

**A COMPARATIVE STUDY OF
ACCESS TO RAILWAYS IN ZAMBIA
RELATIVE TO ROAD TRANSPORT**

By

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**A dissertation submitted to the University of Zambia in
partial fulfilment of the requirements for the degree of
Master of Engineering in Project Management**

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Dedications

This study is dedicated to my son Fred Junior and my wife and soulmate Beatrice Nkondo for their steadfast encouragement, moral support and sacrifices during this work.

Student declaration

I, the undersigned declare that this dissertation entitled ‘A comparative study of access to railways in Zambia relative to road transport’ presents my own work and that it has not previously been submitted for the degree at the University of Zambia or at any other university except as indicated in acknowledgements and references.

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Abstract

Rail transport plays a critical role in the development of any country. With its inherent advantage of being bulk carrier, safer and cheaper, rail transport is an important cog in intermodal transportation. It is also more environmentally friendly, has less congestion and has a better fuel efficiency than other modes of transport. A poorly utilised railway adversely affects transport system and leads to decreased contribution to the country's economy.

The aim of the study was to determine the accessibility of railway transport in Zambia relative to the road and to come up with a framework that would attract heavy and bulk transport to the rail. To attain this objective, the comparative position of the rail relative to the road and the causal factors were analysed.

In order to carry out this research, preliminary interviews, questionnaires and case studies methods were used in addition to detailed literature review. The results revealed that rail transport is poorly used in Zambia. The railways carried a paltry 8.0% of the cargo transported by the road and rail in 2015.

The study also revealed that in all categories of exports, imports, transit and local traffic, the road moved at least 83.0% of the cargo moved by rail and road. The same was the case when cargo was classified by type of traffic with the road moving at least 78.0% of the available traffic. This is despite more than 50.0% of the traffic being made up of heavy and bulk traffic which should traditionally be moved by the rail. Seventy-three percent (73.0%) of respondents think that the road is the best transport in Zambia.

Poor accessibility to the railways caused by inter alia, bad rail infrastructure and equipment, unfavourable government policies, poor management of the railways, very low speeds and limited routes was one of the major reasons for the under performance of the railways in Zambia. A framework aimed at mitigating these causal factors was proposed with a view of improving access to the rail.

Keywords: Accessibility; Rail; Transport; Usage; Zambia

Abbreviations and Acronyms

AAR	Association of American Railroads
AFD	French Development Agency
BTU or Btu	British thermal unit
CEC	Commission of the European Communities
CSO	Central Statistics Office
EJ	Exajoules
EPA	U.S. Environmental protection Agency
EU	European Union
GHG	Greenhouse Gasses
GDP	Gross Domestic Product
IEA	International Energy Agency
K	Zambian Kwacha
NACALA	Chipata, Muchinji, Nacala railway corridor
SADC	Southern Africa Development Community
SRT	State Railways of Thailand
SSA	Sub-Saharan Africa
TAZARA	Zambia Tanzania Railways
U.S.	United States of America
US\$	United States Dollar
ZRA	Zambia Revenue Authority
ZRL	Zambia Railways Limited
RDA	Road Development Agency
SBB	Swiss Federal Railways
WBCSD	World Business Council for Sustainable Development

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Chapter One: Introduction

1.1 Background to the study

Zambia with a population of 13.09 million as at 2010 census is one of Sub-Saharan Africa's most highly urbanized countries (The statistician, 2014). Central Statistics Office (CSO) (2013) indicates that 5.17 million Zambians live in urban areas. Although Gross domestic product has doubled since independence, per capita annual incomes are currently at about two-thirds of their levels at independence (CIA, 2012). Zambia's economy has experienced strong growth in recent years, with real GDP growth in the period 2005-2013 at more than 7.9% in 2013. Zambia's economy is well diversified in terms of GDP sectoral contributions.

The ability to carry goods safely, quickly and cost-efficiently is one of the foundations of globalization and economic growth and it relies on an effective freight transport system. In fact, statistics show that transport demand is closely connected to economic development (Marinov et al., 2013). According to CSO (2014), the construction industry contributes the most to GDP (22.0%) followed by Agriculture, forestry and fishing with 20.1%. Transport, Storage and communication contributes a paltry 3.6%. The CSO (2014) further states that the growth in GDP was as a result of increased output in “Construction and Transport” among other sectors. Transport is therefore a prerequisite to economic growth.

Rail transport is an integral part of intermodal transportation of goods and passengers for countries engaged in intra and international trade and movements. Zambia falls in this category of countries in need of multimodal transportation.

Rail is one of the most important modes of transport due to the advantage it has in terms of facilitating long distance travel and transport of bulk goods which are not easily transported by motor vehicles. The carrying capacity of the railways is extremely large. Moreover, its capacity is elastic which can easily be increased by adding more wagons (Mehta, 2015).

Further rail transport is more advantageous than its major competitor, the road, in the aspects of fuel efficiency, environmental considerations, traffic congestion and safety.

For instance, study sponsored by the United States (U.S.) Federal Railroad Administration in 1991 showed that on average, in ton-miles per gallon of fuel, railways are about 4.5 times

as fuel efficient when compared to trucks. In its white paper, the Commission of the European Communities (CEC), stated that by 2050, 50.0% of road freight transport over 300 km should shift to more energy-efficient transport modes such as rail and waterborne transport (Emerald Insight, 2014).

Environmental considerations also favour rail over road transport. Given the superior fuel efficiency of rail transport, emissions of harmful gases from fuel usage will be less per unit of output for rail compared to road transport. In 1990, the Swedish Commission on Economic Instruments in Environmental Policy proposed pollution charges which concluded that the emission costs for road are more than 270 times that for rail.

In terms of safety, rail transport also has advantages over road transport which has more accidents due to congestions among other causes. For example, the State Railway of Thailand (SRT) in 1990 stated that in Thailand, road accounts for about 94.5%-97.5% of all the country's accidents, deaths and injuries, while rail accounts for about 2.5%-4.8% (Bevis, 1992).

1.2 Statement of the problem

As the Zambian economy continues to grow, there is an increasing demand for transportation of goods and passengers within and outside the country. CSO (2013) stated in its Selected Socio-Economic Indicators that transport contributed to the economic growth of 6.7% in 2012 and 2013. However the performance of railways in Zambia is very poor. Traffic levels have plummeted for the two major railway companies over the years. The tonnage moved by rail between 2009 and 2014 dropped by over 64.0% to 600,000 tonnes on Zambia Railways limited (ZRL) and by over 40.0% to about 220,000 tonnes on Tanzania Zambia Railways (Tazara). Transport users have lost interest in the use of the railways. This has resulted in the railways not earning enough income to sustain and subsequently improve their operations. In order to provide the causes of this scenario, a detailed study was undertaken

The aim of this study was to establish the position of rail transport with respect to the road in the Zambian transport sector and suggest ways of attracting bulk traffic to the rail.

1.3 Rationale

The study derives its motivation from the fact that despite availability of heavy and bulk traffic, rail transport in Zambia is not only a minor player in the transport sector but its performance has also been deteriorating. For example, the following cargo was generated in Zambia:

- Copper: 830,000 tonnes in 2013 (Wall Street Journal, 2015);
- Sugar; 690,000 tonnes in 2014 (Global Cement News, 2014);
- Sugar; 430,000 tonnes in 2010 (Chisanga et al., 2014); and
- Petroleum from Indeni: 621,696 cubic meters (219,550 tonnes) in 2014 (GRZ, 2014).

From the above, it is noted that the available traffic is way beyond the 600,000 tonnes that ZRL carried in 2014. When we consider imports and other traffic generated within Zambia, there is more than enough traffic which the railways can move but is being hauled by road trucks.

The declining contribution of transport services by the rail impacts negatively on national economic growth. It also puts more pressure on the roads which in turn demands for more resources from the national budget to repair roads that are damaged by heavy goods carrying vehicles. Zambia Revenue Authority (ZRA) reported in 2014 that 500 to 600 trucks cross Kasumbalesa border every day, not to mention Nakonde and Chirundu. Furthermore, this means that the advantages that rail has in transportation are not being utilized.

Table1.1 shows tonnages of exports and imports moved by the various modes of transport in Zambia for the period January to November 2014.

Table1.1: Exports and Imports by mode of transport in 2014.

	ROAD	RAIL	AIR	OTHER	TOTAL
EXPORTS	2,724,441	66,242	5,900	1,096,966	3,893,549
IMPORTS	2,511,749	204,321	10,685	1,623,626	4,356,381
TOTAL	5,236,190	270,563	16,585	2,720,592	8,249,930

Source: Central Statistics Office (2014)

Therefore, according to CSO (2014), rail transport carried only 3.3% of the total imports and exports moved in the first eleven months of 2014. On the other hand, the road according to

Table 1.1, moved 63.5% of the total imports and exports moved in the same period. This situation necessitates an in-depth study of the railways to establish the impact this poor performance by the rail transport has in Zambia and find solutions that would help turn around the situation. Thus the study provides the first stage of designing the intermodal transport system critical to national development.

1.4 Research Questions

- (i) What is the economic impact of accessibility of rail transport in Zambia?
- (ii) What factors should be considered to develop an effective railway system that contributes to intermodal transport system in Zambia?

1.5 Research Aim and Objectives

The main aim of the research was to conduct a comparative analysis of access to rail transport in Zambia and develop a framework that improves accessibility. The aim of the research was achieved through objectives indicated in Section 1.5.1.

1.5.1 Specific Objectives

- a) To determine and analyse the comparative position of the railways with respect to road in Zambia.
- b) To analyse the factors affecting accessibility of the railway in the intermodal transport system of Zambia
- c) To develop a framework that would improve accessibility and rail usage.

1.6 Research Methodology

The main aim of the research was to conduct a comparative study of accessibility of rail transport in Zambia and develop a framework that improves accessibility. A brief account of the research methods considered for adoption to meet the research objectives is given. These included literature review, structured interviews, questionnaire survey and case study.

1.6.1 Literature review

In getting a better understanding of the subject, secondary data from what is documented on the subject matter and from what other researchers elsewhere have done was reviewed. Care was taken as to what sources is used due to the disadvantages some have for research purpose. Sources of information included Journal articles, Text books, Conference proceedings, Government and corporate reports especially from major players in the transport like Zambia Railways limited (ZRL) and Road Development Agency (RDA). The internet was used as the main electronic source for secondary data for the enquiry.

1.6.2 Structured interviews

Structured interviews were used as the source of primary data. This involved asking interviewees written down questions. The interviews were preliminary and consultative. Those interviewed were key stakeholders in the railway industry. These were mainly the companies which transport bulk cargo on one hand and the railway companies on the other.

1.6.3 Questionnaire surveys

Self-administered questionnaires using drop-off and e-mail methods were used to collect primary data. Like in the interviews, the targeted respondents were from companies that transport bulk cargo and from the railway industry. The questionnaire was administered to representatives of the companies who are in charge of logistics.

1.6.4 Case study

In order to explore and understand problems, issues and relationships with respect to the objective of the study, ZRL was investigated as a case study. This was aimed at capturing of rich information which could be potentially useful. Case studies can be used as examples to illustrate problems or show benefits of particular practices resulting in making practical improvements to specific situations. Because case studies draw from actual experiences and practices, they are strong on reality.

Further, the case study method was used as it is suitable in achieving the objectives of the study in question as the research is not experimental and cannot be conducted in a laboratory under controlled conditions. Through this case study;

- The prevailing situation in Zambian railway industry was determined;

- Background and key information was gathered; and
- A strong basis for formulating remedial action was established.

1.6.5 Data capture and analysis

The needed data was collected using interviews, questionnaires and case studies. The results from the interviews which were preliminary and consultative were used to come up with appropriate questions for the questionnaire. A total of 15 interviews were conducted, 5 each from the railway industry, transporters and transport users. Responses from questionnaires were analysed using descriptive statistics method. Out of the targeted population of 70 for questionnaires, 51 responses were obtained representing 72.9%. This was considered representative enough as it was above 60.0%. Although the research could not come across published opinion on minimum acceptable response, above 60.0% is considered acceptable (Peninsula RDSU, 2003). The data was analysed using both qualitative and quantitative methods. Qualitatively, data analysis revealed experiences and beliefs of those interviewed and participated in the interviews and questionnaires. On the other hand quantifiable data from questionnaires was used in rating respondents' views using quantitative analysis.

Analysis of the different types of traffic and the actual tonnages moved by various modes of transport was cardinal in understanding the choice of transport. This was especially so for the road and rail modes of transport in Zambia. In order to achieve this, detailed study of the traffic categories and tonnages moved in the year 2015 was carried out on two companies, namely Zambia Railways limited and the Road Development Agency. Zambia Railways was selected because it's the major railway company wholly operated in Zambia. Road development Agency on the other hand has up to date records of the various types of traffic that moves on Zambian roads.

1.7 Limitation and delimitation of the study

The research was aimed at the entire Zambian railway transport sector. This included railway operators of Zambia Railways, TAZARA, Mulobezi and Nacala corridor's Muchinji rail line which is run by ZRL. It also aimed at including major freight transporters and users and the general public in the research. However time, cost and accessibility of respondents' constraints became a limitation to the study. This is especially so that the railway companies involved are in different parts of the country. On the other hand, the

major producers of cargo and passenger traffic are also spread across the country while a further large cargo movers are based outside the country. Therefore only the under listed were included in the investigation:

- a) The major railway system within Zambia, Zambia Railways Limited (ZRL);
- b) Only bulk cargo traffic; and
- c) Major companies along the railway line which require transportation of bulk traffic and road transporters.

To further investigate the methodology used, and the economic comparative study of access to railways in Zambia relative to road transport, the research work could be repeated in Tanzania Zambia Railways (TAZARA) and all other smaller railway companies in Zambia. A separate study could also be made on passenger traffic in Zambia. Furthermore, although most developing countries have commonalities in the way they run affairs of their countries and therefore this Zambian case may be generalized, it is important that more research could be conducted to involve other SADC countries particularly with aims of reducing carbon emission and improving intermodal transport system from cape to Cairo.

1.8 Structure of the dissertation

The report of the research is organized in seven chapters:

Chapter one outlines the background, rationale, main and specific objectives of the enquiry. It also indicates the achievements recorded in the study.

Chapter two discusses literature reviewed relevant to the study conducted.

Chapter three outlines the research methodology and methods used and the justification for adopting such methods.

Chapter four contains the results of the research survey and the analysis.

Chapter five presents discussion of the results.

Chapter six provides a framework of attracting bulk and heavy traffic to the rail.

Chapter seven has summary, conclusions and recommendations of the study.

1.9 Summary

This chapter introduced the study and set out the basis under which the study was undertaken. The main aim and specific objectives, methodology and research achievements have also been presented in this chapter.

The next chapter presents literature review on the comparative study of access to railways in Zambia relative to road transport.

Chapter Two: Literature Review

2.1 Introduction

The previous chapter dealt with the introduction to the study. It outlined the importance of transport to development of economies and how rail transport in general fits in inter modal transportation. It also outlined the rationale, aim and objectives of the study. This chapter presents the information gathered from various literature on the subject of transport (and its position in logistics) in general and railways in particular. The information reviewed is presented under various headings including, an overview, rail-road comparison, logistics and transport in development, advantages and disadvantages of rail transport, usage of railways, challenges, performance of railways and intermodal transportation.

2.2 Brief overview of transport

Mobility is an essential human need. Human survival and societal interaction depend on the ability to move people and goods. Efficient mobility systems are essential facilitators of economic development. Cities could not exist and global trade could not occur without systems to transport people and goods cheaply and efficiently (WBCSD, 2002). Transport or transportation is the movement of passengers and goods from one location to another. Modes of transport include air, rail, road, water, cable, pipeline and space. Transport is important because it enables trade, which is essential for the development of civilizations. Rail transport is an integral part of intermodal transportation of goods and passengers for countries engaged in intra and international trade and movements. Zambia falls in this category of countries in need of multimodal transportation.

2.2.1 Railway transport

Rail transport is a means of conveyance of passengers and goods, by way of wheeled vehicles running on rails. It is also commonly referred to as train transport. Vehicles with steel wheels are guided along steel rails. As the friction coefficient for steel on steel (0.2) is lower than the friction coefficient for rubber (tyres) on paved or unpaved roads (friction coefficient of 0.8 for a tyre on a dry paved road), all things being equal energy needed for rail traction is lower than for road transport. According to Dr Michael J T Lewis, the eminent scholar of early railways, Railway is 'a prepared track which so guides the wheels of the vehicles running on it that they cannot leave the track' (Lewis, 1974). Rail transport consists of all land passenger and freight transport which runs on both dual and single fixed

rails. This principally involves heavy rail, light rail and tram but might also include funicular and monorail rail modes (Whiteing and Menaz, 2009).

2.2.2 History of rail transport

Mechanized rail transport systems first appeared in England in the 1820s. Most historians agree that with the opening in 1830 of the Liverpool & Manchester Railway in the north-west of England, the prototype of the 'modern railway' had arrived: a combination of specialized track, the accommodation of public traffic, the conveyance of passengers as well as freight, mechanical traction, and some measure of public control (Robbins, 1998). These systems, which made use of the steam locomotive, were critical to the industrial revolution and to the development of export economies across the world. Even where railways were not critical for the movement of people and goods inside the town or city, the siting of passenger and goods terminals usually had significant and long term consequences for the urban morphology (Bond & Divall, 1999). They have remained the primary form of land transport ever since for most of the world. Reduction in friction was one of the major reasons for the success of railroads. Since a stiff wheel rolling on a rigid rail requires less energy per ton-mile moved than road transport (with a highly compliant wheel on an uneven surface), railroads are highly suitable for the movement of dense, bulk goods such as coal and other minerals. This was an incentive to experiment with many configurations and shapes of wheels and rails.

The introduction of the Bessemer process, enabling steel to be made inexpensively, led to the era of great expansion of railways that began in the late 1860s (Marshall, 1979). Steel rails lasted several times longer than iron (Coulls, 1999). Steel rails made heavier locomotives possible, allowing for longer trains and improving the productivity of railroads. The Bessemer process introduced nitrogen into the steel, which caused the steel to become brittle with age. The open hearth furnace began to replace the Bessemer process near the end of 19th century, improving the quality of steel and further reducing costs. (Rosenberg and Nathan, 1982) as cited by Wikipedia (2015).

James Watt, a Scottish inventor and mechanical engineer, was responsible for improvements to the steam engine of Thomas Newcomen, hitherto used to pump water out of mines. Watt developed a reciprocating engine, capable of powering a wheel. Watt's

modifications increased the efficiency of the existing steam engines but he needed funds to patent his innovations (MacFadyen, 2013).

The first full-scale working railway steam locomotive was built in the United Kingdom in 1804 by Richard Trevithick, an English engineer born in Cornwall. His second locomotive, called 'New Castle', was the first to be put to practical use when it began hauling iron a year later at the Peny-darren Iron Works in South Wales (MacFadyen, 2013).

In 1814 George Stephenson, the “Father of Railways” (MacFadyen, 2013), inspired by the early locomotives of Trevithick, Murray and Hedley, persuaded the manager of the Killingworth colliery where he worked to allow him to build a steam-powered machine. He built the Blücher, one of the first successful flanged-wheel adhesion locomotives. Stephenson played a pivotal role in the development and widespread adoption of the steam locomotive, Ellis Hamilton (1968) as cited by Wikipedia (2015).

The world's first electric tram line opened in Lichterfelde near Berlin, Germany, in 1881. It was built by Werner von Siemens (Oura et al., 1998). By the 1890s, electric power became practical and more widespread, allowing extensive underground railways.

Diesel-electric locomotives could be described as electric locomotives with an on-board generator powered by a diesel engine. The first diesel locomotives were low-powered machines, diesel-mechanical types used in switching yards. Diesel and electric locomotives are cleaner, more efficient, and require less maintenance than steam locomotives (King, 2011) and (Jern, 1990). After working through technical difficulties in the early 1900s, diesel locomotives became mainstream after World War II. By the 1970s, diesel and electric power had replaced steam power on most of the world's railroads (Wendel, 1987).

In the 20th century, road transport and air travel replaced railroads for most long-distance passenger travel in the United States, but railroads remain important for hauling freight in the United States, and for passenger transport in many other countries. The rail is also important today as can be seen in countries where development has taken place. It is usually used as part of the intermodal transportation of goods, services and people.

2.2.3 Road transport

Road Transport is one of the most important modes of transport. The history of Road Transport started from ancient civilizations. Gradually it becomes more and more popular means of transport. Road Transport can be subdivided into Vehicular Transport (Cars, Trucks, Buses, Lorries, Bullock Carts, and Hand Carts etc.) and Non-vehicular Transport (Animals like Camel, Dogs, Elephant, Horse, Mules etc.). The first methods of road transport were horses, oxen or even humans carrying goods over dirt tracks (Lay, 1992). As states developed and became richer, new roads and bridges began to be built, often based on Roman designs. However, there was little useful innovation in road building before the 18th century. The rail mode was the only practical transport system to reach into the African interior at the time as roads were either non-existent or primitive, while animal-drawn transport or human portage were the norm (Jorgensen, 2012).

2.3 Historical Rail and Road Comparison.

During the mid-20th century roads were being rapidly extended and improved while motor vehicles had become robust, reliable and cost effective. Most rail operations were state owned and protected and many of the newly independent governments looked to rail as employment generators and not as reliable service providers for business and growth. By the 1970s rail infrastructure in some countries had become seriously under maintained (Jorgensen, 2012). This resulted in reduced service levels by the 1980s arising from poor track condition, a lack available rolling stock and increased bureaucratic inefficiency.

Jorgensen (2012) states that road infrastructure improvements, largely made with international donor funding, reached the most isolated areas while there was little rail development which was generally limited to improvements to the 19th century arterial network and the construction of specialised mining railways. At the same time, many important long-distance arterial rail routes, for example Benguela Railway in Angola and the Sena line between Beira in Mozambique and Malawi, were closed due to civil wars in various countries. One important positive and strategic rail development was the construction of the TAZARA railway between Zambia and Tanzania. The impact of increased road haulage was decline in rail traffic (Jorgensen, 2012).

The second half of the 20th century encountered transformations in the modal split of inland freight transport. The need for mass production led to the spread of new logistic philosophies, e.g. just-in-time and lean production, increasing the importance of time, reliability and speed. Figure 2.1 suggests that the road sector was able to capitalize the growing need for the movement of goods, rather than directly taking away market share from the rail freight industry (Marinov et al., 2013).

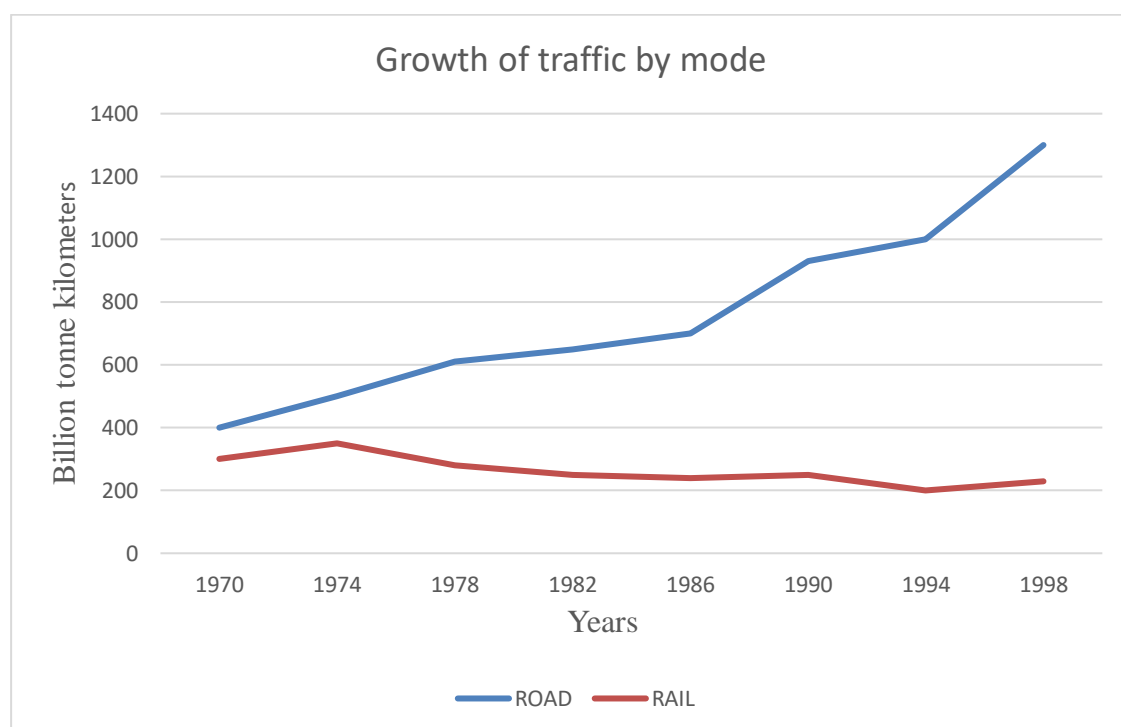


Figure 2.1 Goods transport – Growth of traffic by mode of transport, EU-15: 1970-1991
Source: Adapted from EC, 2001.

This trend in freight transport is a source of concern regarding sustainability, as road freight brings some negative impacts on the planet (environmental sustainability), on people (social sustainability) and on profit (economic sustainability) compared to rail as discussed later in section 2.4.

2.3.1 Rail and Road Competition.

In general, rail traffic in Zambia comprises mainly export of copper mining products and some agricultural products. Domestic and imported goods include fertilizer, chemicals, liquid fuel and grain traffic. Road traffic largely consists of high value consumer goods,

refrigerated and perishable products, mine machinery, and minerals. Jorgensen (2012) states that road transport has become so much the norm for international and local traffic that many companies are convinced that this is the transport mode of the future, while rail has become outdated due to the following:

- With road, communications between customer and transporter are usually carried out on a more personal basis, whereas with rail a high turnover of marketing staff makes it difficult to build relationships;
- Road transport is highly visible while most rail operations take place out of the public view. This creates the impression that rail is of little consequence. The high number of road accidents and health considerations regarding AIDs is, however, casting a negative perception on road transport;
- Road degradation and highway congestion – particularly at border crossing points is prompting governments to upgrade these facilities but at public expense;
- “One stop shops” border crossings facilities speed road transport operations; and
- Smaller truck loads (averaging 32 tons) can be conveniently redirected when required, and on short notice, compared to individual rail consignments such as containers riding on block trains

There are many more international crossing points on road than with rail. This provides road transport operators opportunities to use short-cuts, greatly reducing the overall distance between some points when compared to rail. For traffic between Lusaka and Beira, the road route via Chirundu is only 1 054 km, compared to 2 027 km for rail via Bulawayo. With the opening of the Beitbridge Bulawayo Railway (BBR) rail route from Beit Bridge to Bulawayo, the rail distance from Durban to Lusaka has been reduced to 2,684 km, compared to 2,394 km for road through Harare and Chirundu. Such reductions in theory should make rail more competitive but in practice, road operators are in a better position to obtain return loads and this reduces rail competitiveness (Jorgensen, 2012). Table 2.1 indicates details of selected routes that affect Zambia.

Table 2.1: Comparative Road and Rail Distances

Route	Details	Rail Distance (Km)	Road Distance (Km)
Cape town-Lusaka	Via Gaborone, Bulawayo Road via Chirundu	3,122	3,000
Cape town- Lubumbashi	Via Gaborone, Bulawayo Road via Chirundu	3,714	3,539
Maputo-Lusaka	Rail via Rutenga Road via Inchope	1,996	1,989
Maputo-Lubumbashi	Rail via Rutenga Road via Inchope	2,588	2,528
Beira-Lusaka	Rail via Harare Road via Chirundu	2,027	1,054
Beira-Lubumbashi	Rail via Harare Road via Chirundu	2,652	1,593
Dar-Lusaka	Via Tunduma and Kapiri	2,028	2,021
Dar-Lubumbashi	Via Tunduma, Kapiri and Moshe	2,268	2,148
Walvis Bay-Lusaka		4,153	3,619

Adapted from: Jorgensen (2012)

2.4 The role of logistics and transport in development.

Logistics can be defined as an extended time and space utility of intermediate and finished goods (Havenga, 2007) and services. The Council of Logistics Management (1991) defined that logistics is ‘part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements’. Johnson and Wood’s definition as summarised by Tilanus (1997) uses ‘five important key terms’, which are logistics, inbound logistics, materials management, physical distribution, and supply-chain management, to interpret this. The commonality of these and other recent definitions is that logistics is a process of moving and handling goods and materials, from the beginning to the end of the production, sale process and waste disposal, to satisfy customers and add business competitiveness. What is critical in both definitions however is that intermediate and final production of goods and services does not occur at the time and place of consumption, therefore there is need for storage and transportation of these goods and services to the point of consumption. Logistics is therefore concerned with the efficient flow of raw materials, of work in process inventory, and of finished goods from supplier to customer. In addition to transportation,

logistics entails inventory control, warehousing, materials handling, order processing, and related information activities involved in the flow of products. How these activities are managed and organized determines the quantity and quality of transportation demanded and the nature of the commercial relationships between shippers and transportation service providers.

Logistics, assisting flow of goods, services, and values within the chain from the production spot to the consumption spot and oppositely, from the consumption spot to the production spot; signifies an important point in terms of development of economies. Share of logistics within GDP in most developing countries cannot be denied (Karayun et al., 2012). Therefore transportation in general and rail transport in particular is part of logistics management which can reduce the cost of storage and transportation. This is more striking where logistics is measured on national basis.

2.4.1 Interrelationships between logistics and transportation

Without well-developed transportation systems, logistics could not bring its advantages into full play. Besides, a good transport system in logistics activities could provide better logistics, efficiency, reduce operation cost, and promote service quality. The improvement of transportation systems needs the effort from both public and private sectors (Tseng et al., 2005). A well-operated logistics system could increase both the competitiveness of the government and enterprises. In more highly developed countries like Japan, Canada, the United States of America (US) and most countries in Western Europe, transportation systems are highly sophisticated. This is contrary to most developing countries like Zambia whose transportation systems are still lagging behind.

2.4.2 Transportation and the economy

Transport system is the most important economic activity among the components of business logistics systems. The principal role of transport is to provide access between spatially separated locations for the business and household sectors, for both commodity (freight) and person movements. For the business sector, this involves connections between businesses and their input sources, between businesses and other businesses, and between businesses and their markets. For the household sector, it provides people with access to workplaces and education facilities, shops, and social, recreational, community

and medical facilities (New Zealand Ministry of Transport, 2014). Economics involves production, distribution and consumption of goods and services. People depend upon the natural resources to satisfy the needs of life but due to non-uniform surface of earth and due to difference in local resources, there is a lot of difference in standard of living in different societies. So there is an immense requirement of transport of resources from one particular society to other. These resources can range from material things to knowledge and skills like movement of doctors and technicians to the places where there is need of them (Mathew and Krishna Rao, 2007).

Transport may be regarded as an important sector of the economy in its own right: transport infrastructure provision and transport operations together account for about 5.0% of New Zealand GDP. Given the significance of the sector in economic terms, both the level of transport investment together with the amount of expenditure on transport operations can have wider effects on the economy (as is seen when transport fuel prices increase substantially, resulting in reduced household expenditure on other goods and services), (New Zealand Ministry of Transport, 2014).

Around one third to two thirds of the expenses of enterprises' logistics costs are spent on transportation. According to the investigation of National Council of Physical Distribution Management (NCPDM) in 1982, the cost of transportation, on average, accounted for 6.5% of market revenue and 44.0% of logistics costs (Chang, 1988).

BTRE (2001) indicated that Australian gross value added of the transport and storage sector was \$34,496 million in 1999-2000, or 5.6% of GDP. Figure 2.2 shows the components of logistics costs based on the estimation from Air Transportation Association (Chang, 1988). This analysis shows that transportation is the highest cost, which occupies 29.4% of logistics costs, and then followed by inventory, warehousing cost, packing cost, management cost, movement cost and ordering cost. The ratio is almost one-third of the total logistics costs. The transportation cost here includes the means of transportation, corridors, containers, pallets, terminals, labours, and time. This figure signifies not only the cost structure of logistics systems but also the importance order in improvement processing. It occupies an important ratio in logistics activities. The improvement of the item of higher

operation costs can get better effects. Hence, logistics managers must comprehend transport system operation thoroughly.

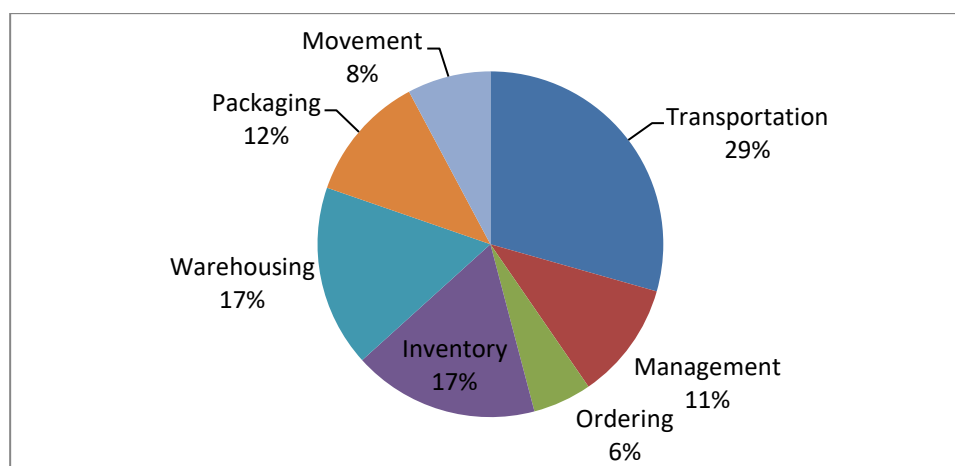


Figure 2.2 Cost ratio of logistics items (modified: Chang, 1998).

One of the best known macro-measurement of logistics costs globally is the annual “State of Logistics Report” for the US economy, initiated by the late Robert Delaney. The report according to Cooke (2004), calculates the total value of logistics as the sum of three components: inventory costs, transportation costs and administrative costs. The performance of logistics as a cost to the economy is calculated for a number of countries as depicted in table 2.2.

From table 2.2, it is noted that the European total logistics cost is 12.2% of GDP. In North America, the other region with most industrialisation is 11.7%. Maspero (2007) reports: “That the best economies in the world have achieved logistics costs of lower than 10.0% of GDP, while the worst could pay as much as 30.0% with an average of between 11.0% and 16.0%.” Further, the best in Sub-Saharan Africa is South Africa with 15.2% of GDP. Developing countries, of which Zambia is a part, on the other hand produce 37.0% of global GDP but carry 48.0% of the logistics bill. It therefore can be seen that a well-managed logistics systems has a bearing on the performance of economies.

Table 2.2: Logistics cost comparisons for various economies

Region	Country	Logistics as % of GDP
Asian region	Australia	11.2
	China	14.5
	Hong Kong	15.9
	Indonesia	12.8
	Japan	10.1
	Korea	12.4
	Philippines	13.3
	Singapore	20.0
	Taiwan	13.5
	Asian total	11.0
European region	Austria	12.2
	Belgium	13.0
	Denmark	12.8
	Finland	11.5
	France	11.7
	Germany	11.8
	Greece	14.0
	Iceland	16.7
	Ireland	14.3
	Italy	12.6
	Netherlands	12.2
	Norway	13.2
	Portugal	13.6
European region	Spain	12.1
	Sweden	12.7
	Switzerland	13.2
	United Kingdom	12.2
	European total	12.2
North American region	Canada	11.8
	Mexico	14.4
	United States	11.6
	North American total	11.7
Industrial total	11.7	

Source: Bowersox and Closs (1996)

2.4.3 The railways and economic development

The availability of efficient railway system is crucial as transport services are essential for economic development. In many countries of the world, rail transport has continued to play

catalytic role in bringing socio-economic development. It contributes substantially to the movement of goods and passengers. Empirical works have shown that rail transport provide the most cost-effective, affordable, energy saving and environmentally friendly form of transportation especially in areas where traffic densities are high (World Bank, 1994). According to Agbaeze and Onwuka (2014), when railway systems are properly integrated with other modes of transportation, economic levels of traffic can be consolidated to enable the railway to provide efficient services for high density flows of homogenous traffic carried over relatively long distances, including high volumes of containerized cargo or bulk freight such as oil, coal, steel or agricultural produce. An efficient and effective rail system will benefit the country in so many ways. These include, in addition to those mentioned in section 2.4, opening up rural areas; attracting development along it lines; relieves pressure on the roads; enhances communication infrastructure; and creates employment (Agbaeze and Onwuka, 2014).

2.4.4 Costs and Benefits of Transportation

The largest volumes of inland freight are carried by road and by rail. Most of commodities can be transported by road even by rail and these transport systems may compete with each other. The decisive factor for choice of carrier is usually the shipping costs or the transport time (Bina et al., 2014).

Kockelma et al.(2013) states that transportation constitutes nearly 20.0% of household expenditures, 30.0% of U.S. greenhouse gas (GHG) emissions, and 70.0% of domestic petroleum consumption. In a world of limited resources, volatile materials prices, energy security issues, and multiple environmental concerns, it is imperative to understand how transportation investments and policies impact stakeholders' and society's bottom lines. Economic practice and theory require familiarity with a variety of costs and benefits. These costs ,and benefits, have direct effect on the accessibility of the transport mode either in the pricing of the service or the quality of the service if all costs are not taken into account. There is also an impact on the national economies due operating costs like provision maintenance of vehicles and infrastructure. An example of this is the cost of road maintenance which is part of the concerns of this study.

2.4.5 Freight Transport Costs

Fixed, independent of the type and size of the cargo, costs of road transport include vehicle depreciation, vehicle maintenance, road tax and mandatory insurance, driver's salary, handling fees for loading and unloading, and overhead costs of the carrier which management, central services, dispatching, etc. (Bina et al., 2014). But this is just among other costs which include road maintenance due to damage caused by excessive usage. The cost structure of rail transport is significantly more complex in comparison to road transport. Fixed, independent, costs of rail transport include vehicle depreciation, vehicle maintenance, salaries of a train's crew, handling fees (loading and unloading), and overhead costs of the carrier. Overhead costs for rail include management, other rail employees' salaries, forming of trains, central services, etc. (Bina et al., 2014). Maintenance of rail infrastructure also fall in this category. Variable, dependent on the type and size of the cargo and on transport distance, costs of road transport include fuel, consumption of tyres, fees for the use of road (toll), and driver's mandatory safety breaks. On the other hand, variable, costs of rail transport include traction energy which could be diesel or electricity, and fees for the use of rail transport route in access fees, fees for train's mileage, etc.

2.4.6 Road damages

When a vehicle travel on a road it causes some damage to the surface and advances the date at which the road needs to be repaired. The most important type of damage done to the road is best measured by the increased roughness of the surface. For a well-designed road, its initial roughness will be low, and will steadily increase with the passage of traffic until, after a typically period of 10 – 20 years, it reaches a level at which major maintenance, such as an asphalt overlay, is required to restore the surface (Newbery, 2008). The damage vehicles cause to roads depends on the characteristics of the vehicle and the type of road (paved or unpaved). The axles load of the vehicles and the frequency of usage also has a big bearing on the rate of damage to the road.

CSO (2014) reports in its Statistician, vol. 4 that Zambia being a landlocked country relies heavily on roads, rail and air to expedite trade flows to and from its trading partners. Roads are the most used mode of transport for bulk export and import products as opposed to other transport types. From 2010 to 2013, the road was the most used mode of transport for

exports compared to other modes of transport. The highest tonnage exported via road was registered in 2012, accounting for 79.2%. In terms of revenue, roads accounted for 92.8%. The rail mode of transport recorded its lowest tonnage and revenue in 2013 with 2.0 % and 2.4%, respectively.

Therefore with most of the bulk traffic moving on road in Zambia, it is expected that the damage to the road will be much more accelerated and hence calling for repairs and thereby adversely affecting the economics of the country.

2.5 Advantages and disadvantages of rail transport

2.5.1 Advantages

Mehta (2015) states the following as the major advantages of rail transport:

- It facilitates long distance travel and transport of bulky goods which are not easily transported by motor vehicles;
- It is a quick and more regular form of transport because it helps in the transportation of goods with speed and certainty;
- It helps in the industrialization process of a country by easy transportation of raw-materials at a cheaper rate;
- It helps in the quick movement of goods from one place to another at the time of emergencies like famines and scarcity;
- It encourages mobility of labour and thereby provides a great scope for employment;
- Railway is the safest form of transport. The chances of accidents and breakdown of railways are minimal as compared to other modes of transport; and
- The carrying capacity of the railways is extremely large. Moreover, its capacity is elastic which can easily be increased by adding more wagons.

In addition, French Development Agency (AFD) in 2014 reported that trains, with their guidance along rails, despite the risk of derailling, are intrinsically safer than road traffic. Another factor which explains the unmatched safety of rail transport is compliance with rigorous procedures which:

- Limit access to companies holding all the necessary qualifications, with requirements that are stricter and better enforced than in road transport which is a fragmented sector;
- Ensure wide separation between running trains using “block sections” to prevent the risk of collisions between trains in both directions, head-on or rear-end.

Further, a block section is a stretch of track, usually between a few hundred meters and some tens of kilometers in length, where a train is only authorized to enter provided there is no other train in it; the outer limits of the block section are marked by signals and possibly by crossing or passing loops.

Rail transport is more advantageous than its major competitor, the road, in the aspects of fuel efficiency, environmental considerations, traffic congestion and safety. A study sponsored by the United States (U.S.) Federal Railroad Administration in 1991 showed that on average, in ton-miles per gallon of fuel, railways are about 4.5 times as fuel efficient when compared to trucks. In its last white paper, the Commission of the European Communities (CEC), stated that by 2050, 50.0% of road freight transport over 300 km should shift to more energy-efficient transport modes such as rail and waterborne transport (Emerald Insight, 2014). This is supported by Ford et al. (1995), who indicated that rail can achieve a 50.0 % reduction in energy usage for each tonne-km compared to road-based freight systems. Furthermore, rail also allows higher axle weights and larger cargo volume capacity for lighter weight products.

2.5.2 Disadvantages

Rail transport has its own disadvantages. The main weaknesses for this were identified by Robinson & Mortimer (2004): poor door-to-door capability; lack of flexibility; competition with passenger services for line capacity; perception of rail infrastructure and related system’s high costs. Mehta (2015) mentions the following disadvantages:

- The railway requires a large investment of capital. The cost of construction, maintenance and overhead expenses are very high as compared to other modes of transport. Moreover, the investments are specific and immobile. In case the traffic is not sufficient, the investments may mean wastage of huge resources;

- Another disadvantage of railway transport is its inflexibility. It's routes and timings cannot be adjusted to individual requirements;
- Rail transport cannot provide door to door service as it is tied to a particular track. Intermediate loading or unloading involves greater cost, more wear and tear and wastage of time. The time cost of terminal operations are a great disadvantage of rail transport;
- As railways require huge capital outlay, they may give rise to monopolies and work against public interest at large. Even if controlled and managed by the government, lack of competition may breed in inefficiency and high costs;
- Railway transport is unsuitable and uneconomical for short distances and small traffic of goods;
- It involves much time and labour in booking and taking delivery of goods through railways as compared to motor transport; and
- Because of huge capital requirements and traffic, railways cannot be operated economically in rural areas. Thus, large rural areas have no railway even today. This causes much inconvenience to the people living in rural areas.

2.5.3 Environmental considerations

Environmental considerations favour rail over road transport in that it produces less greenhouse gases (GHG) than the road. Greenhouse gases trap heat in the atmosphere, which makes the earth warmer. People are adding several types of greenhouse gases to the atmosphere, and each gas's effect on climate change depends on three main factors: How much; How long; and How powerful.

People produce larger amounts of some greenhouse gases than others. Carbon dioxide is the greenhouse gas you hear people talk about the most. That is because we produce more carbon dioxide than any other greenhouse gas, and it is responsible for most of the warming.

Although carbon dioxide is the most important greenhouse gas emitted by humans, but several other gases contribute to climate change, too. This can be seen in figure 2.3 which shows the major types of greenhouse gases produced by human beings' activities. The transport sector plays a crucial and growing role in world energy use and emissions of

Greenhouse gasses (GHGs). This is evident from figure 2.4 and is in agreement with Davis (1998).

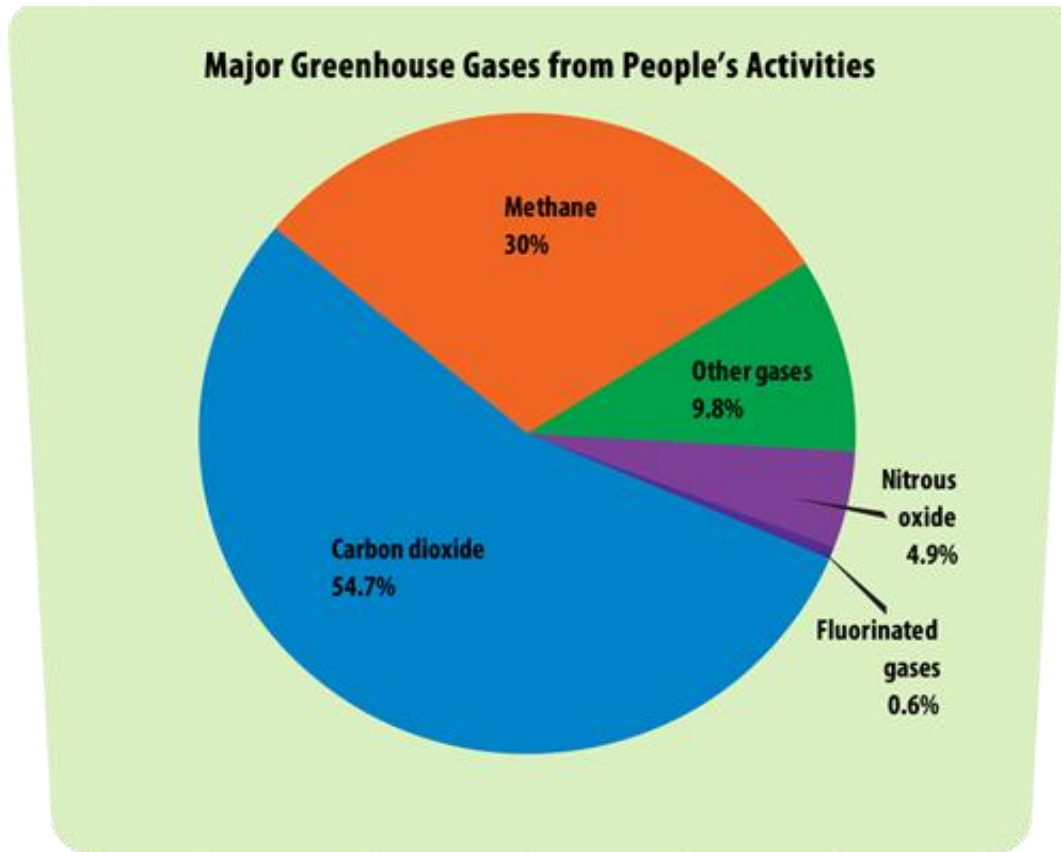


Figure 2.3: Major GHG from people's activities (Cost ratio of logistics items. The size of each piece of the pie represents the amount of warming that each gas is currently causing in the atmosphere as a result of emissions from people's activities.) Source: Intergovernmental Panel on Climate Change, Fourth Assessment Report (2007).

The transportation sector accounts for 27.0% of the 90 quadrillion Btu of energy consumed in the United States each year (Davis, 1998). Petroleum-based fuels account for 97.0% of the transportation energy consumed. In recent years, concern for potential global warming of anthropogenic greenhouse gas (GHG) emissions has rekindled a renewed interest in reducing GHG emissions. The U.S. transportation sector contributes about 26.0% of the U.S. total GHG emissions, U.S. Environmental protection Agency [EPA] as cited by Wang (1999). If the United States is to reduce its overall GHG emissions, it must reduce its transportation GHG emissions. The transportation sector is also a major contributor to urban air pollution problems. Nationwide, this sector accounts for 40.0% of volatile organic compounds, 77.0% of carbon monoxide, and 49.0% of nitrogen oxide emissions,

EPA as cited by Wang (1999). The transportation shares of these emissions in urban areas are even higher.

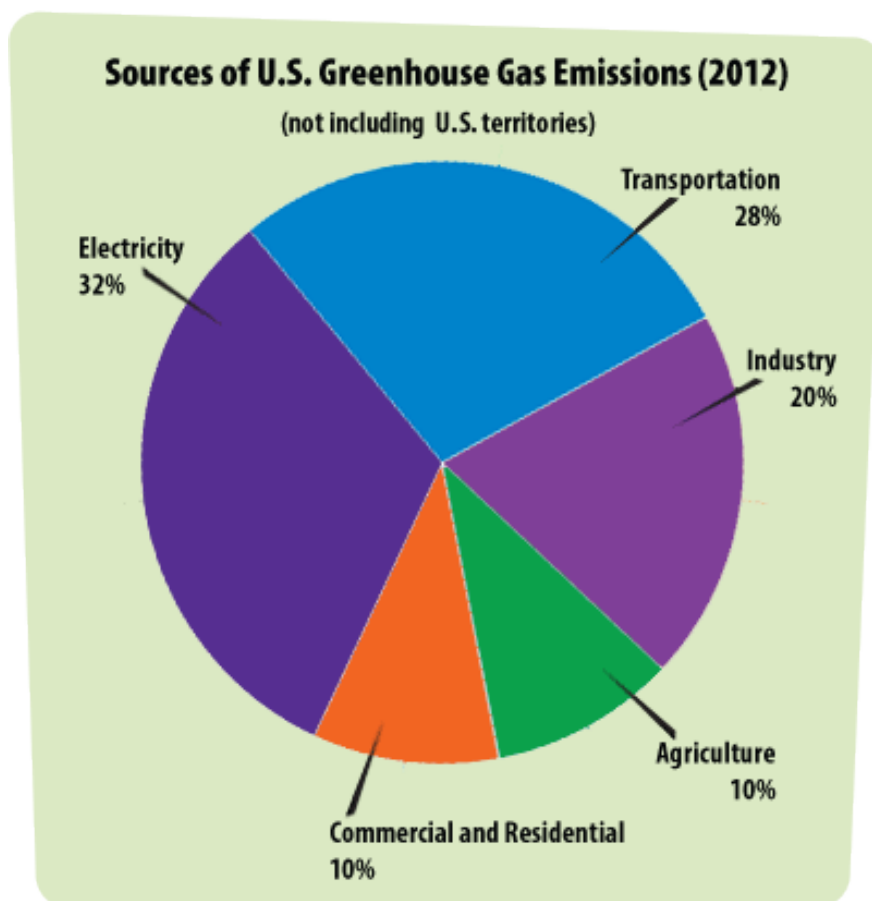


Figure 2.4: Sources of US GHG emissions in 2012
Source: EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks (2014).

In 2004, transport energy use amounted to 26.0% of total world energy use and the transport sector was responsible for about 23.0% of world energy-related GHG emissions (IEA, 2006). The 1990–2002 growth rate of energy consumption in the transport sector was highest among all the end-use sectors. Of a total of 77 exajoules (EJ) of total transport energy use, road vehicles account for more than three-quarters, with light-duty vehicles and freight trucks having the lion's share. Virtually all (95.0%) of transport energy comes from oil-based fuels, largely diesel (23.6 EJ, or about 31.0% of total energy) and gasoline (36.4 EJ, 47.0%). One consequence of this dependence, coupled with the only moderate differences in carbon content of the various oil-based fuels, is that the CO₂ emissions from the different transport sub-sectors are approximately proportional to their energy use.

Given the superior fuel efficiency of rail transport, emissions of harmful gases from fuel usage will be less per unit of output for rail compared to road transport.

In 1990, the Swedish Commission on Economic Instruments in Environmental Policy proposed pollution charges which translated into the following cost responsibilities for the Swedish transport sector's various subsectors:

1. Road US\$ 16,300 million
2. Maritime US\$ 2,600 million
3. Aviation US\$ 900 million
4. Rail US\$ 60 million

Thus the emission costs for road are more than 270 times that for rail.

In terms of safety, rail transport also has advantages over road transport which has more accidents due to congestions among other causes. For example, the State Railway of Thailand (SRT) in 1990 stated that in Thailand, road accounts for about 94.5%-97.5%% of all the country's accidents, deaths and injuries, while rail accounts for about 2.5%-4.8 % (Bevis, 1992).

French Development Agency (AFD) in 2014, concluded in their report that there was excellent energy performance in terms of global environmental for rail freight transport even using diesel traction, and followed by river transport. Heavy road transport which usually use articulated trucks, is around two times less “efficient” than fully-loaded diesel traction trains; this result does not take into account any pre- or post-carriage road connections that may be necessary. Air freight transport has a very low score: around ten times worse than road transport. David L. Greene (2006) reported that in 2003, U. S. Transportation Carbon Emissions by Mode, Highway vehicles, especially passenger cars and light trucks, account for most transportation greenhouse gasses (GHG) emissions as indicated in Figure 2.5.

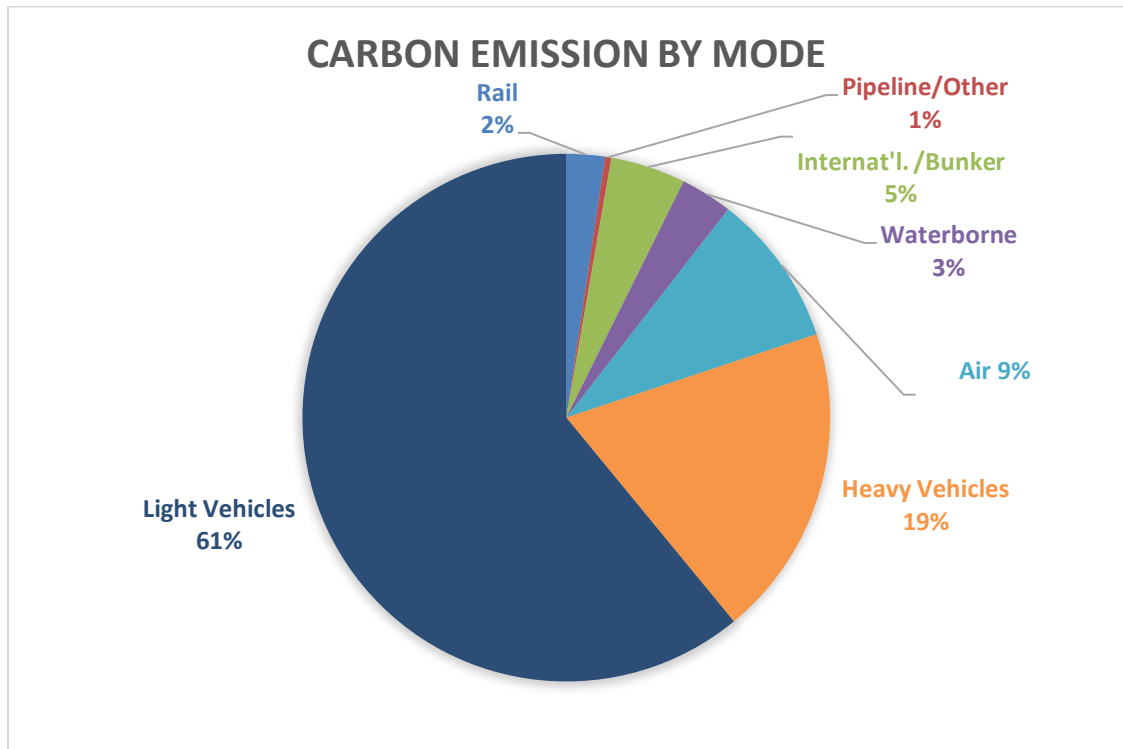


Figure 2.5: Carbon emissions by mode in metric tons of CO₂
Source: Greene (2006)

These figures give a rough guide to the advantage of rail service in fuel efficiency, containing environmental pollution, traffic congestion and safety. The actual would of course differ from country to country.

2.6 Usage of rail transport

Due to the benefits arising from the advantages mentioned in 2.4.1, rail transport is a major form of passenger and freight transport in many countries. It is ubiquitous in Europe, with an integrated network covering virtually the whole continent. In India, China, South Korea and Japan, many millions use trains as regular transport. In North America, freight rail transport is widespread and heavily used, but intercity passenger rail transport is relatively scarce outside the Northeast Corridor, due to increased preference of other modes, particularly automobiles and airplanes (EuDaly et al., 2009). South Africa, northern Africa and Argentina have extensive rail networks, but some railways elsewhere in Africa, including Zambia are isolated lines.

Railways deliver economic, social and environmental benefits. The last of these is particularly relevant with the current policy emphasis on sustainable transport. Rail travel has pronounced environmental benefits over road and air transport. It helps to relieve road traffic congestion and reduce the number of road accidents. With continuing growth in air transport, it also provides congestion-free surface access to airports (Whiteing and Menaz, 2009).

2.7 Challenges associated with railway transport

Many railways in the world have been facing keen competition from highway carriers over past decades. Some railways have even suffered from a major decline in the market share and failed to adopt effective strategies to correct the situation (Lan and Lin, 2006). Taking freight transport as an example, the market share, ton-km, for European Union (EU) rails had declined from 32 per cent in 1970 to 12 per cent by 1999 as reported by Lewis et al., as cited in Lan and Lin (2006).

2.8 Performance of rail transport

2.8.1 Performance in Europe

Rail freight transport in Europe suffered a major decline in the period from the 1970s to the early 1990s. Since then there has been a recovery in the European Union's (EU) 15 countries, with a 15.0 % increase in rail freight tonne-kilometres over the period 1990-2007. In the wider EU28, however, decline had continued with a 14.0% decrease between 1990 and 2007 (Menaz and Whiteing, 2010). Marinov et. al, (2013) reports that between 1995 and 2008, freight transport inside the European-Union (EU-28) increased as fast as the economy, with an average annual growth of 2.0%. Moreover, during the economic downturn (2008-2009), the decrease of 4.2% in the EU-28 gross domestic product (GDP) was accompanied by a drop of 11.2% in the freight transport.

Passenger traffic by rail (passenger-kilometres) had increased by 28.0% in the EU15 countries over the period 1990-2007, against the backdrop of a 32.0% increase in car travel. The Commission of European Communities (CEC) as indicated by Menaz and Whiteing (2010) reports that rail passenger growth in the EU15 countries has not been matched in the wide EU28, where a 6.0% fall had been recorded over the same time period.

Switzerland has the highest train density in Europe, a higher proportion of the population uses public transport and they travel longer distances than in any other country except Japan. In total, about 353 million people travel with Swiss Federal Railways (SBB) every year. Every Swiss resident uses rail 50 times a year (EU 27: 15 times). Rail travel in 2010 totaled 17.5 billion passenger km a rise of about 50.0% since 2000 (EU 27: +10.0% since 2000). On average, 149.7 trains per line travel on the Swiss rail network each day (EU 27: 45 trains). In other words, 8,000 trains run on the network each day. SBB transports 480,000 items of baggage every year; (Bosch, 2014).

2.8.2 Performance in Sub-Sahara Africa and SADC

Olievschi (2013) states that in most of the Sub-Saharan African (SSA) countries, railways have played a key part in the economic development through transporting freight and passengers. During the last 50 years, the road transport in the region, as throughout the world, has expanded rapidly due to the aggressive development of the automobile industry. African governments have invested mainly in road infrastructure improvement, neglecting railways. The liberalization in road transport and the slow response of railways to adapt to the new market conditions resulted in dramatic traffic decline in rail transport. By 1990 most of the Sub-Saharan African railways were in virtual bankruptcy, requiring permanent cash injection and large investments in infrastructure and rolling stock (Olievschi, 2013). This is still the case for Zambia Railways Limited (ZRL) and Tanzania Zambia Railways (TAZARA).

Apart from South Africa which has shown consistent growth in rail freight and passenger volumes, most countries in the Southern African Development Community (SADC) have recorded declines. For example whereas South Africa recorded a steady increase of 4.0% in freight between 2010 and 2014 (Transnet, 2014), Zambia, on ZRL and TAZARA recorded a decline of 3.0% and over 60.0% respectively.

2.8.3 Challenges facing railways in Sub Saharan Africa (SSA)

The weak financial performance of railways in SSA is the major threat to the future development of the railway sector. The railway sector in SSA cannot achieve the development goals expected by governments as long as the railway companies are financially non-viable. Olievschi (2013), reports that various analyses developed by the

World Bank during the last years lead to the following major challenges that have generated the current unsustainable financial status of railway companies:

- 1) Overoptimistic expectations on the potential of growth of freight volumes. In most cases, traffic gains have been much lower than the estimated figures used in the business plans.
- 2) Underestimated investment needs. The investment needs proved much larger than anticipated, the traffic evolution did not generate the necessary resources for investments, and the governments were, in many cases not ready to be involved in the financial support of railway infrastructure.
- 3) Operation of passenger transport services. In spite of the steady economic growth of most of the sub-Saharan countries during the last decade, the increase in passenger services in railways is not visible. In fact, passenger traffic has stagnated or declined in most of the railways, losing the competition with road transport. In most cases these services are cross subsidized by the freight transport, creating additional barriers for the development of freight transport. The passenger services currently represent only 1.7% of the total passenger transport services in Africa. The sub-urban services consist mainly of morning inbound and evening outbound trains with little services at other times. The long distance passenger trains, which were historically the only practical mode of transport in the region, are less and less competitive; the road networks are improved and the busses provide strong competition (Olievschi, 2013).
- 4) Undercapitalization. The overoptimistic assessment of the market growth and of the costs for upgrading the infrastructure or rolling stock technical status has generated another risk. The companies created for this purpose have been endowed with far too limited a capital base to address the operating issues. It is common to discover that the estimated positive cash flows did not occur because the traffic growth did not happen as predicted, the need of investments for continuing operations are higher than estimated in the business plans.
- 5) The railway sector is not assessed as part of the transportation system of SSA. Logistic performance in African countries is very low. The political and economic conditions in Africa does not allow the development of modern logistic systems that have stimulated trade and economic growth in the other regions of the world. According to the World Bank Logistic performance Index (LPI), with the

exception of South Africa, the African countries perform very poorly on infrastructure quality and in all main aspects of logistics. Main weaknesses are:

- a) Poor functionality of rail-ports connections due to conflicts between rail and port authorities related with the control of rail activities in port areas;
- b) Lack of institutional and operational connectivity between neighboring railways and difficult border crossing procedures;
- c) Customs and transshipment barriers that limit the performance of regional corridors;
- d) Lack of transport safety due to poorly maintained vehicles and infrastructure;
- e) Failures of governance due to corruption of police allowing laws to not be enforced; and
- f) Ill-equipped transport infrastructure, poorly managed, operated, or maintained.

In addition to the above, Agbaeze and Onwuka (2014) includes the following challenges:

- 1) Poor response to emerging rail transport needs: The rail transport network has remained virtually static, with little accretion to the network since the early 1960s;
- 2) Loss of patronage to the road transport sector;
- 3) Other problems and challenges facing the railways include poor productivity (and its negative effect on staff morale), retention and maintenance of unremunerative routes, huge wage and pension bills and other personnel related costs.

2.8.4 Performance in Zambia

Rail transport is a major sector with a significant contribution to the GDP of any country. This is especially very ideal for landlocked counties like Zambia (Dzawanda, 2009). Although Zambia's Gross domestic product has doubled since independence, per capita annual incomes are currently at about two-thirds of their levels at independence (CIA, 2012). Zambia's economy has experienced strong growth in recent years, with real GDP growth in the period 2005-2011 of more than 7.9% in 2013. Zambia's economy is well diversified in terms of GDP sectoral contributions. Table 2.3 outlines the structural composition of Zambia's GDP for the year 2008.

From Table 2.3, it can be seen that the construction industry contributes the most to GDP (22.0%) followed by Agriculture, forestry and fishing with 20.1%. Zambia's dependence on mining and quarrying as seen from the table is not very significant as it only contributed 4.1% for the year 2008 in which world copper demand was lowest due to the financial crisis. For the period 2009-2011 though, Mining and quarrying contributed an average of 9.0% to Zambia's GDP. Transport, Storage and communication contributes a paltry 3.6%. Government is however concerned that production data from the mining sector does not fully reflect actual production (Deloitte, 2012). Zambia's dependence on copper as a source of foreign exchange income is outlined in Table 2.4.

According to CSO (2013), the growth in GDP was as a result of increased output in “Construction and Transport” among other sectors. Transport is therefore a prerequisite to economic growth. Rail transport is an integral part of intermodal transportation of goods and passengers for countries engaged in intra and international trade and movements. Zambia falls in this category of countries in need of multimodal transportation.

Table 2.3: Sectoral contribution to GDP in Zambia

Sector	Percentage contribution to GDP(2008)
Agriculture, forestry and fishing	20.1%
Mining and quarrying	4.1%
Manufacturing	9.4%
Electricity Gas and Water	2.7%
Construction	22.0%
Wholesale and Retail trade	15.0%
Finance & insurance	7.0%
Hotels, bars and restaurant	1.0%
Transport Storage and communication	3.0%
Real Estate and business services	2.0%
Community Services	10.0%

Source: Central Statistics Office

Table 2.4: Traditional (Metal) and Non-Traditional Exports (K' Billion)

Category / Year	2005	2006	2007	2008	2009	2010
Total Metal Exports (fob)	6,709.4	10,737.8	14,572.1	15,231.2	16,518.6	28,253.1
<i>% Increase in Metals</i>		60.0	35.7	4.5	8.5	71.0
Metals as % of Total	69.8	80.1	79.2	81.7	77.3	81.9
Total NTEs(fob)	2,903.5	2,673.2	3,827.0	3,421.8	4,846.2	6,243.7
<i>% Increase in NTEs</i>		(7.9)	43.2	(10.6)	41.6	28.8
NTEs as% of Total Exports	30.2	19.9	20.8	18.3	22.7	18.1
Total Exports (fob) (Metals + NTEs)	9,612.9	13,410.9	18,399.1	18,653.0	21,364.8	34,496.8

Source: CSO (2012), International Trade Statistics

However, Zambia has not made use of the advantages of the rail. Rail in Zambia is not only a minor player in the transport sector but its performance has also been deteriorating. For instance, freight traffic hauled by Zambia Railways Limited (ZRL) has fallen from 1.7 million tonnes in 2002 to 0.6 million in 2012. The same is true for passenger volumes which dropped from 223,347 passengers carried in 2009 to 192,608 passengers in 2012 (ZRL, 2014). For Tanzania Zambia Railways (TAZARA), the picture is just as gloomy with freight traffic having dropped from 1.2 million tonnes in 1990 to below 400,000 tonnes in 2013. TAZARA passenger levels have also dropped from 998,000 in 1990 to an average of 197,240 passengers per year between 2011 and 2014.

With better performance, the railway can take up its position in the intermodal transport which is critical to national development. The following descriptions of the railway entities further explain the deteriorating position of rail traffic in Zambia.

a) Zambia Railways Limited (ZRL):

Zambia Railways limited was formerly part of Rhodesia Railways. The construction of the line started at Vic falls Bridge in 1903 and was finally connected to Zaire (Democratic Republic of Congo) in 1909. The line operated as Rhodesia Railways until the dissolution of Federation of Rhodesia and Nyasaland in 1963 when it was operated as a Unitary Railway System with assets being jointly owned by Zambia and Zimbabwe. In 1967, the

Zambian government passed the Zambia Railways Act, which gave birth Zambia Railways board. Zambia Railways has a total track length of about 1,266 km, of which 948 is the main line, and runs from the border with Zimbabwe in Livingstone in the south up to the border with the Democratic Republic of Congo, with branch lines in the Copperbelt.

ZRL in its present form has passed through various managements. In 1978, it was placed under the care of Zambia mining and industrial corporation, ZIMCO. In 1982, the Railways Act vested all assets and liabilities of Zambia Railways Board into ZRL, a company incorporated under the companies Act of Zambia. The transfer was effected in 1984 (ZRL, 1990). It has been operating as such apart from 2003 to 2012 when it was concessioned to Railways systems of Zambia (RSZ), a private operator.

In the late 1980s the performance in terms of freight movements was averaging about 4.6 million tonnes per annum (ZRL, 1990). However in the subsequent years there has been a steady decline in both freight and passengers. Figure 2.6 exemplifies this decline in terms of freight traffic on ZRL which had dropped from 1,719,792 tonnes in 2002 to 732,284 tonnes in 2013:

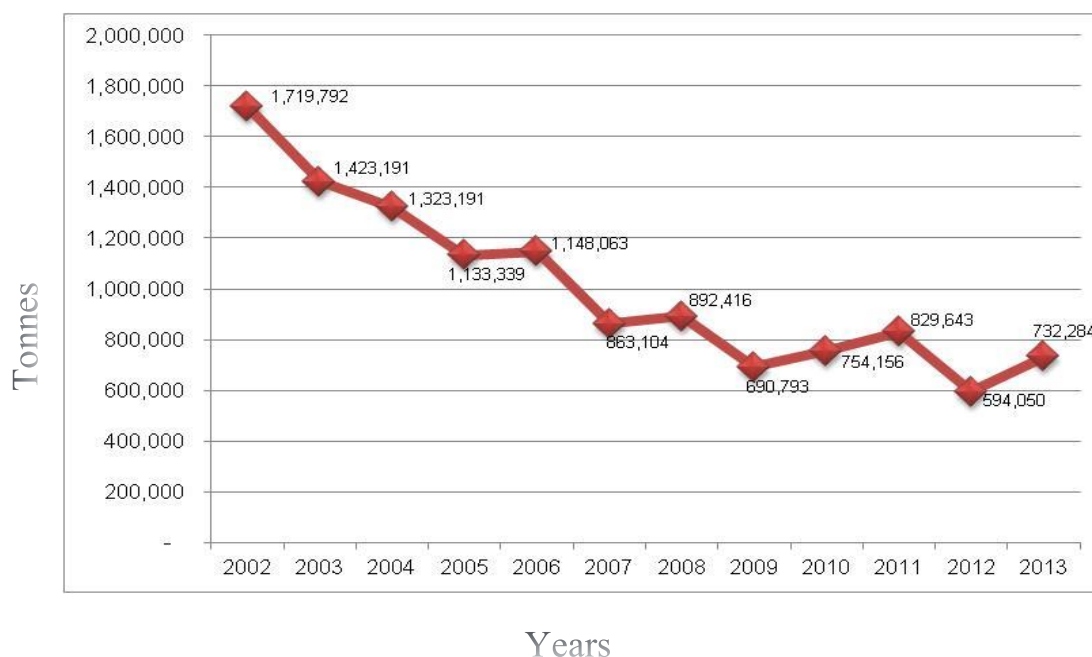


Figure 2.6: Performance in tonnes from 2002 to 2013
Source: (ZRL, 2014)

b) Tanzania Zambia Railways (TAZARA):

TAZARA is jointly owned by the Tanzanian and Zambian governments and operates in both countries. The construction of the railway line was funded by China. It was completed in mid-1975 and started operations in 1976. An important economic consideration was to provide landlocked Zambia with a new access route to the sea, reducing its dependence on existing routes in Southern Africa such as the then Rhodesia (now Zimbabwe) and South Africa which at that time had not attained political independence. In Rhodesia particularly, there was great animosity with Zambia which needed alternative route to the port. The railway line runs from Dar-es-Salaam to Kapiri Mposhi in Zambia, where it connects with ZRL. It covers a distance of 1 860 kilometres and transports both freight and passengers (Zambia Privatisation Agency, 2005).

After decline in performance of TAZARA in the initial stages of operations, the Tanzanians and Zambians invited the Chinese back to help manage the railway in 1983. Passenger traffic on the railway rose from below 500,000 in the early 1980s to 988,000 in 1990 (Monson, 2004).

In the 1990s, the economic performance of the railway began to decline with changes to the broader economic and political environment. With the independence of Namibia in 1990 and the end to apartheid in South Africa in 1994, Southern African regimes were no longer dominated by unfriendly white leaders and Zambian copper had more economic outlets to the south and east. Road transport provided competition in the form of the Trans-Caprivi Highway and the Walvis Bay Corridor to Namibia. The completion of the U.S.-sponsored Tan-Zam Highway brought direct roadway competition along route. Freight traffic fell from 1.2 million tons in 1990 to 630,000 tonnes in 2003, to 533,000 tonnes in 2011 and 480,000 tons in 2013.

c) Mulobezi Line

The Mulobezi Railway line (once known as the Zambezi Sawmills Railway) was constructed to carry timber from Mulobezi to Livingstone in the Southern Province of Zambia. The Zambezi Sawmills company was founded in 1916 to exploit forests of Rhodesian Teak on the north bank of the Zambezi above Livingstone. The timber is hard and strong and termite-resistant and found a ready market as railway sleepers, parquet

floors and other domestic use. Hence the need for rail to transport the timber. Mulobezi Railway Line was constructed by the government then in the early 1930s. The railway line covers a distance of 163 kilometres and links Livingstone in the Southern Province to Mulobezi in the Western Province of Zambia. According to the Zambia Privatisation Agency (2004), the Mulobezi Railway Line played a significant economic role since the 1930s as it transported hardwood timber to the copper industries on the Copperbelt in Northern Rhodesia (now Zambia) and in Southern Rhodesia (now Zimbabwe). A study conducted by the Zambia Privatisation Agency (2004) revealed that at the peak of its operations in the 1970s, the Mulobezi railway line ferried about 1 000 000 tonnes of sawn timber and 150 000 tonnes of round timber. The Zambia Privatisation Agency (2004) study also reveals that the Mulobezi area was not serviced by road infrastructure, making the Mulobezi Railway Line the only means of transport for people between Livingstone and Mulobezi. In the early 2000s, Mulobezi Railway Line carried an average of about 18 000 passengers per annum. However the line suffered years of disrepair to the point of running as slow as 10km/hr. As a result, both the freight and passenger levels have drastically reduced almost to nothing. In 2005, the line carried about 700 tonnes of freight but in 2013 only 500 tonnes were conveyed. On the hand, 16,500 passengers used the Mulobezi train in 2005 but in 2013 there were only 13,000 passengers.

d) Chipata-Muchinji-Nacala (Nacala)

Zambia Railways limited commenced operations on the Nacala corridor in 2014. Nacala is the terminal of the Nacala Railway that connects to the Central East African Railway (CEAR) of Malawi and the Chipata – Muchinji line which is owned by Zambia Railways up to the border with Malawi. In 2014, Zambia Railways only managed to move a paltry 96,000 tonnes of traffic. This further reduced to 75,645 in 2015.

This poor performance of the railways in Zambia is despite bulk traffic being available. For example the following cargo was generated in Zambia:

- a) Copper: 830,000 tonnes in 2013 (Wall Street Journal, 2015);
- b) Sugar: 690000 tonnes in 2014 (Global Cement News, 2014);
- c) Sugar: 430,000 tonnes in 2010 (Chisanga et al., 2014); and
- d) Petroleum from Indeni: 219,550 tonnes (621,696 m³) in 2014 (GRZ, 2014).

From the above, we can see that the available traffic is way beyond the 600,000 tonnes that ZRL carried in 2014. Considering imports and other traffic generated within Zambia, it is noted that there is more than enough traffic which the railways can move but is being hauled by road trucks. The declining contribution of transport services by the rail contributes negatively to national growth. It also puts more pressure on the roads which in turn demands for more resources from the national budget to repair roads that are damaged by heavy goods carrying vehicles. Zambia Revenue Authority (ZRA) reported in 2014 that 500 to 600 trucks cross Kasumbalesa border every day, not to mention Nakonde and Chirundu. Furthermore, this means that the advantages that rail has in transportation will not be utilized.

To a large extent, this is poor competitive position in rail versus road (not to mention air and waterway which are very poor) transport is mainly due to:

- a) Overall government policy concerning the transport sector through infrastructure investment, pricing, fare controls, poor appointment of Board of Directors, etc.;
- b) Operational inefficiencies by the two rail operators in Zambia.

2.9 Intermodal transportations

Abbasi (1996) defines Intermodal freight transportation as the concept of transporting freight using more than one mode of travel in such a way that all parts of the transportation process are effectively connected and coordinated, safe, environmentally sound, and offering flexibility. An intermodal system should be defined to include both the points of connections (e.g. ports, warehouses, etc.) and the links between them (e.g. roads, rails, etc.). Intermodal and multimodal processes are not the same. Bektas and Crainic (2007) refers to intermodal transport as the transportation of goods and people from their destination by a sequence of at least two modes. Transfer from one mode of transport to the other is done at intermodal terminals which maybe sea port or in-land terminal, rail yards, etc. A multimodal transportation process uses two or more modes of transportation but is not necessarily an efficient, cost effective, and flexible process. Improvement of intermodal transportation plays an important role in achieving “seamless” transportation. In other words, the transportation of goods by different modes is done so efficiently that the changes in mode are hardly noticeable (Abbasi, 1996).

The fundamental idea of intermodal transport is to consolidate loads for efficient long haul transportation (by rail or sea) while taking advantage of the efficiency of short haul local pick-up and delivery of trucks (Crainic and Kim, 2007). The performance of intermodal transportation depend on the performance of the key individual elements of the chain as well as the quality the interaction between them regarding operations, information and decision making. The railways face significant challenges in being part of intermodal networks competing with trucking in offering customers timely, flexible and long haul transportation services. This is due to the traditional policies of railroads which were based on long-term provision of “sure” high volumes of (very often bulk) freight with very little attention paid to delivery and customer satisfaction (Crainic et al., 2006). This resulted in long and unreliable trip times that generated inefficient asset utilization and loss of market.

Rail intermodal is defined by Association of American Railroads (AAR) (2016) as the long-haul movement of shipping containers and truck trailers by rail, combined with a (usually much shorter) truck movement at one or both ends. Intermodal allows railroads, ocean carriers, trucking companies, and intermodal customers to take advantage of the best attributes of various transportation modes to yield an efficient and cost-effective overall freight movement. Successful intermodal corridors need sufficient line haul and terminal capacity to keep trains moving and to avoid congestion or delay. With this in mind, U.S. railroads have created the most advanced intermodal network in the world by more fully utilizing existing rail capacity and through tens of billions of dollars in spending on new infrastructure and equipment directly connected to intermodal operations. This spending includes: New or expanded inland intermodal terminals to facilitate the transfer of containers and trailers between rail and truck; New near-dock intermodal terminals to facilitate the transfer of containers between ship and rail; Raising clearances along rail routes to accommodate the additional height required for doublestack trains; Adding track capacity and advanced signaling systems to accommodate faster, more frequent trains on the rail network; Introducing a variety of new intermodal car types and modernizing the locomotive fleet to enhance reliability for rail customers (AAR, 2016).

2.10 Summary

This chapter presented a review of literature on the subject of study, the comparative study of access to railways relative to road transport. The reviewed literature showed that rail transport has a lot of advantages over road. However, it was revealed that the usage of rail transport especially in developing countries like Zambia does not utilize these advantages. It is this background that motivated the study on the causes of the low utilization of railways in Zambia and the impact it has on the economy. The next chapter discusses the research methods used in this study. The merits and demerits of the various research methods are also discussed and presented.

Chapter Three: Research Methodology

3.1 Introduction

The previous chapter presented the literature on transportation in general and railways in particular reviewed during the course of the study. This chapter outlines the methodology and methods used to carry out the investigations in this dissertation in order to address the objectives. The chapter explains how the problem was investigated and the tools used to do this. The characteristics of the research samples and the way data analysis was done is also presented.

3.2 Definition

Ghosh (2013) defines Research as a careful critical enquiry or examination in seeking facts or principles; “diligent investigation in order to ascertain something”. Research is often mistaken for gathering information (leady and Ormrod, 2010). However it’s a process of collecting, analysing and interpreting data in order to understand a phenomenon.

3.3 Research types

From a paradigm point of view, research can either be qualitative (Phenomenological paradigm) or quantitative (Positivist paradigm) (Kombo and Tromp, 2009). Trochim (2004) as cited by Mwanaumo (2013) differentiates qualitative and quantitative approaches as follows; Data is quantitative if it is in numerical form while qualitative data is not presented in numerical form. However there are a lot of arguments as to which of the two methods is more superior. The quantitative protagonists argue that their data are hard, rigorous, credible and more scientific and thus better than qualitative type. The qualitative protagonists on the other hand believe that their data is more sensitive, nuanced, detailed, contextual in capturing and therefore more superior to the other type. Trochim (2006) states that this debate is unproductive but both paradigms should be viewed and used from a contextual point of view. Therefore others like Mancosa as cited by Mwanaumo (2013) talk of Triangulation which is the combination of the two. The following is a brief description of the paradigms:

3.4 Qualitative Vs Quantitative Research

According to Neuman (2000), the fundamental difference between qualitative and quantitative research designs and techniques are that quantitative research designs deal with the 'what' and 'when' of the knowledge as oppose to qualitative research designs that deal with the 'why and 'how' of human behaviour.

3.4.1 Qualitative research

This form of research involves description. It seeks to describe and analyse the culture and behavior of humans. Qualitative research uses natural setting and relies on a strategy that is flexible and interactive. In qualitative research, the feelings and insights are considered important. Interviews, focus group discussions and questionnaires fall under this category (Kombo and Tromp, 2009).

The main focus of qualitative research is to understand, explore, discover, and explain situations, feelings, perceptions, attitudes, values, beliefs and experiences of people. Study designs of qualitative research are thus based on a deductive rather than an inductive logic. One of the most distinguishing features of qualitative research is its adherence to the concept of respondent concordance. In this type of research approach the researcher makes every effort to seek the agreement of respondents with regard to interpretation, presentation of the situations, experiences, perceptions and conclusions (Kumar, 2011). The parameters of the scope of the study as well as the information collecting methods and processes are often regarded as flexible and evolving; hence most qualitative research designs are not structured and sequential.

3.4.2 Quantitative research

Quantitative research relies on the principle of verifiability. Knowledge emerges from what can be proved by direct observation. It is mainly applicable to science. The values, interpretations and feelings of the researcher are not considered. Quantitative research focuses on measurements. Amongst other applications, quantitative research is used when statistics and frequencies are sought to explains meanings. (Kombo and Tromp, 2009) and (Dawson, 2013). Quantitative research focuses on measuring quantities and relationships between attributes by following a set of scientifically complex problems (Bowling, 2005). The quantitative research approach is thus ideal for situations where knowledge about the

phenomenon of interest already exists; this allows for the use of standardised methods of data collection (Bowling, 2005). In quantitative research, sufficient details about the study exist this allows for the study to be verified, replicated and reassured, whereas in a qualitative research approach the replication of a study becomes impossible (Kumar, 2011).

According to Hopkins (2003), the main aim in quantitative research is to determine the relationship between one thing (an independent variable) and another (a dependent variable) in a population. Quantitative research designs are either descriptive or experimental. Furthermore, this type of research is all about quantifying relationships between variables (Hopkins, 2003).

The advantages associated with quantitative research are that quantitative study designs are specific and well-structured. They are able to handle large samples sizes, are less expensive and quicker to undertake, are easier to quantify, have been tested for their validity and reliability, and can be openly defined and recognised. On the other hand, qualitative study designs either do not have these aforementioned qualities or have them but to a lesser degree. Qualitative study designs are also less specific and precise, and do not have the same structural depth as quantitative study designs (Kumar, 2011).

This research was conducted by adopting both qualitative and quantitative methods. This is called triangulation. These methods were adopted because of the nature of the study which involved collecting data through interviews and questionnaires. It also involved getting numerical data, analyzing it and drawing conclusions.

3.4.3 Triangulation

Many researchers believe this is a good way of approaching research as it enables you to counteract the weakness in both qualitative and quantitative research (Dawson, 2013).

Ziyani et al. (2004) states that Triangulation approaches can be categorised into seven types:

- a) Data Methodological Triangulation is defined by Kimchi et al. (1991) as cited by Ziyani et al. (2004) as the use of two or more research methods in a single study. The difference can be at the level of design or data collection. LoBindoWood and

Haber, 1998) as cited by Ziyani et al. (2004), identified two different types of methodological triangulation: the within method triangulation which is used when the phenomenon being studied is multidimensional; and the across method or between method triangulation which involves combining research strategies from two or more research traditions in the same study;

- b) Data Triangulation involves the collection of data from multiple sources with the intent to obtain diverse views of the studied phenomenon with the purpose of enhancing the validity;
- c) Investigator Triangulation is a process whereby two or more investigators with diverse research training backgrounds examine the same phenomenon. The use of investigator triangulation according to Burns and Groves (2001) removes the potential for bias that may occur in a study conducted by a single investigator;
- d) Time Triangulation is applied to both cross-sectional and longitudinal studies. Cross sectional data is collected with time-related processes from different groups at one point in time, while longitudinal studies collect data from the same group at different points in time sequence. Cross sectional studies compare the measurements for the individuals in different samples at one point in time, while longitudinal studies examine selected processes in the same individuals comparing the same sample's results repeatedly over time;
- e) Space Triangulation attempts to overcome the limitations of studies conducted within one culture or subculture, as not all the behavioral sciences are culture bound;
- f) Theoretical Triangulation draws upon alternative or competing theories in preference to utilising one viewpoint only; and
- g) Analysis Triangulation is a situation whereby two or more analysis techniques are used for the same data set, and from the three principal levels identified by Cohen and Manion (1997) as cited by Ziyani (2004), namely, the individual level, the interactive level, and the level of collectivist.

The blending of qualitative and quantitative data in a single project is advantageous because they are complementary and represent the two fundamental languages of human communication; words and numbers. Methodological triangulation increases support for validity.

In this study both qualitative and quantitative research were used in addition to the descriptive one in order to meet the objectives set out. Data collected qualitatively through interviews was coded and analysed quantitatively through statistical methods.

3.5 Research design

Welman and Krugger (2001) described research design as a plan according to which participants and subjects are obtained and how information obtained from these will assist in arriving at a conclusion. According to Kumar (2011), a research design is defined as a plan, structure and strategy of investigation that is perceived to obtain answers to research questions or problems. The design plan consists of the complete scheme or programme of the works. It includes an outline of what the researcher will do – from writing research objectives and their operational implications all the way to the final analysis of the data (Kumar, 2011). Therefore research design provides the glue that holds the research together and is used to design the structure of the study. It shows that the process conforms to certain appropriate process in data gathering, analysis and presentation. Leady and Ormrod (2010) describes methodology as an operational framework within which the facts are placed in such a way that their meaning maybe seen clearly.

The above mentioned definitions propose that a research design has two main functions. The first relates to the identification and development of the procedures and logistical arrangements required to undertake a study, and the second function highlights the importance of quality in these procedures to ensure validity, objectivity and accuracy. According to Kumar (2011), through the use of a research design one should be able to:

- a) Conceptualise an operational plan to undertake the various procedures and tasks required to complete your study; and
- b) Ensure that these procedures are adequate to obtain valid, objective and accurate answers to the research questions.

The basis for a research design is therefore to plan and structure a research project in such a manner that the eventual validity of the research findings is maximised through either minimising or where possible eliminating potential errors (Mouton, 1996). The different

research approaches use different techniques or methods. Research approach can be classified as:

- Exploratory;
- Descriptive;
- Explanatory or analytical;
- Predictive;
- Experimental;
- Correlational; and
- Case study.

Two of the above approaches, descriptive statistics and case study, were used in this research while taking into account the views of the positivists and phenomenological paradigms (qualitative and quantitative types). The adopted two approaches are described briefly below:

3.5.1 Descriptive research

This study included descriptive research in establishing the how much rail transport is accessed and causes of poor usage of railways in Zambia. It also described the impact of such access and usage has on the Zambian economy. The purpose of descriptive research is to describe an existing phenomenon (Welman and Kruger, 2001). It is to examine a phenomenon that is occurring at a specific place(s) and time. A descriptive research is concerned with conditions, practices, structures, differences or relationships that exist, opinions held processes that are going on or trends that are evident.

3.5.2 Case study

Case study is when a limited number of units of analysis such as an individual, a group or institution are intensively studied (Welman and Kruger, 2001). This allows the researcher to explore and understand problems, issues and relationships. When an institution or group is investigated, the researcher is conducting fieldwork. Welman and Kruger (2001) disclosed that whichever technique is used to collect data, the concern is not merely to describe what is being observed but to search in an inductive fashion for recurring patterns and consistent regularities. Therefore, this method being a non-experimental, descriptive

type of study and not explanatory one, discussions about cause-effect relationships cannot be drawn. Advantages of case study method include the capture of rich information from which potentially useful hypothesis can be generated. Case studies can be used as examples to illustrate problems or show benefits of particular practices resulting in making practical improvements to specific situations. They provide more comprehensive examination of a particular situation than any other research design. Because case studies draw from actual experiences and practices, they are strong on reality, making case studies useful as a consultancy.

The case study approach raises concern because it does not allow the researcher to generalize from one case. The case would need to be contextualised and carefully described for others to consider its usefulness in other contexts and examples (Wisker Gina, 2001). Information collected from a case may be retrospective as some studies take too long. In this case it's historical and is therefore subject to the problems inherent to memory. Sometimes, impartiality is lost and subjectivity becomes an issue.

The case study method was used as it is suitable in achieving the objectives of the study in question because this research is not experimental and cannot be conducted in a laboratory under controlled conditions. This also took advantage of the case of Railway companies operating in the research environment. Through the case study;

- a) The prevailing situation in Zambian railway industry will be determined.
- b) Background information and key information was gathered.
- c) Remedial action can thus be recommended.

In order to determine the traffic categories and tonnages moved in the year 2015 by rail and road, a detailed study was carried out on two companies, namely Zambia Railways limited and the Road Development Agency

3.6 Sources of data

There are two major sources of data used by researchers both of which were used in this research. These are the primary and secondary sources (Kombo and Tromp, 2009):

3.6.1 Primary data collection

The collection of one's own data or information. The person collecting is the first one to use it. It includes methods observations, interviews and administration of questionnaires (Kombo and Tromp, 2009). Focus group discussion is also one of the primary techniques of data collection. Primary data collection can be done by observation, case study and survey.

3.6.2 Secondary data collection

This method involves the use of available information that was collected by someone else. The researcher in this case is the secondary user of the data or information. Literature review is the most common type of secondary data collection.

3.7 Research data collection methods used

In order to carry out this study as per the problem identified in Section 1.2 and achieve the objectives outlined in Section 1.5, three major types of methods of data collection were adopted. These are literature review, interviews and questionnaires.

3.7.1 Literature review

In getting a better understanding of the subject, secondary data was obtained from what is documented on the subject matter and from what other researchers elsewhere have done. During case study of Zambia Railways, documented data was also be obtained and analysed. This method was used in order to lay a foundation of the research, and build it up on what has been established by others Nkhata (1997) as cited by Kaliba, (2010). Further information on the trends of affairs was established. In carrying out literature review, care was taken as to what sources are used due to the disadvantages some have for research purpose. Nevertheless the sources included Journal articles, Text books, Conference proceedings, Government and corporate reports. News articles, magazines and the internet was also used as they can be helpful in this kind of enquiry.

3.7.2 Interviews

Interviews were conducted prior to questionnaire surveys. The interviews helped to obtain preliminary data that enhanced the questionnaire survey. Participants were selected such

that various viewpoints of the main stakeholders in the rail industry are incorporated in the questionnaire survey. Therefore the interviews targeted major transport industry in Zambia. Because preliminary data needed to be gathered quickly to help conclude the questionnaire, the interviews were limited to participants within Lusaka, where most corporate companies have a presence and Kabwe, the headquarters of Zambia railways. Fifteen (15) interviews were conducted, 5 each from the railway industry, transporters and transport users

3.7.3 Questionnaire Survey

Self-administered questionnaire surveys were used as the main research instrument. This is because representative sample could be realised within manageable time or costs. The method allowed most stakeholders in the Zambian railways industry to make their contribution. The respondents were assured of anonymity in order to induce honest in their answers. This was also to avoid respondents trying to impress the interviewer if present, thereby giving biased answers. This method also allows respondents to have adequate time to consult where they were not sure, thereby answering the questions more appropriately. The above factors makes this method advantageous compared to the other methods available.

(i) Questionnaire writing, distribution and collection

The questionnaires were written in one format and distributed to transport (rail and road) professionals, customers and the general public in Zambia. However there were specific questions in the questionnaires meant for transport operators and users respectively.

In order to receive a high response level the following was done;

- a) provided a covering letter;
- b) identified the type of research;
- c) explained the purpose and the benefits of the study;
- d) encouraged the participants to fill in the questionnaire;
- e) assured the participants 'anonymity';
- f) structured the questionnaire in a neat format; and
- g) Kept the questionnaire as short as possible, but comprehensive enough.

Distribution method used for each respondent was such as to get fast response. Most questionnaires were personally distributed and collected by hand. This ensured that the questionnaires reach the targeted organizations and individuals in good time and within budget. For the other respondents who could be easily reached, the questionnaires were distributed and collected via email, in which case prior arrangements were made by phone.

3.8 Survey Sampling

The population of this research consisted of Transport (road and rail) professionals, railway customers and/or their representatives and the general public. In order to get rich data from stakeholders in the railway industry, non-probabilistic purposive sampling was used. We choose groups and subgroups within the greater population of rail users in Zambia by factors they have in common. These included corporate users, small businesses and the general public.

3.9 Data analysis

Data collected from the survey was analysed using descriptive and inferential statistical techniques. Descriptive statistics describe what is or what data shows. The descriptive analysis was used to analyze the data from the questionnaires and interviews. Inferential statistics infer from the sample data what the population thinks (Trochim, 2006). Data collected was analyzed quantitatively and qualitatively. The qualitative data collected from questionnaires was coded, entered, and analyzed quantitatively. The quantitative data collected from the case studies was further analysed in graphical form for easy of presentation.

3.10 Summary

This chapter presented the methodology used to carry out the research and address its aims and objectives. Highlights about the various methodologies that could be adopted for research purposes were also included in this chapter. The chapter further presented an explanation of how the problem was investigated and described the tools used to undertake the investigation. It also described the characteristics of the research sample and the method of analysis that was employed. The next chapter discusses the data collected and analysed in the study.

Chapter four: Results and Analysis

4.1 Introduction

The previous chapter outlined the methodology for carrying out the research and the methods used to analyze the data collected. This chapter presents the research results and how they were analysed. Section 4.2 presents information pertaining to the case studies of the traffic moved by both rail and road, while section 4.3 presents the results and analysis of the questionnaires.

Research data can be defined as “the recorded factual material commonly accepted in the scientific community as necessary to validate research findings”. According to Devos (2002), data analysis is the process of bringing order, structure and meaning to the mass of collected data. This chapter discusses the data analysis of the survey conducted within the transport industry in Zambia. The data obtained from the completed questionnaire are presented and analysed by means of mean percentages as applicable.

4.2 Case Study data and analysis

Case studies on the tonnages and various categories of traffic moved in 2015 were conducted between January and February 2016. Case studies provide in depth examination of the subject matter as they draw from actual experiences and practices.

Two case studies were reviewed:

- a) Traffic moved by rail on Zambia Railways in 2015;
- b) Traffic moved on road in the same period.

4.2.1 Distribution of Traffic Moved by Road and Rail

From the case studies it was established that 6,702,498.40 tonnes of traffic was moved in Zambia in 2015. Out of this only 511,730.00 tonnes was carried on the rail as indicated the graph on the following page. Based on this sample of traffic as the available cargo on the market, the rail has only 8.0% of the market share. This can be seen in Figure 4.1.

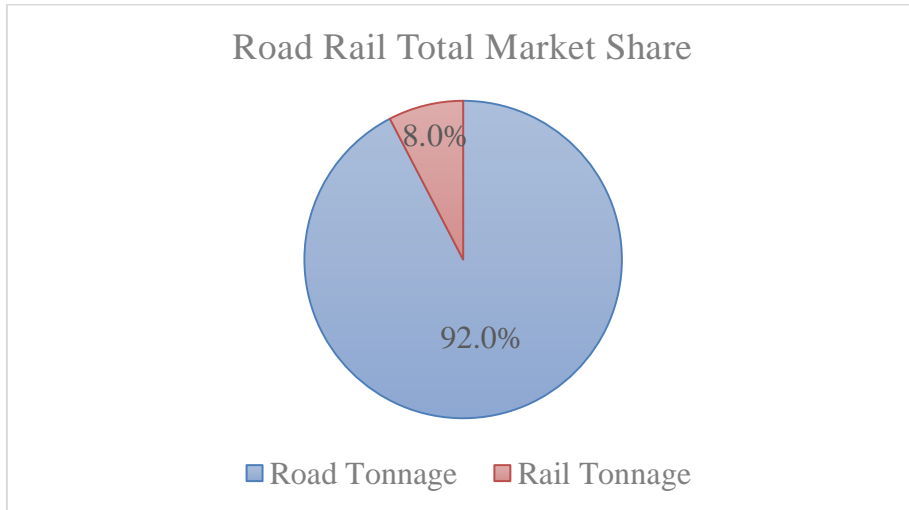


Figure 4.1 Road – Rail Traffic share in 2015.

4.2.2 Road and Rail Traffic, Export-Import Category Wise

Categorising the traffic moved by road and rail in 2015 into export, import, transit and local, it was discovered that at 37.6%, imports accounted for the largest portion moved. Exports only had a partly 13.47% while local and transit traffic was 28.9% and 20.4% respectively. Figure 4.2 shows this and also how in the various categories the road carried most of the traffic.

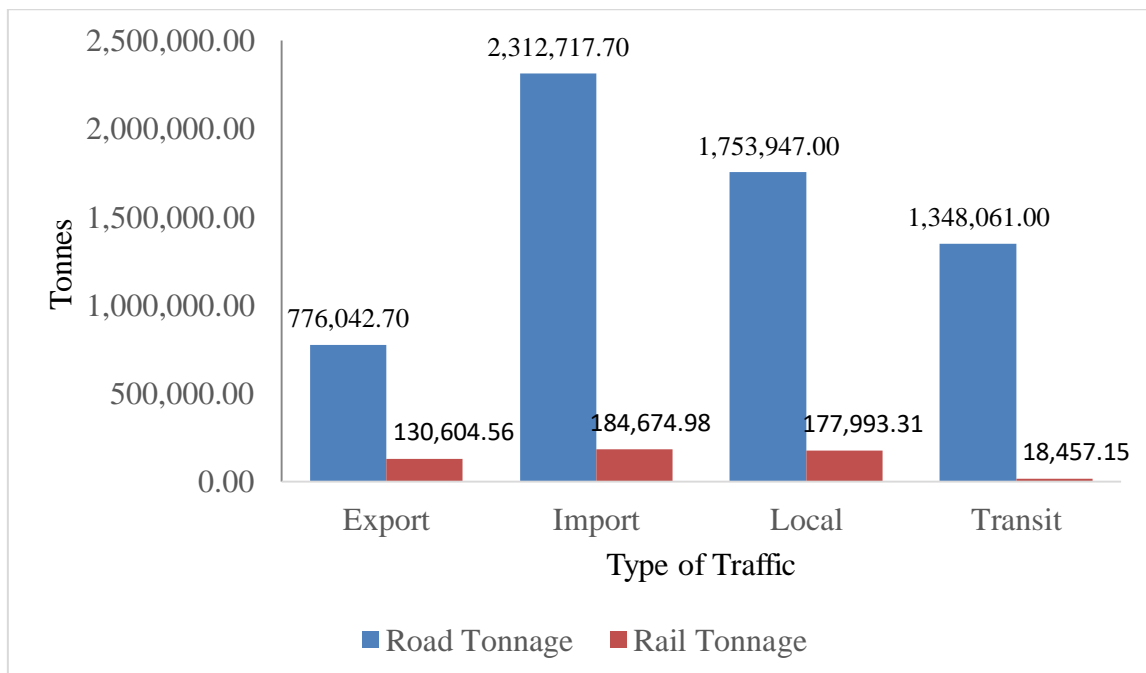


Figure 4-2 Road & Rail Traffic category wise.

4.2.3 Type of traffic moved

The traffic moved was classified into thirteen categories based on the type of cargo. Table 4.1 below shows how much of each type was moved by road while Table 4.2 depicts the traffic moved by rail in terms of export, import, local and transit traffic. Figure 4.3 on the other hand shows the distribution of the same traffic between the road and rail.

Table 4.1 Traffic moved by Road cargo type wise.

Categories of cargo moved on road in tonnes (% of total/category)						
Type of cargo	Export	Import	Local	Transit	Grand Total	
Agric	57,707.60	52,247.50	63,023.20	36,482.90	209,461.20	3.4%
Beverages	3,888.70	18,231.70	30,709.80	4,633.10	57,463.30	0.9%
Building Materials	9,066.20	61,418.70	137,382.40	37,959.30	245,826.60	4.0%
Chemicals	1,026.70	84,418.10	5,733.20	74,802.50	165,980.50	2.7%
Food stuff	46,135.00	89,235.60	181,345.70	60,984.50	377,700.80	6.1%
Grain	259,700.60	253,934.30	262,166.10	43,525.30	819,326.30	13.2%
Household	4,001.70	148,274.00	30,823.50	32,342.30	215,441.50	3.5%
Metal	307,953.30	577,898.70	409,770.00	562,084.40	1,857,706.40	30.0%
Others*	60,645.30	531,935.10	276,204.30	187,186.90	1,055,971.60	17.1%
Paper	579.90	18,963.30	3,177.00	3,533.80	26,254.00	0.4%
Passengers	12,214.20	24,046.10	295,217.50	16,882.80	348,360.60	5.6%
Petroleum	12,455.20	441,008.20	57,097.30	283,994.70	794,555.40	12.8%
Rubber	668.30	11,106.40	1,297.00	3,648.50	16,720.20	0.3%
Grand Total	776,042.70	2,312,717.70	1,753,947.00	1,348,061.00	6,190,768.40	100.0%

Metals, Petroleum and grain products accounted for more than half, 56.0%, of all the traffic moved by road. Metal leads the way at 30.0% followed by grain at 13.2% with petroleum at 12.8%. These categories (Metals, Petroleum and grain) are major constituents of the bulk traffic that ideally should be moved by rail. At 8.0% market share as indicated in section 4.2.1, most of this traffic is being moved by road. This can be seen in Figure 4.1.

**Other cargo includes some food stuffs, tarpaulins, beverages, books, plastics, sacks, and packages which are declared as generals or boxes.*

Table 4.2 Traffic moved by Rail cargo type wise.

Categories of cargo moved on rail in tonnes (% of total/category)						
Type of cargo	Export	Import	Local	Transit	Grand Total	
Agric	651.10				651.10	0.1%
Beverages	797.02				797.02	0.1%
Building Materials	3,745.00	1,100.00	7,804.96		12,649.96	1.6%
Chemicals	12,557.97	58,853.32	40.00	200.00	71,651.28	9.2%
Food stuff	39,430.62		42,330.18		81,760.80	10.5%
Grain	56,801.20	25,630.64	38,303.24		120,735.07	15.6%
Metal	91,672.01	143,289.71	156,868.22	24,423.56	416,253.50	53.7%
Others*	297.18	72.52		399.34	769.04	0.1%
Petroleum		18,113.99	44,775.02	7,157.05	70,046.05	9.0%
Grand Total	205,952.09	247,060.17	290,121.62	32,179.94	775,313.82	100.0%

Figure 4.3 indicates that the road moved 1,857,706.4 tonnes, which is 81.7%, of all the metals moved by road and rail compared to 416,253.5 tonnes by rail. For grains, 819,326.3 tonnes (89.2%) of the road and rail traffic, was moved by road as opposed to 120,735.07 tonnes moved by rail. The scenario is worse for Petroleum and other cargo of which the road moved 91.9% and 99.9% respectively.

The trend of which type constitutes bulk of traffic moved in the various categories of export, import, local or transit is however different. It also depends on whether the traffic is moved by road or by rail. The following graphs, Figures 4.4, 4.5, 4.6 and 4.7, indicates this.

Figure 4.4 shows that apart from a bit of petroleum products, metals, grain and chemicals, almost all imports into Zambia move by road. This also true for goods like food staffs, tarpaulins, beverages, books, plastics, sacks, and packages which are declared as generals or boxes which fall on “others”. Figure 4.5 shows the exact picture like figure 4.4, but for exports, that most traffic goes out of Zambia by road. Only a bit of metals, grain and chemical, food staffs and building materials use the rail. The picture is the same for local and transit traffic. Figures 4.6 and figure 4.7 show this. Transit traffic is worst in terms of rail transport as only a bit of metals, petroleum, chemicals and others move on the rail.

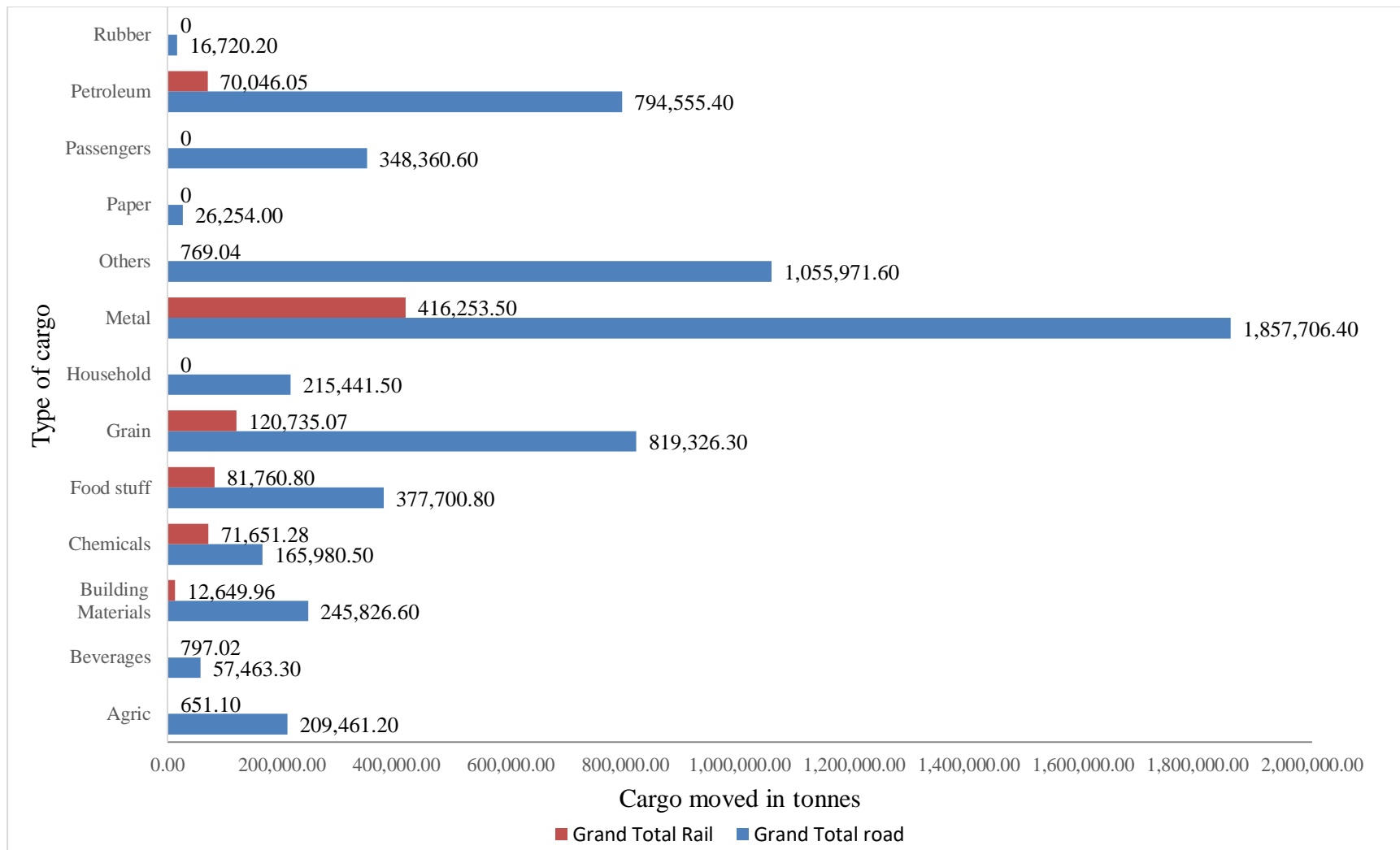


Figure 4.3 Road & Rail Total Traffic based on type of cargo.

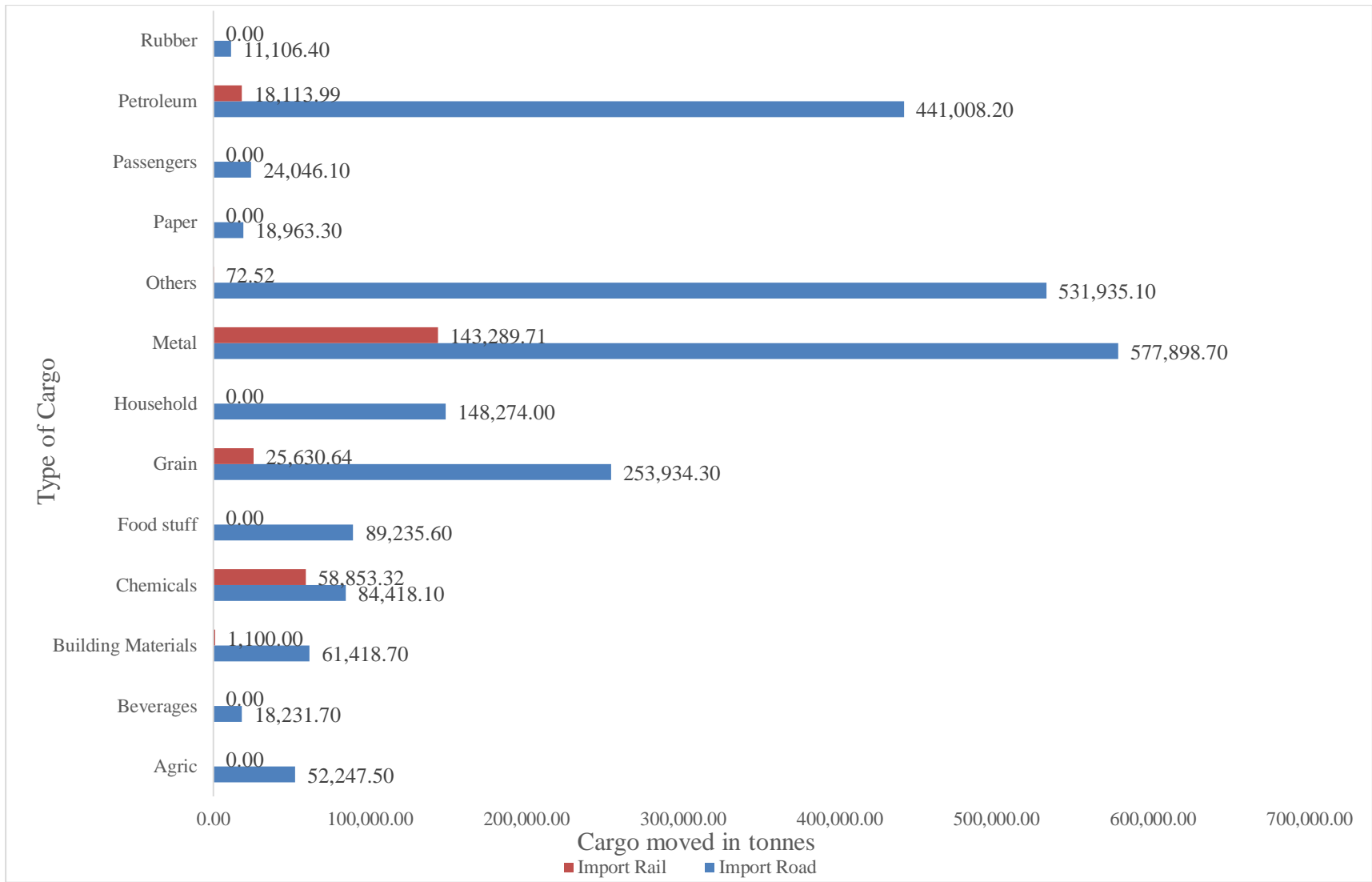


Figure 4.4 Road & Rail Import Traffic based on type of cargo.

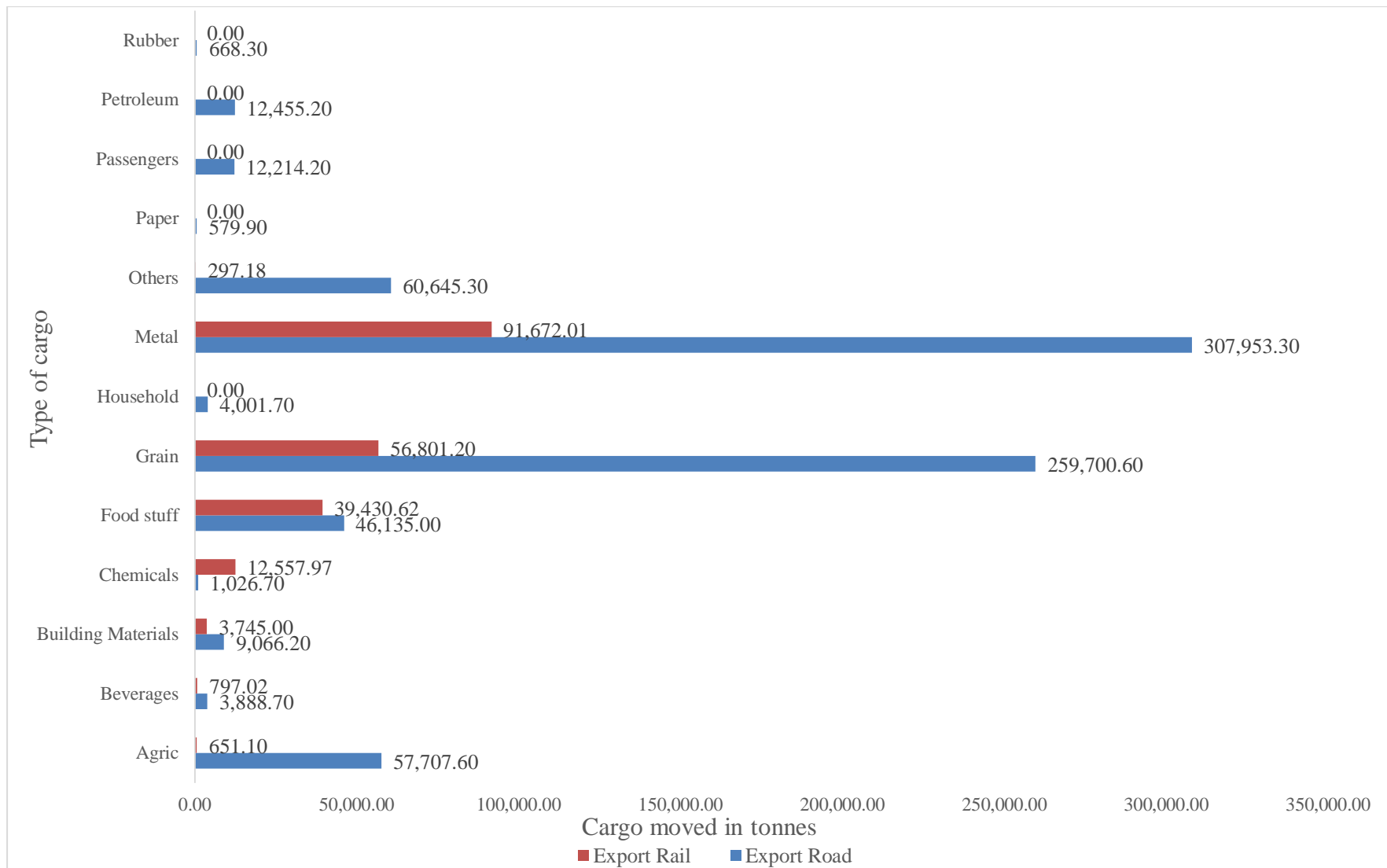


Figure 4.5 Road & Rail Export Traffic based on type of cargo.



Figure 4-6: Road & Rail Local Traffic based on type of cargo.

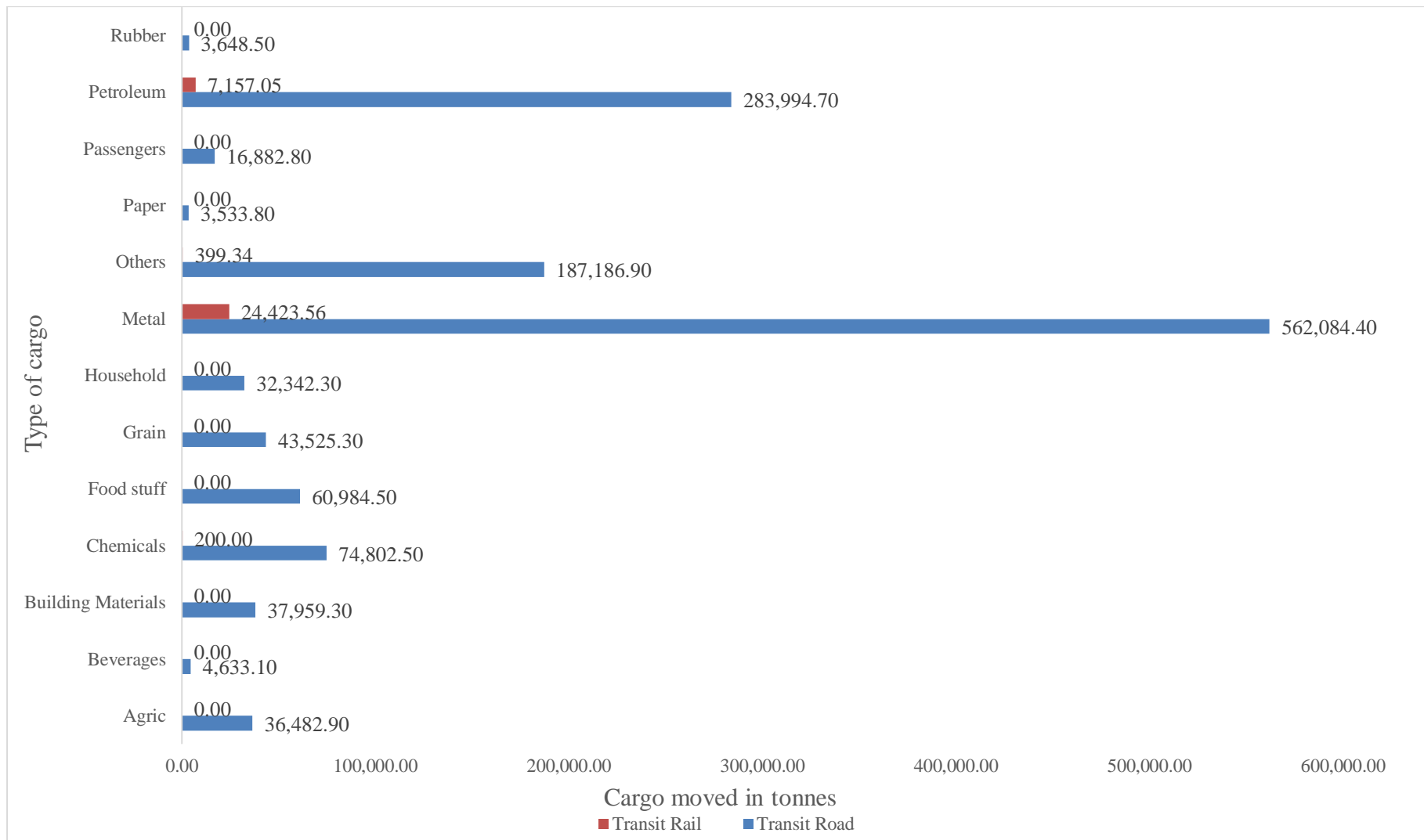


Figure 4-7 Road & Rail Transit Traffic based on type of cargo.

4.2.4 Summary

An in-depth study of the traffic moved by road and rail revealed a number of issues. There is a lot of traffic movement to and fro and within Zambia. However almost the entire traffic available to the road and rail is being moved by the road. The rail is only moving less than 10.0 % of this traffic. This is despite the fact that more than 50.0% of the traffic is made up of Metals, grains and petroleum products which can be categorized as heavy and bulky. Heavy and bulk traffic is traditionally economically moved by the rail. However it is now evident that this is not the case for Zambia.

4.3 Questionnaire survey

The questionnaire survey was carried out over a period of three months between December 2015 and March 2016.

The population sample was confined to Railways freight and passenger “Transport Operators” and “Transport Users”. “Transport Operators” are service providers like railways and trucking companies while “Transport Users” are clients who use these services. Non-probabilistic purposive sampling was used. This is because the respondents were purposively chosen to give a representative sample in the rail and road transport sector. Respondents were from the copper belt, central, Lusaka and southern provinces of Zambia. However there was a bias towards copper belt and lusaka in order to target the area with a larger concentration of the population group but also to be representative of the Zambian population.

A total of 70 questionnaires were distributed. However only 51 responses were obtained resulting in a response rate of 72.9%. The questionnaire was designed to establish accessibility of transport in general and rail in particular and its economic impact. The questionnaire for transport users also sought to establish causal factors for choice of transport mode.

4.3.1 Profile of Respondents

(i) Transport mode and sector type

Respondents were from transport operators and users from both the public and private.

Forty-nine percent (49.0%) of the respondents were transport users while the rest, 51.0%, were operators. As is indicated in Figure 4-8, 96.1% of the respondents use either road or rail or both modes of transport. Figure 4-9 on the other hand shows that 32 of the respondents were from the private sector with the remainder, 19 coming from the public sector.

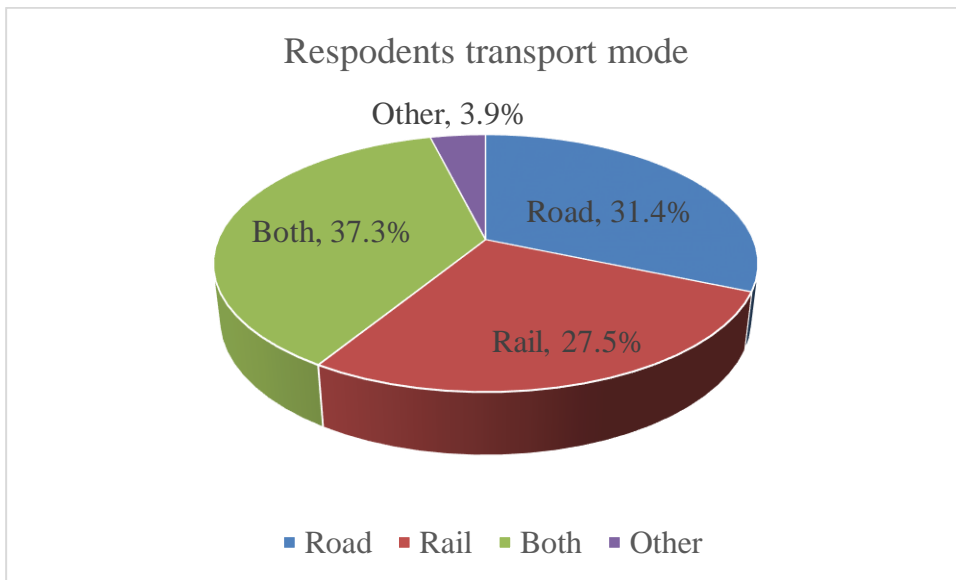


Figure 4-8 Percentage of respondents.

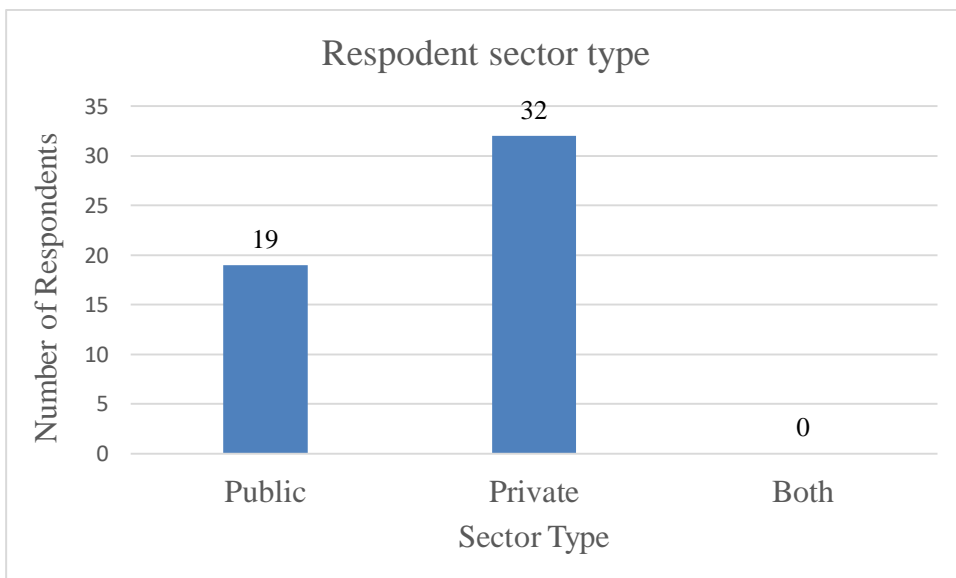


Figure 4-9 Number of respondents by sector type.

(ii) Amount of tonnages moved

The respondents were asked to indicate the amount of tonnages they move per given period. After basing all responses to per year, it was revealed that 21.6% of respondents moved less than 250,000 tonnes per year while 23.5% of the respondents moved between 250,000 and 500,000 tonnes per year. Twenty one and half percent (21.5%) of the respondents moved between 500,000 and 750,000 tonnes per year while 33.3% more than 750,000 tonnes but less than 1,000,000 tonnes per year. This is indicated in Figure 4.10.

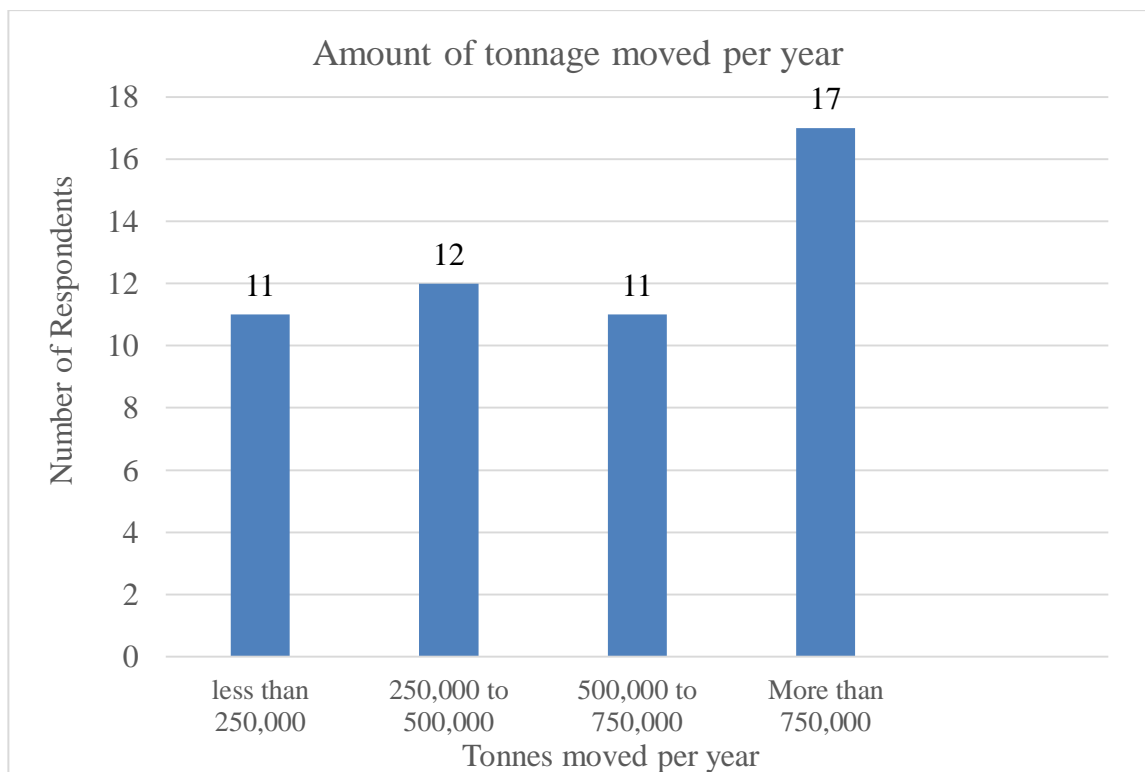


Figure 4-10 Respondents’ tonnages moved per year.

4.3.2 Transport Mode Preferences and Accessibility

To determine which mode of transport the respondents prefer and which one they thought was easily accessible, they were asked to choose from road, rail, air, water and any other mode of transport.

(i) Rating and preference of transport mode

To determine which mode of transport is the most preferred in Zambia, all respondents were asked to choose the mode they thought was the best from road, rail, air, water and any other transport. The responses are indicated in Figure 4-11 showing that 68.6% thought road transport was the best while only 15.7% thought rail was the best. The rest was split to air, water or combination of rail and road.

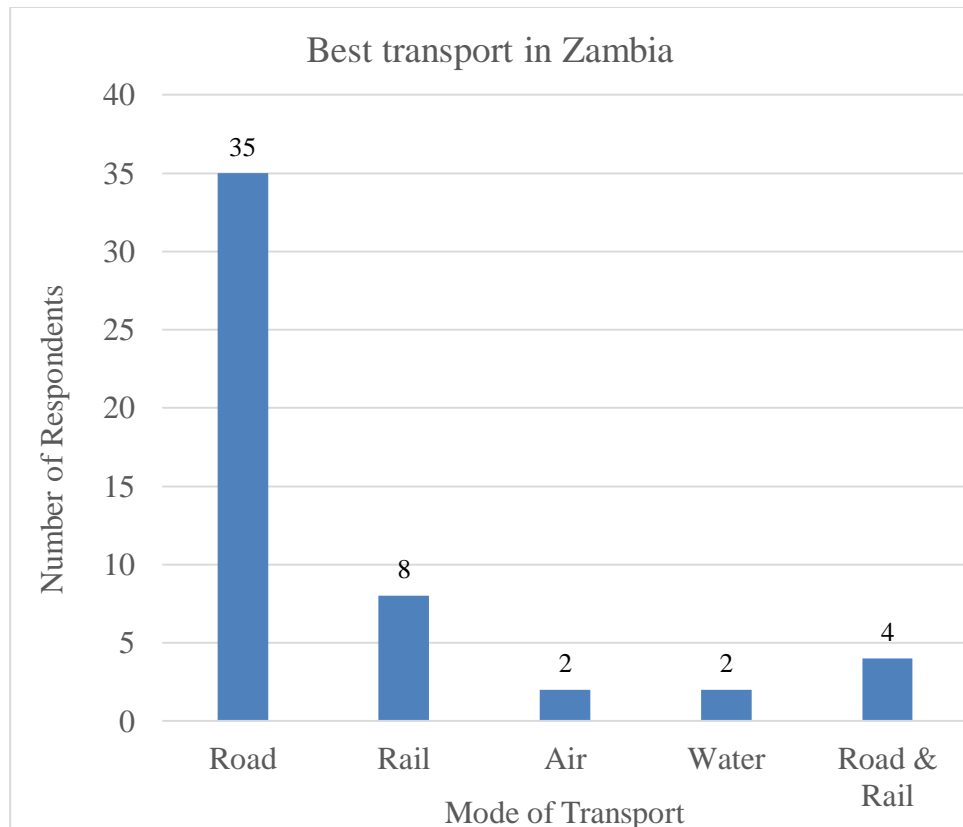


Figure 4-11 Best Transport in Zambia.

The responses received were put into two groups of transport operators and transport users. These two were further sub divided into road and rail categories. Ninety-three percent (93.0%) of road operators rated their transport mode as either “Good” or “Very good” compared to 42.0% for the rail operators.

From the transport users group, 95.0% of the road users respondents indicated that they “usually” or “always use” road transport. On the other hand 36.0% of the rail users indicated that they “usually” or “always use” rail transport.

(ii) Most used transport mode

In order to ascertain which mode of transport is usually used in Zambia, the questions “Which mode of transport do you think is best for you?” and “which mode of transport do you normally use?” were asked to transport users only. Figure 4-12 indicates that 56.5% of users think road transport is best for them while only 8.7% think rail is best for them. On which transport mode normally used, 73.9% of users say they use road transport with no one saying the normally use the road.

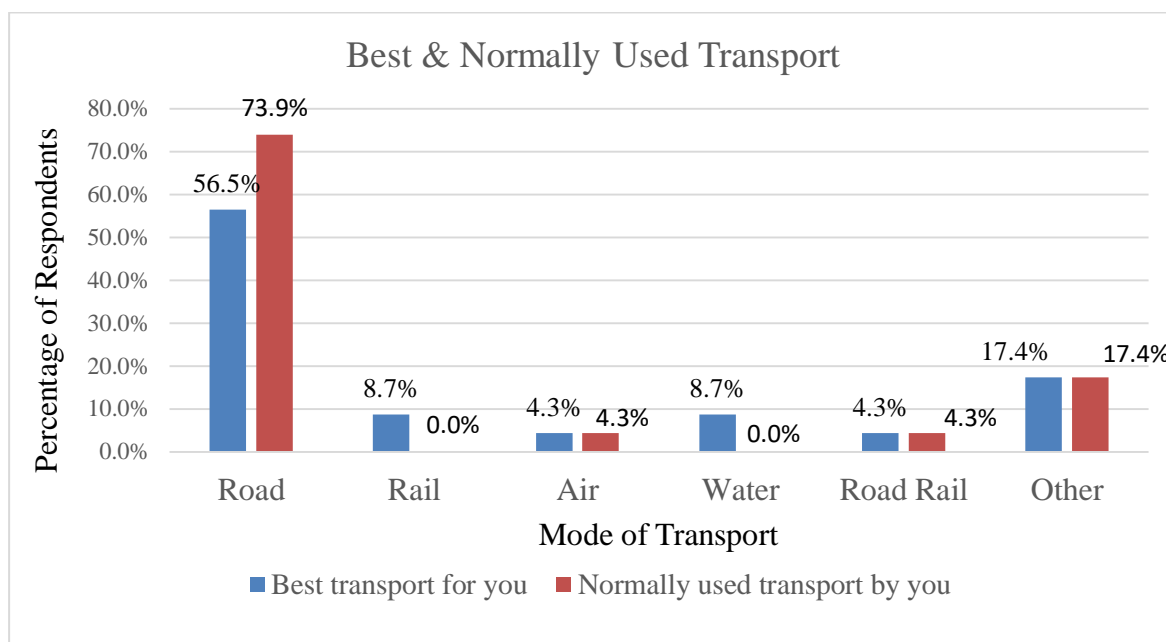


Figure 4-12 Transport users best and most used mode.

(iii) Causal factors for choice transport mode

In order to determine the reasons for which mode of transport is considered the best and usually used in Zambia, transport users were asked about their major consideration for choice of transport, how satisfied they were and how easy it was to access the transport mode they use. Figures 4-13 and 4-14 indicate that 47.8% of the users took cost as their major consideration for choice of transport, 17.4% each for accessibility and efficiency and only 4.4% considered safety first.

Over 52.2% indicated that they were very satisfied with their choice of transport, 21.7% were either satisfied with or barely accepted the services provided by their transporters.

On accessibility, 52.2% of the transport users indicated that they very easily access their transport mode, 26.1% easily access transport while 20.7% considered accessibility to their transport mode as manageable.

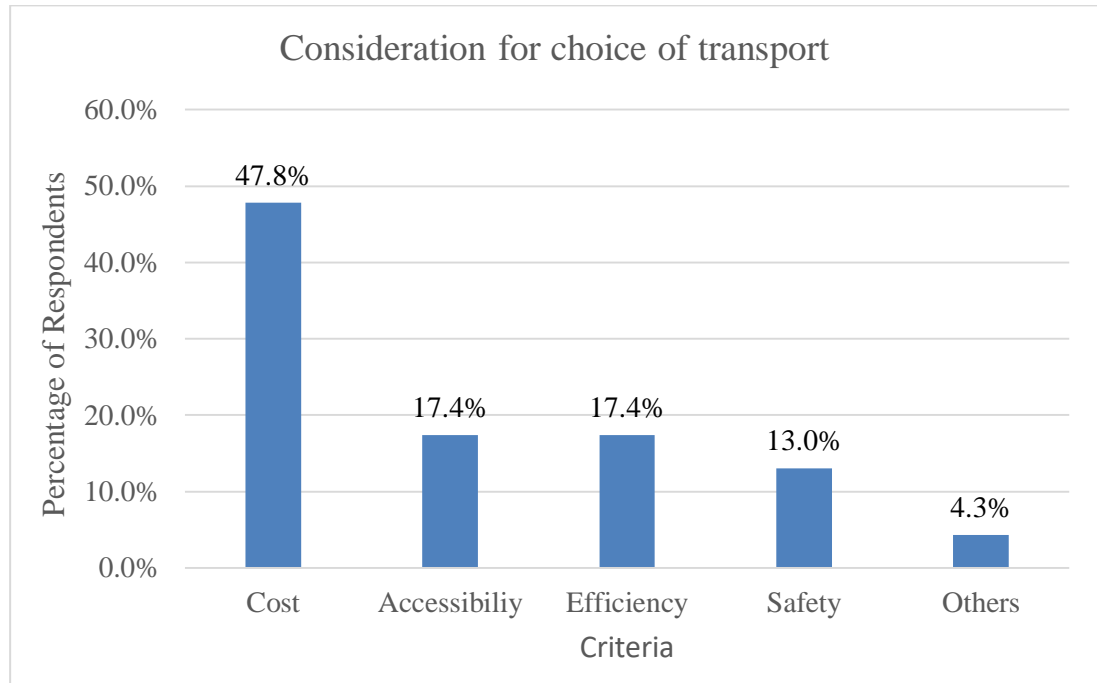


Figure 4-13 Transport users criteria for choosing transport.

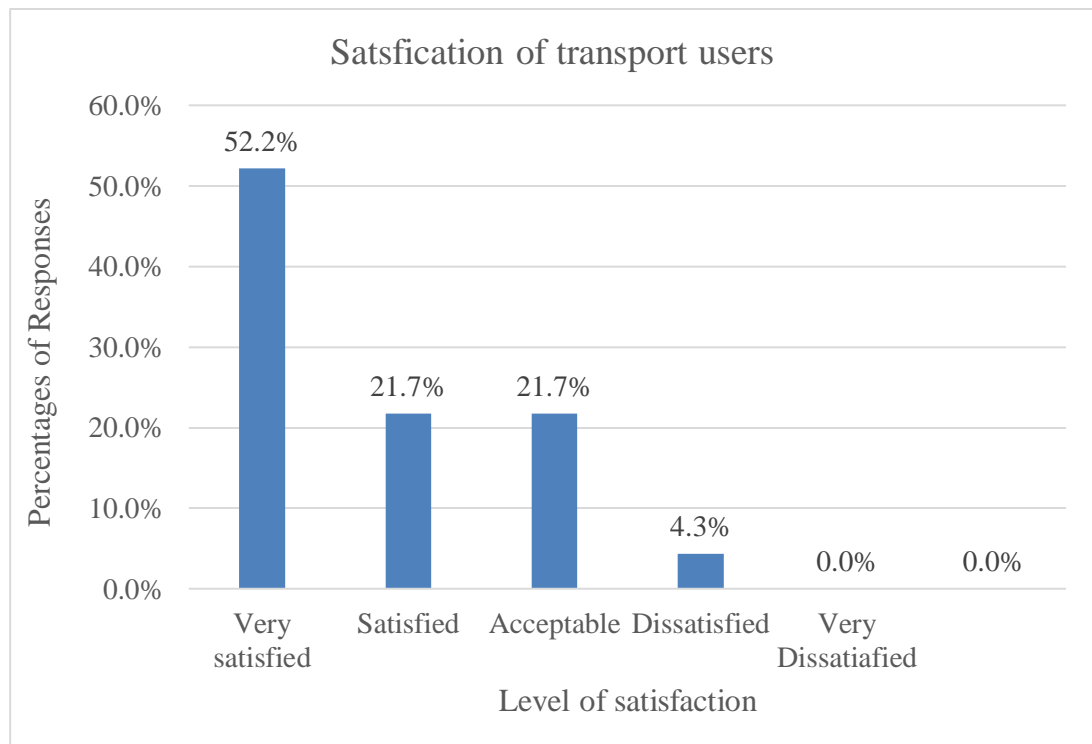


Figure 4-14 Transport users' level of satisfaction of transport mode used.

4.3.3 Accessibility of Transport in Zambia

All the respondents were asked whether they considered accessibility as a major factor in their choice of transport. As indicated in figure 4-15, only 17.7% did not consider accessibility as a major factor in the choice of transport mode.

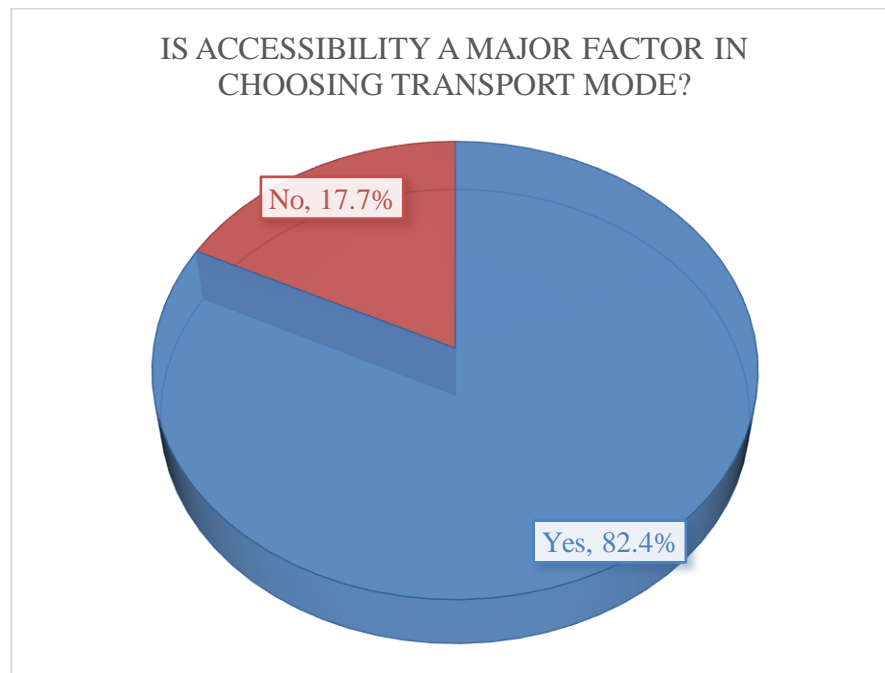


Figure 4-15 Response on whether accessibility is a major factor in the choice of transport mode.

(i) Factors affecting accessibility of transport in Zambia

To determine which factors the respondents considered in the determination of accessibility to transport in Zambia, they were asked to choose and rate the critical factors. The respondents indicated that “proximity to the loading and off-loading points was the most critical factor. Safety of goods was second while speed of delivery and cost came in third and fourth respectively. Figure 4-16 indicates the ranking of all the factors considered.

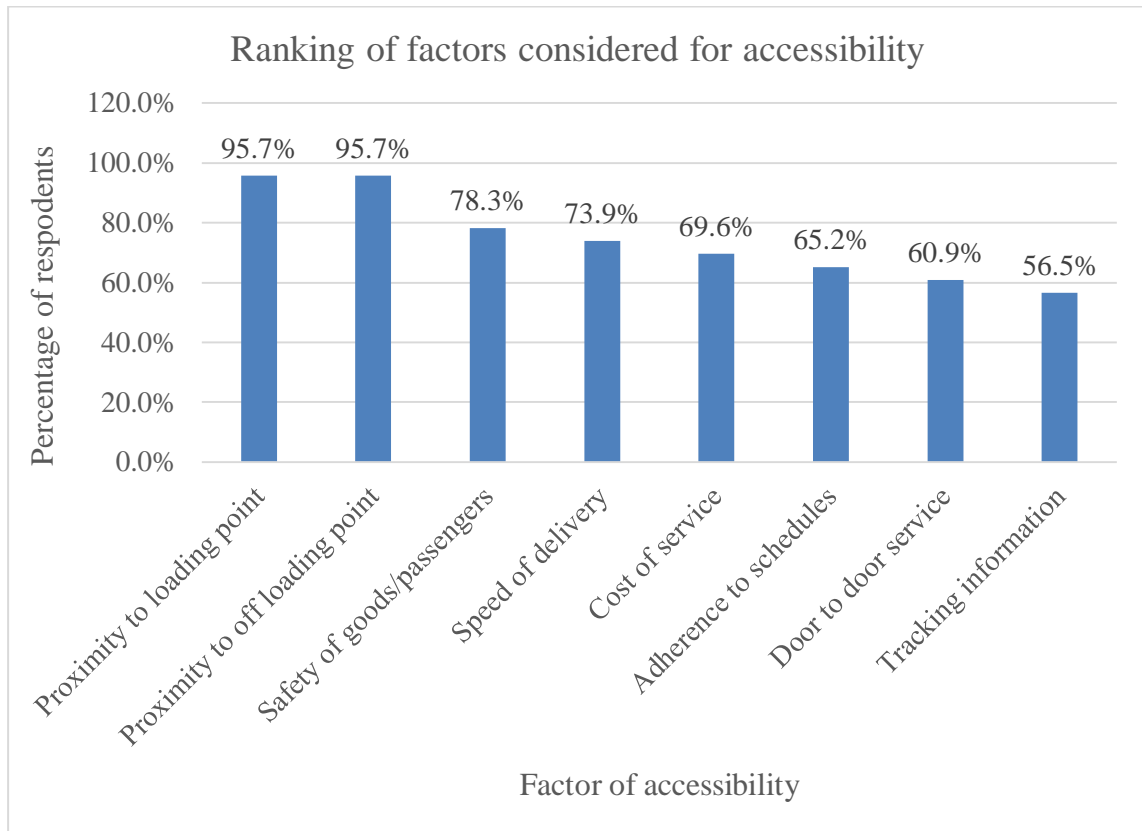


Figure 4-16 Ranking of major factors considered in determining accessibility of transport.

(ii) Grading of accessibility of transport in Zambia

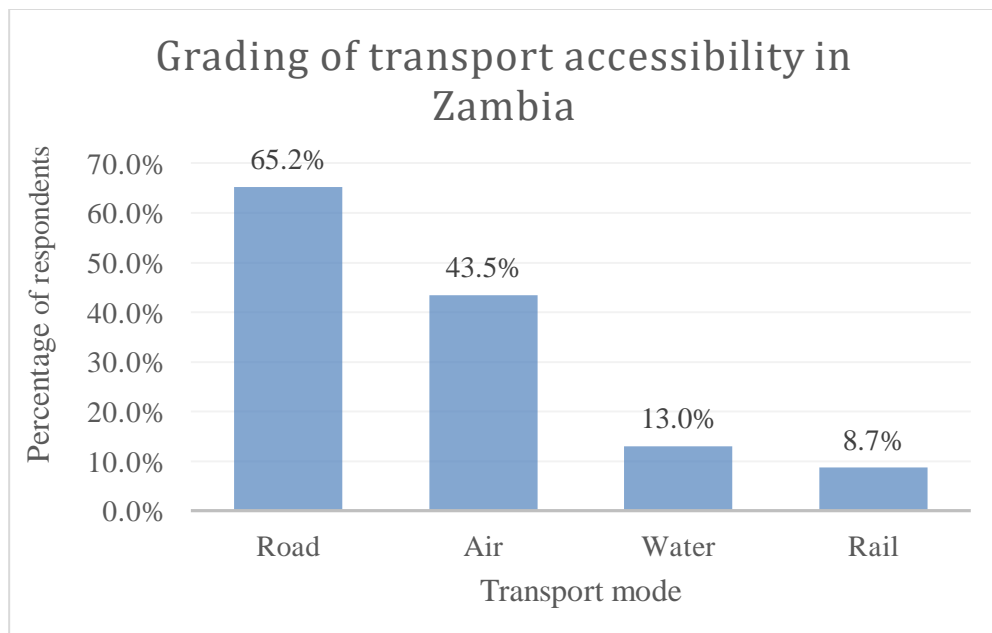


Figure 4-17 Ranking of accessibility of transport in Zambia.

4.3.4 General Perception on state of Rail Transport in Zambia

In addition to the explanations given to support responses on Likert scales, answers were obtained from respondents to the questions “State any other comment that you may have on the accessibility and usage of rail transport in Zambia” from all respondents. The answers obtained were grouped into eight (8) categories with results as shown below in Figure 4-18. The ninth category under other indicated what could be done to help improve the railways?

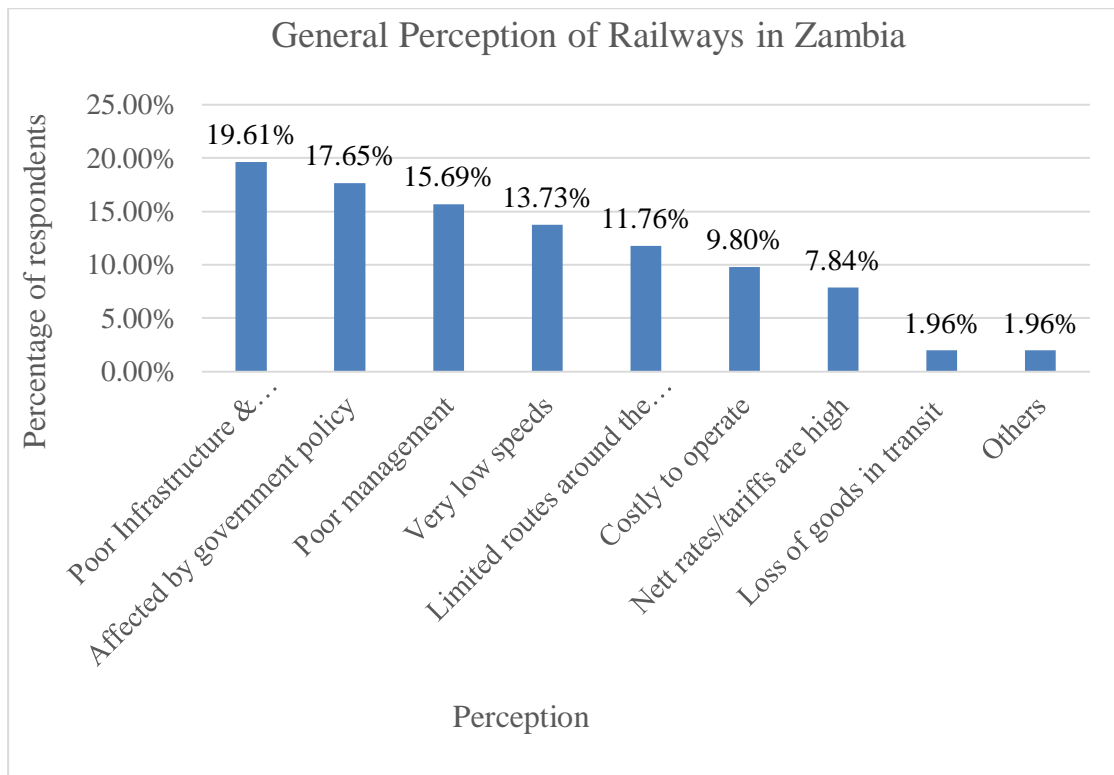


Figure 4-18 General perception of the railways in Zambia.

The general perception of the railways in Zambia is that it's performing below expectations due to a number of reasons. Poor infrastructure and equipment, government policies, poor management, very low train speeds and limited routes around the country and rank very high with 19.6%, 17, 6%, 15.7%, 13.7% and 11.8% of the respondents respectively stating so.

4.4 Conclusion from data analysis

The data obtained in this research are based on case studies conducted on ZRL and RDA where traffic moved by road and rail was obtained. It was also based on the personal views of respondents and on their perceptions, and not on any quantitative measures or its causes.

The results indicate that:

- The rail market share of the traffic moved by road and rail is only 8.0%.
- Road transport is the main competitor for railways.
- That in all categories of this traffic, the road moves more than that moved by rail.
- More than 50% of traditional rail traffic like metals, petroleum products and grain is being moved by road instead of the rail.
- Transport users consider cost, accessibility, efficiency and safety, in that order, as the main factors in their choice of transport.
- More than 80.0% of transport users think that accessibility is a major factor for choice of the mode of transport they use.
- Road is the most accessible mode of transport in Zambia followed by air, water and rail.
- The following, in order of ranking, are the factors which affect accessibility of transport;
 - Proximity to loading point;
 - Proximity to offloading point;
 - Speed of delivery of goods;
 - Cost of service;
 - Adherence to time schedules;
 - Door to door delivery; and
 - Tracking of movement of goods.
- The general perception on the causes of factors, in order of ranking, affecting poor position of rail transport in Zambia are:
 - Poor rail infrastructure and equipment;
 - Poor government rail policies;
 - Poor management of the railways;
 - Very low speeds resulting in long transit times;
 - Limited rail routes;

- Costly to operate especially in provision of and maintenance of rail infrastructure and equipment;
- Net cost of rail charges/fees are high; and
- Safety of goods in transit is very low.

Chapter Five: Discussion of results

5.1 Introduction

This section presents discussion of the findings as presented in line with the objectives of the study.

- To determine and analyse the comparative position of the railways with respect to road in Zambia.
- To analyse the factors affecting accessibility of the railway in the intermodal transport system in Zambia.
- To develop a framework that would improve accessibility and rail usage.

This section specifically discusses the first two specific objectives while the third one is dealt with under chapter six.

5.2 To determine and analyse the comparative position of the railways with respect to road in Zambia

The study revealed that the railways in Zambia have a very poor position in the transportation of goods. It was revealed in this study that the rail market share of the traffic moved by road and rail in 2015 was less than 10.0% as is indicated in figure 4.1 of section 4.2.1. This is due to steady decline in traffic moved by the railways and the findings are in line with the general performance in SADC and Zambia in particular (ZRL, 2014). This means that the rail has failed to recover from the general global decline of rail traffic which happened globally in the 1970s (Lan and Lin, 2006). Efforts to turn round the decline end up with plans which are not supported by improved investments in equipment and infrastructure. This is in line with what Olievschi (2013) observed. Whereas most developed and some developing countries recovered from this decline, Zambia has failed to do so. This is evident in the poor state of rail infrastructure and equipment currently being used by the railways in Zambia as can be seen in figure 4.18 of section 4.3.4

The study results, like Olievschi (2013) had concluded, also show that road transport is the main competitor for railways. The responses from respondents in the survey suggest that in all categories of this traffic, the road moves more than that moved by rail. For instance, tables 4.1 and 4.2 show that 6,190,768.40 tonnes moved by road in Zambia, whereas the railways moved a paltry 775,313.82 tonnes in 2015. This is in line with what Marinov (2013) reported.

The rail is also performing very badly in terms of the “traditional rail” (bulky and heavy) traffic. For example in the period under review more than 50.0% of bulk and heavy cargo like metals, petroleum products and grain was moved by road instead of the rail. This is indicated in figure 4.3 of section 4.2.3. When a vehicle travel on a road it causes some damage to the surface and advances the date at which the road needs to be repaired (Newbery, 2008). This explains why the roads in Zambia do not last as long as they are expected. For a well-designed road, its initial roughness will be low, and will steadily increase with the passage of traffic until, after a typically period of 10 – 20 years, it reaches a level at which major maintenance, such as an asphalt overlay, is required to restore the surface (Newbery, 2008). However, this is not the case in Zambia. Most roads do not last their full life span. The result is the major road maintenance we see in Zambia which in turn gobbles a lot of national resources which could have been channeled to other developmental projects. Further if the heavy and bulk traffic was being hauled by the rail, most of the road damage could have been avoided. The money being used on road maintenance could have been used elsewhere or at least in opening up new roads. This would have contributed to the realization of Zambia being a land linked and not land locked country.

5.3 To analyse the factors affecting accessibility of the railway in the intermodal transport system in Zambia

The results from respondents in the survey as presented in figure 4.15 of section 4.3.3.suggest that most transport users (80.0%), think that accessibility is a major factor for the choice of the mode of transport they use. Transport users consider cost, accessibility, efficiency and safety, in that order, as the main factors in their choice of transport. On accessibility, which is ranked second in the order of factors affecting the choice of transport, the respondents say that road is the most accessible mode of transport in Zambia followed by air, water and rail.

The results also indicated the following order of ranking as the factors which affect accessibility of transport: Proximity to loading point; Proximity to offloading point; Speed of delivery of goods; Cost of service; Adherence to time schedules; Door to door delivery; and Tracking of movement of goods. All these aspects are either non-existent on the Zambian railways system or are very poor. As a result, transport users find it difficult to

access railway facilities and instead opt to use the road. The railways should therefore improve the above needs of the transport users by attending to the root causes.

The general perception by the respondents on the causal factors of poor position of the rail transport in Zambia are in agreement with literature reviewed. The major ones ranking more than 10.0% in figure 4.18 are discussed below in order of ranking:

Poor rail infrastructure and equipment;

African governments have invested mainly in road infrastructure improvement, neglecting railways. The liberalization in road transport and the slow response of railways to adapt to the new market conditions resulted in dramatic traffic decline in rail transport. By 1990 most of the Sub-Saharan African railways were in virtual bankruptcy, requiring permanent cash injection and large investments in infrastructure and rolling stock (Olievschi, 2013). This general picture for SSA is typically the position prevailing in Zambia.

Poor government rail policies;

Government policies concerning the transport sector through infrastructure investment, pricing, fare controls, poor appointment of Board of Directors among others have not been favorable to the railways. Infrastructure development has been loop sided towards the roads. Many new roads have come up in the last five years in addition to the rehabilitation and normal maintenance. This has been fully financed by the government while nothing has gone into the railways. The government collects fuel levy from all including the railways whose proceeds are exclusively used for road provision. The government has failed to put in place adequate legislation to ensure that road damaging cargo are forced to use the rail. The appointment of board of director by the government is almost always based political affiliations and not professional qualification (Dessler, 2015). This in turn filters to the appointments of senior managers as well.

Poor management of the railways;

The political appointments are not only limited to the Board of Director but also to the chief executive officers and hence the executive management. Therefore most of the managers are not equipped with the business acumen that is necessary to run the railways efficiently

and competitively. The result of lack of investment has led to limited rail routes across the country. The only single lane line is concentrated along the “line of rail”. This has further resulted in the other causes. These include poor accessibility to the rail of very low speeds resulting in long transit times, costly to operate especially in provision of and maintenance of rail infrastructure and equipment, high net cost of rail charges/fees and poor safety of goods in transit.

Very low speeds;

Due to the very poor infrastructure and rolling stock, the average speed of freight trains in Zambia is extremely low. On the main railway, ZRL, the average speed is less than forty kilometers per hour (40 km/h). As a result of this it is not uncommon for cargo to take a month from the Zambian copper mines to the port of Durban where the road trucks take less than a week. The result is that transport users prefer the road to rail for transport services

Limited routes around the country;

The Zambian railway route has remained the same since its first construction in between 1903 and 1909. One important positive and strategic rail development was the construction of the TAZARA railway between Zambia and Tanzania. Apart from TAZARA which was initially politically driven, no other new railway lines have been developed. The impact of this is increased road usage with decline in rail traffic (Jorgensen, 2012). This is because a large part of the country is not serviced by rail and thus the railways cannot be accessed.

5.4 Summary

The chapter presented the data obtained from case study and questionnaire survey. The analysis revealed the position of the rail transport in Zambia which is very poor compared to the road. The analysis of the data also revealed which factors are significant causes of poor accessibility and usage of rail transport in Zambia. The results of this chapter were integrated in formulating a framework for improving the performance of the railways which is discussed in the following chapter.

Chapter six: Designing of a Framework

6.1 Introduction

In the previous chapter, data collected by use of a questionnaire survey were discussed. The comparative position of the railways in Zambia compared to the road and the various factors affecting the accessibility of railways were discussed based on the research findings and the reviewed literature. In this chapter, the framework for attracting bulky traffic to the rail is presented. One of the aims of the study was to develop a framework that would improve accessibility and usage of the rail. The design and explanation of the framework is also described.

6.2 Development of the framework

A framework usually denotes a structure, overview, outline, system or plan consisting of various descriptive categories, e.g. concepts, constructs or variables, and the relations between them that are presumed to account for a phenomenon (Sabatier, 2007). Frameworks do not provide explanations; they only describe empirical phenomena by fitting them into a set of categories (Frankfort-Nachmias and Nachmias, 1996).

Determining the operational framework involves task arrangement among units within the organization. Railway transport enterprise is capital intensive. It is, therefore, essential that care be taken in deciding which operational model/option to adopt. In this consideration, the dynamics of transport market is paramount. Operational model-choice must be such that it maintains 'cost-balance' both to the operator(s), on the one hand, and transport users/customers, on the other hand. The World Bank (1999) stated the need for transport to be cost-effective and continuously responsive to market dynamics; that liberation arising from regulatory reform forces transport supplies to respond to users' needs at lower costs. The commercialization of public firms (such as the Zambia railways) is necessary for economic and sustainability reasons. Private sector participation, therefore, becomes essential.

Development of the framework for attracting bulky and heavy traffic to the rail was done by taking into consideration the literature review, the results of the questionnaire survey and case study. Therefore it's aimed at addressing the causal factors established in this

research. Out of the eight factors established, only five main are considered in the framework. These are: Poor rail infrastructure and equipment; Poor government rail policies; Poor management of the railways; Limited rail routes; and Low safety of goods in transit. The framework presented in figure 6.1 comprises the elements that allocate responsibilities to the government and operators/companies for improved railway transport. It also states factors that enable identification and determination of which cargo is optimally conveyed by the rail. Considering the operational framework to adopt, in establishing transport mode is very important.

6.3 Explanation of the framework

There are two main tiers of the framework; Government level and Market and/or Customer level. The two levels allocate responsibilities to the state, railway operating companies and other stakeholders in order to attract traffic to the railways.

6.3.1 Government level

- **Transport policy:** The national transport policy should be such that it provides a level playing field for road and rail transportation by owning the rail infrastructure like it owns the road. The policy must spell out clear roles and responsibilities of all the stakeholders in the national transport setup and the strategy guiding implementation. Government's responsibility must not be relegated in the background. Use of private funds to improve the railways indispensable but better management of Public Private Partnership (PPPs) is critical to succeed.
- **Ownership:** Railway infrastructure, track, signalling and telecommunication, is very capital intensive in terms of provision and maintenance. It should therefore be the responsibility of the state to own and maintain all railway infrastructure and just charge access fee to the users just like it does to the road. This ownership by the state may be extended to rolling stock, locomotives, wagons and coaches in case of parastatal companies only. The government may not directly run the ownership but do it through a profit oriented agency.

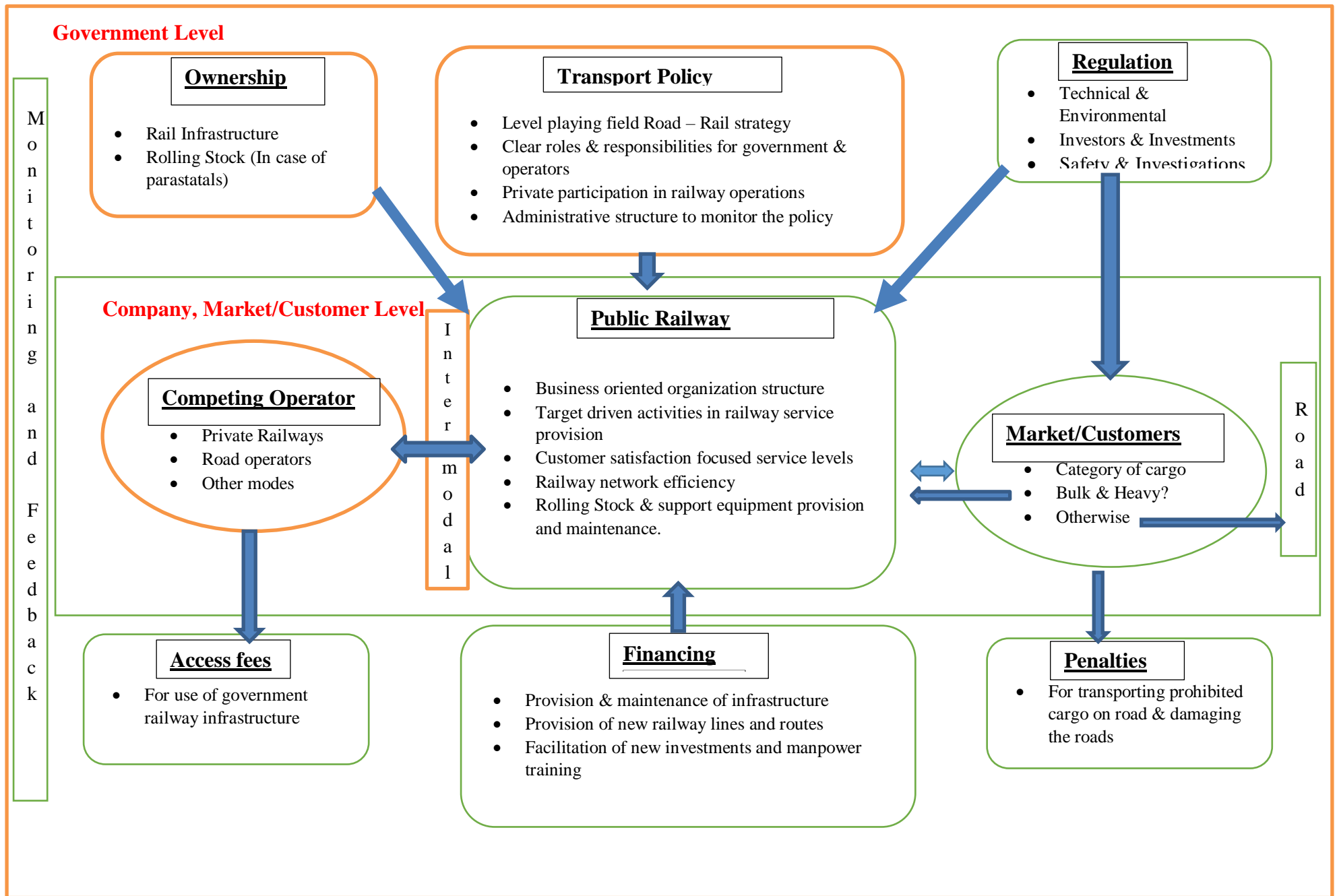


Figure 6.1: Framework for attracting bulk and heavy cargo to the rail.

- **Regulation:** Government policy should have a strong regulatory body/department for the railways. This body/office should take care of the monitoring of the management of the railways in terms of structures, economy, safety, technical and accident investigations amongst other systems of railway operations.
- **Financing:** The role of government should include the sourcing of funds for financing of provision and maintenance of infrastructure, coming up of new railway lines and new investments in the railway sector. This should also include manpower development.
- **Access fees:** The provision and maintenance of railway infrastructure by the state can be alleviated greatly with funds raised through access fees by all using the infrastructure. This entails that the government or its agent charges fees to all operators using the railway line and the funds so realised can be ploughed back into provision and maintenance of the infrastructure for the public railways. This infrastructure can in turn be used by private operators to earn more funds through access fees.
- **Penalties:** The policy must provide for penalties for all breaking law on access fees and bulk and heavy goods conveyance. Whereas the penalties should not be a source of funds, they should be punitive enough to deter offenders

6.3.2 Company and stakeholder level

- **Public railway companies:** Government owned railway companies must be business oriented and not as a political tool with very little emphasis on efficiency and customer satisfying service delivery.
- **Competing operators:** In addition to public railway companies, private railways are encouraged in addition to the road in order to promote competition and therefore improved performance. These competing transporters will enhance cooperation which would in turn lead to sustainable intermodal transportation.
- **Market/Customers:** The transport market should be guided by national transport policy on what category of goods is exclusive for each type of transport mode. The government regulatory framework should monitor and enforce this.

Chapter Seven: Recommendation and conclusion

7.1 Introduction

The main aim of this study was to conduct a comparative study of access to rail transport in Zambia and develop a framework that would improve accessibility and rail usage. The proposed framework is aimed at mitigating the causes of poor accessibility to railways as indicated in chapter six. They are reproduced below for easy following in the recommendations.

7.2 Factors affecting the poor performance of railways

This inquiry revealed that the causal factors affecting the poor performance of railways in Zambia are:

- a) Poor rail infrastructure and equipment;
- b) Poor government rail policies;
- c) Poor management of the railways;
- d) Very low speeds resulting in long transit times;
- e) Limited rail routes;
- f) Costly to operate especially in provision of and maintenance of rail infrastructure and equipment;
- g) Net cost of rail charges/fees are high; and
- h) Safety of goods in transit is very low.

Literature review on the hand brought to light the under listed factors as contributing to poor performance of railways in SSA. These are tightly related to the pattern of transport networks in the region and the structure of the economies. The railways operate in an unfriendly environment marked by:

- a) Obsolete, non-functional infrastructure;
- b) Reduced connectivity between the countries in the region;
- c) Very low traffic for the existing railway network;
- d) Unsatisfactory agreements for operating passenger transport services with negative impact on the financial stability of operators;

- e) Chronic lack of resources to finance the maintenance and rehabilitation of infrastructure inducing the vicious circle of continuous decrease of quality of services; and
- f) Lack of competitiveness compared to road transport.

7.3 Recommended approach for mitigating poor accessibility to railways

The main problem for the railways in Zambia is not being able to find more funds to finance the railways; the money is only an instrument to put in place a consistent program for the development of the railway transport as part of the coherent vision and strategy for the development of national and international routes. If a credible strategy exists, the money will easily be found. The running of railways should not be isolated or left to management for solving limited objectives. The government must be a greater part of a broader strategy for the development of the transport. The right questions for putting in place sustainable railways should be:

- a) How to enhance the governance capacity for managing the transport sector in general and the railways in particular?
- b) How to define and implement a long-term vision for the development of the railway system as part of the transport sector?

Developing a sustainable railway transport system in Zambia is not possible if the government is not effective in fulfilling its role. For instance, the country has limited experience in market-oriented economy; business management skills were not the main criterion for the selection of managers. The railway concession of Zambia railways in 2003 was an important step in the resolution of the governance weaknesses, the administration of the railway sector was transferred to the private sector. While this proved to be a good solution for operating transport services, the private sector could not replace governments in addressing the strategic issues of the railway sector. To overcome the problems of the railway sector in Zambia, the government has to rightfully play its role as policy makers, regulators, owners of transport infrastructure, and client of transport services. This requires strengthening the governance capacity, or the vicious circle will continue.

The government must develop long-term strategic plans for the rehabilitation and development of the railway infrastructure like they have done in the road sector. Considering the dilapidated status of railway infrastructure in Zambia, it is highly recommended to elaborate a comprehensive assessment of long-term needs for creating a reliable system, fully integrated in the national and regional transportation markets. Such an evaluation should be the basis for a long-term strategy (10-20 years), defining a vision about the envisaged role of the railways in the transportation system of the country. The long-term strategy for railway infrastructure should be developed in a harmonized approach with the road infrastructure strategy and should propose variants and priority lists of projects to be financed based on the available financial resources and on answers to the following questions:

- a) What will be the transportation needs of the country in the next 10-20 years, taking into consideration the predicted annual growth of GDP and considering that the transportation needs will increase at a higher percentage rate than the GDP?
- b) What is the transportation market share in the country targeted for the railways for the next 10-20 years, taking into consideration the economic criteria and environmental and social aspects such as climate change, mobility needs, trade and logistic chains, traffic safety, and land utilization?
- c) How much of the predicted transportation volumes in the next 10-20 years could be taken by the existing infrastructure? What additional capacities are potentially necessary?
- d) How should the low-density traffic lines necessary for economic and social reasons be financed?

Future concession or Public private partnerships (PPP) agreements must include, for the railway infrastructure given in operation to the concessionaire, clear and specific tasks compliant with the goals and modes of financing defined in the elaborated strategy. However, the state must remain involved in the ownership and financing of railway infrastructure. The state ownership of railway infrastructure will solve the conflict between the medium-term interest of private operators and the long-term interest of the governments. As owner of railway infrastructure the state will elaborate the long-term needs.

The government must develop unbiased policies for land transport. Government policies in transport must be restructured to become fully transparent and unbiased. Currently, road transport is treated favorably in that the infrastructure cost is covered by the government. The biased public financing of road infrastructure, the tax fraud by truck companies, the over-loaded trucks exceeding the legal weight restrictions, and the lack of safety standards on roads are factors generating distortions in the transport market and creating additional barriers to freight railway sector.

Putting the rail and road transportation on an equal footing will allow the users to make the right choice between the two modes for each expedition. The railway sector will stand no chance of attracting traffic from roads if the government will not put in place an equivalent regulatory framework. The clear rules of licensing for the truck companies, the technical requirements for a vehicle to operate transport services, the licensing of truck drivers, the strict rules regarding the allowed time of driving, the safety standards, the periodical technical revision of vehicles, and the fight against tax evasion and corruption in transport are the minimum rules to be put in place and strictly controlled for creating equal chances for road and rail transport.

Railways in Zambia suffer of obsolete rolling stock, but considering the market uncertainties, the financial risks of acquisition of new rolling stock fleet that is supposed to last 20 years is currently too high. Adopting a system of leasing or remanufacturing rolling stock rather than buy new ones and making room for higher contributions for rehabilitation of infrastructure. In this respect, the government need to mobilize political and commercial institutions to secure and demand higher investments from private operators.

Adequate legal framework must be put in place to secure long-term government financing of railway infrastructure in a similar approach as for road infrastructure. Creation of a railway fund, similar with the road fund, or replacing the road fund with a land transport infrastructure fund to be used by government for equally financing road and rail infrastructures could be considered. Fuel excise tax collected from road and rail fuel users (trucks and locomotives) could be used for feeding the land transport infrastructure fund unlike the current situation were only the road benefits.

The government could agree to adapt the legal framework to allow divesting assets from stranded railway assets to finance public financial obligations for railway infrastructure.

The railways still have huge real estate properties that could be turned, through long-term leases, into a source of finance funds to satisfy government investment obligations. All these sources would complement direct budgetary contributions.

The railways should revitalize the training schools necessary for railway specialties (engineers, technicians, signaling specialists, traffic managers, locomotive drivers, etc.). Currently, the Zambia railways face the serious issue of aging of the experienced labour force (average age 50+) jeopardizing the development of the railway industry. The new entrants (average <30) do not have adequate specialized knowledge and experience. If government/railway company alone does not have enough leverage to address this on its own, it could be sponsored by international donors like the World Bank.

Regulations

The management of the railway sector development should include planning activities and implementation of development programs. These activities could be accomplished by one or more entities charged by the government with precise responsibilities. Adequate structures must be created to define the railway development strategy as part of the national strategy for transport. It should enhance the current office of the government inspector of railways so that it's more responsive to the demands of the sector.

Economic regulation. The goal of this component of the regulatory body is to define the conditions for licensing an entity to provide railway transport services, to handle the licensing requests, to issue, monitor, amend, and decide on revocation/suspension of licenses. It can also receive and process complaints from the market, and monitor anti-competitive behavior conducting investigations when necessary. The economic regulation should be limited as much as possible, avoiding interference in the transport business.

Safety regulation. This is more what the current office of the government inspector of railways is doing. However it needs to be stepped up with more specialists. The scope of this component of the regulatory entity is vital for the development of the railway sector. It has to manage the technical performance and to ensure the safety of railway traffic. It will have to set up the safety objectives and standards, and will assess the safety management system of each railway operator licensed to operate railway activities. Safety certifications of processes and products will be issued by this entity as a condition for operating railway

activities. Audits and inspection activities are instruments this important component of the regulatory framework will use to achieve its role.

Technical standards. It is recommended to institute under the umbrella of the regulatory body, a Technical Committee of specialists selected from the existing railway operators and the government for building or maintaining infrastructure and rolling stock, major suppliers, and training providers. The role of the Technical Committee will be to ensure adherence to international standards and to agree upon common technical standards where there are no international standards applicable.

Accident investigation. This entity will be fully independent of any railway activity or any other regulatory structures, having the power to investigate without any prejudice the accidents in the railway sector. The main role is to investigate the causes of accidents without the attribution of blame, but to identify the recommended improvements to avoid similar events in the future. Obviously, this entity shall not replace any other legal authorities involved in the investigation of railway accidents.

7.4 Research conclusion

The research has shown that the position of the railways in Zambia transport is extremely bad. Rail transport is poorly used in Zambia. The railways market share of the traffic available to the road and rail is less than 10.0%. Bulk and heavy traffic which should traditionally be moved by the rail is being moved by road and this has in turn contributed to accelerated damage to the roads resulting in huge cost in form of maintenance. The rail is dogged by many accessibility/usage challenges ranging from poor infrastructure and equipment through poor management and unfavorable government policies. This poor position of the railways if not checked could adversely affect the economic development that the country recorded in the recent past. The railways could actually come to total collapse. This should be avoided at all cost as restarting a totally collapsed railway would be much more costly. A framework, in form of recommendations, aimed at mitigating the causal factors of the current position of the railways were drawn.

7.5 Future research

This research work can also be repeated on Tanzania Zambia Railways (TAZARA) and all other smaller railway companies in Zambia. A separate study could also be made on

passenger traffic as this has increased many folds in Zambia. Furthermore, although most developing countries have commonalities in the way they run affairs of their countries and therefore this Zambian case maybe generalized, it's important that more research could be done in other SADC countries to ascertain the general trend and learn from other countries which could have made improvements in their railway industry.

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APPENDICES

APPENDIX 1



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

Dear Sir/Madam,

Questionnaire Survey - The comparative study of access to railways in Zambia relative to road transport.

Rail transport plays a critical role in the development of any country. This is especially so for Zambia which is not only a developing country but also land locked. With its inherent advantage of being bulky carrier, safer and cheaper, rail transport is an important cog in intermodal transportation chain of goods and services. However, accessibility to the railway, amongst other factors plays a pivotal role in tapping into the economic advantages of rail transport.

It is with the above background that you are being requested to participate in a research project seeking to establish the economic impact of access to railways with respect to the road. I would greatly appreciate you taking time to provide the requested information in this questionnaire. Be assured that the information you will provide will not be identified with you personally

Please send the completed questionnaire to the undersigned or call so that it could be collected.

Thank you and we look forward to your assistance.

Fred Mwila

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APPENDIX 2



THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Interview questionnaire for companies

**THE COMPARATIVE STUDY OF ACCESS TO RAILWAYS IN ZAMBIA
RELATIVE TO ROAD TRANSPORT**

1.0 General Information: Interviewee and Company details.

1.1 YOUR POSITION IN THE COMPANY

1.2 FOR HOW LONG HAS THE COMPANY EXISTED?

1.3 WHAT IS YOUR COMPANY MAIN BUSINESS?

1.4 WHAT BUSINESS IN TRANSPORTATION IS YOUR ORGANISATION INVOLVED IN? (Please Cross)

1.4.1 Transporter

1.4.2 Client Of Transporter

1.4.3 Other _____

1.5 IF THE ANSWER TO 1.4 IS TRANSPORTER, WHAT DOES YOUR COMPANY'S USUALLY TRANSPORT?

1.5.1 Passengers

1.5.2 Cargo

1.5.3 Both

1.6 WHAT VOLUMES DO YOU MOVE PER YEAR?

1.6.1 Passenger _____

1.6.2 Cargo _____

1.7 DO YOU THINK YOU HAVE A FAIR SHARE OF THE MARKET?

1.7.1 Yes

1.7.2 No

1.8 IF THE ANSWER TO 1.6 IS NO, IN YOUR OPINION WHAT PERCENTAGE OF YOUR MARKET SHARE ARE YOU MOVING?

1.8.1 Less than 15%

1.8.2 15% to 30%

1.8.3 31% to 45%

1.8.4 46% to 60%

1.8.5 More than 60%

1.9 WHAT ARE THE MAJOR REASONS FOR THIS PERFORMANCE?

1.10 WHICH MODES OF TRANSPORT ARE YOUR MAJOR COMPETITORS? _____

1.11 WHAT ADVANTAGE DO YOUR COMPETITORS HAVE OVER YOU?

1.12 WHAT SHOULD BE DONE TO IMPROVE YOUR COMPETITIVE POSITION? _____

1.13 HOW EASY IS IT TO ACCESS YOUR SERVICES?

1.13.1 Very Easy

1.13.2 Easy

1.13.3 Difficulty

1.13.4 Very Difficulty

1.14 IF THE ANSWER TO 1.13 IS “Difficulty” or “Very Difficulty”, WHY?

1.15 WHAT CAN BE DONE TO MAKE ACCESSIBILITY EASIER?

1.16 WHAT PRODUCT OR SERVICE DOES YOUR COMPANY'S PRODUCE FOR TRANSPORTATION?

1.17 WHAT IS YOUR ANNUAL OUTPUT OF THE PRODUCT/SERVICE? PLEASE INDICATE WHETHER TONS OR PASSNGERS

1.17.1 < 100,000_____

1.17.2 100,000 – 250,000_____

1.17.3 250,000 – 500,000_____

1.17.4 500,000 – 750,000_____

1.17.5 750,000 – 1,000,000_____

1.17.6 > 100,000_____

1.18 HOW MUCH OF THE ABOVE IS TRANSPORTED BY RAIL

1.18.1 Less than 15%

1.18.2 15% to 30%

1.18.3 31% to 45%

1.18.4 46% to 60%

1.18.5 More than 60%

1.19 WHAT ARE THE MAJOR REASONS FOR YOUR ANSWER IN 1.18 ABOVE? _____

1.20 WHAT ALTERNATIVE MODE OF TRANSPORT IS MOVING THE OTHER PORTION OF YOUR PRODUCT/SERVICE?

1.21 WHICH MODE OF TRANSPORT SERVES YOU BETTER?

1.21.1 Rail

1.21.2 Road

1.21.3 Air

1.21.4 Water

1.21.5 Other Mode

1.22 DOES YPUR CHOICE OF TRANSPORT AFFECT THE PROFITABILITY OF YOUR COMPANY?

1.22.1 Yes

1.22.2 No

1.23 IF THE ANSWER TO 1.24 ABOVE IS YES, PLEASE EXPLAIN HOW?

1.24 ACCORDING TO YOU, WHAT IS THE PONTENTIAL OF RAIL TRANSPORT IN ZAMBIA?

1.25 IS THIS POTENTIAL BEING UTILISED?

1.26 WHAT CAN BE DONE TO FULLY HARNESS THE PONTENTIAL OF RAIL TRANSPORT IN ZAMBIA?

1.27 WHAT ADVANTAGES HAS RAIL TRANSPORT COMPARED TO OTHER MODES OF TRANSPORT?

1.28 IS ACCESSIBILITY TO THE MODE OF TRANSPORT A MAJOR FACTOR IN YOUR CHOICE OF TRANSPORT?

1.28.1 Yes

1.28.2 No

1.29 WHAT CAN BE DONE TO IMPROVE ACCESSIBILITY TO RAIL TRANSPORT? _____

1.30 DO YOU HAVE ANY OTHER COMMENTS ON THE ACCESSIBILITY AND USAGE OF RAIL TRANSPORT IN ZAMBIA.

THIS IS WHERE WE END AND THANK YOU FOR YOUR TIME.

APPENDIX 3



THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Questionnaire – for Transport Users

THE COMPARATIVE STUDY OF ACCESS TO RAILWAYS IN ZAMBIA RELATIVE TO ROAD TRANSPORT

1.0 General Information: This section is designed to obtain general information.

1.1. WHAT TRANSPORT SERVICE DO YOU USE?

- A. Passenger
- B. Freight
- C. Both

1.2. WHAT MODE OF TRANSPORTATION IS YOUR ORGANISATION INVOLVE
IN?

- A. Railway Transport
- B. Road Transport
- C. Both
- D. Other please specify _____

1.3. WHAT IS THE SECTOR TYPE YOU WORK FOR?

- A. Public
- B. Private
- C. Both

1.4. HOW LONG HAVE YOU BEEN DEALING WITH TRANSPORTATION?

- A. <5 years
- B. 5-10 years
- C. 10-15 years
- D. >15 years

1.5. WHAT TONNAGE OF FREIGHT DO YOU MOVE PER PERIOD GIVEN BELOW? PLEASE INDICATE IN THE SPACE PROVIDED BUT WITHIN GIVEN LIMITS.

	TONNAGE	PER MONTH	PER 6 MONTHS	PER YEAR
A	< 100,000			
B	100,000 – 250,000			
C	250,000 – 500,000			
D	500,000 – 750,000			
E	750,000 – 1,000,000			
F	> 100,000			

1.6. WHAT NUMBER OF PASSENGERS DO YOU MOVE PER PERIOD GIVEN BELOW? PLEASE INDICATE IN THE SPACE PROVIDED BUT WITHIN GIVEN LIMITS.

	TONNAGE	PER MONTH	PER 6 MONTHS	PER YEAR
A	< 100,000			
B	100,000 – 250,000			
C	250,000 – 500,000			
D	500,000 – 750,000			
E	750,000 – 1,000,000			
F	> 100,000			

2. Transport Mode Preferences and Accessibility

2.1. RATE YOUR PREFERENCE OF TRANSPORT MODE ON A LIKERT SCALE OF 1=NEVER USES, 2=RARELY, 3=SOMETIMES, 4=USUALLY AND 5=ALWAYS USES.

MODE	1	2	3	4	5
Road					
Rail					
Air					
Water					
Other, Specify					

2.2. WHICH MODE OF TRANSPORT DO YOU THINK IS THE BEST FOR YOU?

- A. Road
- B. Rail
- C. Air
- D. Water
- E. Other please specify _____

2.3. WHICH MODE OF TRANSPORT DO YOU NORMALLY USE?

- A. Road
- B. Rail
- C. Air
- D. Water
- E. Other please specify _____

2.4. WHAT IS YOUR MAJOR CONSIDERATION FOR CHOOSING WHICH MODE OF TRANSPORT TO USE?

- A. Cost
- B. Safety
- C. Accessibility
- D. Efficiency
- E. Other please specify _____

2.5. HOW SATISFIED ARE YOU WITH THE SERVICE DELIVERY OF THE TRANSPORT MODE YOU USE?

- A. Very Satisfied
- B. Satisfied
- C. Acceptable
- D. Dissatisfied
- E. Very dissatisfied

2.6. HOW EASY IS IT TO ACCESS THE TRANSPORT MODE YOU USE?

- A. Very easy
- B. Easy
- C. Manageable
- D. Difficult
- E. Very difficult

2.7. IS ACCESSIBILITY A MAJOR FACTOR IN YOUR CHOICE OF TRANSPORT MODE?

- A. Yes
- B. No

2.8. WHAT FACTORS DO YOU CONSIDER IN DETERMINING ACCESSIBILITY TO TRANSPORT? PLEASE INDICATE ON A LIKERT SCALE OF 1=VERY RARELY, 2=RARELY, 3=MODERATELY, 4= HIGHLY AND 5 VERY IMPORTANT.

	1	2	3	4	5
Proximity to loading point					
Proximity to off-loading point					
Cost of service (Rate/ Fares)					
Safety of goods / passengers					
Speed of delivery					
Door to door service					
Adherence to schedules					
Tracking information					
Any other. Please specify _____					

2.9. HOW DO YOU GRADE THE ACCESSIBILITY OF TRANSPORT MODES IN ZAMBIA? PLEASE INDICATE ON A LIKERT SCALE OF 1= very bad, 2=bad, 3=acceptable, 4=good and 5=very good

	1	2	3	4	5
A Road					
B Rail					
C Air					
D Water					
E Other _____					

3. Rail Transport

3.1. ON A FIVE POINT LICKERT SCALE OF 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = NOT SURE, 4 = AGREE AND 5 = STROGLY, HOW WOULD YOU RATE THE FOLLOWING STATEMENTS ABOUT THE RAIL IN ZAMBIA?

Statement	1	2	3	4	5
Railway transport is important for the development of the country					
Railway transport is well positioned in the Zambian transport sector					
You transport is widely used in Zambia					
It is very easy to use railway transport in Zambia					
You only use railway transport as a last resort					
It is not easy to access rail transport in Zambia					
Railway transport is very expensive to use in Zambia					
The service delivery by the railways in Zambia is very poor.					
The overall performance of the railways in Zambia is acceptable					

4. Economic Impact of Rail Transport

4.1. ON A FIVE POINT LICKERT SCALE OF 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = NOT SURE, 4 = AGREE AND 5 = STROGLY, HOW WOULD YOU RATE THE FOLLOWING STATEMENTS ABOUT THE RAIL IN ZAMBIA?

Statement	1	2	3	4	5
The railways in Zambia is moving its fair share of bulk traffic					
The use of Railway transport makes your operations more efficient					
It is profitable to use railway transport in Zambia					
You always use rail transport for your bulk international traffic					
It is easier for you to clear international rail traffic at the border than when you use other modes of transport					
You usually suffer losses when you use rail traffic in Zambia					
Heavy goods carrying vehicles are highly contributing to the faster deterioration of roads in Zambian					
Railway transport is positively contributing to National development in Zambia.					

5. Other comments?

5.1. STATE ANY OTHER COMMENTS THAT YOU MAY HAVE ON THE ACCESSIBILITY AND USAGE OF RAIL TRANSPORT IN ZAMBIA.

This is the end and thank you for your time.

APPENDIX 4



THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Questionnaire – for Transport Operators

THE COMPARATIVE STUDY OF ACCESS TO RAILWAYS IN ZAMBIA RELATIVE TO ROAD TRANSPORT

1.0 General Information: This section is designed to obtain general information.

1.1 WHAT TRANSPORT SERVICE DO YOU OFFER?

- A. Passenger
- B. Freight
- C. Both

1.2 WHAT BUSINESS IN TRANSPORTATION IS YOUR ORGANISATION INVOLVED IN?

- E. Railway Transporter
- F. Road Transporter
- G. Contractor of both Rail and Road Transporter
- H. Other please specify _____

1.3 WHAT IS THE SECTOR TYPE YOU WORK FOR?

- D. Public
- E. Private
- F. Both

1.4 FOR HOW LONG HAVE YOU BEEN IN TRANSPORTATION?

- A. <5 years
- B. 5-10 years
- C. 10-15 years
- D. >15 years

1.5 WHAT TONNAGE OF FREIGHT DO YOU MOVE PER PERIOD SPECIFIED BELOW? PLEASE INDICATE IN THE SPACE PROVIDED BUT WITHIN GIVEN LIMITS.

	TONNAGE	PER MONTH	PER 6 MONTHS	PER YEAR
A	< 100,000			
B	100,000 – 250,000			
C	250,000 – 500,000			
D	500,000 – 750,000			
E	750,000 – 1,000,000			
F	> 100,000			

1.6 WHAT NUMBER OF PASSENGERS DO YOU MOVE PER PERIOD SPECIFIED BELOW? PLEASE INDICATE IN THE SPACE PROVIDED BUT WITHIN GIVEN LIMITS.

	TONNAGE	PER MONTH	PER 6 MONTHS	PER YEAR
A	< 100,000			
B	100,000 – 250,000			
C	250,000 – 500,000			
D	500,000 – 750,000			
E	750,000 – 1,000,000			
F	> 100,000			

2.0 Your Transport Mode Accessibility

2.0 HOW WOULD YOU RATE YOUR TRNSPORT MODE IN TERMS OF CUSTOMER PREFERENCE ON A LIKERT SCALE OF 1=VERY BAD, 2=BAD, 3=AVERAGE, 4=GOOD AND 5=VERY GOOD? PLEASE INDICATE AGAINST YOUR TRANSPORT MODE.

	1	2	3	4	5
Road					
Rail					
Air					
Other, Please specify _____					

2.1 WHICH MODE OF TRANSPORT DO YOU THINK IS THE BEST IN ZAMBIA?

- A. Road
- B. Rail
- C. Air
- D. Water
- E. Other please specify _____

2.2 HOW SATISFIED ARE YOU WITH YOUR LEVEL OF SERVICE DELIVERY TO YOUR CUSTOMERS? PLEASE INDICATE AGAINST YOUR TRANSPORT MODE ON A LIKERT SCALE OF 1=VERY DISSATISFIED, 2=DISSATISFIED, 3=MODERATE, 4=SATISFIED, 5=VERY SATISFIED.

	1	2	3	4	5
Road					
Rail					
Air					
Other, Please specify _____					

2.3 HOW EASY IS IT TO ACCESS YOUR TRANSPORT MODE BY THE USERS?

- A. Very easy
- B. Easy
- C. Manageable
- D. Difficult
- E. Very difficult

2.4 DO YOU THINK ACCESSIBILITY PLAYS A MAJOR FACTOR IN YOUR CUSTOMERS' CHOICE OF TRANSPORT MODE?

- A. Yes
- B. No

2.5 HOW DO YOU GRADE THE ACCESSIBILITY OF YOUR TRANSPORT? PLEASE GIVE REASONS FOR YOUR ANSWER IN THE SPECIFIED SPACE

Your Transport Mode	Very Bad	Bad	Fair	Good	Very Good

Reasons: _____

3.0 Economic Impact

3.1 GRADE YOUR TRANSPORT MODE IN ZAMBIA ON THE INDICATED ASPECTS ON A LIKERT SCALE OF 1=VERY UNACCEPTABLE, 2=UNACCEPTABLE, 3=AVERAGE, 4=ACCEPTABLE AND 5= VERY ACCEPTABLE. EXPLAIN ON SPACE PROVIDED UNDER EACH ASPECT

	ASPECT	1	2	3	4	5
3.1.1	The amount of traffic you are moving					
	Explain:					
3.1.2	Your Market Share					
	Explain:					
3.1.3	The level of international traffic you move					
	Explain:					
3.1.4	Speed of movements of goods / passengers					
	Explain:					
3.1.5	Cost of operations (provision of the service)					
	Explain:					
3.1.6	Tariffs / Fares charged to customers					
	Explain:					
3.1.7	Level of tariffs / fares in Foreign exchange					
	Explain:					
3.1.8	Rate at which the traffic is cleared at the borders					
	Explain:					
3.1.9	Accidents and loss of customer goods					
	Explain:					
3.1.10	Level of vandalism					
	Explain:					

3.2 DO POLICY DECISIONS AFFECT YOUR BUSINESS?

- 3.2.1 Never
- 3.2.2 Rarely
- 3.2.3 Sometimes
- 3.2.4 Regularly
- 3.2.5 Always

3.3 PLEASE EXPLAIN YOUR ANSWER IN 3.2 ABOVE

4 Other comments?

4.1 STATE ANY OTHER COMMENTS THAT YOU MAY HAVE ON THE
ACCESSIBILITY AND USAGE OF RAIL TRANSPORT IN ZAMBIA.

This is the end and thank you for your time.