

Rail transport and the economic competitiveness of South Africa: Timeous delivery of goods and demurrage

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PREFACE

My most sincere appreciation goes to Prof Christoff Botha for his advice, guidance and support as I worked my way through delivering this dissertation. Your insights and instructions have certainly helped me to give structure where I really needed it most.

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ABSTRACT

Rail transport refers to the transportation of various commodities, goods and services traded as cargo and freight within South Africa and out of South Africa for export to the other Southern African communities (SADC region), the rest of Africa and other continents of the world. It also refers to the imports into South Africa from the regions mentioned. Competitiveness relates to a country or company's available resources and supporting policies and regulations in place which allow them to compete and do business locally, internationally and globally while improving the country's economy and the company's profitability. There are different criteria that can be used to determine the level of competitiveness, depending on each company or country's capabilities.

In the past years, the progress and development of the South African rail industry has been neglected and this has resulted in the rail transportation not being used. Railway line maintenance has become a challenge and service delivery is below customer expectations. Road transport has better availability and reliability, which has led companies to prefer road transport for freight.

The main objective of this study is to reach a detailed understanding of the views of freight rail transport consumers and the impact of rail transport on the economic competitiveness of South Africa. Another important objective is to present the study in a format that is easily understandable. The approach adopted for this study is quantitative and uses a survey research questionnaire which was distributed to freight rail transport customers and providers. The data collected from the questionnaire was submitted to a statistical consultant service at North-West University. The statistical consultant analysed the data using the SPSS statistics computer programme to arrive at the results presented in this study.

The overall findings from this study are that companies that use roads to transport freight do so because of the unavailability and unreliability of the freight rail transport provider Transnet Freight Rail and that these companies opt for road transport because they use a 'just in time' (JIT) system whereby a small quantity of stock is transported

continuously which Transnet Freight Rail (TFR) does not accommodate. These factors have resulted in TFR's poor service delivery.

Therefore, a market demand strategy has been initiated by TFR to improve the performance of the company. It is important to note here that freight rail transport should concentrate on improving service delivery and not only on increasing capacity. The research participants indicated that the TFR objective to move freight back to rail could be accomplished. This will lessen the burden and damage to South African roads and reduce traffic congestion and accidents caused by trucks on the roads. It will also increase employment opportunities and the country's economic competitiveness while reducing transport costs. All these aspects will make a significant impact on the economy of the country.

Keywords

Competitiveness, economic competitiveness, freight rail transport, freight road transport, economy, reliability, efficiency and service delivery.

ABBREVIATIONS

AAR	Association of American Railroads
AMSA	Arcelormittal South Africa
ANOM	Analysis of Means
ANOVA	Analysis of Variance
CIAP	Containerised Infrastructure Assistance Programme
DBSA	Development Bank of Southern Africa
DoT	Department of Transport
GESAT	General Electric South Africa Transportation
IMD	International Institute for Management Development
ITF	International Transport Forum
JIT	Just in Time
LPI	Logistics Performance Index
MDS	Market Demand Strategy
MSP	Municipal Service Partnership
NCFRP	National Cooperative Freight Research Program
NFLS	National Freight Logistics Strategy
OECD	Organisation for Economic Co-operation and Development
PRASA	Passenger Rail Agency of South Africa
SACU	Southern Africa Customs Union
SADC	Southern African Development Community
SARB	South African Reserve Bank
SCS	Statistical Consultation Services
SSA	Sub-Saharan Africa
TFR	Transnet Freight Rail
TRE	Transnet Rail Engineering
WEF	World Economic Forum

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CHAPTER 1: NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

The study was about how the recovery of rail transport in South Africa can improve the economic competitiveness of the country. Specific areas which must be considered are the freight system and service delivery which are currently below customer expectations because of poor maintenance, inefficiency and unreliability.

Competitiveness, according to Atkinson (2013:3), is an expressive concept related to the national level of productivity. The International Institute for Management Development (IMD) World Competitiveness Yearbook defines competitiveness as how an economy manages the totality of its resources and capabilities to increase the prosperity of its population (Atkinson, 2013:3).

Department of transport minister Radebe (2013a:36) explains that freight rail transport is a means of transport for various commodities, goods and services traded as cargo and freight within and out of the South Africa for export to the Southern African Development Community (SADC) region, the rest of Africa and other continents of the world as well as the imports into South Africa from the same regions. For the country to ensure the supply chain competitiveness of commodities, goods and services, reliable, prompt and flexible freight logistics operations and freight transport services are required (DoT, 2013a:36).

Mutambara (2008:4) explains that South Africa has an extensive railway network which provides assistance to road networks to move millions of tons of freight all over the country. However, for many years, the conditions of railway networks have been deteriorating as track maintenance was deferred because of a lack of funding. This has resulted in poor railway lines. The performance standards of rail transport declined due to the frequent unavailability of appropriate wagons, delays and unpredictable delivery times as well as difficulties in obtaining information on wagons. Consignment companies started to choose road transport to move their freight instead of rail transport (Mutambara, 2008:4).

According to the European Logistics Association as stated by DoT (2013a:35), freight logistics is the organisation, planning, control and execution of goods flow, including development, purchasing, production and distribution to the final customers, with the goal of satisfying market requirements for minimum costs and capital use (DoT, 2013a:35).

DoT (2013a:36) stresses that freight logistics play a crucial role in a country's economy and globally it is regarded as essential for national and regional economic development. Some developed countries like Canada, Germany and the USA are investing in freight logistics systems and technologies, while less developed countries are using freight logistics as a means of achieving greater economic growth and positioning it as a central aspect in their economic development plans (DoT, 2013a:36).

1.2 PROBLEM STATEMENT

Some of the challenges facing South Africa's transport infrastructure are seen in the country's economic geography. Thirty-four per cent of the country's Gross Value Added goods and service are concentrated in Gauteng, which lies 1 400m above sea level, a considerable distance from ports (DoT, 2013:1).

According to Borralho (2013:50), for the past 20 years progress and development in the South African rail industry has not kept up with the demand. The maintenance of railways lines are also a challenge, service delivery is below expectations which has contributed to the business community preferring road transport to rail because of the need for flexibility and on time deliveries (Borralho, 2013:50).

Borralho (2013:54) further explains that, currently, the existing issue of accidents are caused by more trucks on the roads. For example, in a 2014 Field Hill accident in KwaZulu-Natal, 24 people lost their lives. These kinds of accidents result from truck drivers working long hours without rest to transport thousands of tons of goods per day. Furthermore, Borralho stated that there is an increase in environmental costs as well. Additional greenhouse gas emissions, caused by the large number of trucks on the road

throughout the country, are a problem. If rail transportation can be improved these kinds of problems can be reduced (2013:54).

According to Pienaar (2012:2), TFR is the major rail transport provider which should be involved in maximising prosperity in South Africa. The national transport policy should be more effective and help to encourage competition among the various carriers and modes of freight transport. Competition is the major factor for attaining the principal objectives the transport system is meant to achieve. Some of these objectives are to promote economic growth in both the domestic and foreign trade sectors in the country's economy and provide the organisation needed to develop and enforce rational investment policies that will promote effective transport services in the most effective manner (Pienaar, 2012:2).

Pienaar (2010:2) stated that defining the economic role of rail freight transport in the national transport system of South Africa is one of the ingredients in an economically viable transport policy and essential for the effective functioning of Transnet Freight Rail (TFR) (2010:2).

Borralho's (2013:50) work shows that South Africa's population growth average is 1.3% a year while its Gross Domestic Product growth is under 4% a year. However, rail corridor traffic has declined by 20% over the past 15 years because people and businesses are opting to use road transport instead of rail transport. As a result, the road corridor traffic has doubled, now comprising 89% of freight volume with only 11% for rail (2013:50).

Borralho (2013:54) said that, in order to improve the performance level of rail transport, the Passenger Rail Agency of South Africa (PRASA) has allocated R124 billion for a rolling stock fleet renewal procurement programme and a Transnet locomotive procurement programme for the acquisition of 1 064 new locomotives at an estimated value of R35 billion. This is part of a R300 billion upgrade for railways and ports with the goal of overcoming freight bottlenecks. This will go a long way towards revitalising rail transport and making it a more preferable freight transport mode in the country. Recent

concerted efforts to reverse the decline in rail corridor traffic are starting to show positive results (2013:54).

1.3 OBJECTIVES OF THE STUDY

1.3.1 Primary Objective

The primary objective of the study is to

- Explore the current challenges faced by rail transportation due to lack of maintenance.

1.3.2 Secondary Objectives

The secondary goals of the study are:

- To investigate why freight rail transport is no longer in use as compared to the previous dispensation and how the enhanced rail transport can positively affect its services and attract the global business opportunities.
- The influence of rail transport on economic competitiveness in South Africa.
- Investigate how freight transported on the roads affect the maintenance of roads, traffic congestion and road accidents.
- Comparing the logistical costs of rail and road transportation for freight loads.
- Examine the positive impact the use and improvement of rail transport can make job opportunities, skills training and development to boost economic competitiveness.

1.4 SCOPE OF THE STUDY

The scope of this study encompasses rail transportation in South Africa in terms of economic competitiveness. The study has focused on the current system of rail transport which the provider (TFR) is operating at and the main reasons for the lack of rail infrastructure and maintenance, ineffectiveness, poor performance by the TFR as explained by customers. The aim of the study was to compare the impact of current poor rail transportation on the economy and the positive changes it could make if the industry is revived, to consider the difference the Department of Transport (DoT) and TFR can make by improving freight services and freight transport systems and redirecting freight loads which are currently on the country's roads to the rail routes.

Arcelormittal South Africa (AMSA) is a large steel company that uses rail transport regularly for the transport of raw materials such as iron ore, lime and coke from Sishen and Kumba mines. These companies are in partnership with TFR to make use of its services to transport the raw materials to manufacture steel. In general, this study tested the efficiency of rail transportation system in South Africa.

Furthermore, the study has examined how South Africa can be more competitive within the sub-Saharan region in Africa (SSA) and create greater prosperity for the country using rail transport.

1.5. RESEARCH METHODOLOGY

1.5.1 Literature Review and Theoretical Study

Information for the literature review was obtained from the university and public libraries and with the assistance of Christian Bronkhorst and the participants being TFR, AMSA and others. Published academic journals, newsletters, articles and presentations and internet sources were also consulted to generate the literature review.

1.5.2 Empirical Study

The study approach is quantitative in nature. Questionnaires were distributed to the participants (rail transport users and rail transport provider) to test the identified aspects of rail transport.

The collection of data was conducted on a voluntarily basis. The participants were not obliged to provide any information they were uncomfortable with and the information received was treated as confidential. The request by participants who did not wish to be named was honoured. The main goals of the empirical study were to find valuable information (to determine the findings) that has assisted in achieving the objectives and providing recommendations. Although personal details (age, level of education, years of experience in the field, knowledge of the rail transport and its services and more) played a crucial part in analysing the data and was clearly stated that true information be provided, furthermore by request the final outcome (findings) of the research was provided to the organisations that participated and others that may be interested.

1.6 LIMITATIONS OF THE STUDY

- Due to the nature of this study, no physical or experimental studies were involved. This research study is based on information gathered from different authors and parties with knowledge of the research topic.
- The study provides assumptions that the rail transport is no longer in operation as compared to current use of freight road transport; the reasons are based on participants' opinions.
- Despite the confidentiality and anonymity the participant may still be biased and respond in an acceptable manner.
- Some of the participants required certain sensitive information to be excluded and these requirements have been adhered to.

1.7 LAYOUT OF THE STUDY

Chapter 2 is an extensive literature review and includes an in-depth analysis of the influence rail transport has on economic competitiveness and economic growth. The major concepts of the study are also discussed, namely, economic competitiveness, rail transport management, rail transport leadership, the South African road network, the South African rail transport industry, the road freight industry with a specific focus on the overloading of freight vehicles, road maintenance and repairs expenditure as well as the direct costs and delivery lead times of rail and road transport within South Africa.

Chapter 2 again provides an analysis of the transport industry's impact on the environment as a result of the greater number of trucks on the roads, specifically in terms of the high carbon emissions which negatively impact on the Green Economy. Finally, the study considers rail transport systems and technologies currently used in other countries.

Chapter 3 is the introduction to the empirical study and discussion on how the data was gathered and generated. Chapter 3 also includes the empirical study which provides the results and the results' discussions.

Chapter 4 summarises the recommendations stemming from this study and the possibilities for future research. It also evaluates how the study objectives have been achieved.

CHAPTER 2: RAIL TRANSPORT AND ECONOMIC COMPETITIVENESS IN SOUTH AFRICA

2.1 INTRODUCTION

This chapter analyses the rail transport and the economic competitiveness of South Africa in depth. The focus topics are economic competitiveness, rail transport management and leadership, the South African road network, rail freight transport and the industry, with the specific focus on the overloading of freight vehicles on the roads, increased expenditure on South African roads for maintenance and repairs, the costs and the delivery time related to rail and road transport within South Africa, the influence of rail transport on the economy and competitiveness, the influence of rail as a mode of transport on economic growth, the impact of high carbon emissions caused by freight transports on the roads and its impact on the Green Economy and also a comparison between the current South Africa rail system and technologies and other countries' systems.

2.2 The Major Concepts of the Study

2.2.1 The Freight Rail Transport Industry

This concept was addressed to provide the enhanced understating of the freight rail transport industry and the insight of the research topic with regards to rail transport.

South Africa has an extensive rail network, the 14th longest in the world. It connects to the sub-Saharan region network. The country's rail infrastructure accounts for about 80% of Africa's total and it connects the ports with the rest of South Africa. The government has made enhancing the country's 20 247 km rail network a top priority and the project is aimed at increasing the freight rail volumes and market share of rail container traffic. The rail network is managed by the Department of Public Enterprises through Transnet. TFR is a Transnet division and the largest railroad and heavy haulier company in Southern Africa. It has a rail network of about 21 000 km, of which 1 500 km are heavy lines and 8 200 km are electrified (SAinfo, 2012).

According to Transnet (2012:6), South Africa is an export-driven economy. Freight commodities have to be delivered safely and reliably. TFR is responsible for maintaining

and operating a rail network that covers the whole country including the lucrative coal export line running from the mineral-rich Waterberg and the coast of KwaZulu-Natal. It has become a profitable and sustainable freight railway business that drives competitiveness in the Southern African economy (Transnet, 2012:6).

The South African freight system and its links with the sub-Saharan regions are a network that delivers a range of services. Some of these are poor while others are excellent, depending on the infrastructure, operations and specific modal challenges in the area. The growth of freight traffic has already exceeded the 20-year forecasts which were made 14 years ago and this has put huge pressure on the infrastructure and operations to deliver acceptable services. In the meantime the system must be transformed in response to growth and the level of demand (DoT, 2012:4).

2.2.2 Economic Competitiveness

Brussels (2014:42) defines the competitive position of rail transport in the transport system is influenced by the factors such as rail transport costs and quality of rail services. Transport cost affects productivity and efficiency improvements; for example, if passing lowered operating costs to transport users can increase the attractiveness of the transport mode and again be used to enhance the technologies and invest in rolling stock and the quality of rail transport services also affected by various factors such as journey time, reliability, frequency, flexibility and customer information (Brussels, 2014:42).

According to Stewart (2013:14) freight railways boosts the economic competitiveness because these are energy efficient; a freight train moves one ton of freight for an average of 484 miles on a single gallon of fuel and that is an estimate of four times as far as the same cargo a freight truck can move. Moreover, freight railways provide safe transportation for chemicals and hazardous materials; the industry has a 99.9% safety rating (Stewart, 2013:14).

However, competitiveness is defined by Arslan and Tathdi (2012:32) as the ability of a country to produce goods and services that meet the requirements of international

markets, concurrently maintaining and expanding real incomes and escalating citizen welfare. Competition also depends on the company's operating and industrial power and size or scale (Arslan & Tathdi, 2012:32).

Pienaar (2008:2) defines the competitiveness of rail freight transport with regards to the national transport system as effective functioning of a rail transport provider, TFR and the economically rational transport policy; TFR can be effective if it specialises in the field where it provides excellent services at competitive prices tailored to the customers' needs (2008:2).

According to the World Economic Forum (WEF) (2013:13) in their Global Competitiveness Report, infrastructure, innovation and market efficiency are three of the 12 pillars of competitiveness (WEF, 2013:13).

Delgado (2012:6,18) indicates that the term "competitiveness" can be defined in different ways. Some define competitiveness as the ability to achieve outcomes, like a high standard of living and economic growth, while others focus on the ability to achieve economic growth through employment creation and increased exports. Competitiveness may also be seen in the light of government fiscal policies which facilitate the management of short-term fluctuations in economic activity (Delgado, 2012:6,18).

According to Pienaar (2012:2), competition is a significant factor in attaining the principal objectives that should be achieved by a transport system and further states, "It will provide the discipline needed to develop and enforce the kinds of rational investment policies that will provide effective transport services in the most efficient manner" (2012:2).

The most recent WEF (2013:11) report showed that South Africa is ranked 52 out of 144 countries with regards to economic competitiveness. This is a decrease of two places since the 2011/2012 report. It should be noted that other African economies have showed significant development in their economies as well (2013:11).

Arslan and Tathdi (2012:33) further explain international competitiveness as the ability to sustain activity in the global economy along with a satisfactory level of growth. The real standard of living of the population should steadily increase and there should be an acceptably fair distribution of wealth. Employment which will not reduce the growth potential and standard of living for future generations is also important for competitiveness. Competitiveness may be measured as the capacity a country can sustain in the producing of goods and services that meet the international requirements within the prevailing market system (2012:33).

In summary, economic competitiveness requires a combination of the country or company's key resources, supporting policies and regulations which facilitate business opportunities locally and internationally and improve the country's economy. There are different measures that can be used to determine competitiveness, depending on the company or country's capabilities. The government plays a crucial role in supporting the country in terms of the procedures, policies and systems that must be in place for the country to be economically competitive.

2.2.3 Development initiatives of Freight Rail Transport

It is most countries' priority to take development initiatives of freight rail transport in order to improve its services, satisfy the existing customers' needs, to attract local and international markets, and by doing so, it will boost the country's economic competitiveness.

According to Ubogu (2011:89), modern transport and the freight distribution systems all over the world require reliable, timely and cost effective services. Nigeria conducted a study for rail-road integration and port-hinterland for freight which focuses on these requirements which will be considered later in this section (Ubogu, 2011:89).

According to Pienaar (2012:4), TFR has a monopolistic power over the freight rail transport system but, for it to achieve any of the monopolistic advantages, it has to be more cost-efficient and efficient in its services (Pienaar, 2012:4).

The Logistics Performance Index (LPI) is based on surveys conducted among about 1 000 global freight forwarders and carriers and compares the logistics profiles of 155 countries. The LPI allows countries to identify challenges and opportunities in their logistics system. In 2010, according to the World Bank, South Africa had an LPI score of 78.9% (CSIR, 2010a:2).

It is highlighted in the South African DoT (2013:17) annual report that freight logistics forms part of economic growth in the country, the SADC countries, the African continent, and in the global arena. It is therefore important to commence with freight logistics programmes that will improve and streamline freight traffic flows across the country, over the borders within the country, nearby regions and the continent as the whole. Management and leadership programmes which will enhance freight rail transportation will also be required (DoT, 2013:17).

Management of rail transport improvements involve a continuous search for the best systems that can be used to improve the overall system, to increase cost effectiveness, efficiency and make it the most attractive mode of transport for industry. These objectives can be achieved by comparing the rail transport of other countries to that of South Africa. This may also be achieved by outsourcing the system or improving the existing railways. This may be achieved by facilitating and coordinating the development of sustainable rail transport policies, economic and safety regulations and infrastructure development strategies.

2.2.4 The History of South Africa Rail and Road network

According to the Development Bank of Southern Africa (DBSA) (2012:12), South Africa's rail network was developed to support the growth of the mining sector and other heavy cargo industries and the large-scale agriculture and forestry in the past.

The majority of South Africa's national network is older than 25 years which exceeds the design life of the roads, even if they are well maintained. These roads experience extraordinarily high traffic volumes. For example, current data shows that the N3 highway in Gauteng has carried expected traffic volumes equivalent to 20 years in a

period of only two years (CSIR, 2010:7). Furthermore, for the past ten years, the provincial and municipal road network has depreciated dramatically because of the frequent and excessive damage to roads for which there is insufficient funding (CSIR, 2010:7). Although routine maintenance is carried out, it has proved to be insufficient and also experience budget constraints.

Transnet Rail Engineering (TRE) is a division of Transnet that provides maintenance, repair, upgrade, manufacturing and support services to TFR and to other rail and terminal operators both locally and internationally. Some of the TRE's outputs are locomotives, wagons, coaches and rotating machines. The TRE's intention is to expand the regional market to include narrow-gauge rail operators around the world. TRE operations date back to the first railway built in Southern Africa and TRE also built the Cape's first railway line in 1862. This railway line currently accommodates trains that are seven kilometres long (the longest in the world) and operate on Transnet's iron ore export corridor from Sishen to Saldanha (Transnet, 2012:9).

According to Transnet Freight Rail (2012:31), South African leaders attended the African Union Summit in Kampala in 2010 where it was brought out that intra-Africa trade is being hampered by lack of infrastructure which increases the cost of conducting business, suffocates economic growth and also increases poverty. These are the result of the inadequacies and inefficiencies of Africa's rail, road and port systems which must be given due attention by government (TFR, 2012:31).

At the Freight Intra-Africa Conference the TFR highlighted that, in the European Union, intraregional trade accounts for 80% of international trade and most of this is conveyed by trucks, whereas in Africa it accounts for merely 12% with 95% being truck borne. This results in more damage to road due to traffic loads. A practical example is from Ermelo where coal deliveries to the Eskom power station are made by road and the town's roads are extremely damaged. This emphasises the need to make the change back to cargo by rail a national priority (TFR, 2012:32).

Since the announcement of Transnet's Market Demand Strategy (MDS) by the South African president, Jacob Zuma, in February 2012, Transnet planned to expand the country's railways, ports and pipelines. This will make the country a transshipment hub for sub-Saharan Africa, strengthening its position as a gateway to the continent which is one of the world's fastest-growing economic regions (Transnet, 2012:19).

According to the DBSA (2012:47), South Africa's total road network comprises approximately 154 000 km of paved roads and 454 000 km of gravel roads, which are national or municipal roads. Undeclared roads account for 140 000 km or 33% of the total gravel network of 593 000 km. (these undeclared roads are mostly in rural areas and there is no authority responsible for their maintenance or upgrade.) Therefore the total road network is in the order of 750 000 km in length (DBSA, 2012:47).

2.2.5 A selective comparison of Freight Railway Systems

Furtado (2013:65) defines modal share as "a structural or inherent differences like the competitiveness of non-surface modes, shipment distances (both influenced by geography) and commodity mix like coal, the important differences are in productivity". In Europe they transport seven times the number of tons and use more trains compared to the US. Operational revenues per ton-mile in Europe are around twice that of the US and the operational expenses are four times lower. Therefore, it is not a priority for Europe to set the same modal share as the US but they only need to reduce the operational costs by increasing train size (Furtado, 2013:65).

As Ittmann expresses in a CSIR report (2010:5), for South Africa to be a player in the global marketplace, the logistics and supply chain must play an integral part in the country's economy. Environmental management needs to be enhanced continuously to reduce the costs and keep abreast of new developments to improve the country's competitiveness (2010:5).

According to DBSA (2012:11), when comparing the size in route kilometres, South Africa's network is similar to those of Poland, Italy, the Ukraine and Mexico. In terms of overall geography and density of networks, Mexico and South Africa have similar

networks and they both have main commercial centres located far from the sea. For example, it is 575 km from Gauteng to Durban and 1 000 km to Port Elizabeth while in Mexico from the central business district to Altamira is 500 km and to Manzanillo is 800 km. Both countries use rail to connect ports to urban and industrial hinterlands over long distances (2012:11).

Nigeria is strivings to become one of the 20 leading economies by 2020. Therefore it is imperative that industrialisation and the development and strengthening of local capacity for manufacturing of relevant locomotive and rolling stock spares continues with rail transport contributing to the transformation of the Nigerian economy like in other countries. Nigeria proposes double stacked container trains (see the Figure 2-1 below), which are a feature of modern rail transport systems. The advantage of this train is that double quantities of heavy cargo can be loaded at once. This reduces the number of trips a train must make to transport that cargo and the transport costs and time are also decreased. Nigerians are willing to overcome rail transport problems through a rail transport policy that will respond to the existing and future rail transport user needs (Adesanya, 2010:17).

Figure 2-1: Double Stack Container train



Source: Adesanya (2010:17)

Rail transport has suffered considerable neglect in the past. Regardless of the enormous potential and opportunities that are available to turn its fortunes around for good, the past negligence has caused a massive reverberation in the road transport

industry, increasing road transport costs and unprecedented damage to the roads. Countries like South Africa must strengthen their initiatives to keep up with other countries' rail transportation systems and it is especially important to resuscitate freight rail.

2.3 The Influence of Freight Rail Transport

This study is about how freight rail transport affects the economic competitiveness and how the freight rail transport services can be improved to return the freight loads currently on the roads back to the rail; the following are selected factors freight rail transport has influences on.

2.3.1 The Influence of Freight Rail Transport on the Economy and Competitiveness

Pienaar (2012:1) stresses that the economic role of rail freight transport in South Africa's national transport system needs to be based on an economically rational transport policy and the operative functioning of TFR with the best interests of the economy at the forefront. The TFR must specialise in these fields in order to provide quality services at competitive and defensible prices in terms of economic philosophies (Pienaar, 2012:1).

According to Havenga and De Bod (2010:91), SA's development challenges remain a priority and for the region to achieve a 7% GDP growth rate required a reduction in poverty, infrastructure investment twice the amount the region has invested historically. It is imperative for freight transport infrastructure to be reliable, effective and efficient. The research conducted by the Organisation for Economic Co-operation and Development (OECD) confirms that the transport costs in SSA are higher as compared to elsewhere in the world and this is hampering the competitiveness of the region (Havenga & De Bod, 2010:91).

However, Ubogu (2011:89) states that without efficient transport it is hardly possible for an economic transformation and the development of any country to occur because

goods should be transported from the origin to the destination at the minimal cost (2011:89).

Transnet (2012:9) and General Electric South Africa Technologies (GESAT) have made a deal for GESAT to supply TFR with 143 heavy haul diesel locomotives (ten manufactured in the USA and 133 assembled in Koedoespoort) to haul freight and coal across South Africa in order for Transnet to meet the Competitive Supplier Development Programme objectives. These locomotives indicate that there are great opportunities for Transnet, South Africa and GESAT. Transnet can have three C30ACI model trains tow a load that requires four older locomotives, reducing the annual consumption of diesel fuel by 600 000 litres and also carbon dioxide emissions by 1500 metric tons per year which is equivalent to a reduction of emissions from about 310 cars on the South African roads (2012:9).

Transnet (2012:17) has been allowed to put the retired freight stock to good use through the Containerised Infrastructure Assistance Programme (CIAP). Large, secured and watertight out-of-use freight containers are converted into community buildings and small offices in outlying rural areas in underdeveloped parts of the country such as Limpopo (2012:17).

In figure 2-2 below, Metropolitan Council has the goal for municipal service partnerships (MSPs) 2040 to be “a vibrant and globally competitive economy creates opportunities for residents and employers”. Economic competitiveness is of importance to the Metropolitan Council and the Council has long-term planning and infrastructure investments on the cards. Some of the objectives are to plan for the efficient transport of people and freight globally, nationally and regionally, to provide cost-effective and efficient wastewater treatment and contribute to the quality of life and cost structures that will attract and retain a talented workforce. Overall imperatives include the economic competitiveness in the drive for community development, which supports the infrastructure, amenities and quality of life essential to attracting and retaining businesses and employees (Metropolitan Council, 2013:1).

Figure 2-2: Economic Competitive Programme



Source: Metropolitan Council (2013:1)

There are several criteria affecting the economic growth of the country. In this study, rail transport has been identified as one of them. The improvement of rail transport can boost the economy by increasing the employment rate; reduce the need for road maintenance and accidents caused by trucks on the roads while increasing local and global competitiveness.

2.3.2 Freight Rail as a Mode of Transport in the Pursuit of Economic Growth

Transnet Freight Rail (TFR) (2012:3) is a state-owned company responsible for freight transport in South Africa. The company is also responsible for enabling competitiveness, growth and development in the South African economy by providing reliable freight transport and services that satisfy customer demand. Its mandate is to efficiently lower the cost of doing business in South Africa and within acceptable benchmarks (Transnet, 2012:3).

Recently, the TFR's biggest project is the R300 billion Market Demand Strategy (MDS) which will profoundly boost infrastructure development, employment creation and investment in the country. Furthermore, it will expose the country to a host of international trading possibilities. Despite the country's annual real growth rate deterioration calculated by the South African Reserve Bank (SARB), TFR's key commodities remain positive as per the MDS to target the customers' demand

satisfaction through additional capacity to export coal, iron ore and manganese and also the key domestic commodities like coal, magnetite, iron ore, cement, agricultural produce and containers (Transnet, 2012:3,4).

According to Havenga and De Bod (2010:89), the economic growth of SSA slowed by 1% in 2009 due to the global recession but it is expected to increase by 5% more than it was the past decade. These historic growth performance factors and expectations are based on internal developments like practical macroeconomic management and external developments like debt relief and global demand for commodities which assist in increasing resources and boost growth (2010: 89).

Although the plan to boost the economic growth has been well defined, there are still challenges facing the region, namely, the complex web of regional integration agreements such as the SADC and Southern Africa Customs Union (SACU) in Africa that leads to inefficiency, the heavy dependence on primary commodity exports which is still a common feature of most of SSA countries and exposes the priority to change the policies on the continent and, finally, the cross-border corridor transport is expensive, slow and unreliable in most of SSA due to the fact that the transport infrastructure is limited, operating under poor conditions, below design capacity and in need of development (Havenga, 2012:89, 90).

In South Africa, the TFR has successfully raised funds required for its capital investment programme despite the global financial markets and economic growth outlook (both locally and abroad). Beginning in 2012, Transnet's target for capital expenditure of 50% was higher than the gearing ratio that deteriorated from 42.1% to 41.1% on 31 March 2011 and it was not expected to surpass the target ratio further. Regardless of this, Transnet will continue to improve financial risk management throughout the capital investment programme and seek to establish better public policy and regulatory certainty with Southern African states and regulators (Transnet, 2012:5).

According to Pienaar (2012:3), in order for the TFR to be a fully competitive business, it needs to develop a conducive environment to manage its operations in by fostering a

competitive freight transport market and providing socio-economic rail services under concessionary agreements. Transnet's board of directors must also define management objectives and grant real management autonomy to TFR for it to define clear performance indicators (2012:3).

Association of American Railroads (AAR) (2012:1,2) stresses that freight rail played an important role in American's economic development for the past 180 years and even today it serves almost every industry including the wholesale, retail and resource-based sectors of the economy. It remains critical today with millions of Americans working in global economic competitive industries that benefit from freight railroads. One third of all US exports are conveyed on the railroads. Freight railroads save America money as well. US freight rail rates were 42% lower in 2012 than in 1981 meaning the average rail shipper can move close to twice as much freight for the same price it used to pay 30 years ago (2012:1,2).

Pienaar (2012:4) empathizes that TFR can be cost efficient, increase turnover and maximise profit to increase economic growth by identifying physical efficiency indicators such as the volume of freight carried and the distance covered, locomotive and rolling stock availability and utilisation, wagon turnaround times and staff productivity. Valuable measures of management effectiveness in accomplishing technical efficiency may be established by benchmarking these indicators to measure total service effectiveness against road transport competitors (2012:4).

The Metropolitan Council (2013:2) stated that freight rail makes substantial contributions to economic competitiveness but it is often underappreciated. Findings highlighted by the Metropolitan Council and DoT report show the tensions between land use and economic activity need to be addressed. For example, there is pressure to redevelop industrial land along rivers and railroads which may threaten the viability of water and rail-dependant industries and freight terminals. This may also increase non-industrial land development and encroachment upon industrial land (2013:2).

2.3.3 The Environmental Impact of the Road Freight Transport Sector

Pienaar (2010:1) stresses that, after 20 years of economic deregulation in land freight transport, there has been an increase in the amount of freight on the road carried long distances on South Africa's intercity road network which is receiving extensive attention with the focus on the great number of commercial vehicles, their large size and huge mass and the external costs they incur. Allegations have been made that road freight carriers do not fully compensate for the damage they cause on the roads and that they remove TFR's business (Pienaar, 2010:1).

Transport as a whole has several environmental impacts as it produces emissions that contribute to air pollution (causing damage to humans, the biosphere, soil, water) and climate change (greenhouse gases contributing to global warming), noise that causes a nuisance and health risks (affecting sleep patterns, especially in children). Additionally, transport has severe environmental impacts on society. For example, the high accident rate and number of people killed and injured and the high congestion levels that result in time wastage. It has been stated that road transport contributes more to the above-mentioned environmental impacts compared to rail transport (ITF, 2008:4).

According to the AAR (2013:2), highway congestion costs the US economy about \$121 billion per annum from time and fuel wastage, lost productivity, cargo delays and more. Trains' can carry freight which would require several hundred trucks and this would mean less highway congestion, less road maintenance and less pressure to build new highways. Furthermore, moving freight by rail can reduce the emissions and provide cleaner air (AAR, 2013:2).

The Auto-Mobile Association of South Africa (2010:7) stresses that the poor conditions of the South African road network and, more specifically, the frequent occurrence of potholes cause road users high costs and safety hazards, cause traffic jams that also increase fuel consumption, transportation costs and loss of production time. All these factors combined have an estimated cost of nearly R200 billion per year to the economy (CSIR, 2010:7).

According to the National Cooperative Freight Research Program (NCFRP:2012) a company needs to perform environmental benchmarking in order to reduce environmental impacts and contribute directly to business objectives that will enhance profitability and company value for the owners and shareholders. In this regard, a company needs to collect and understand data on the use of fuel and other resources that will allow for more informed business decision-making. The largest contributor to operating costs for freight carriers is fuel. Fuel consumption produces emissions of air pollutants, air toxics and more and it is also a major measure of environmental performance for freight carriers. Therefore, comparative benchmarking is critical to decide on the improvement in fuel economy and motivate new actions to implement additional fuel efficiency strategies (NCFRP, 2012:8).

2.4 A Comparison between Road and Rail Transport

2.4.1 Costs versus Time

Havenga and De Bod (2012:92) confirmed that the research conducted by the World Bank for SSA railway concessions shows that rail still offers the most cost-effective solution to transporting non time-sensitive freight for longer distances. A few authors also highlight the significance of density in leveraging the rail's cost-effectiveness for longer distances due to rail's high fixed infrastructure component (2012:92).

CSIR (2010:9) stresses that moving freight cargo on the roads causes high maintenance and repair costs for road users, "the increased maintenance and repair costs lead to increased vehicle operating costs for transport operators" and if the situation continues it could lead to increased vehicle vibrations and result in more damage to transported cargo. Moreover, if the quality of the roads depreciates, road freight tariffs will also increase and that will mean that the price of products will also increase. The conclusion was that transporting freight cargo on the roads will be more expensive than using railways because the maintenance of vehicles will be high as a result of bad road conditions caused by the freight transported by roads instead of the railways (2010:9). This is shown in the table below.

Company	Route Information	Average IRM (m/km)	Road condition rating	Average maintenance & repair costs (R/KM)
A	Gauteng to Durban	2.7	Good	1.01
B	Gauteng to Durban N3	2.9	Fair	0.82
	Newcastle to Gauteng (N11 & N17)	4.2	Bad	2.09

Table 2-1: Summary of vehicle maintenance and repair costs for routes with different IRIs, (Source: CSIR, 2010).

The road conditions are deteriorating every minute. Bean, in a CSIR report (2010:11), stresses further that the study they conducted indicated that there is a potential increase in maintenance and repair costs of up 120% per annum for trucks that travel on good roads than on bad ones. Refer to Table 2-2 below.

Road Condition	Average maintenance & repair costs (R/km)	Average % increase in truck maintenance & repair costs	Average % increase in Company Logistics costs
Good	R 0.96	0	0
Fair	R 1.24	30.24%	2.49%
Bad	R 2.11	120.94%	9.97%

Table 2-2: Summary of potential increases due to worsening road conditions, (Source: CSIR, 2010).

Rail transport is not the only one competing with road transport. During the past 20 years, road transporters have acquired much of the traffic that should be moved by coastal shipping concluded when comparing the costs structures and unit costs of these modes of transport according to the law. For equivalent quantities of cargo transported by road instead of by sea more resources are needed. The costs of public infrastructure (namely the road network) used by road transporters is extremely high when compared to the infrastructure required by coastal shipping services and ships are cheaper on average to operate per tonne of cargo than road vehicles (NDoT, 2011:12).

2.4.2 Service Delivery Level of Rail and Road Freight

Transnet's MDS (2012/2013: 6) is expected to make TFR one of the top five best rail freight companies in the world and will increase the rail volume from 201 million tons as of 2011 to 350 million tons in 2019. From 2011, the number of trains per day increased from 800 (22.3%) to 1440 per day (42.1%) and will increase the market share of container traffic from 79% to 92%. Through the Market Demand Strategy, rail freight cargo will be shifted from the roads back to rail by transporting 225 million tons of freight in 2012/13. Market share will also grow from about 24% to around 36% in 2018/2019 (Transnet, 2012:6).

From a national perspective, an efficient railway system can increase revenues and minimise the costs while providing the preferred level of service. However, there are several characteristics and differences each country can use to define the efficiency of a railway system as railways can be run and owned by the government or by private firms, within either a monopolistic firm or within the competitive market. Furthermore, the railway flow of efficiency can be impacted by capacity constraints and pricing/tendering policies. For example, a missing piece of infrastructure like a switch can limit the system capacity efficiency and utilisation (ITF, 2013:7,13).

The integration of ports and rails in South Africa caused the bottlenecks and inefficiencies in the railway industry. This in turn resulted in a loss of potential efficiencies and robbing profitable businesses of funds as revenue which are used to subsidise other parts of the system. Therefore, the separation of ports and railways is the starting point for improvement in performance, the transparency of financial flows and the benefits for competition and freedom. Iron ore and coal lines are feasible without public support and are very different in nature from the general freight network (ITF, 2009:9).

2.5 SUMMARY

In this chapter, the freight rail transport and the history of the South Africa rail and road network have been covered. A comparison of freight railway systems was made, the influence of economic competitiveness in freight rail was considered as a major factor and a general comparison between road and rail transport was outlined.

According to TFR CEO, Siyabonga Gama, for Africa to unlock the economic value of intraregional trade, it must elevate its various transport modes development and infrastructural efficiencies to equal competing international markets. Gama further stresses that it is a priority for each company to provide reliable and efficient service. Therefore, TFR intends to do the same and adopt a market-driven business model (TFR, 2012:32).

Investing more in technology, especially in the freight market can be of benefit in terms of making the railway system efficient. For example, track maintenance costs can be reduced by introducing automated track maintenance technology and electronic and computerised systems can reduce the administration costs. Moving to automated systems and other technology has significant advantages. Further examples are the ability to operate longer freight trains safely on the system which contributed to the reduction in costs for freight railways. This system has led to the improvements in US freight market (ITF, 2013).

The following chapter will discuss the empirical part of the study in details which includes the research approach, the design, the participants, the measuring instrument used to interpretation the data, the procedure followed to gather and analyse the data and lastly, the chapter covers the interpretation of the data.

CHAPTER 3: EMPIRICAL STUDY, INTERPRETATION AND ANALYSIS OF THE DATA

3.1 INTRODUCTION

The purpose of this chapter is to discuss the research design and methodology that are used for this study, the processes followed to obtain the findings and also the reasons for these choices in more detail. For this study the research methods used include an extensive literature review and statistical data collection and analysis.

The focus was to explore the challenges faced by rail transportation due to lack of maintenance; the literature has covered the history of rail network which included the aspects of how the rail transport maintenance was neglected thus caused the freight loads to be transported by the roads. It also covers arguments by various authors on how the rail infrastructure can boost the economic competitiveness because the competitiveness is also guided by cost efficiency, if rail transport is continuously used and maintained freight currently on the roads can be brought back to freight to save the costs maintenance of roads, the environment and to transport large amount of bulk on a single train trip. Only participants who have the knowledge of rail and road transport were approached to collect the data by approaching the freight rail transport users.

Furthermore, the detailed empirical research will be discussed. The secondary objectives of the study will be considered; which are to investigate if the improvement of rail transportation can increase economic competitiveness and if moving freight loads from road back to rail will reduce gas pollution, road traffic and accidents and also save costs in reducing the road maintenance costs.

3.2 Research Approach

The scope of this study is rail transportation in South Africa and the associated economic competitiveness of the industry. The study considers the current system of rail transport in the country, the current performance of the South African rail transport service provider TFR and its vision and mission to improve the system and its

operations in order to enhance the services to satisfy its customers and also to attract new markets.

Explanations for the lack of rail infrastructure and maintenance, ineffectiveness and poor service delivery provided by TFR were examined. The impact of the current poor rail transport services on the economy and the benefits of resuscitating the industry are also discussed. The difference the DoT and TFR can make to improve freight services and freight transport systems which will move freight loads off the country roads and onto the rail routes was investigated.

AMSA is a steel giant company and one of the companies that use rail transport on a daily basis for transporting raw materials that are used to manufacture steel such as iron ore, lime and coke from the Sishen mine and Kumba iron ore. These companies are some of the companies in partnership with TFR and make use of TFR's services to transport raw materials and other materials and goods. Therefore, the service delivery and performance of the rail transport provider is very important to these businesses. Therefore, AMSA due accessibility has been targeted as one of the participants in order to gather the data. The findings from this analysis will be discussed in more detail in the next chapter.

3.3 Research Design

The study approach was quantitative and questionnaires were distributed to freight rail transport users, AMSA as one of them in the Vaal Triangle, Gauteng. The purpose was to assess the following main factors:

- The preference between rail and road transport.
- If the rail transport system can be improved, will the freight loads currently transported on the roads be moved back to rail?
- If the improvement of rail transport system can boost the economy and the competitiveness of the country.
- The environmental impact causes road freight and freight rail transport.

The design of the study was based on what happened in the past and the current circumstances, the contextual background of the study was considered in order to provide a full understanding and interpretation of the research problem. The sources are both authentic and usable for academic research and the historical sources can be used in future to study different research problems or to replicate a previous study. The sources are also descriptive as the recommendations and conclusions are derived from the collected data.

In this study, the quantitative method was used as one of the goals of the study is to determine the relationship between dependent and independent variables in a population. A detailed analysis is required to gain an understanding of the topic and to present the information in a logical manner.

The statistical data used was primarily sourced from the questionnaires distributed. Yin (2009:114-115) states that it is important to use multiple sources to collect evidence such as observations, documents, archived records, interviews and questionnaires. Therefore, for this study the questionnaires were used to collect evidence.

3.4 Participants

The target population is 200 employees from companies that use the freight rail transport services of the rail transport provider TRF within the Vaal Triangle area. The research was conducted by issuing 400 questionnaires to the target population from various companies. The reason this method was used is because questionnaires are easy to compile, cost-effective and the confidentiality of the participants is guaranteed. Participants from the following companies were part of the empirical study:

- AMSA, Vanderbijlpark works, Logistics Department
- Ford, Vanderbijlpark
- TRF
- Samancor

3.5 Sample

The questionnaire was compiled with specific questions which would help to identify whether the improvement and continuous maintenance of the rail transport system can

increase the economic competitiveness of South Africa considering how rail transport has deteriorated and the freight loads are now being transported by road.

The probability sampling method was used based on simple random selection. The reason for this is that only employees who are dealing with planning and managing rail transport activities on a daily basis were approached with the aim of getting detailed feedback from participants who fully understand the road and rail transport impact on the economy, the environment and also the crucial role rail and road transport play in the companies that depend on them on a daily basis.

3.6 MEASURING INSTRUMENT

The questionnaires were used as a measuring instrument for gathering of the data. Participants were asked to address their opinions on whether improvements rail transport system can boost the economic competitiveness, the environmental effect of road use versus the use of rail transport and the overall current performance of rail transport among other aspects.

The draft questionnaire was completed and verified for content validity and permission to proceed was granted by the Statistical Consultation Services (SCS) of the North-West University (Potchefstroom Campus) after approving the questionnaire template.

The instrument used to assess the questionnaire data for this study was the SPSS Statistics programme used by SCS to determine the validity, reliability and Cronbach's alpha value of the findings. This will be discussed in more detail below.

3.6.1 Statistical Measurements

The instrument/programme measured the following statistics:

- **Correlations:** Cohen (1988) states that correlations are used as effect sizes and their value indicates an important variable relationship.

Cohen suggests the following guidelines:

Small effect: $|\rho| = 0.1$

Medium effect: $|\rho| = 0.3$

Large effect: $|\rho| = 0.5$

Cohen (1988) further motivated this as follows:

Small effect: $|\rho| = 0.1$, there is a small correlation which means that only 1% (that is, $100 \times \rho^2 = 100 \times 0.1^2$) of the variation in y is explained by x .

Medium effect: $|\rho| = 0.3$, there is a medium correlation which means that about 10% of the variation in y is explained by x . This is a typical correlation in social sciences and such relationships can be observed by the naked eye.

Large effect: $|\rho| = 0.5$ means that 25% of the variation in y can be explained by x , which means that x and y are linearly related.

- **Reliability**
- **Cronbach's alpha**

3.7 PROCEDURE

The participants in this study are employees of companies that are using rail transport for raw materials and other goods necessary for production purposes. These employees have knowledge of rail transport and some are handling and managing rail transport activities on a daily basis.

The questionnaires were distributed to the participants by email and hard copies were hand delivered as well. The questionnaires were accompanied by an introduction to the research, the research topic, a special request to complete the questionnaire and instructions on how to complete the questionnaire and submission. Several reminders were sent to prompt the participants to return the completed questionnaire by the due date.

3.8 ETHICAL CONSIDERATIONS

Data was collected on a voluntarily basis, all information received was treated as strictly confidential and the participants and their biographical information will remain anonymous. Therefore the names of participants will not be disclosed in the reporting of the research findings nor will any personal information be shared.

3.9 STATISTICAL ANALYSIS

The questionnaire had five sections (A to E). Section A was for demographic information. Four scales were used to measure how participants rate the rail transport and the impact it has on the environment, economy and competitiveness, namely, 1 = strongly agree, 2 = agree, 3 = disagree and 4 = strongly disagree (section B to D). In Section E the participants were asked to measure the rail transport services delivery in four dimensions, namely, 1 = more important, 2 = important, 3 = unimportant and 4 = more unimportant. The full questionnaire is attached as Appendix B.

The responses were analysed statistically by SCS and variables such as means, reliability, frequencies and Cronbach's alpha were measured. The results are tabulated and graphically presented in the section below. The frequency distribution is calculated as all relevant questions on the questionnaire are related to the objectives of the study.

3.10 INTERPRETATION AND ANALYSIS OF THE DATA

3.10.1 Introduction

The following section will discuss the detailed empirical research. The secondary objectives of the study will be considered; which were to investigate if the improvement of rail transportation can increase economic competitiveness and if moving freight loads from road back to rail will reduce gas pollution, road traffic and accidents and also save costs. This section will also include:

- An analysis of the data retrieved from the research instrument.
- A summary of the research questions, based on the analysis of information retrieved from the measuring instrument, will be given to clarify the answer to the research question.

After the questionnaires were received and manually checked for errors, the data was sent to the Statistical Services of the North-West University (Potchefstroom Campus) to be processed further. The SPSS Statistics 2013 version 21, release 21.0.0, program was used to determine mean scores, standard deviation, percentages, T-test, ANOVAS and frequencies.

3.10.2 Reliability

Tavakol and Dennick (2011:53) state that “Alpha was developed by Lee Cronbach in 1951 in order to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1.” Field (2009:675) quotes Kline with regard to acceptable values for Cronbach’s alpha as follows:

Kline (1999) notes that although the generally accepted value of 0.8 is appropriate for cognitive tests such as intelligence tests, for ability tests the cut-off point of 0.7 is more suitable. He goes on to say that when dealing with psychological constructs; values below even 0.7 can realistically be expected because of the diversity of the constructs being measured.

The literature on Cronbach’s alpha coefficients confirms that the acceptable values of the alpha are between 0.7 and 0.9. The Cronbach’s alpha coefficients for factor 1 of the study are all 0.9 and have therefore passed the reliability test. This is shown in Table 3-1 below.

Item -Total Statistics

Question	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
B1	30.60	88.482	.751	.749	.910
B2	30.39	88.879	.554	.534	.914

B3	29.82	91.828	.324	.337	.921
B4	30.44	90.348	.520	.515	.915
B5	30.20	91.840	.345	.798	.920
B6	30.48	89.952	.631	.614	.913
B7	30.15	91.248	.379	.816	.919
C1	30.52	90.312	.586	.527	.914
C2	30.12	88.686	.480	.506	.917
C3	30.64	87.372	.776	.730	.909
C4	30.62	88.897	.676	.683	.912
C5	30.41	88.824	.664	.539	.912
D1	30.58	89.525	.655	.626	.912
D2	30.37	87.034	.764	.669	.909
D3	30.41	89.684	.551	.607	.914
D4	30.54	87.510	.812	.756	.909
D5	30.46	89.190	.694	.745	.911
D6	30.41	89.244	.622	.700	.913
D7	30.46	88.810	.632	.677	.912

Table 3.1: Cronbach's alpha coefficients for factor 1 (Section B to D)

With regard to the questions in factor 2 (section E), all Cronbach's alpha values are above 0.61. This is shown in Table 3-2 below. Field (2009:675) quotes Kline as saying that low psychological construct values, even below 0.7, can realistically be expected because of the diversity of the constructs being measured. Cronbach's alpha values for factor 1 are below 0.7 and this is due to the low number of questions in this section.

• **Item-Total Statistics**

Question	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
E1	8.66	4.689	.321	.217	.647
E2	8.38	3.911	.439	.320	.610
E3	8.48	4.194	.440	.331	.613
E4	8.30	3.633	.516	.387	.582
E5	8.69	4.564	.336	.209	.642
E6	8.33	4.071	.386	.171	.627
E7	8.37	4.390	.223	.177	.679

Table 3-2: Cronbach's alpha coefficients for factor 2 (Section E)

3.10.3 Response Rate

A total of 200 questionnaires were handed out. A total of 106 valid questionnaires were returned. The response rate is therefore 53%, as shown in Table 4-3 below.

Target sample size	Respondents	Response rate
200	106	53%

Table 3-3: Response rate

Carley-Baxter *et al.* (2009) conducted research to determine if the response rate is a major reason for research rejection and the results showed that only 3% of the participants indicated that submissions are rejected primarily due to low response rates. Sixty-seven per cent indicated that this is the case some of the time and 29% indicated that submissions were never rejected due to a low response rate. Furthermore, the authors mentioned four often-cited measures of quality considered in publication

decisions other than response rate which are sampling, questionnaire, methods and representatives (Carley-Baxter et al,2009:4).

Galea and Tracy (2007) address the reasons for low participation rates in research studies. Some of these are: potential participants receive countless requests to participate in studies including academic and government-sponsored research, participants view participation as less worthwhile and there is a decrease in willingness to participate. They stated moreover that low and high participation rates do not determine the extent of bias present in the study and that forcing participation may introduce more bias than if the participants were less conscientious in their survey participation (2007:646-648).

Therefore, the response rate of this study is acceptable as the authors stated that the response rate does not necessarily matter because it is not the only measurement of the quality of sampling data.

3.10.4 Descriptive Statistics

The data was analysed as received from the research questionnaire. Graphical representation of the data was done by means of bar graphs, pie charts and tables. The demographic profile of respondents in terms of gender, race and occupation is shown in Figures 3-1, 3-2 and 3-3. Figure 3-1 below shows the ratio of males to females who responded to the questionnaire. There were 45 (43.7%) females to 58 (56.3%) males from the total of 106.

Figure 3-1: Females vs. Males.

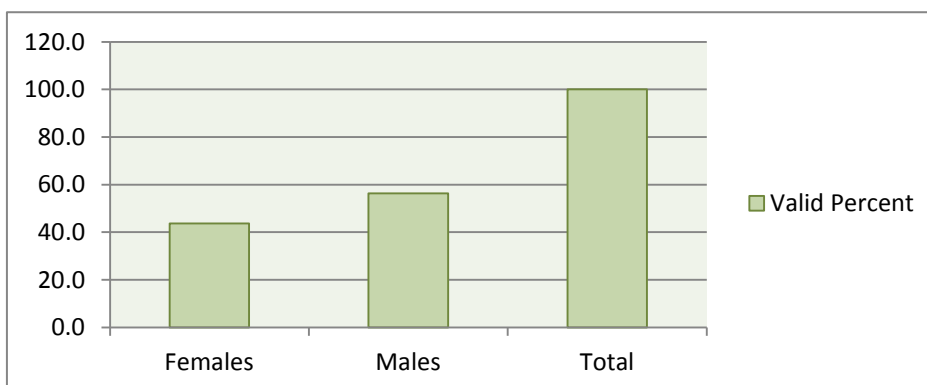
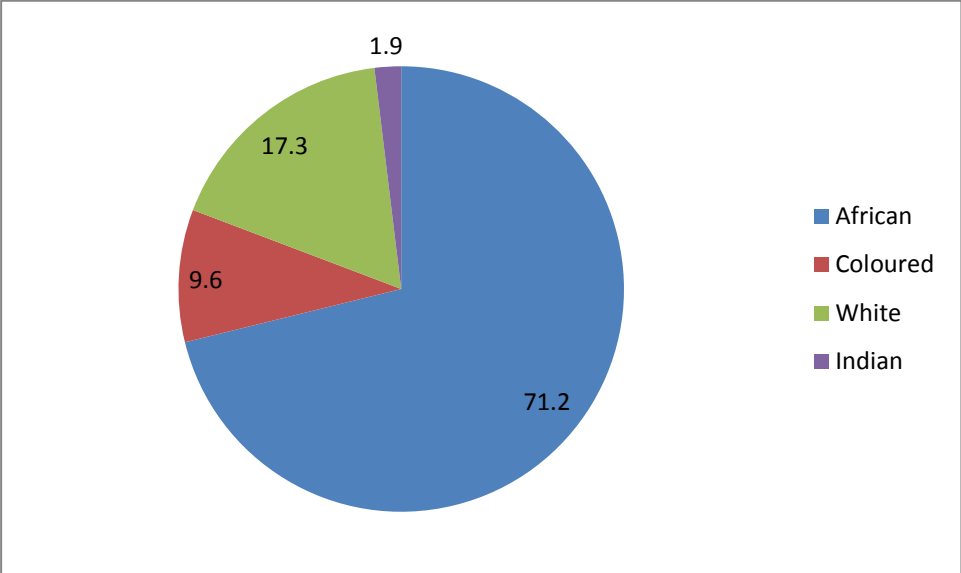


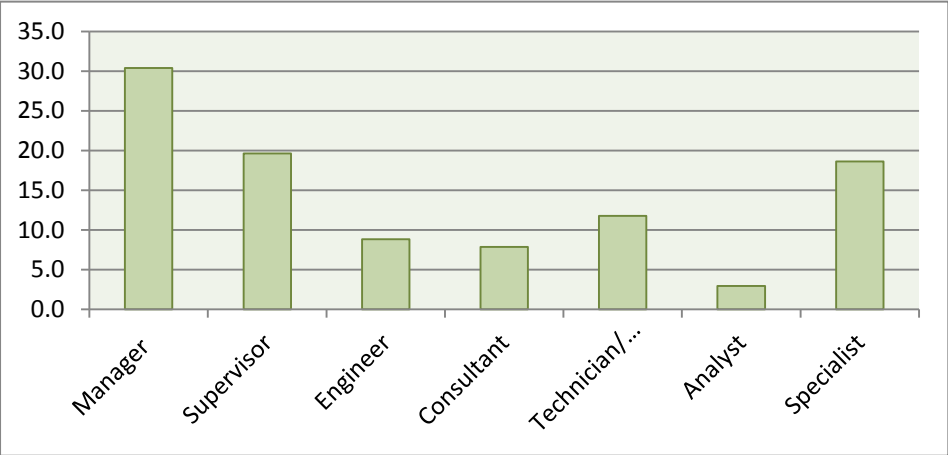
Figure 3-2 below shows a pie chart dividing the respondents by race. A large percentage of respondents were African, making up 71.2% of the total percentage, followed by whites at 17.3%, 9.6% coloureds and a low number of Indians at 1.9%.

Figure 3-2: Racial groups.



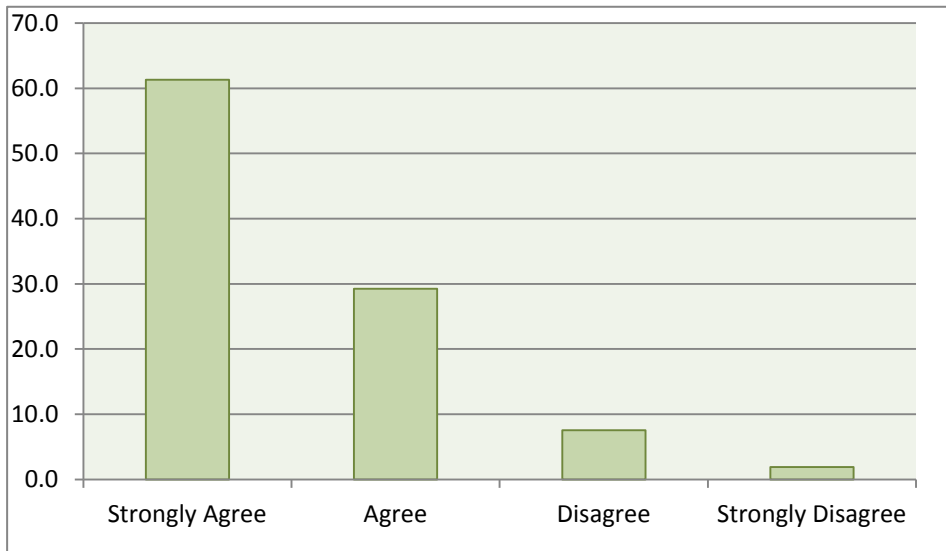
The occupation chart was used on the analysis to determine if the data was drawn from participants who have knowledge of the research topic. Figure 3-3 below shows the percentages of individuals in various occupations. There were 30% managers, 19% supervisors, 16% specialists and the rest of the respondents were few and excluded on the reporting.

Figure 3-3: Occupation.



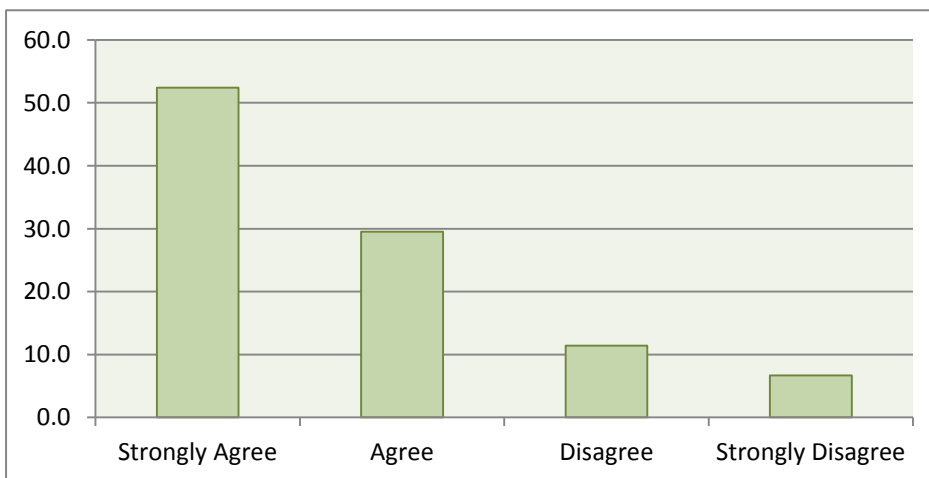
More than 60% of the respondents strongly agreed and 29.2% agreed that the development of rail transport can improve the economic competitiveness of South Africa. This question tested secondary objective 1. The results are illustrated in Figure 3-4 below.

Figure 3-4: The development of Rail transport can improve the Economic Competitiveness in South Africa.



As shown in Figure 3-5 below, more respondents (53%) strongly agreed that rail transport is more carbon efficient than road transport. Less than 10% strongly disagreed. The question deals with the environmental impacts caused by rail and road transports and as covered by secondary objective 3.

Figure 3-5: Rail transport is more carbon efficient than Road.



The results in Figure 3-6 illustrate that the response to Question B3 that rail transport is currently the preferable mode of transport for freight goods had an equal percentage for strongly agree and disagree responses (30.2%), 28.3% of the respondents agreed to the question and 11.3% strongly disagree. This level of agreement may have been caused by the current trend of transporting freight goods by road instead of rail. The freight road transporters have slowly gained the market because of the inefficiency and unreliability of rail transport which is caused by a lack of rail maintenance as discussed in the literature.

Figure 3-6: Rail transport as a preferable freight mode of transport.

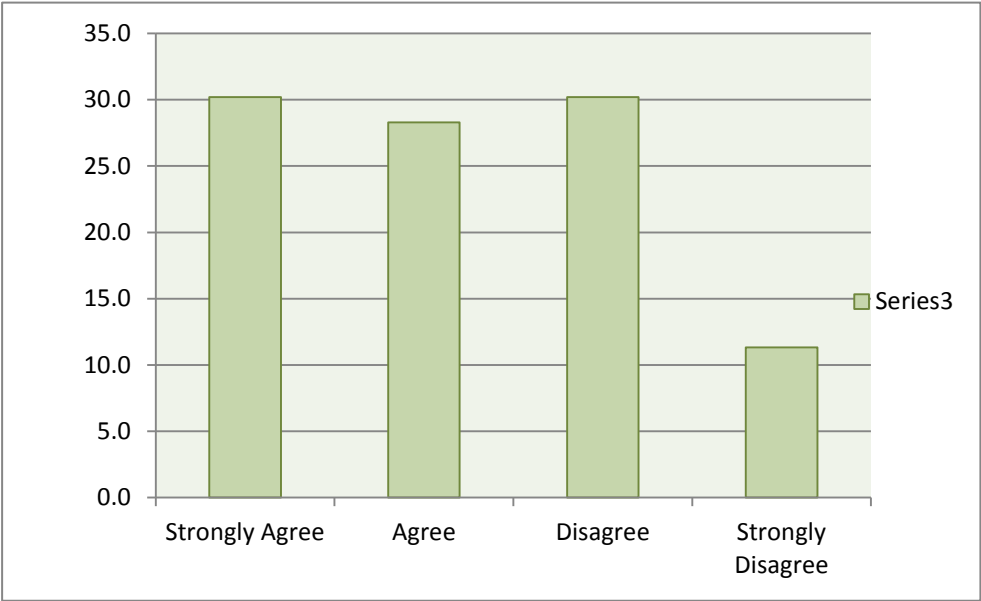
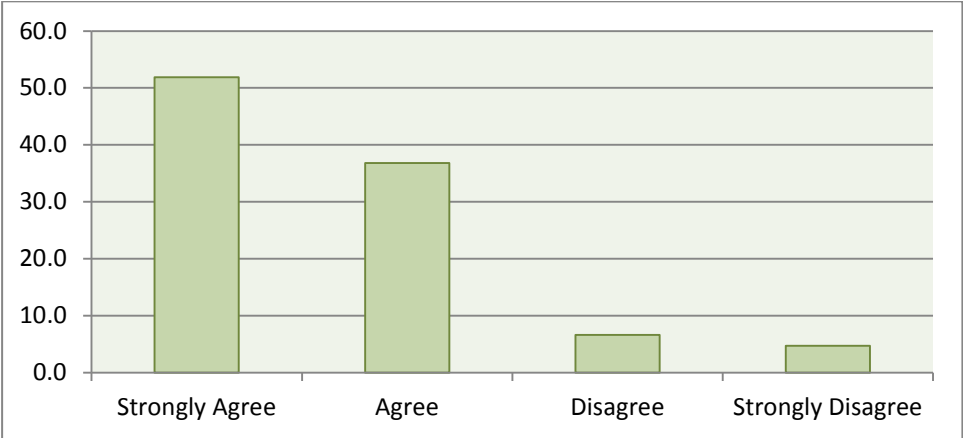


Figure 3-7 below shows that 52% of the respondents strongly agree that rail transport is cheaper than road transport and it can reduce demurrage, whereas 0.4% strongly disagree. This question deals with secondary objective 4 where the cost comparison of road and rail is measured and the results show that the majority of participants agree that rail transport costs are competitive.

Figure 3-7: Freight Rail transport costs are more competitive than freight road costs.



Rail network improvement in terms of service delivery and reducing road maintenance costs are covered in secondary objective 1. A renewal of rail transport can lead to increased business for rail freight transporters and decreased business for road freight service providers. Of the total, 42% of the respondents strongly agreed, 36% agreed, only 10% disagreed and 9% strongly disagreed. This is illustrated in Figure 3-8 below.

Figure 3-8: Rail transport and road freight.

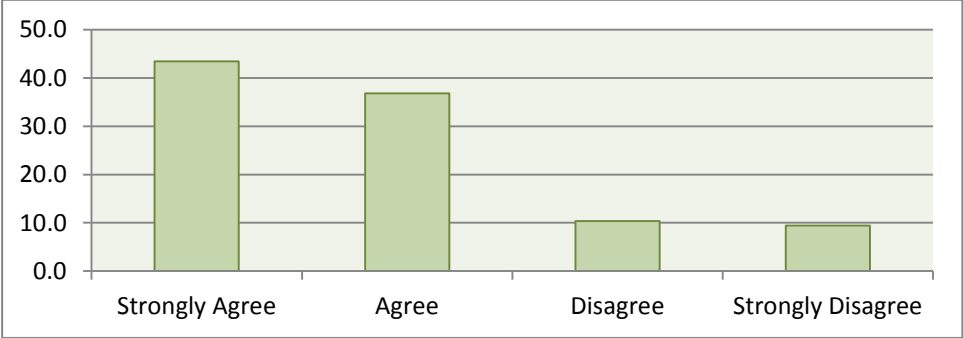
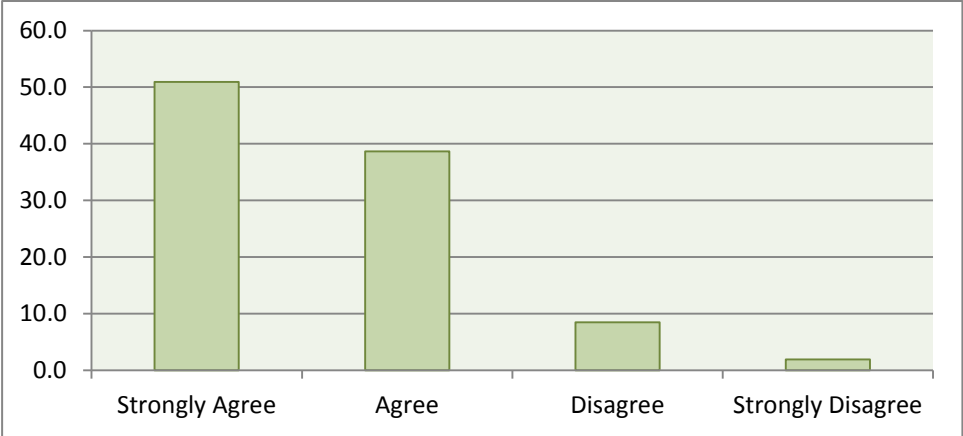


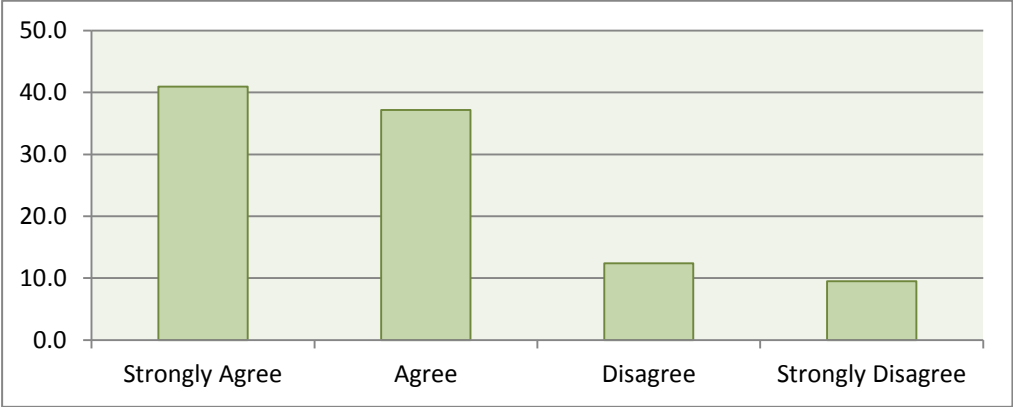
Figure 3-9 below shows that 51% strongly agree, 38% agree, 9% disagree and only 2% strongly disagree that continuous maintenance of railways is required to improve the service delivery of freight rail. This factor is covered in secondary objectives.

Figure 3-9: Continuous maintenance to improve freight rail service.



Question B7 was about the use of rail transport in reducing the need for road maintenance. This question was included to determine whether the respondents have the same level of agreement on the need for rail transport improvement for a positive environmental impact. As illustrated in Figure 4-10, 40% strongly agree, 37% agree, 11% disagree and only 9% strongly disagree with the notion that increased use of rail transport will decrease environmental damage.

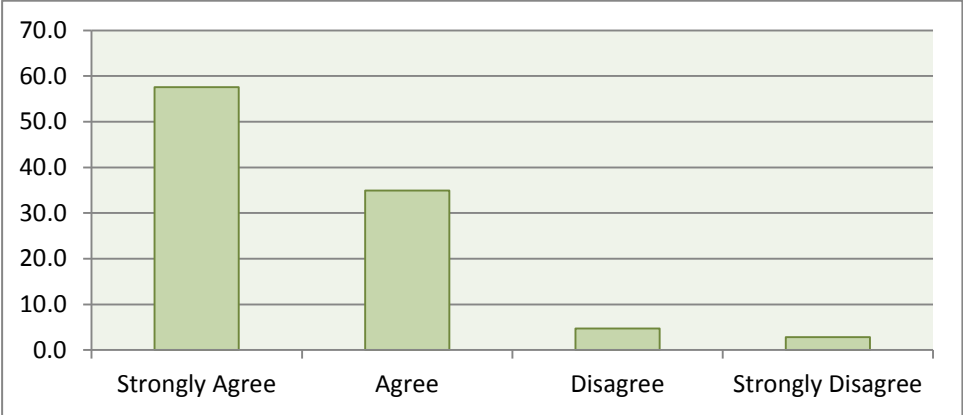
Figure 3-10: Shifting road freight back to rail to reduce road maintenance.



Only factor 1 was chosen to interpret the results as they both contain the questions related to the secondary objectives of the study. Therefore, Section C was excluded for that reason.

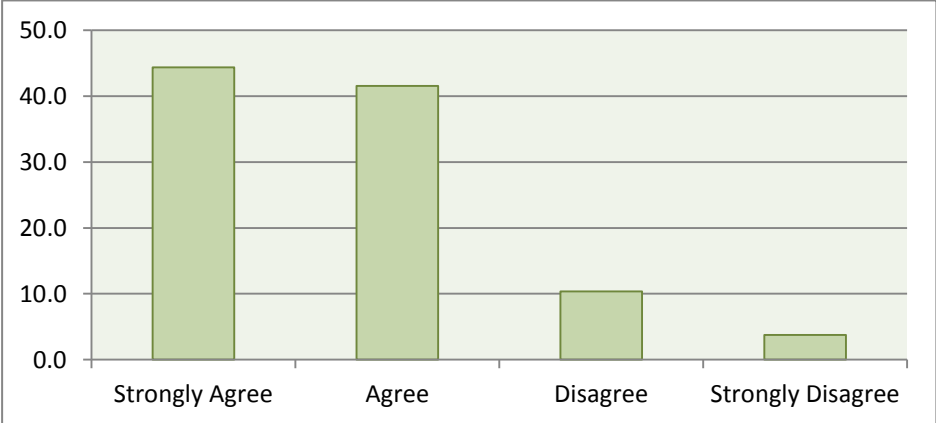
Figure 3-11 below shows the results from question D1. More than half of the participants (58%) strongly agree and 35% agree while 4% disagree and only 3% strongly disagree that more capital investment in railway infrastructure can add value to freight rail transport. This is confirmed by Transnet as they place investment in advanced rail transport systems as a priority.

Figure 3-11: Railway infrastructure adds value to Freight rail transport.



As illustrated by Figure 3-12 below, freight rail improvements can also enhance Transnet’s performance. Almost half (45%) strongly agree that Transnet’s malperformance is due to a lack of freight rail improvements and 42% agreed whereas 10% disagreed and only 3% strongly disagreed. The minority disagreement might be caused by a lack of understanding on how an improvement in operations can impact performance.

Figure 3-12: Lack of railway maintenance affects Transnet’s performance.



Secondary objective 5 addresses the need for an improvement in rail infrastructure in order to create much-needed job opportunities. The survey results related to this question show that 49% strongly agree, 37% agree, 11% disagree and 3% strongly disagree that upgrading rail infrastructure will have an impact on job creation. See Figure 3-13 below in this regard.

Figure 3-13: Rail Infrastructure and job opportunities.

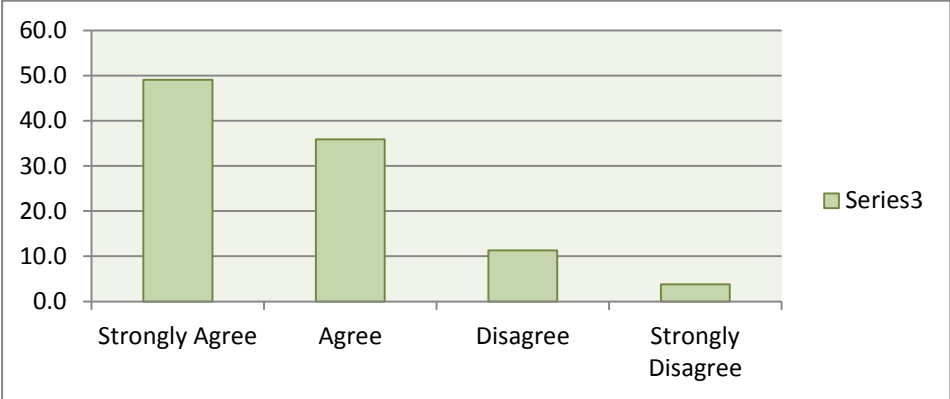
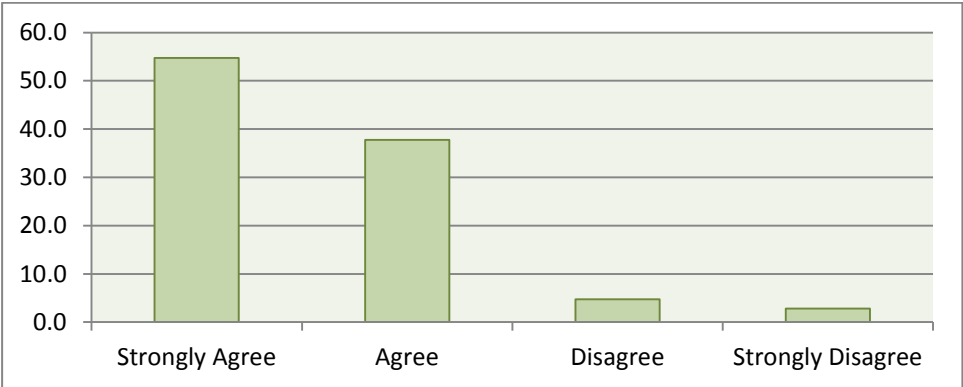


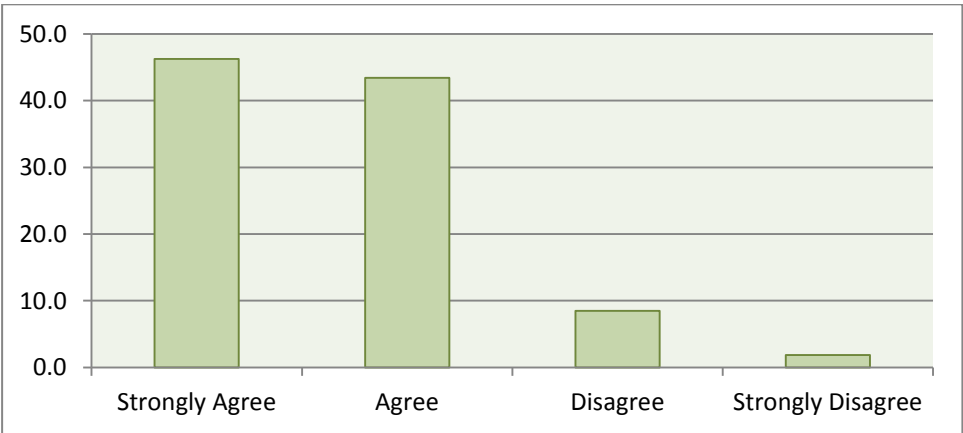
Figure 3-14 shows that 54% strongly agree, 39% agree, 4% disagree and 3% strongly disagree that railway infrastructure can add value to the economy. This positive result is confirmed by Transnet (as covered in the literature review) since there is now a greater budget allocation for rail transport infrastructure. There is also an increase in the job employment rate as Transnet is employing more people because new railway lines are being built and there is also service improvement which requires more staff (Transnet, 2012:19).

Figure 3-14: Impact of Rail infrastructure on Economy.



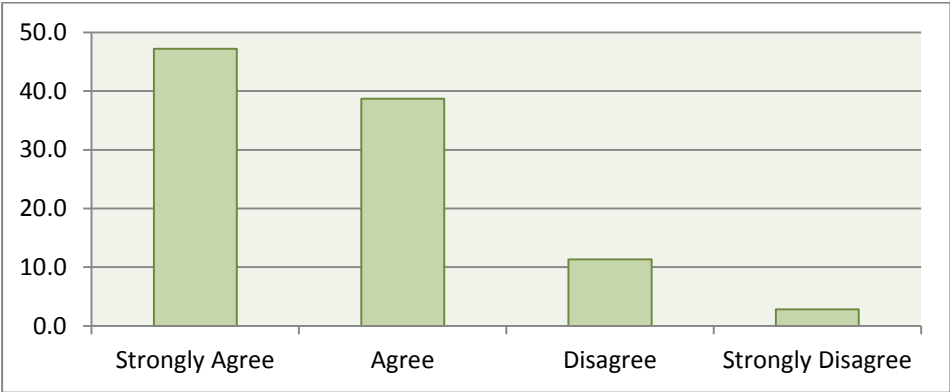
It is every country's priority to be competitive and South Africa is investing in rail infrastructure. Secondary objective 1 was addressed in questions D5 and D6 which examine if an improved freight rail transport system can make South Africa locally and globally competitive. Almost half of the respondents (46%) strongly agree, 43% agree, 9% disagree and only 2% strongly disagree with the statement that improved rail service can make the country more competitive locally. This shows that more than 80% agree with the importance of rail in being competitive locally. The results are presented in Figure 3-15 below.

Figure 3-15: Rail infrastructure and country's local competitiveness.



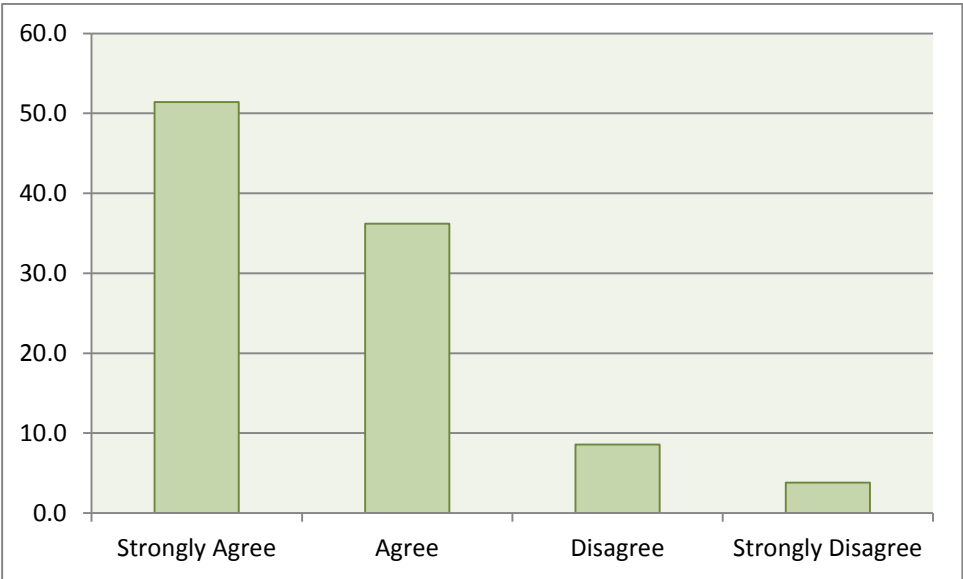
The majority of the respondents agreed that an improved freight rail transport system can make South Africa globally competitive. The results are illustrated below in Figure 3-16.

Figure 3-16: Rail infrastructure and country's global competitiveness.



Furthermore, road to rail migration can unlock job opportunities because rail transport has been ignored, causing freight goods to be transported by road. Question D7 covered the factors in secondary objective 3: measuring the previous and current performance status of rail transport. Figure 3-17 below shows that less than 10% strongly disagree and more than 50% strongly agree that job opportunities and better road conditions will result from the increase in rail transport use.

Figure 3-17: Positives of back to rail.



3.10.5 Gender Comparisons

Factor 1 analyses the responses to Sections B to D of the questionnaire. Factor 2 analyses Section E of the questionnaire. Descriptive statistics for gender and race was only done to determine the gender and race perspectives with regards to economic competitive and freight and rail transport; this was done for interest sake and do not form part of the findings and recommendations. Males had higher means than females. For factor 1, males had a mean of 1.75 and females had a mean of 1.64. For factor 2, males had a mean of 1.45 and females 1.37. This is shown below in Table 3-4.

GENDER		N	Mean	Std. Deviation	Std. Error Mean
FACTOR 1	Females	45	1.64	.56248	.08385
	Males	58	1.75	.50140	.06584
FACTOR 2	Females	45	1.37	.33281	.04961
	Males	58	1.45	.33306	.04373

Table 3-4: Descriptive Statistics for Males vs. Females

According to Levine (2011: 286), the t-test was developed in the 20th century by William Gosset to help the Irish brew better beer and less expensively. There were only small samples to study and they needed to find a way to make inferences about the means without knowing the standard deviation. The t-test looks at the t-statistic, t-distribution and degrees of freedom in order to measure a probability that can be used to determine if population means differ. Therefore, the students' distribution (t-test) was developed with the assumptions that the:

- Population standard deviation is unknown; and
- Population is normally distributed.

A t-test was conducted to statistically compare females and males at a 0.05 level of significance as shown in Table 4-5 below. The t-test revealed no statistically significant difference between the two genders. The values of the 2-tailed test were above 0.05 at 0.31 for factor 1 and 0.21 for factor 2.

Independent Samples Test for Males and Females										
		Levine's Test for Equality of Variances		T-test for Equality of Means						
			Sig.	<i>t</i>	<i>Df</i>	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
FAC1	<i>Equal variances assumed</i>		.1	-1.02	101	.31	-.11	.11	-.31	.10
	<i>Equal variances not assumed</i>			-1.00	88.89	.32	-.11	.11	-.32	.10
FAC2	<i>Equal variances assumed</i>		.74	-1.26	101	.21	-.08	.07	-.21	.05
	<i>Equal variances not assumed</i>			-1.26	94.77	.21	-.08	.07	-.21	.05

Table 3-5: T-tests for Males vs. Females

3.10.6 Comparisons by Race

As explained before the comparisons by gender and race was not important for the research topic it was only done to present the results and therefore do not form part of the findings and the recommendation of the study. A t-test was also done to statistically compare the means between the different races at a 0.05 level of significance, as shown in Table 4-6 below. The t-test revealed no statistically significant difference between the races of the respondents. The values of the 2-tailed test were above 0.05. The means for factor 1 were at 1.69 for blacks, 1.78 for coloureds and 1.58 for whites. For factor 2, the means were at 1.39 for blacks, 1.28 for coloureds and 1.51 for whites.

Indians were not included in the analysis because of their low representation in the sample. A group collapse was conducted so that the results do not violate the tests, allowing for some basic statistical assumptions.

Descriptive Statistics for Racial Groups									
			<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>		<i>Min</i>	<i>Max</i>
						<i>Lower Bound</i>	<i>Upper Bound</i>		
<i>FAC1</i>	<i>Blacks</i>	74	1.6900	.47503	.05522	1.5833	1.8034	1.00	3.26
	<i>Coloured</i>	10	1.7800	.82831	.26193	1.1852	2.3703	1.00	3.68
	<i>Whites</i>	18	1.5390	.28555	.06730	1.3970	1.6810	1.11	2.11
	<i>Total</i>	102	1.6744	.49249	.04876	1.5776	1.7711	1.00	3.68
<i>FAC2</i>	<i>1</i>	74	1.3996	.32506	.03779	1.3243	1.4749	1.00	2.00
	<i>2</i>	10	1.2810	.28611	.09048	1.0763	1.4856	1.00	1.71
	<i>3</i>	18	1.5159	.38313	.09031	1.3253	1.7064	1.00	2.29
	<i>Total</i>	102	1.4085	.33481	.03315	1.3427	1.4743	1.00	2.29

Table 3-6: Descriptive statistics between the different races

According to Levine (2011:418), an analysis of variance (ANOVA) is the test used to compare three or more variances. The technique is called analysis of means (ANOM) and the name is appropriate because inferences about means are made by analysing variance.

In order to use ANOVA for the f test, the following assumptions must be made (Levine, 2011:418):

- Randomness and independence – the validity of variance depends on random sampling therefore randomness and independence are critical.
- Normality – the values must be from a normally distributed population.
- Homogeneity of variance – the variances of the groups must be equal.

Table 3-7 below shows the results of the ANOVA test by race. It shows that there were no statistically significant differences between the different races with regard to their questionnaire answers. The significant level is at a 0.05 as the significant value of factor 2 is 0.19 and significant value of factor 1 is 0.39.

ANOVA Test for Race						
		<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Significant value</i>
<i>FAC1</i>	<i>Between Groups</i>	.463	2	.232	.954	.39
	<i>Within Groups</i>	24.034	99	.243		
	<i>Total</i>	24.497	101			
<i>FAC2</i>	<i>Between Groups</i>	.376	2	.188	1.701	.19
	<i>Within Groups</i>	10.946	99	.111		
	<i>Total</i>	11.322	101			

Table 3-7: ANOVA test for Race

3.10.7 Comparisons by Occupation

A t-test was also done to statistically compare the means between the respondents' occupations at a 0.05 level of significance, as shown in Table 4-8 below. The t-test also revealed that there is no statistically significant difference between the occupations of the respondents. The values of the 2-tailed test were above 0.05. The means for factor 1 were at 1.65 for respondents working as managers, at 1.77 for supervisors, 1.71 for technicians/coordinators and 1.70 for specialists. Furthermore, for factor 2 the results revealed the means as 1.40 for managers, 1.38 for supervisors, 1.51 for technicians/coordinators and 1.45 for specialists.

Occupational Descriptive Statistics									
			<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>		<i>Min</i>	<i>Max</i>
						<i>Lower Bound</i>	<i>Upper Bound</i>		
<i>FAC1</i>	<i>Manager</i>	31	1.6581	.47343	.08503	1.4844	1.8317	1.05	3.00
	<i>Supervisor</i>	20	1.7731	.67029	.14988	1.4594	2.0868	1.00	3.58
	<i>Technician/ Coordinator</i>	12	1.7105	.52320	.15103	1.3781	2.0429	1.16	3.16
	<i>Specialist</i>	19	1.7051	.57540	.13200	1.4277	1.9824	1.05	3.68
	<i>Total</i>	82	1.7047	.54876	.06060	1.5841	1.8253	1.00	3.68
<i>FAC2</i>	<i>Manager</i>	31	1.4009	.36031	.06471	1.2688	1.5331	1.00	2.00
	<i>Supervisor</i>	20	1.3833	.34494	.07713	1.2219	1.5448	1.00	2.29
	<i>Technician/ Coordinator</i>	12	1.5119	.31333	.09045	1.3128	1.7110	1.00	2.00
	<i>Specialist</i>	19	1.4511	.32389	.07431	1.2950	1.6072	1.00	2.00
	<i>Total</i>	82	1.4245	.33848	.03738	1.3501	1.4989	1.00	2.29

Table 3-8: Descriptive Statistics by Occupation

Table 3-9 below shows the results of the ANOVA test by occupation for the respondents. It shows that there are no statistically significant differences between the different races with regard to their answers to the questionnaire at a 0.05 significance level as the significant value of factor 2 is 0.72 and significant value of factor 1 is 0.91.

ANOVA Test by Occupation						
		<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<i>FAC1</i>	<i>Between Groups</i>	.161	3	.054	.173	.914
	<i>Within Groups</i>	24.231	78	.311		
	<i>Total</i>	24.392	81			
<i>FAC2</i>	<i>Between Groups</i>	.156	3	.052	.445	.721
	<i>Within Groups</i>	9.124	78	.117		
	<i>Total</i>	9.280	81			

Table 3-9: ANOVA test by Occupation

3.10.8 Comparison by Education

Some respondents were excluded from this analysis because of the low sample size. A collapse is done so that the results do not violate the tests, allowing for some basic statistical assumptions.

A t-test was also done to statistically compare the means between the respondents' education levels at a 0.05 level of significance, as shown in Table 3-10 below. The t-test again revealed that there is no statistically significant difference between the education levels of the respondents. The values of the 2-tailed test were above 0.05. The means for factor 1 are at 1.58 for respondents who have Grade 12, at 1.63 for diploma holders, 1.71 for degree holders and 1.79 for postgraduates. Furthermore, for factor 2 the results revealed the means at 1.46 for respondents who have Grade 12, at 1.41 for diplomats, 1.40 for degree holders and 1.44 for postgraduates.

The majority of the respondents have degrees (46 in total) and only 11 have Grade 12. This means that the respondents are mostly well educated and likely have a good understanding of the questionnaire. All the respondents have a basic education. Thus, they likely all have at the very least a general idea of what rail transport is and economic competitiveness in the industry. Table 3-10 below summarises the results.

Descriptive Statistics for Education									
		<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval for Mean</i>		<i>Min</i>	<i>Max</i>
						<i>Lower Bound</i>	<i>Upper Bound</i>		
<i>FAC1</i>	<i>Grade 12</i>	11	1.5885	.32171	.09700	1.3724	1.8046	1.11	2.05
	<i>Diploma</i>	24	1.6338	.32126	.06558	1.4981	1.7694	1.00	2.21
	<i>Degree</i>	46	1.7192	.63271	.09329	1.5313	1.9071	1.05	3.68
	<i>Postgraduate</i>	19	1.7793	.57272	.13139	1.5033	2.0554	1.00	3.26
	<i>Total</i>	100	1.6957	.52900	.05290	1.5908	1.8007	1.00	3.68
<i>FAC2</i>	<i>Grade 12</i>	11	1.4675	.37846	.11411	1.2133	1.7218	1.00	2.00
	<i>Diploma</i>	24	1.4167	.36946	.07541	1.2607	1.5727	1.00	2.29
	<i>Degree</i>	46	1.4089	.30260	.04462	1.3190	1.4988	1.00	2.00
	<i>Postgraduate</i>	19	1.4436	.34959	.08020	1.2751	1.6121	1.00	2.00
	<i>Total</i>	100	1.4238	.33230	.03323	1.3579	1.4897	1.00	2.29

Table 3-10: Descriptive Statistics for level of education

Table 3-11 below shows the results of the ANOVA test for the occupation of the respondents. As can be deduced from the results there are no statistically significant differences between the various races with regard to their answers to the questionnaire at a 0.05 significant level as the significant value for factor 1 is 0.72 and significant value for factor 2 is 0.95.

ANOVA for Education Level						
		<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<i>FAC1</i>	<i>Between Groups</i>	.377	3	.126	.44 1	.724
	<i>Within Groups</i>	27.328	96	.285		
	Total	27.704	99			
<i>FAC2</i>	<i>Between Groups</i>	.040	3	.013	.11 7	.950
	<i>Within Groups</i>	10.892	96	.113		
	Total	10.932	99			

Table 3-11: ANOVA test on level of education

3.11 SUMMARY

This chapter described the research approach and design, the participants, sampling techniques and the measuring instruments used to gather, analyse the required data for the study of economic competitiveness and rail transport in South Africa. Lastly the findings were also discussed.

Two main research methods were used: an extensive literature review and statistical data collection.

In conclusion, it can be stated that most of the respondents agree that an improvement in rail transportation can increase the economic competitiveness of the country, provided more capital investment is allocated for rail transport infrastructure. This will result in moving freight loads from road back to rail, reduce the gas pollution and make the environment welcoming, reduce road traffic and accidents. The respondents mostly agree that this will decrease the need for and costs of road maintenance while also increasing job opportunities. The ANOVA tests for occupation, race and level of education show that there are no statistically significant differences between these variances because the values are all greater than the significant level of 0.05.

The t- tests conducted for females and males who participated in this study also showed no statistically significant difference between the two genders. The values of the 2-tailed test were above 0.05 at 0.31 for factor 1 and 0.21 for factor 2.

It is also worthwhile noting that all the sections of the questionnaire have passed the acceptance level of reliability.

There are several crucial factors affecting the economic growth of the country. This study has identified rail transport as one of these factors. The improvement of rail transport can boost the economy by increasing the employment rate, reducing the need for road maintenance and accidents caused by freight rail loads being transported by trucks on the roads as well as increasing local and global competitiveness for South Africa.

Transnet has prioritised the improvement of the rail transport system as there is a critical need for it. The South African government is supporting these initiatives and a budget of R300 billion has been allocated for this large-scale project. The significant funding injection as well as the new railway Market Demand Strategy will meaningfully boost infrastructure development and employment creation. This is also a substantial investment in the overall South African economy (Transnet, 2012: 3, 4).

The practical significance of the research results is not only important for population data reporting but also for conclusions to be made on the practical significance of the

statistically significant results in the case of random samples from populations. A careful analysis and interpretation of the quantitative data will assist in making sound and valuable recommendations in Chapter 4.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

In Chapter 4, the results obtained from the research were presented, integrated and analysed. This final chapter includes the recommendations and conclusions made based on the literature review from Chapter 2, together with the empirical study conducted in Chapter 3.

The questionnaire results are used to compare the impact of rail transport and economic competitiveness in South Africa in theory and in practice as the primary objective of the study was to explore the challenges faced by rail transportation due to lack of maintenance. Therefore, the conclusions were made as it was proven also from the data received that the participants also support the literature review that the poor service delivery provided by TFR as the freight rail transport provider is due to the lack of maintenance. Concluded that there is in need a problem with regards to lack of maintenance in rail transport the recommendations were made on how TFR can be more effective and efficient in their attempt to improve service delivery and increase capacity to boost the economic competitiveness of South Africa.

4.2 CONCLUSIONS

Based on the information and analysis given in the previous chapters, it is evident that there is a significant need for an upgraded rail transport infrastructure. The poor service delivery caused by Transnet freight rail inefficiencies is the result of a lack of rail maintenance. Poor infrastructure and maintenance mean that the benefits rail transport can bring to the South African economy are not being realised.

The literature review has shown that there is a problem caused by freight rail which is transported by road. Road freight vehicle overloading is one of South Africa's major challenges, especially on secondary roads where law enforcement is ineffective. The overloading is not only detrimental for the quality of South Africa roads but also poses a major safety risk for other road users. Operator overhead costs are also increased by the overloading of vehicles as these vehicles require more maintenance and repairs.

Europe, Australia, the US and South Africa experience a disparate share between road and rail transport volumes because the demand for freight movement has increased and rail transport has not keep up with the demand. Road transport has experienced an increased demand whereas rail transport remains relatively unaffected or has experienced only minor increases as a result of the increased demand.

As Illustrated in figure 3-12 in chapter 3, the respondents indicated that freight rail improvements can also improve Transnet's performance. Almost half (45%) strongly agree that Transnet's malperformance is due to a lack of freight rail improvements such as maintenance and 42% agree, whereas only 10% disagreed and 3% strongly disagree, of the small number of respondents who disagree may be due to the fact that most companies have adopted JIT practices and this system requires stock to be kept at low levels. This has led to an increase in the number of smaller shipments which rail transport does not accommodate. The lack of rail availability to meet freight customer demand allows road transport operators to take advantage of this gap.

4.3 RECOMMENDATIONS

The recommendations are directed to TFR as it is the leading freight rail transport provider in South Africa. The objective is to encourage TFR to improve its services in order to satisfy customers.

The following recommendations are made based on this study:

- **TFR needs to be cost efficient and more effective in its service provision**

For TFR to achieve any dominant advantage it has to be cost-efficient and service-effective and it has the capacity to do so for freight rail transport (Pienaar, 2012:4).

- **TFR needs to use the Logistics Performance Index (LPI) regularly**

The LPI indicates the logistics performance of 155 countries with regard to freight, TFR can be warned well in advance of its logistical performance problems and weak areas by checking the country's score (CSIR, 2010:2).

- **TFR needs to know how to define its modal share**

In continents like Europe and the United States of America, the modal share is measured by the country's need for rail transport. For example, Europe transports seven times the same number of tons transported in the US. Their operational revenues per ton are approximately twice that of the US. As a result, Europe cannot set the same modal share as the US but they can reduce the operational costs by increasing the train sizes to escalate productivity (Furtado, 2013:65).

- **TFR needs to relocate the main commercial centres near the coastline**

South Africa is using a similar rail network to Poland, Italy and Ukraine in terms of the overall geography and density of the network. It is also similar to Mexico in that the main commercial centres are located far from the coast which results in long distances for transporting freight. The commercial centres should be at least a few kilometres from the sea ports.

- **TFR should consider introducing double stacked container trains**

The advantage of using double stacked trains is that they carry double quantities of heavy cargo at once. This reduces the number of train trips, transport costs and time. By using this type of train, TFR can overcome many of its rail transport problems and become more efficient and effective in service delivery (Adesanya, 2010:17).

By adopting these recommendations, TFR can improve service delivery for its customers, becoming the efficient, reliable and effective freight rail service provider South Africa needs to unlock greater local and global economic competitiveness and boost the country's economy.

4.4 Achievement of the study objectives

The primary objective of this study was to investigate the influence of rail transport on economic competitiveness, the impact of moving from road to rail transport, to explore the challenges faced by the rail transport provider and compare the South African situation to the rail transport systems used in other countries. The primary objective was covered in the literature review conducted in Chapter 2.

In order to understand the primary objective, the following secondary objectives had to be encountered. The data collected using the survey research also assisted in achieving the secondary objectives. A summary of the findings is given below.

- **To compare the logistics costs of rail and road transport**

Figure 3-7 and 3-8 show that most of the respondents strongly agree that rail transport is cheaper than road transport. Less than 10% strongly disagreed. This is also evidenced by Simelane (2010:1) who indicates that a collaborative partnership between TFR and the Department of Road and Transport, Agriculture and Economic Development in Limpopo specifically will reduce the transportation costs of fruit in the province from R1.9 billion to R1.7 billion (Simelane, 2010:1).

- **The influence of rail transport before its decline and the results of its enhancement**

As shown in Figure 3-11, almost 60% of the respondents strongly agree that more capital investment in railway infrastructure can add value to freight rail transport. This is confirmed by Simelane (2012:1) who states that the TFR has embarked on the lean six sigma methodology to improve operations nationally, to ensure more cost-effective and efficient decision-making and to achieve a properly scheduled railway system that will meet customer demand (Simelane, 2012:1).

- **The influence the improved and continuous maintenance of rail transport will have on conducting business globally and locally, particularly in terms of moving freight off the roads and onto rail**

Figure 3-15 and 3-16 show that improved freight rail transport services can make South Africa more competitive locally and globally, Almost 89% of the respondents strongly agree or agree on the importance of the railways in competitiveness. Transnet (2012:4) says that its Market Demand Strategy is targeted at satisfying customer demand. The strategy provides for additional capacity for exporting coal, iron ore and manganese and also key domestic commodities such as coal, magnetite, iron, cement, agricultural commodities and containers (Transnet, 2013:4).

- **To examine whether rail infrastructure can increase job opportunities, skills training and development in order to increase economic competitiveness**

As can be seen in Figure 3-13 and 3-16, various factors were measured in the questionnaire with regard to the positive impact rail infrastructure can have on the employment rate if it is given attention and improved. Transnet's Market Demand Strategy and the investment of R300 billion in rail, port and pipeline infrastructure will stimulate growth and skills development, allowing for the employment of more people, promote local industry, empower black businesses and enable better regional integration (TFR, 2012a:7).

- **Environmental impact of using freight road instead of freight rail transport**

Numerous questions were asked on this issue and the respondents indicated that if rail transport is used for freight loads, the roads can be saved, costs can be reduced and traffic congestion can be less. This is illustrated in figure 4-16 above.

Simelane (2010:1) also states that Limpopo province is responsible for 30% of the country's citrus and 45% of the country's Valencia orange variety exports but freight rail transported only 5% of this in 2009. If TFR can provide for 35% of citrus fruit producers' transport needs by sharing the load with road trucks from the number of trips required can be reduced from 55 000 to 32 000. This will reduce the carbon footprint of citrus fruit transportation drastically from 56 million tons of carbon dioxide to 25 million tons (Simelane, 2010:1).

4.5 RECOMMENDATIONS FOR FUTURE RESEARCH

This study has focused on the economic competitiveness of rail transport in South Africa; especially the positive impact rail transport can have on the country's economy. If rail transport is improved and used more often, local and global trading advantages can be realised. A better rail system can also bring down the cost of transportation and decrease the environmental impact of freight loads which are transported by the roads instead of railways.

It is therefore recommended that future research be extended to focus more on the main contributing factors that can boost the South African economy other than rail transport infrastructure.

4.6 SUMMARY

This study was about the economic competitiveness of rail transport in South Africa, it was highlighted in the problem statement that for the past 20 years progress and development of South African rail industry has not kept up with the demand due to rail corridor decline, that has pushed people and businesses to opt for road transport instead of rail transport. The challenges faced by rail transportation due to the main motive mentioned simply being lack of maintenance have been explored in the literature by identifying the main root of the problem, development initiatives that can be taken to improve the rail transport infrastructure in bring freight back to rail. The employees of the rail transport users were approached in order to gather the data from people who have the adequate knowledge on rail and road transport. The findings of this study have shown that the TFR should not only expand its existing capacity but also improve the services it provides to its customers which will enable a move from freight road back to rail. If the service to customers remains dissatisfactory, road transport will still be used for freight loads and the roads will continue to deteriorate, requiring excessive investment for repairs.

Furthermore, there are several factors that affect the choice transport mode for the companies and it is generally understood that some companies prefer to use road

transport for short distances and JIT commodities, while rail is preferred for long-distance, bulk and containerised commodities. It is therefore imperative that action plans to improve rail operations and infrastructure and which will facilitate an expanded capacity are effectively implemented to provide an opportunity for a modal shift in freight transport from road to rail.

The completion of this research report is an important personal achievement, writing this report has fulfilled the personal objective of gaining insight into the subject of Economic Competitiveness in South Africa with regards to rail transportation. It has been an inspirational journey to overcome the challenges in conducting substantial research and applying the knowledge and techniques obtained from the MBA course. The insights gained into the specific area of study have increased my personal interest in the field and improved my career prospects and potential.

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APPENDIX A:

Introductory Letter to Research Participants

Dear Participant

RESEARCH PROJECT

I am conducting research towards MBA at the North-West University (Vaal Triangle Campus). The purpose of this study is to ***investigate if the improvement of rail transportation can improve the economic competitiveness, if the moving freight loads from road back to rail will reduce the gas pollution and road traffic and accidents and also save costs.***

These results can be used to determine if the rail transport development can improve the economic competitiveness in South Africa.

All information received will be treated with strict **Anonymous**. Participation in the study and the provision of biographical information in the study will remain anonymous. Therefore, no names of participants or institutions will be disclosed in the reporting of the research findings, nor will any personal information be shared. Your contribution to the study will be highly appreciated, as the study's success is dependent on the number of participants who are willing to partake.

It would be greatly appreciated if the questionnaires be returned as swiftly as possible, not exceeding **two weeks** after the distribution date. Feedback to the institution, in the form of a dissertation, will be done as soon as the statistical analyses are finalised and recommendations can be brought to the forefront.

It will take you not more than **20 minutes** to complete the questionnaire.

Thank you for investing your time and effort into my study.

Should you have any queries regarding the study do not hesitate to contact me:

Contact Persons:

Dineo 072 850 9686

Researcher Project Leader

Prof Christoff Botha
(018) 299 1672

APPENDIX B: Survey Questionnaire

SECTION A

BIOGRAPHICAL INFORMATION

Please indicate your biographical information by clicking "X" in the appropriate block.

Gender	Racial Group	Occupational status	Educational Level	Coding
Female	African	Manager	Grade 12	1
Male	Coloured	Supervisor	Diploma	2
	White	Engineer	Degree	3
	Indian	Consultant	Post-graduate degree	4
	Other (please specify):	Technician/Coordinator	Other (please specify):	5
		Analyst		6
		Specialist		7

Age (in years): _____

Current Employer/Company: _____

Time in current position (in years): _____

The next sections contain a range of questions

Listed on the following pages are statements that represent possible opinions that YOU may have related to how you view the freight rail transport.

- Read all statements carefully, note the scales supplied and then decide where on the scale to indicate your response using a clearly marked **X**.
- Mark responses clearly and take note that more than one response to a particular question will be disqualified and therefore disregarded.
- **Please answer ALL the questions. Each page is printed on both sides**
- Be honest.
- Do not spend too much time on any particular question.
- Rather be spontaneous by giving your first response to each question.

- Work as quickly as you can.
- There is no right or wrong answers.

Thank you for your time.

SECTION B

Please indicate your agreement with each of the statements by clicking “X” in the appropriate block, using the 4-point scale below.

1 Strongly Agree	2 Agree	3 Disagree	4 Strongly Disagree
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	STATEMENTS:	1	2	3	4
1	The development of rail transport can improve the economic competitiveness of South Africa.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Rail transport is more carbon efficient than road transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Rail transport is currently the preferable mode of transport for freight goods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	The rail transport is cheaper than road transport.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	If railway network is improved it can reduce the need for road maintenance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	The continuous maintenance of railways is required to improve service delivery of freight.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	The use of rail transport will reduce the need for maintenance of roads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION C

1	The development of rail transport will move freight currently on road back to rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	If I had to choose between rail and road I will choose rail for freight transport.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	The use of rail transport will reduce traffic on the roads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	The use of rail transport will reduce the road accidents caused by trucks on the roads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	The use of rail transport will reduce gas pollutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION D

1	More capital investment into railway infrastructure can add more value to freight rail transport.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Freight rail improvement can also improve Transnet's performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	The improvement can create much needed job opportunities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	The railway infrastructure can add value to the economy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Improved freight rail transport can make South Africa locally competitive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Improved freight rail transport can make South Africa globally competitive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Road to rail migration can save road infrastructure and unlock job opportunities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION E

Please indicate if the statements be with each of the statements by clicking "X" in the appropriate block, using the 4-point scale below.

1 More important	2 Important	3 Unimportant	4 More unimportant		
1	The time period to deliver the goods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Availability of railway wagons.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Service delivery of goods/freight.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Quality of loading and offloading of freight.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	The rail transport should be more reliable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	The development of new railways can shorten the time to deliver the freight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	The development of new access from/to the ports is required to improve quick delivery of freight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think the use of freight rail transport can improve the economic competitiveness of South Africa? Please motivate your answer:

Thank you!!!