has provided an in-depth understanding of the rail infrastructure deterioration and how it affects passenger experience. Chapter one will outline the background of the problem, problem statement, research questions, objectives and limitations as well as structure of the study. Chapter two presents a review of the literature that will provide a deeper understanding of the phenomenon under study. Then chapter three will outline the research methodology that will be undertaken for the investigation whilst chapter four will outline the results. Chapter five will discuss the results. Lastly chapter six will outline the conclusion of the study.

1.2 Background to the problem

According DBSA (2012), throughout the past 30 years, there was a steeply decline of commuter rail demand from the “700 million trips per year in the early 1980s” to a low of “400 million in the early 1990s” which arose from deregulation of passenger transport and an introduction of the minibus-taxi industry. A further rise was seen in 2003 because the taxi and minibus fare was raised in line with the increase of fuel price, then rail prices were fixed from September 2003 until the beginning of 2010. The reasons were mainly due to 20% of their oldest rolling stock being removed from the service which placed significant pressure on the network largely because of the delays in refurbishing and procurement of new rolling stock to keep up with the demand. Signaling instability and failures, as well as, more recently, power outages caused by aging infrastructure limit capacity (DBSA, 2012). Wall, Smit and Amod (2021) indicated that the South Africa grading of the infrastructure conducted between 2006 and 2017 showed that the passenger line was categorized as the *risk of failures* which means that it was in a bad state and was evidently deteriorating.

PMG (2021) stated that according to the annual report 2019/20 of the company under study, since 2018/19 the entity continued to experience a decline of trains at a time when signaling was a major contributor of train delays because it is inclined to vandalism, theft and obsolescence. According to StatsSA (2021) based on the household travel survey conducted, there was a significant decrease of the trains from 1.4 million to 0.5 million, with an increase in the number of taxis from 9.8 million to 11.4 million, as their preferred transportation method. The train has contributed to higher dissatisfaction rates which are pertaining to poor service delivery and unreliability. According to Sonjica (2021), the Minister of Transport indicated the challenges that the entity was encountering which include vandalism and theft of rail infrastructure. The budget allocation to Company X in the medium term to increase the number of working trains and rehabilitate deteriorating infrastructure, was all part of their broader rail-to-road strategy, which was critical to establishing rail as the backbone of their public transportation system.

Shibata, Hanyu, Doi Hata and Yamaoka (2014) conducted the research about crime and disorder-related expectations and perceptions in train stations which was mainly focused on the passenger experience. Despite the fact that several other scholars have performed empirical studies on the influence of rail infrastructure management, whereby they have primarily focused on passenger experience and service quality, especially in emerging

countries; this studies is crucial in understanding how rail transportation was rapidly changing in order to improve service delivery and customer satisfaction.

Macchi (2012) stated that railway infrastructure management is critical in responding to business pressures in rail transportation. In reality, on the one hand, while there were market pressures for cost effectiveness and customer service, there were also social obligations to preserve people's safety and health (Macci, 2012). Fourie and Zhuwaki (2017) maintained that managing and maintaining railway infrastructure is essential to ensuring the availability and dependability of rail transportation. Odolinski and Wheat (2018) acknowledged that infrastructure investment necessitates a significant amount of money, and the rationale was that infrastructure needs to be maintained and renewed because of traffic and, to some extent, weather-related wear and tear; this is because maintenance and renewals will impact the infrastructure's performance and dependability.

According to Schwager and Meyer (2007), customer experience refers to a customer's internal and intuitive reactions to any active or passive contact with the organization. Rego, Morgan and Fornell (2013) explain that customer satisfaction is correlated to the market share, which is considered to be a key driver for the profit maximization of the organization. Hickish, Fletcher and Harrison (2019) stated that passengers' experiences and satisfaction is also used as a network performance indicator for various rail networks around the world.

Camacho *et al.* (2016) critically argued that passenger-centric innovation is imperative for the future of the public transportation which address the core quality of services such as “availability, efficiency, safety, and comfort”. The national development plan addresses the difficulties of inadequate investment, inefficient operation, and maintenance of existing infrastructure, including rail infrastructure, in order to maintain and expand it by closing the gap created by a growing economy (National Planning Commission, 2010). Kingston (2021) argues that rail drives economic expansion and job creation because it has the capabilities to transport about 2.5 million to 3 million daily.

Mattsson and Jenelius (2015) as quoted by Szymula and Bešinović (2020) indicated that when it comes to transportation networks, disruptions can result in longer travel times, cancelled trips; and hence higher costs, as well as fewer activities and locations

accessible. Szymula and Bešinović (2020) maintain that “trains may be cancelled, redirected, short-turned, or re-timed” during a disruption, forcing passengers to take other routes through the network, taking the fastest route possible, and occasionally not being able to get to their destination.

Golightly and Dadashi (2016) state that railway delays and disruptions have a monetary cost in terms of lost revenue and penalties for late attribution. Thomas *et al.* (2006) as quoted by Golightly and Dadashi (2016) indicate that travelers' high regard for reliability means that delays weaken passenger confidence while also preventing prospective mode shifts from car to train.

1.3 Problem Statement

The South Africa rail infrastructure deterioration which arises from vandalism and ageing has resulted in train delays, train stoppages, train derailment and low security level that render millions of commuters stranded and force them to resort to other public transport that are exponentially more expensive and more reliable as their preferred mode of transport. Havenga *et al*. (2021) critically argue that vandalism and other external issues, as well as a lack of funds, are not the sole cause of poor operational performance; poor governance and weak leadership, as well as dissatisfied or demotivated staff, all contribute. Thus, these results in fundamental challenges of poor organizational performance which has a direct bearing on economic development and passenger satisfaction due unreliable service provision. The consequences will result in a major loss in customer base and revenue, which may endanger the continued sustainability of the organization under study.

1.4 Research questions

1.4.1 Primary research question

What is the impact of rail infrastructure and passenger experience in Johannesburg?

1.4.2 Secondary research questions

- What are the factors contributing to the deterioration of rail infrastructure?
- What is the impact of poor rail infrastructure on customer experience?

1.5 Research objectives

1.5.1 Primary Research Objective

To understand the impact of rail infrastructure and passenger experience in Johannesburg.

1.5.2 Secondary Research Objectives

- To determine the factors contributing to the deterioration of rail infrastructure.
- To determine the impact of poor rail infrastructure on customer experience.

1.6 Limitation of the study

The limitations for this quantitative research are as follows:

The company under study does not have travelling statistics per region which was supposed to assist in the determination of the sample size. Furthermore, most individuals that use the services are illiterate and others do not have smartphones or could not afford to purchase data which contributed to the slow response rate.

1.7 Scope of the Study

In the context of South Africa, the research will focus on the rail infrastructure and passenger experience. The study's major focus will be on the rail infrastructure, which encompasses all buildings, structures, land, and equipment, including but not limited to the tracks that support the railway lines. The commuters who use the services in the Johannesburg region, particularly at the still-operating railway station, are the focus of this research study.

1.8 Importance of the Study

This research is a crucial addition to the body of knowledge since it provides insight of rail infrastructure management, passenger experience and how that may be deployed to gain competitive advantage and increase or retain existing customers. The study will stimulate interest in the area of rail infrastructure and passenger experience in both qualitative and quantitative fields. Institution responsible for rail infrastructure may also use the findings of this study for future planning and investment.

1.9 Structure of the study

The structure of the study is as follows:

Chapter one: Introduction

Chapter one presents information on the background and problem of the study. It covers the main research problem statement, research questions and research objectives of the study; including the limitations of the study.

Chapter Two: Literature Review

This chapter presents a literature review, which mainly focuses on areas such as customer experience, effects of assets management, rail infrastructure risk mitigation done in multiple countries and technology solutions in full depth.

Chapter Three: Research Methodology

This chapter will provide more information about the research methodology that was employed and it covers the quantitative methodology as a suitable methodology for the study. It will present the sampling and data collection method used for the study. The quality criteria and ethical consideration for the study will also be presented.

Chapter Four: Presentation of Results

This chapter will present and evaluate the findings derived from responses to the online survey conducted pertaining to the study.

Chapter Five: Discussion

This chapter embodies the presentation of findings, discussion, analysis and interpretation of the results obtained from the survey. These discussions on findings are presented in relation to each research question.

Chapter Six: Conclusion and Recommendation

This chapter will outline the conclusion of the study. Recommendation based on the conclusions drawn from the study will also be presented in this chapter.

2.0 Chapter summary

Chapter one outlined the purpose of the study. It further outlined the background problem, problem statement, research questions, objectives as well as the limitations pertaining to the study. The next chapter will focus on the literature review to provide a deeper understanding on the impact of rail and passenger experience.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The objectives of this chapter are to provide in-depth understanding of the purpose of the study. These will be achieved through literature review pertaining to customer experience, effects of assets management, rail infrastructure risk mitigation done in multiple countries and technology solutions in full depth.

2.2 Customer experience and retention

Customers are always looking for new ways to interact with service organizations, especially if they provide a superior experience in terms of service brands (Lemon & Verhoef, 2016 as quoted by Bolton, McColl-kennedy, Cheung, Gallan, Orsingher, Witell and Zaki , 2018). Bolton, *et al*. (2018) acknowledge that organizations can respond swiftly to demand from customers and markets by inventing and offering distinctive experiences which would give them an advantage in the marketplace and lead to positive business outcomes. Nevertheless, for organizations to comprehend and create value together with the consumer, organizations will necessitate an all-encompassing vision of the user experience in order to combine the digital, physical, and social spheres because without integration, organizations in business-to-business as well as business-to-consumer marketplaces encounter a multitude of customer experience hurdles. Since it has been recognized as a prevalent issue around the world, it is critical to understand and improve passenger experience (Hickish, *et al.*, 2019).

Cundari (2015) purports that the components that make up your consumers' experience include availability, value, and quality of your material. Whether you have a customer for life or just a moment depends on your ability to match their demands with the proper message at the right phase in their journey. Customer loyalty is never taken for granted, which presents businesses with a retention issue. Keeping your clients loyal needs the devotion of every employee in your company because attractive, competitive offerings are widely available (Cundari, 2015). Cundari (2015) includes that since it affects every aspect of a business, customer experience has become a key component in successful firms. Given the availability of simple analytical tools that monitor online consumer

behavior, there is a tendency to believe that "customer experience" has a deeper relationship to the digital domain. However, customer experience is equally significant in offline situations.

Chou and Kim (2009) as quoted by Chou, Lu and Chang (2014) critically argue that any competitive and sustainable organization is expected to treat customer response as critical to their long-term success, consumer loyalty which results from word-of-mouth advertising and income, is dependent upon customer retention. According to Chou and Kim (2009) as quoted by Chou *et al*. (2014) studies conducted previously state that customer loyalty is rewarding and that providing great quality and services that deliver outstanding value is considered to be most effective. Numerous studies already examined the importance of customer loyalty and service quality within specific industries, which has deemed service quality to be major driver to preserving clients (Wong & Sohal, 2003 as quoted by Chou *et al.*, 2014). Therefore, under the intense rivalry from railways, for a company to maintain market share, service excellence and customer pleasure are crucial to profit maximization. If a transportation mode continues providing unsatisfactory service, customers may switch to other available public transport modes.

According to Binder, Maknoon and Bierlaire (2015), one of the main causes of passenger dissatisfaction in the railroad sector is delays. Timetables, crew schedules, or rolling stock may be impacted, depending on the severity of the delay. Hickish *et al.* (2019) state that several distinct actions, or stages, can be combined and repeated to represent a passenger journey. For instance, Wang *et al.* (2015) as quoted by Hickish *et al.* (2019) claim that the stages of entering and leaving a station, waiting on the platform, boarding a train, and changing across platforms are good representations of a passenger journey. However, they neglect to consider how much each stage's relative passage of time affects the overall passenger experience. According to Shi, Feng, Li and Tao (2022), passengers are those who should receive the most attention from railway passenger stations since they are the primary object to intuitively perceive railway passenger transport services. In order to increase the quality of service from the standpoint of the customer, it is crucial to weigh the benefits and drawbacks of passenger service.

Oliveira, Bruen, Birrell and Cain (2019) critically highlighted that when compared to other modes of transportation like private car, walking, and cycling, bus and railway passengers

report feeling the most negative feelings (Morris and Guerra, 2015). Travel pleasure tends negatively impacted by using public transportation, thus it's important to make it an attractive alternative to make passengers feel better (Friman *et al*., 2017). Comfort and convenience enhancements, which are largely affordable, may be used to enhance public transportation and increase usage (Litman, 2008 in Oliveira *et al*., 2019).

Do and Vu (2020) stated that rail transportation organizations must establish essential measures to attract more customers to their business as one of the measures to tackle the obstacles and problems of the transportation market. Customer satisfaction is an important aspect in achieving market success and is used as a key performance indicator (Mostaghel, 2006 as quoted by Do & Vu, 2020). Customer satisfaction is a term used in business to describe how well goods and services meet or surpass customers' expectations (Do & Vu, 2020).

Štefancová, Nedeliaková and López-Escolano (2017) postulate that in the highly competitive and budget-conscious economy of today, it's critical to provide world's best railway transportation services and create a strong transportation market position. Optimizing the workplace is crucial to a functional service system that is constantly advancing and strengthening service quality. A services provider is only as good as its employees, transport firms must also understand the demands and expectations of their staff in order to provide excellent service to their customers. Employees will never be adequately motivated to meet the organization's objectives if they are not sufficiently inspired individually. Štefancová *et al.* (2017) critically highlighted that transportation companies should not focus only on profit maximization but mainly on improving services for customers to have positive travel experiences. The quality of railway service depends on various standards which also includes the front-line employees in the process (refer to below Figure 1).

Figure 1: Service quality transportation process



Source: (Štefancová, et al., 2017)

According to Ross, May and Cockbill (2020) it will imperative to switch to more sustainable forms of transportation, such as public transportation, and railroad is a method that allows for faster passenger utilization while avoiding traffic congestion. Existing train users must be retained and non-users must be enticed to the service in order to maximize its potential. For a broad spectrum of people, the rail sector's service must be seen as being of the highest quality and functionality.

Technology has the ability to bring about the improvements required to boost rail transport efficiency and enhance the customer experience (Oliveira et al., 2019). Making the journey more enjoyable is necessary if society is to be persuaded to take public transportation more frequently. Examples include measures to improve the flow of information and communication, convenience, control, and ease of arranging a trip (Camacho et al., 2013; Foth and Schroeter, 2010; Islam et al., 2017) as quoted by (Oliveira et al., 2019). In addition to pre-trip information for planning purposes, passengers also want information while traveling, such as timing, connections, and platform allocation (Blainey et al., 2012) as quoted by (Oliveira et al., 2019). According to a thorough study, excellent navigation information can improve passengers' experiences using public transportation (van Lierop et al., 2018) as quoted by (Oliveira et al., 2019).

Innovative technologies may change how passengers perceive rail travel and enhance their overall experience. Public transportation users regularly use smartphones, which might make waiting times feel shorter (Lyons et al., 2016; Oliveira et al., 2016) as quoted

by (Oliveira et al., 2019). Additionally, special system features created for railway passengers have the potential to enhance the traveling public's experience. However, it is vital to assess what client’s value in order to build the appropriate solutions and boost their acceptance and implementation (Goodman et al., 2012).

2.3 Effects of Assets Management

Szymula and Bešinović (2020) state that economy, society, and technology all rely on critical infrastructure networks to thrive. With the growing significance of ecologically friendly and sustainable transportation, public transportation, particularly trains, is gaining even greater public attention and desire to provide high-quality services. For passengers and potential users to completely benefit from the advantages of public transportation and railways, transportation services must be appealing and beneficial. Assessing performance and behavior during interruptions is critical for the organization’s various interconnected strategical and tactical planning processes e.g., “incentivizing future network investments, assigning spare, emergency, and maintenance assets, and designing traffic operations” that are resilient.

According to Lima, McMahon and Costa (2021) investing efficiently in your asset management is critical to obtaining greater returns, particularly for businesses looking to increase the value of their assets. Asset management is a set of important operations that comprise technical and management processes to support and control the assets under management, which implies that effectively, investing entails prioritizing asset management based on the organization's strategy. As a result, asset-intensive firms that want to be competitive and sustainable must maintain their assets according to best practices and comprehend 'how asset management maturity impacts on business performance'. According to Kirwin and Gradinariu (2010) as quoted by Rama and Andrews (2014) asset management decisions in the railway industry are expressly focused on asset maintenance, augmentation, and renewal is necessary to deliver the necessary level of dependability and service enhancement at the most affordable price.

Stenström, Parida, Galar and Kumar (2013) state that the effectiveness of railway infrastructure must be assessed in order to effectively manage assets against stated objectives. The selection of assets is the main consideration in the decision-making

process for managing railway infrastructure assets and intervention tactics with the goal of providing cost-effective and reliable infrastructure (Rama & Andrews, 2014). Andrews and Rama (2016) argue that implementing railway infrastructure which is both dependable and sustainable in terms of availability and safety while working within ever-shrinking budget restrictions is a massive problem. Railway infrastructure providers experience a severe problem in expanding capacity on ageing infrastructure without jeopardizing its dependability and safety while working within budget constraints (Rama & Andrews, 2014).

2.4 Rail infrastructure risk mitigation in multiple countries

According to Asmag (2015), given that there were over 120 000 miles of railway track in European railways, it was difficult to cost-effectively deploy video surveillance systems throughout the region. This made it necessary to permanently protect sensitive areas that were exposed to high levels of criminal activity. Another issue was the delay of trains caused by the delay in removing graffiti, which necessitated the cleaning of the area. The German rail had to allocate budget to deploy spy drone that would track down and arrest graffiti. The French company RFF allocated funds to upgrade their rail network and protect it against cable theft, and vandalism.

Soilán et al. (2019) indicate that a previous study conducted about European countries regarding technologies concluded that it is imperative to emphasize that improving infrastructure resilience is critical to reducing risk exposure and minimize the impacts of hazards at various levels such as the extreme events which are becoming more common as a result of climate change and human-made events (accidents, vandalism or terrorism). The study indicated that resilience requires preparation and that would address three critically areas as follows: i) the ability to forecast risk; (ii) “the infrastructure monitoring”; and (iii) the systems that assist in determining, mitigating, and safeguarding infrastructure from any deterioration. The study indicated that utilization of new technologies for data collecting, as well as tools that improve decision-making with that data, are critical factors in the creation of more efficient infrastructure monitoring and maintenance. The 3D cloud data is considered to be feasible for infrastructure monitoring application and the LiDAR (Light Detection And Ranging) “technologies for infrastructure monitoring and asset inventory” are still evolving.

Shibata *et al*. (2014) investigated assessing the anticipated and perceived occurrences of crime and disorder in the train stations of Tokyo, Japan. Their study's objective was to investigate the people's views of the station's surroundings in terms of how they estimate and experience unpleasant events while using railway stations, with an emphasis on crime and disorder incidents. The authors found that the recurrence of such incidents ~~which the event was encountered~~ was a major predictor of its discomfort. Therefore, the report proposed initiatives to enhance railway comfort for passengers.

2.5 Technology solutions

Castillo-Mingorance, Sol-Sánchez, Moreno-Navarro and Rubio-Gámez (2020) critically highlighted that the growth of society and the economy depends critically on the movement of both people and things. With growing infrastructure utilization in recent years, mobility has significantly grown, necessitating higher investments to maintain their operation and safety. This is made more apparent by the fact that train capacity and speed are also rising in an effort to shorten travel distances and improve railway productivity. This makes it vital to maximize the time, resources, and expenditures for maintenance tasks in order to ensure good track operability (which are increasing in frequency due to increased use).

According to Van Schalkwyka, Joostea and Lucke (2021) infrastructure maintenance on railways continues to remain difficult. Technology advancements are the reason why businesses across a range of industries are being forced to modify and adapt their current business practices in order to stay competitive. Predictive maintenance is one technique for maintenance that can profit from the use of cutting-edge technologies. Such a strategy needs ongoing inspection and monitoring, which can be accomplished. One industry that stands to gain from the adoption and application of cutting-edge technologies for asset condition monitoring in support of preventive maintenance is the railroad sector**.**

According Laiton-Bonadiez *et al.* (2022) **one** of the key sectors for a nation's economic development and transportation needs is the railroad sector. The digitalization of the railway industry must coincide with these technical advancements. This, due to its

significance in the economic development of nations as the world experiences significant changes in industry operations as a result of new improvements in our technology. The incorporation of new technologies into industrial processes, such as artificial intelligence (AI), the internet of things (IoT), and cloud computing, has the potential to change productivity, employment, and other aspects of the human economy.

Industry 4.0 technologies are currently the culmination of advancements made in information and communication technology (ICTs) (Laiton-Bonadiez *et al.,* 2022). These technologies are able to use information and resources more effectively, enhancing business operations and opening up fresh possibilities for the creation of new services. Industry 4.0 is actually based on technologies that enable communication environments, environmental identification, comprehensive data gathering, and bespoke instrument judgments, all of which are essential for the improvement and upkeep of operations and infrastructure in the railway sector (Laiton-Bonadiez *et al.*, 2022).

To better understand the main issues that the scientific community is facing in the railway industry and how these technologies are being used to address them, it is crucial to understand the extensive amount of research that has focused on the development of new tools based on industry 4.0 technologies in this field (Laiton-Bonadiez *et al.*, 2022).

Fraga-Lamas, Fernández-Caramés and Castedo (2017) posit that intelligent transportation systems that integrate technologies over a wide rail network architecture to lower life-cycle costs are projected to be the railway industry's future. New services including “integrated security, asset management, and predictive maintenance are intended to assist with issues like safety, scheduling, and system capacity”. Modern rail infrastructure, including automated ticketing, digital displays, and smart meters, as well as networked technological products and components, make up "smart railways.".

2.6 Chapter summary

The chapter has provided in-depth understanding of the importance and effects of the customer experience, assets management, technology solutions in the rail transportation industry and the measures taken by the multiple countries to eradicate the poor conditions pertaining to the rail infrastructure.

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CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

A research methodology is a process of collecting information and data for making decisions. The research design is a plan of how the researcher will go about responding their research questions and objectives. This chapter will provide more information about the research methodology that was used as well as literature review about the quantitative methodology. The chapter will further describe the research design and data collection method that was used, followed by the data storage and sampling techniques as well as data analysis. The section will also review the quality criteria which covered the validity, reliability and objectivity of the study. The section will be concluded with the ethical consideration, informed consent, protection from harm and rights to privacy pertaining to the participants or respondents for this study.

3.2 Research approach

Creswell and Creswell (2018) describe quantitative research as a technique for examining the relationship between variables in an effort to verify generalizations. Qualitative research is a way to look into and understand the significance that people or groups place on a social or human issue. Creswell and Creswell (2018) state that a sort of investigation known as "mixed methods research" collects both quantitative and qualitative data, combines the two, and uses various designs that may contain philosophical presumptions and theoretical frameworks. For the research being conducted, to acquire insight into current situation of rail infrastructure, establish links between variables, and occasionally attempt to explain causal relationships between variables (customer experience), quantitative research approach was applied.

3.3 Sampling

3.3.1 Target Population

Any group of individuals that share a certain set of traits is referred to as a target population (Quinlan et al., 2019, p. 173). According Daniel (2021), during the period of 2013/2020, there was a survey conducted for national household travel survey which showed that there was significant decrease of train usage nationwide; from 700 000 to 150 000 passengers, as a preferred mode of transport. Therefore, for this study the people who live in and use train services in the Johannesburg area made up the demographic for this study.

3.3.2 Sampling Methods

Different sample designs exist, including “probability sampling and non-probability sampling”. Kothari (2009) posits that “probability sampling is based on the concept of random selection, whereas non-probability sampling is ‘non-random’ sampling”. Therefore, the selection of participants used for this study is the non-probability sampling technique, specifically convenience sampling has been adopted. According Etikan, Musa and Alkassim (2015) convenience sampling techniques prioritize generalizability (i.e., ensuring that the knowledge gained is representative of the population from which the sample was drawn).

3.3.3 Sample size

According to Delice (2010), in a survey-based study, 100 samples should be found for each major subgroup in the population, and 20 to 50 samples should be found for each smaller subgroup. Therefore, for this study, sample sizes was about 500 potential participants, to whom an invitation was sent with a survey questionnaire.

3.4 Data Collection

When conducting the survey research, the researcher can choose from a variety of data collection methods. Therefore, the online self-administered survey questions were used to gather the required data and the questionnaire comprised of closed ended questions.

Meadows (2003) states that online survey has the ability to cover a large, dispersed population and a broader research population while also being less expensive than other methods.

3.4.1 Data collection instrument

Creswell and Creswell (2018) state that the primary objective of a survey design is to look at a sample of a population in order to give a quantitative description of patterns, opinions, and trends in that population's attitudes, or to search for correlations between various variables. Wherever else, an experimental design is methodically adjusting one or more variables to observe how they effect a desired result (or outcomes). Therefore, survey design was adopted, and the study's main goal was to empirically evaluate the relationships between the impact of rail infrastructure and passenger experience.

The rationale was that an online survey is easily administered and can be administered remotely, capable of collecting information from large number of respondents. According to Fielding *et al.*, (2008:144), a self-administered questionnaire is beneficial for the researcher and respondents because it can be done at their own time, place, and speed, which saves money, time, enhances privacy, and eliminates interviewer-related biases, all of which led to greater data quality. Bell (1996) as quoted by Glasow (2005) critically argues that one weakness of online survey is that there may be biases in the kind and quality of the responses received, the lack of response from suggested participants, or both. Respondents who intentionally report inaccurate actions to influence survey findings or hide unpleasant behavior are additional sources of inaccuracy. Lastly, individuals may find it challenging to assess their own actions or recall the details surrounding their behavior. The survey adopted was cross sectional because of the time-constraints.

According to Creswell and Creswell (2018) instruments are increasingly being given via a growing number of online survey platforms (e.g., Qualtrics, Survey Monkey). Although these items are expensive, they can be quite useful in speeding up and improving the survey research process. Therefore, for this research study, the instrument that was adopted is Qualtrics that is provided by the Wits Business School.

3.4.2 Data capturing and storage

Digital content has been saved by researchers so it may be recovered in the future. Given the growth of large data sets, researchers' obligation to preserve data securely has become more important and burdensome. According to Qualtrics (2021), the most critical priority for Qualtrics is the security and dependability of consumer data. High-end firewall systems secure our servers, and scans are run on a regular basis to guarantee that any vulnerabilities are immediately identified and corrected. Therefore, the data has been stored in Qualtrics to protect it against any cyber-attacks.

3.4.3 Data analysis

For data analysis of the quantitative study, descriptive analysis was adopted. Creswell and Creswell (2018) defined descriptive analysis as data on variables in a study, including means, standard deviations, and the range of scores used to describe the outcomes. May (2018) stated that to measure and examine the fundamental characteristics of a data collection, the researcher can utilize descriptive statistics. The IBM SPSS version 26 software was utilised, and this is short for “Statistical package for the Social Sciences”. The researcher used “descriptive analysis, inferential statistics, frequency tables, diagrams, and charts” to analyze data for quantitative research (Bryman, *et al.*, 2017). Furthermore, a correlation test was also utilized since, as Quinlan *et al.* (2019) point out, in addition to measuring the degree to which an independent variable predicts a dependent variable, it is a single number that can express the degree of relationships between any two variables; thus, the regression analysis was utilized.

3.5 Quality Criteria

A research questionnaire's reliability and validity were critical for testing constructs and variables.

3.5.1 Validity

The degree to which a measurement tool actually measures what it claims to measure is a common definition of validity (Blumberg et al., 2005, as quoted by Mohajan, 2017). A research tool's validity determines how well it measures what it was intended to measure (Robson, 2011, as quoted by Mohajan, 2017). It refers to how accurate the results are. Therefore, a survey tool (questionnaire) is needed to precisely quantify the concepts being studied (Pallant, 2011, as quoted by Mohajan, 2017). In quantitative research, the

degree to which a test achieves its intended goals is referred to as validity (Thatcher,2010, as quoted by Mohajan, 2017).

3.5.2 Reliability

A measurement that yields constant, equal findings is referred to as being reliable (Blumberg *et al.*, 2005, as quoted by Mohajan, 2017). It measures consistency, precision, repeatability, and trustworthiness of a research (Chakrabartty, 2013, as quoted by Mohajan, 2017). In quantitative research, reliability refers to the stability, consistency, and recurrence of results; for example, if consistent results were obtained in identical but dissimilar situations, a researcher's findings would be viewed as reliable (Mohajan, 2017). The reliability of this study will be evaluated using the Cronbach's alpha. According to Tavakol and Dennick (2011) in order to quantify the internal consistency of a test or scale, Lee Cronbach created alpha in 1951; it is represented as a number between 0 and 1. It further explains that there are several reports on appropriate alpha values, which range from 0.70 to 0.95.

3.5.3 Objectivity

“Objectivity is a key concept in scientific and philosophical reasoning” (Maul, 2018). In principle, objectivity refers to the assumption that scientific findings are not or should not be influenced by the distinctive characteristics of any one person or group of people, such as their ideas, values, biases, interpretations, or sentiments. "Bias-free," "value neutral," or "fair" are all terms used to describe objectivity (Maul, 2018).

3.6 Ethical considerations

According to Creswell and Creswell (2018) ethical issues are vital concerns for every study. Thomas and Hodges (2013) define research ethics as the principles of appropriate behaviour that researchers must uphold when interacting with participants. Carpenter (2019) state that the focus of most ethical analyses of quantitative research, including experiments, is on the reported methodology and outcomes. Prior to collecting data for this study, an ethics clearance from the Wits Business School Ethics committee was obtained.

3.6.1 Informed Consent

According to Cahana and Hurst (2008) the need for informed consent in research is essential since it enables participants to freely and voluntarily decide whether or not to engage in the study. They further explain that disclosure, understanding, decision-making capacity, and voluntariness are commonly used to explain the elements of informed consent (Cahana and Hurst, 2008). In this research, the survey was based on voluntary participation whereby the respondents were given an opportunity to decide on their own accord whether to participate or not in the research.

3.6.2 Protection from harm

Shaw and Barrett (2006) state that the lens through which we predict the results of research, and the impact of researchers' actions is risk assessment. Before participating in the study, the volunteers must be mindful of the risks and accept them because the researcher cannot entirely guarantee their protection. There are two different types of harm which are negligent harm (also called intentional) and non-negligent harm (also called unforeseen). As a result, the results of this study will be sent to the recommended journal for review, and if accepted, they will be published with all pertinent information kept private.

3.6.3 Right to privacy

Privacy of the identity and personal information of the respondents shall be protected by ensuring participants remain anonymous and confidential during the analysis and interpretation or reporting of the data.

3.7 Chapter summary

This chapter presented the research methodology that the study would embark on to successfully obtain useful data from the commuters around the Johannesburg region. The study was based on the descriptive statistics and correlation to ensure the successful outcome of the study. Data will be collected from different commuters using the online survey. Quality of the research instrument was assessed for both validity and reliability. The next chapter will present findings from the data collected.

CHAPTER FOUR
PRESENTATION OF RESEARCH RESULTS

4.1 Introduction

The purpose of this section is to present research results derived from distributed questionnaires and demographic information. We shall attempt to accomplish this by means of conducting various analysis related to research questions as identified in the first chapter.

Firstly, we performed statistical analysis to test whether the variables conformed to the requirements concerning reliability as well as validity. Furthermore, the normality conditions were explored in order to identify the appropriate statistical tests.
Secondly, we attempted to address the first research question that explores the possible relationships between the various poor infrastructure factors. Thirdly, we assessed the second research question which looks at the impact that reliability perception has on customer experience. Lastly, findings were then summarised.

4.2 Demographic information

The demographic data of respondents which fall into various age categories, together with their proportion, are shown in table 1 below. As a result, respondents between the ages of 25 and 34 made the highest percentage of respondents (50.5%), who were followed by respondents between the ages of 35 and 44 (41.4%). About 7.2% of those between the ages of 45 and 54 came in third place. The lowest number, which is around 0.9%, was of people who were 55 or older.

Table 1:Demographic information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25-34 years old	56	48.7	50.5	50.5
	35-44 years old	46	40.0	41.4	91.9
	45-54 years old	8	7.0	7.2	99.1
	55 years or older	1	.9	.9	100.0
	Total	111	96.5	100.0	
Missing	System	4	3.5		
Total		115	100.0		

4.2.1 Response Rate

Out of 500 distributed survey questionnaires, 115 responses were received and showed a response rate of about 23%. The survey's age distribution and response rate were shown in table 1 above.

4.3 Data Analysis

4.3.1 Reliability and Validity Analysis

Statistics regarding the inter-rater reliability for the Customer Experience scale.

Table 2: Reliability Statistics

Scale	Cronbach's Alpha	No of Items
Customer Experience	.821	5

Table 2 above aims to assess whether the customer experience scale complies with the requirements concerning inter-rater reliability. Questions 7-11 were selected to construct this specific scale because it complies with the requirements of the inter-rater reliability. The Cronbach's alpha was consulted to assess for inter-rater reliability. As seen in Table 2 above, the scale could be deemed reliable as a Cronbach's Alpha value of .821 was achieved. For a scale to be considered reliable, an alpha value of at least .70 would be needed (Salkind, 2017).Following the reliability analysis, passenger experience scale was then tested for construct validity. For the validity test, the Pearson's Correlation Analysis was opted for. The results from correlation analysis are stated below as follows:

Table 3: Validity Statistics - Passenger Experience

Correlations						
		Q7	Q8	Q9	Q10	Q11
Q7	Pearson Correlation	1	.525**	.518**	.526**	.424**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	96	96	96	96	96
Q8	Pearson Correlation	.525**	1	.694**	.585**	.377**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	96	96	96	96	96
Q9	Pearson Correlation	.518**	.694**	1	.552**	.331**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	96	96	96	96	96
Q10	Pearson Correlation	.526**	.585**	.552**	1	.379**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	96	96	96	96	96
Q11	Pearson Correlation	.424**	.377**	.331**	.379**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	96	96	96	96	96
**. Correlation is significant at the 0.01 level (2-tailed).						

For passenger experience scale to comply with construct validity, moderate to strong correlations that are statistically significant were required (Salkind, 2017). As seen in the table above most correlations were statistically significant. We then summed the means of all the variables and constructed a customer experience variable. Note that other variables could not be tested for reliability or validity due to the nature of the data. Only one variable was used for specific constructs such as the reliability variable and this would be noted as a limitation concerning the data.

4.3.2 Assessing the significant factors that could contribute to rail infrastructure deterioration perceptions

In this section questions 12.1 -12.4 is evaluated by means of a correlation analysis. This technique was used to answer the first research question as stated in the introduction. The test conducted was to determine if factors that lead to poor rail infrastructure have no relationship with one another.

A normality test will was run to decide if the Pearson's Correlation (a parametric test) should be opted for or a Spearman's correlation analysis which is its non-parametric counterpart (Salkind, 2017). Results from normality test are noted below:

Table 4: Normality Statistics - Poor Infrastructure factors

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Inadequate investment	.140	96	<.001	.932	96	<.001
Vandalism/cable theft	.254	96	<.001	.768	96	<.001
Poor Maintenance	.186	96	<.001	.860	96	<.001
High Unemployment rate	.202	96	<.001	.832	96	<.001

a. Lilliefors Significance Correction

Table 4 above depicts the results from the normality test. Since the sample size was greater than 50, the Kolmogorov-Smirnov statistic was interpeted (Salkind, 2017). Since results were statistically significant, we concluded that variables were not normally distributed. Therefore, it was opted to run the Spearman's correlation analysis instead of the Pearson's correlation analysis.

4.3.2.1 Descriptive Statistics – Spearman's Correlation Analysis

Table 5: Descriptive Statistics - Spearman's Correlation Analysis

Descriptive Statistics					
	No.	Minimum	Maximum	Mean	Std. Deviation
Inadequate investment	96	10.00	100.00	60.6250	27.48445
Vandalism/cable theft	96	.00	100.00	82.0833	23.97001
Poor Maintenance	96	.00	100.00	78.3333	22.69554
High Unemployment rate	96	.00	100.00	69.2708	32.64626
Valid No (listwise)	96				

The descriptive statistics above in Table 5 showed that the Vandalism variable *(M* = 82.0833, *SD* = 23.97001) demonstrated the highest mean while the High Unemployment variable showed the highest variance *(M* =69.2708, *SD* = 32.64626). This means that vandalism was the highest rated variable in the survey while High unemployment showed the most variation in the responses.

4.4.2 Spearman's Correlation Analysis with Poor Infrastructure

Table 6: Correlation Results for Infrastructure

Correlations						
			Inadequate investment	Vandalism/cable theft	Poor Maintenance	High Unemployment rate
Spearman's rho	Inadequate investment	Correlation Coefficient	1.000	.225*	.203*	.055
		Sig. (2-tailed)	.	.028	.047	.594
		N	96	96	96	96
	Vandalism/cable theft	Correlation Coefficient	.225*	1.000	.291**	.218*
		Sig. (2-tailed)	.028	.	.004	.033
		N	96	96	96	96
	Poor Maintenance	Correlation Coefficient	.203*	.291**	1.000	.241*
		Sig. (2-tailed)	.047	.004	.	.018
		N	96	96	96	96
	High Unemployment rate	Correlation Coefficient	.055	.218*	.241*	1.000
		Sig. (2-tailed)	.594	.033	.018	.
		N	96	96	96	96
**. Correlation is significant at the 0.05 level (2-tailed).*						
***. Correlation is significant at the 0.01 level (2-tailed).*						

Table 6 above shows the results from Spearman's correlation analysis. The test conducted was to determine if the variables have no relationship with one another. The results regarding Spearman's correlation analysis demonstrated that Poor Maintenance had the most significant relationships with Inadequate Investment, Vandalism and High unemployment although these relationships were quite weak (less than .30). Based on the above results, it could therefore be conclude that there was an association between more than two variables contained in the analysis.

4.3.3 Analysing the impact of rail infrastructure reliability on Customer Experience.

For the next Question, it was evaluated whether reliability perceptions of railway platforms could impact the customer experience. The simple linear regression was conducted to assess the impact of rail infrastructure reliability on customer experience. The results was denoted as follows:

4.3.3.1 Descriptive Statistics – Simple Linear Regression Analysis

Table 7: Descriptive Statistics regarding SLR

Descriptive Statistics

	Mean	Std. Deviation	N
Customer Experience	1.9958	.74437	96
Reliability	.3021	.46157	96

The descriptive statistics in Table 7 above shows that Customer experience had the highest mean as well as the highest variance (*M* = 1.9958, *SD* = .74437).

4.3.3.2 Simple Linear Regression Analysis with Customer Experience as our dependent variable

Table 8: Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.206[a]	.042	.032	.73228	1.883

a. Predictors: (Constant), Reliability

b. Dependent Variable: Customer Experience

Table 8 above showed that the linear regression model was only able to explain 4.2% of the variance in the dependent variable. This was very small from a magnitude perspective. Moreover, the Durbin-Watson statistic showed that the model does not suspect any evidence of auto-correlation as it lies between 1.5 and 2.5 (Salkind, 2017).

Table 9: ANOVA Statistics

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.232	1	2.232	4.162	.044[b]
	Residual	50.407	94	.536		
	Total	52.638	95			

a. Dependent Variable: Customer Experience
b. Predictors: (Constant), Reliability

The ANOVA table above has indicated whether the model was a good fit. It was shown that the model was indeed a good fit at the 95% confidence level (F(1,94) = 4.162, p=.044). Due to the results within the Table above, linear regression analysis was proceeded with. The results also showed that the sample size might have been too small as seen in the low value concerning the R-squared result.

Table 10: Regression Coefficients

		Unstandardized Coefficients		Standardized Coefficients			Correlations		
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	1.896	.089		21.188	<.001			
	Reliability	.332	.163	.206	2.040	.044	.206	.206	.206

Table 10 above demonstrated the impact of stated independent variable (reliability). Reliability proved to be a significant predictor of Customer Experience (t=2.040, p=.044). Furthermore, when analyzing the coefficients, it was discovered that for every one unit increase in Reliability, Customer Experience on average increased by 33.2%. Based on the results above, it can therefore concluded that reliability does have an impact on customer experience regarding railway infrastructure.

4.4 Chapter summary

This chapter addressed the research questions that were identified in Chapter one. First a reliability and validity analysis was run to test whether customer experience construct was suitable for data analysis. It was found that customer experience variable was statistically reliably and statistically valid. It should be noted that the variables used in the first correlation analysis within the first research question could not be tested for reliability and validity as these questions did not follow a Likert Scale approach. We then tested the first research question. It was found that Vandalism, Poor Maintenance, and Inadequate investment did have an association with each other. Lastly, the impact that reliability has on customer experience was tested. It was found that it was a significant predictor but could probably be ineffective when looked at in isolation. The next chapter uses the above results to discuss the findings against the literature review stated in chapter 2.

CHAPTER FIVE
DISCUSSION OF RESULTS

The aim of this study was to investigate the rail infrastructure and passenger experience in Johannesburg. This chapter will be focused on discussion of results which are related to each research questions.

5.1 Rail infrastructure and passenger experience in Johannesburg

The results in the context of available literature review has revealed more details about the implications of asset management, including those pertaining to rail infrastructure, which was regarded as one of the primary assets in the railway transportation industry. It emphasizes that a maintenance strategy should be in place to manage the assets in a way that increases their value and yields higher returns. The organization under study should place a strong emphasis on customer service in order to improve the passenger experience and deliver high-quality service. This will require staff support in order to succeed. In order for an organization to remain in business, it must not undermine the influence of its consumers, who are crucial to its survival because they are constantly seeking out new products and services in light of the environment's constant change.

Several authors critically argue that organizations are always under immerse pressure because rail infrastructure requires massive budgets to be able to effectively manage assets, hence many providers are faced with the challenges of not being able to increase capacity on ageing infrastructure without impacting its reliability and safety. Customer experience is negatively impacted when rail infrastructure is deteriorating, and commuters finally turn to alternative modes of transportation. Therefore, organizations must develop customer retention strategies to keep their existing clients and attract new ones.

The correlational results have shown that most customers care more about communication and prompt resolution of delays. The results have indicated that about 94.6% of respondents were fully aware of the current state of the transportation infrastructure which means that customers were well informed about railway transportation service because their main justification for commuters using rail transportation was to avoid congestion. The customer service provided by Company X indicated to have suffered as a result of the company's poor communication skills and

lack of urgency to address the delays that left travelers stranded. No app exists that would allow them to interact with commuters. Due to a lack of train infrastructure, many important routes that were essential around the city of Johannesburg were not operational. Existing clients are not given any information regarding dates on which certain routes would resume service. Customers therefore turn to alternative modes of transportation, which were more dependable and more expensive.

The results further showed that commuters' main concern has been about the current security level, which was one of the contributing factors to the current deterioration of the train infrastructure. This had a negative impact on customer satisfaction since commuters perceive their service as unsafe and unreliable. The current state of the country has forced commuters to be more cautious about their safety especially around public areas or using public transportation. Hence, company X has recruited about 3000 security to improve their security level.

The findings show that respondents are more interested in a technology enhanced solutions which plays a significant role in improving the customer experience and provide high quality service. Because Company X is still reliant on obsolete methods and has no technology solutions to effectively manage its assets, customer satisfaction was continuing to deteriorate. Competitors have implemented technological solutions that make it seamless to monitor their assets, connect with clients constantly via an app about any delays, timetables, or special discounts, and have maintenance staff on hand to rapidly address any concerns. Competitors are aware of the critical role that customers play in their businesses and the necessity of adapting to changing environmental conditions in order to remain competitive. Therefore, in order to build a winning strategy and stay competitive, the organization under study needs to learn from its recent failures.

5.2 Contributing factors to the deterioration of the rail infrastructure

The results in the context of available literature review have summarized the various case studies that are carried out in various countries, particularly on vandalism, and it has revealed that European countries do experience vandalism. It was explained that it was impossible to install video surveillance, but they have installed them on crucial areas that were exposed to a risk of being vandalized, and the most prevalent vandalism was known

as the Graffiti on trains which has no impact on its functionality but causes a delay because it reduces the amount of trains that could run. Resultantly, removing the graffiti needs specialized equipment, which costs them a lot of money. Germans have swiftly responded to such attacks by using spy drones to put an end to criminal activity.

The findings have demonstrated that vandalism, poor maintenance, and insufficient funding were the main causes of the problems that result in poor train infrastructure. The organization under study should be in a position to ensure that there was a strategy in place to handle those issues because that threatens the existence of the business. This will ensure proper functionality of the service without any unsolicited disturbance. Despite the fact that company X has been working tirelessly with the South African Police Services to apprehend those responsible for the criminal activities, more needs to be done because vandalism, in particular, has negative effects on commuters who depend on the service on a daily basis, and company X continues to experience customer losses and decrease total revenue because security level was a problem. South Africa is ranked as having one of the highest rates of vandalism, which endangers the nation's ability to thrive economically.

Even if insufficient investment may not have been the primary cause of the breakdowns, the organization's poor maintenance practices have demonstrated that their assets have been neglected for many decades. One of the knock-on effects is that corruption spreads across the organization, making it impossible to hold accountable those entrusted with doing preventative maintenance on the company's assets who instead misappropriate funds for their own benefit. One of the wicked problems was the unemployment rate, which has skyrocketed and was rendered much worse by the pandemic. As a result, businesses were being shut down and being liquidated. High unemployment was identified as the biggest difference in the results. Even illegal immigrants from neighbouring countries are becoming more involved in criminal activity as a result of the existing situation, which puts the rail infrastructure at risk of further vandalism even when additional investments were made. These issues have not been resolved by the present administration. The black-market scrapyard has been deemed to be one of the contributors to the poor rail conditions because criminals were able to sell to them without proper evidence or documentation. According Khumalo (2022), two illegal immigrants

have been sentenced to 15 years direct imprisonment for theft and smelting of stolen copper cables which is estimated to be worth about R2.6 million.

In terms of inadequate investment, the findings showed that this was one of the factors that contributes to the poor railway's conditions. The National Treasury was able to rescue Company X, proving that funds were available, indicating that improper financial management continues to be a major contributing cause to the failure to address deterioration. According Sonjica (2021), billions of Rands were allocated to address the poor rail infrastructure conditions. If problems are not swiftly resolved, Company X may soon contemplate cutting expenses by reducing work forces. These will result in a further rise given the current unemployment rate.The Johannesburg region offers several roads that are close to amenities that were crucial to the performance of business operations. These will result in a further rise given the current unemployment rate.

5.3 Impact of rail infrastructure on customer experience

The results in the context of available literature review revealed that the rail infrastructure's dependability and functioning were crucial because customers depend on a service that will operate normally and without interruption, including that rail travel was thought to be less congested than road travel. Safety, time, customer care, delay, and availability was some of the key factors that were outlined for service quality in transportation. Organizations should be able to offer high-quality transportation services that meet consumer needs because doing so would guarantee their sustainability and competitiveness as well as their ability to keep both current and potential clients. When compared to vehicle transportation, rail transportation is significantly inexpensive and has fewer accidents.

The results have shown that dependability has an impact on customer experience, which means that commuters are more concerned with a service that won't experience any disruptions, especially given that many customers use the service during peak hours or to reach all amenities. There were about 59.8% respondents who indicated that they utilize their preferred mode of transport mainly because of its reliability which is deemed as one of the driving factors for the selection. The results found that about 28.6% of respondents indicated that their current budget spending on transportation falls under

between 15% and 20% of their monthly income and that shows that people are reliant on transportation on a daily basis to reach all amenities. The transportation industry has a significant impact on South Africa's economic growth.

Company X's services were deemed to be unsafe which compromises the commuters convenient of the service because any disruption can happen at any time without prior notice to the consumers. These usually result from vandalism, poor maintenance, or aging rail infrastructure. Due to ongoing operational concerns that were not being resolved quickly, commuters lost trust in the organization under study. Numerous redundant stations in Johannesburg have weak security, which continues to have a detrimental effect on the user experience. These factors were what caused the higher level of customer dissatisfaction with railway transportation, and despite the fact that taxi fares continue to be higher than those for railway transportation because the cost of fuel increases, the number of people using these modes of public transportation has increased significantly. The expense of life has grown intolerable for the people of South Africa due to rising food and interest rates and making ends meet is a further burden.

Chapter 6
Conclusion

6.1 Introduction

The study mainly focused on the investigation of the rail infrastructure and passenger experience in Johannesburg. The study divulges more information about the investigation through exploration of literature review. The study managed to gain an overview of knowledge about the effects of the rail infrastructure and passenger experience has on the rail transportation as well as the economy. This section will cover the conclusion of the study and conclude the chapter by making recommendations.

6.2 Conclusion per Study Objection

6.2.1 Conclusion on research objective 1

The literature review is consistent with the findings, which highlighted the significance of rail infrastructure and its influence on customer experience as well as South Africa's economic growth. From the literature review, it is evident that many providers are faced with challenges of lack of financial investment to increase capacity or tackle ageing infrastructure because it requires massive budgets which is necessary to increase reliability, safety and customer retention as well as keeping the organisation competitive and sustainable for long term success. However, Company X faces a number of difficulties in order to satisfy customers with the current state of rail infrastructure. The South African population is what keeps the railway transportation system operational, hence Company X needs to develop customer retention strategies and offer technology solutions such as a mobile app to enhance the customer experience and communication as well as proactively address any issues raised by customers.

6.2.2 Conclusion on research Objective 2

According to the literature analysis and the findings, vandalism is a severe problem that needs substantial attention and that requires strong leaderships that could be able to develop a turnaround strategy to tackle it. From the literature review, it has revealed that European countries do experience vandalism, but they have managed to deploy video

surveillance on critical areas to mitigate the risks. Company X should have dedicated a task team that will keep collaborating with SAPS to combat corruption and vandalism, and the government should enforce border gate security to stop illegal immigration. In order to urge residents to report any infrastructure damage to SAPS, company X should educate the locals on the value of the railway system. The business X ought to be proactive about modernizing the infrastructure's existing detection systems with security features that alert the task team of any abnormalities. Government should continue working with private institution to create job opportunities that will assist in reducing the unemployment rate because it is largely due to poverty that people turn to criminal activity. South Africa should set standards based on developed countries to make sure its infrastructure is well protected.

6.2.3 Conclusion on Research Objective 3

The results of the literature review and the findings indicate that the reliability of the rail infrastructure is crucial to the satisfaction of the customer. From the literature review, it has revealed that organisation that continues provides high quality transportation or exceed customer expectation will remain competitive and sustainable because customers need transportation that is reliable. The Company X should be able to quickly resuscitate services that are dependable and affordable by taking advantage of the current scenario of rising food prices and interest rates. By doing these actions, South Africans' burdens will be less, and their trust will be earned. These will aid them in navigating and establishing themselves as the core of the public transit system.

6.3 Conclusion of the study

The findings of the study have revealed that most people are aware of the impacts of the transportation infrastructure on customer satisfaction. The findings of the study have discovered that there are three critical factors that has an association with each other, which contribute to the rail infrastructure deterioration, namely vandalism, poor maintenance and inadequate investment. These factors have negative effects on the organization under study because it will experience ripple effects such as a decrease of customer base and loss of profit margins.

The findings of the study found that customers are concerned about the security level while using the public transportation. The findings of the study revealed that reliability of railway transportation plays a significant role on the customer experience. Hence, it is necessary to make sure that there are less disruptions while customers use their services because customers are constantly looking for better service.

6.3 Recommendation

The study recommends that Company X should develop a compelling turnaround strategy that will ensure that investment allocation are channelled to the critical areas that will address the current state of the rail infrastructure and implement monitoring measures to prevent corruption and vandalism. This could be achieved through deployment of technology enhanced solutions and collaboration with the South Africa Police Service. This will advance the quest to revive railway transportation as the backbone of public transportation because it will then be deemed as a reliable and safe. The study further recommends formulation of customer retention strategies that would act as competitive advantage and is necessary to keep the existing customers and lure new customers to utilize the services .The study recommends that Company X should enhance communication through the development of a mobile application that would share information or notifications with the commuters pertaining to the services such as schedules, delays, purchase of tickets online, offer special discount rates etc. These initiatives would make the commuters feel valued.

The study further emphasizes that for the turnaround strategy to be successfully executed, it would require strong leaderships that is dedicated and understand the company vision. The bottom-up approach is necessary because the employees play an important role to the success of an organization’s vision.

Feedback on the online research tool was received from a small portion of commuters due to various reasons. Hence, generalizing the findings at this stage is not ideal. It is proposed that further studies should be pursued on larger samples.

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Appendix

WITS BUSINESS SCHOOL

RESEARCH QUESTIONNAIRE

Thank you for taking the time to respond to this research questionnaire. This questionnaire will be used as part of research on the rail infrastructure and passenger experience in Johannesburg**.** By completing this questionnaire, you are acknowledging that you are willing to participate in this study.

Please rest assured that your responses will be kept strictly anonymous and will only be used for the purposes of this study.

Yes, I do consent

Questionnaire Survey (Passenger)
SECTION A: Background Information

1. What is your gender?
    - Male
    - Female
    - Prefer not to answer
2. What is your age?
    - 18-24 years old
    - 25-34 years old
    - 35-44 years old
    - 45-54 years old
    - 55 years or older

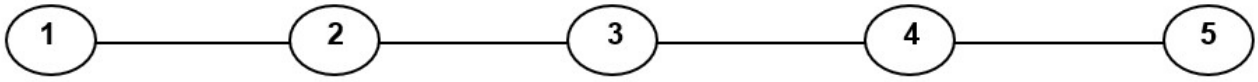
3. Please specify your ethnicity
    - Black
    - White
    - Coloured
    - Indian
    - Other/Unspecified
4. What is the highest level of education you have completed?
    - Less than high school

- High School
- Some University or College
- Diploma
- Degree
- Master’s Degree
- Doctoral Degree

5. What is your employment status?
    - Self-employed
    - Temporary employed
    - Permanent employed
    - Not employed
    - A student
    - Retired
6. Are you aware of the impact of transportation infrastructure (rail, road)?
    - Yes
    - No

SECTION B: Mapping your Passenger experience and Rail infrastructure in Johannesburg

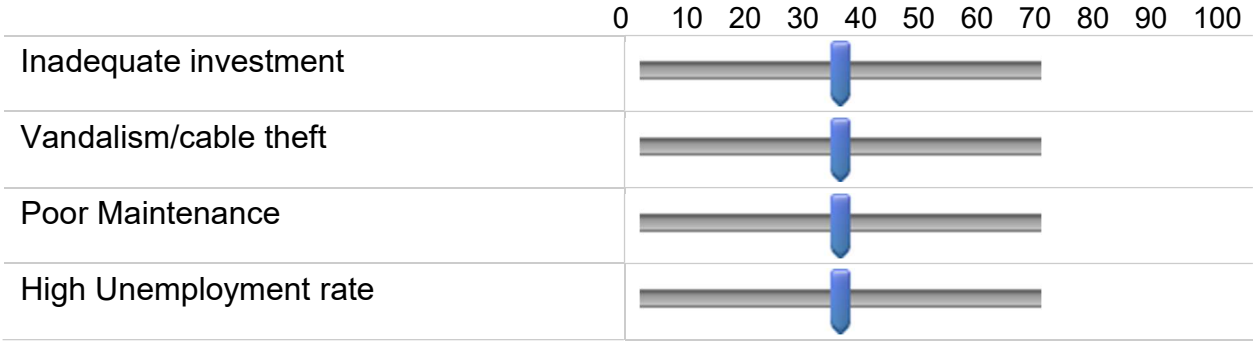
Please rate the level of satisfaction using the scale shown below:



Very poor Poor Neutral Good Excellent

Item Code	B.1: Relationships between the rail infrastructure and Passenger Experience	Rate the degree of customer satisfaction				
Q7	How do you rate the effects of rail infrastructure deterioration on customer satisfaction?	1	2	3	4	5
Q8	What is their responsiveness during breakdown and delays?	1	2	3	4	5
Q9	How do you rate the level of communication with customers?	1	2	3	4	5
Q10	How do you rate their security level?	1	2	3	4	5
Q11	How do you rate the current technology solutions on rail infrastructure?	1	2	3	4	5

12. What do you think is the cause of the rail infrastructure deterioration?
    "Move the slider to indicate your choice- any value is acceptable"



13. What is your preferred mode of transportation?
    - Private transport
    - Public transport
    - Both Public and Private transport
14. How do you rate the below in terms of usability?
    "Move the slider to indicate your choice- any value is acceptable"

0 10 20 30 40 50 60 70 80 90 100

Car	
Taxi	
Bus	
Train	

15. Why is it your preferred mode of transport? Select one or more
    - Reliability
    - Affordability
    - Safety
    - Convenient
16. What is your spending budget on transportation?
    - None
    - 10%-15%
    - 15%-20%
    - 20%-25%
    - 25%-30%
    - 30% or more.