The impact of the moratorium on the regulation governing vehicle height restriction: A South African high cube container case

by

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Declaration

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Abstract

South Africa's export industry is reliant on deep-sea shipping. Over the past twenty years, there has been a shift in the global shipping industry, resulting in a move away from the standard general purpose and refrigerated 12-metre container to high cube containers that have an external height of 2.896-metres. Subsequently, there has been an increase in the number of container shipments worldwide and South Africa has joined this contagion. The majority of the fruit that is cultivated in South Africa is exported to international markets via refrigerated containers and more specifically the 40-foot high cube container.

Regulation 224 (b) of the National Road Traffic Act of 1996 legislates that the maximum legal height limit for vehicles without an abnormal permit in South Africa is 4.3-metres. The regulations provide that any vehicle, other than double-deck busses, may not exceed an overall height limit, including load projections of 4.3-metres. Since 2009, there has been an increase in the number of high cube containers in use. With a 2.9-metre container on a flat deck trailer standing at 1.60-metre deck height, it results in an overall height of 4.5 metres, thus exceeding the legislative limit of 4.3-metres. In 2009, the Road Traffic Inspectors in KwaZulu-Natal identified that High Cube ISO Containers, being transported on a normal road transport trailer, exceeded the legislated limit of 4.3m by approximately 0.2m to 0.3m. In 2011, a moratorium, which for a period of seven years, exempted the operation of a motor vehicle transporting an ISO container from complying with the provision of regulation 224 (b) was implemented.

The main research objectives of this study are as follows; firstly, to research and understand the process of impact analysis in freight regulation by providing an understanding of the extent of the impact and to research the stakeholder analysis process and provide an overview of the stakeholders. Secondly, to identify the consequences that the various industries will encounter if the legislation is not amended by determining whether there will be an effect on industry's productivity and on the efficiency of operations within industry. Thirdly, to identify what international best practices could be implemented to ensure road users' safety and increase the growth of the economy. Lastly, to gather the necessary data, analyse the data, and provide a conclusion on the likely impact should the legislation not be amended.

The study was explorative in nature and a purposive form of non-probability sampling was used to select the sample units. Two hundred and forty-seven (247) stakeholders were included in the sample, but the response rate was 77 stakeholders. The researcher contacted the stakeholders via telephone, email and by sending out a survey to obtain more insight into the moratorium and the regulation governing vehicle height restriction. The

researcher used the internet to investigate websites, annual reports, academic publications and articles. After collecting the data, the researcher combined the individual responses into the stakeholder groups in Excel, after which, the researcher analysed the data using the AHP method to conduct an impact analysis on the findings.

The AHP method allowed the researcher to determine a score of how 'valuable' the choices are and how the decision maker 'feels' about the choices. The researcher identified two impacts, namely: a financial impact and a transportation risk. The data analysis identified that there would be a negative financial impact on the South African economy if the regulation remains under the status quo. Many of the stakeholders are concerned about the financial impact and the preferred height choice of between 4.3m and 4.6m as many transporters are operating at a height of 4.5m.

South Africa's government needs to consider the views of all stakeholders involved in the regulation governing vehicle height restriction and the transportation of high cube containers. The main findings of the study have concluded that there is a greater financial impact on the economy. Although, government has stated its claims, there have not been any recorded accidents or incidents related to the height of high cube containers.

Keywords: Department of Transport; high cube containers; regulation; moratorium; legislation; height limit; height restriction; containers; fruit industry; shipping industry

Opsomming

Die uitvoerbedryf in Suid-Afrika maak staat op diepsee-skeepvaart. Gedurende die afgelope twintig jaar was daar 'n verskuiwing in die wêreldwye skeepsbedryf, wat gelei het tot 'n skuif weg van die standaard algemene doel en verkoelde 12-meter-houer na hoër volume vraghouers ("*high cube containers*") met 'n buitehoogte van 2.896 meter. Verder was daar 'n wêreldwye toename in die aantal vraghouers versend en Suid-Afrika het by hierdie tendens aangesluit. Die meerderheid van die vrugte wat in Suid-Afrika verbou word, word via koelhouers en meer spesifiek die 40 voet hoër volume vraghouers na internasionale markte uitgevoer.

Regulasie 224 (b) van die Nasionale Padverkeerswet van 1996 bepaal dat die maksimum wettige hoogtelimiet vir voertuie sonder 'n abnormale permit in Suid-Afrika 4.3-meter is. Die regulasies bepaal dat enige voertuig, uitgesluit dubbeldekkerbusse, nie 'n algehele hoogtelimiet mag oorskry nie, met inbegrip van vragprojeksies van 4.3-meter. Sedert 2009 was daar 'n toename in die aantal hoër volume houers wat gebruik word. Met 'n houer van 2.9 meter op 'n platdekwa wat op 'n dekhoogte van 1.60-meter staan, lei dit tot 'n totale hoogte van 4.5-meter, wat die wetlike limiet van 4.3-meter oorskry. In 2009 het padverkeersinspekteurs in KwaZulu-Natal geïdentifiseer dat hoër volume ISO vraghouers, wat op 'n normale padvervoer sleepwa vervoer word, die wetlike perk van 4.3m met ongeveer 0.2m tot 0.3m oorskry. In 2011 is 'n moratorium ingestel, wat die werking van 'n motorvoertuig wat 'n ISO-houer vervoer vir 'n periode van sewe jaar, vrystel om aan die vereistes van regulasie 224 (b) te voldoen.

Die hoof navorsingsdoelwitte van hierdie studie is soos volg: Eerstens, om die proses van impakanalise in vragregulering na te vors en te verstaan deur 'n begrip te gee van die omvang van die impak, en om die proses van belanghebbendes te ontleed en 'n oorsig te gee van die belanghebbendes. Tweedens, om die gevolge te identifiseer wat die verskillende bedrywe sal moet dra indien die wetgewing nie gewysig word nie, deur te bepaal of dit 'n invloed op die produktiwiteit van die vrugte-uitvoerbedryf en die doeltreffendheid van hulle bedrywighede sal hê. Derdens, om vas te stel watter internasionale beste praktyke geïmplementeer kan word om die veiligheid van padgebruikers te verseker en die vrugte industrie se bydrae tot die ekonomie te verhoog. Laastens, om die nodige data in te samel en te ontleed, en 'n gevolgtrekking te maak oor die waarskynlike impak indien die wetgewing nie gewysig sou word nie.

Die studie was verkennend van aard en 'n doelgerigte vorm van nie-waarskynlikheids steekproefneming is gebruik om die steekproefeenhede te selekteer. Tweehonderd sewe-en-veertig (247) belanghebbendes is by die steekproef ingesluit, maar die

responspersentasie was 77 belanghebbendes. Die navorser het die belanghebbendes per telefoon en/of e-pos gekontak, en 'n opname gestuur om meer insig te verkry in die moratorium en die regulasie wat voertuighoogtes beperk. Die navorser het die internet gebruik om webwerwe, jaarverslae, akademiese publikasies en artikels te ondersoek. Nadat die data versamel is, het die navorser die individuele response vir die belangegroepe in Excel gekombineer, waarna die navorser die data met behulp van die AHP-metode ontleed het om 'n impakanalise op die bevindings uit te voer.

Die AHP-metode het die navorser toegelaat om 'n waarde te bepaal van hoe 'waardevol' die keuses is en hoe die besluitnemer 'voel' oor die keuses. Die navorser het twee impakte geïdentifiseer, naamlik: 'n finansiële impak en 'n vervoerrisiko. Die data-ontleding het geïdentifiseer dat daar 'n negatiewe finansiële impak op die Suid-Afrikaanse ekonomie sou wees as die regulasie die huidige status behou. Baie van die belanghebbendes is bekommerd oor die finansiële impak en die voorkeurhoogte keuse van tussen 4,3m en 4,6m is bepaal, aangesien baie vervoerders op 'n hoogte van 4,5m werk.

Die regering van Suid-Afrika behoort die siening van alle belanghebbendes wat betrokke is by die regulasie rakende die beperking van voertuighoogte en die vervoer van houers met 'n hoër volume te oorweeg. Die bevindinge van die studie het tot die gevolgtrekking gekom dat daar 'n groter finansiële impak op die ekonomie is. Alhoewel die regering sy bewerings uitgespreek het, was daar nog geen aangetekende ongelukke of voorvalle wat verband hou met die hoogte van die houers met 'n hoër volume nie.

Sleutelwoorde: Departement van Vervoer; hoër volume vraghouers*; regulasie; moratorium; wetgewing; hoogtelimiet; hoogtebeperking; houers; vrugtebedryf; skeepsbedryf*

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Acronyms and abbreviations

AHP:	Analytic Hierarchy Process
CBA:	Cost-Benefit Analysis
CBR:	Case-Based Reasoning
CEA:	Cost-Effectiveness Analysis
CGA:	Citrus Growers Association
CIMC:	China International Maritime Containers Group Company Limited
CO_2:	Carbon Dioxide
COSCO:	China COSCO Shipping Company
CSIR	Council for Scientific and Industrial Research
DAFF:	Department of Agriculture, Forestry and Fisheries
DEA:	Data Envelopment Analysis
DoT:	Department of Transport
DPE:	Department of Public Enterprises
DTI:	Department of Trade and Industry
EcIA:	Economic Impact Analysis
EIA:	Environmental Impact Analysis
GDP:	Gross Domestic Product
Genset:	Generator set
GVM:	Gross Vehicle Mass
ICS:	Institute of Chartered Shipbrokers
ISO:	International Organisation of Standardisation
ITP:	Integrated Transport Planning
LSPs:	Logistics Service Providers
MACS:	Maritime Carrier Shipping
MAUT:	Multi-Attribute Utility Theory
MCDA:	Multi-Criteria Decision Analysis
MCI:	Maersk Container Industry
MOL:	Mitsui-OSK Line
MSC:	Mediterranean Shipping Company
NAMC	National Agricultural Marketing Council
PPECB:	Perishable Products Export Control Board
PwC:	Price Waterhouse Coopers
RFA:	Road Freight Association
SANRAL:	South African National Roads Agency Limited
SATI:	South African Table Grape Industry
SIA:	Social Impact Analysis
Subtrop:	Subtropical fruit
TEUs:	Twenty-foot Equivalent Units
TNPA:	Transnet National Ports Authority
TPT:	Transnet Port Terminals
UNCTAD	United Nations Conference on Trade and Development

Chapter 1 : Introduction

1.1. Introduction

Many countries worldwide have been awarded the opportunity to exchange goods that they lack with countries that are in excess of these goods, because of international trade. The world has become interconnected, and international trade has increased the volume of perishable products being transported globally. International trade represents 58.2% of South Africa's gross domestic product (GDP) (Santander Trade, 2018). South Africa is dependent on international trade as well as oceanic transportation, as 96% of the country's exports are transported via sea, because of South African ports being regarded as the gateway to southern Africa (PwC, 2012).

South Africa's export industry is dependent on shipping for economic development. Approximately 90% of South African fruit is exported to international markets via refrigerated (reefer) containers, as South Africa is one of many fresh fruit producers. Refrigerated containers are used for the entire shipment of the fruit to ensure that the fruit is delivered in a good quality. The most commonly used refrigerated containers in South Africa are the 20-foot (6M), 40-foot (12m) and the 40-foot (12m) high cube (Goedhals, 2003). For the purpose of this study, the researcher focuses on the 40-foot high cube reefer container.

In South Africa, regulation 224 (b) of the National Road Traffic Act of 1996 legislates that the maximum legal height limit for vehicles without an abnormal permit in South Africa is 4.3-metres. The regulations provide that any vehicle, other than double-deck busses, may not exceed an overall height limit, including load projections of 4.3-metres (O'Leary, 2018). Since 2009, there has been an increase in the number of high cube containers in use. With a 2.9-metre container on a flat deck trailer standing at 1.60-metre deck height, it results in an overall height of 4.5-metres, thus exceeding the legislative limit of 4.3-metres. A moratorium was put into place exempting the operation of vehicles transporting ISO containers from the provisions of regulation 224 (b) for a period of seven years. However, there is not any record of damages or accidents as a result of the high cube container having the additional height.

Therefore, this research attempted to identify whether there would be an impact on South Africa's economy if the regulation governing the vehicle height restriction were not amended to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6-metres. If the regulation is not amended to allow the additional height of 0.3-metres, high cube containers would become illegal to use on South Africa's roads.

1.2. Background and motivation

Around 60% of 4.4 million tons of fruit produced annually in 2014 by South Africa's farms was exported as fresh fruit to various global destinations (Fruit South Africa, 2018). Many of the exported fresh produce utilised refrigerated transport equipment, either "break-bulk" refrigerated vessels or 40-foot ISO refrigerated containers, also known as reefers. The past twenty years has seen the global shipping industry move away from a standard general purpose and refrigerated 12-metre container to high cube containers that have an external height of 2.896-metres. Thereafter, there has been an increase in the number of container shipments worldwide and South Africa has joined this contagion with approximately 20 000 to 25 000 containers being transported around Southern Africa per month (Brooke, 2015).

Regulation 224 (b) of the National Road Traffic Act of 1996 legislates that the maximum legal height limit for vehicles without an abnormal permit in South Africa is 4.3-metres. In 2009, the Road Traffic Inspectors in KwaZulu-Natal identified that High Cube ISO Containers, being transported on a normal road transport trailer, exceeded the legislated limit of 4.3m by approximately 0.2m to 0.30m (Chadwick, 2018). Therefore, carriage on the roads of a high cube container is unlawful without an abnormal permit in South Africa (Edwards, 2018). Thus, in 2011 a moratorium, which for a period of seven years, exempted the operation of a motor vehicle transporting an ISO container from complying with the provision of regulation 224 (b) was implemented.

The Road Freight Association (RFA) states that the purpose of the moratorium, which was put in place, was to give the Department of Transport (DoT) time to commission a study that would focus on the stability and safety of the carriage of high cube containers by road. The RFA also states that there has been no danger in transporting high cube containers on normal trailers at the height of 4.6-metres and there have been no instability issues to date (Edwards, 2018).

The DoT's position appears to be that the purpose of the moratorium was to give the road freight industry time to convert or replace their normal trailers to trailers that could carry high cube containers without exceeding the height restriction of 4.3-metres (Edwards, 2018).

High cube containers are increasingly the norm with around five million high cube containers moving through South Africa annually (Edwards, 2018). Thus, this study aimed to determine the impact on South Africa's economy should the regulation pertaining to vehicle height restriction not be amended to allow road transport operators to transport high cube containers at a height of 4.6-metres.

1.3. Problem statement

During the latter part of 2009, the Road Traffic Inspectors in KwaZulu-Natal identified that the High Cube ISO Containers, being transported on a normal road transport trailer, were in excess of the legal height limit of 4.3m by approximately 0.2m to 0.3m (Chadwick, 2018). Carriers were detained and fined for lapse of regulation. In 2011, a moratorium exempting high cube containers from being fined for being transported on a road transport trailer for seven years was announced (Bleue, 2018). Industry representatives requested government to amend the regulation to include and permit the transportation of the high cube containers to a maximum allowable height of 4.6m (Chadwick, 2018).

Brooke (2015) stated that South African ports handled over four million containers (TEU's) in 2009. One million were transhipped and the rest were transported via road and rail to destinations all over southern Africa. Fifty percent (50%) of the four million containers were 12-metre containers and 50% were 6-metre boxes (Brooke, 2015). Brooke (2015) stated that of the 12-metre containers, 80% were high cube containers. Since 2009, there has been an increase in the number of high cube containers in use. With a 2.9-metre container on a flat dock trailer standing at 1.60-metre deck height, it results in an overall height of 4.5-metres. However, the maximum height currently allowed on South Africa's roads is 4.3-metres according to the National Road Traffic Act (Brooke, 2015). Therefore, carriage on the roads of a high cube container is unlawful without an abnormal permit in South Africa (Edwards, 2018). In addition, South Africa makes use of trucks to transport high cube containers. The movement of these containers are vital for economic growth, however, these trucks can have a negative impact, if not managed correctly. These negative impacts include high energy usage, accidents and have excessive costs to maintain the road infrastructure. With high cube containers becoming the international standard, it is important that the negative impacts of trucks be minimised.

Therefore, South African freight owners have been using high cube containers throughout the country on a large scale and has yet to report on any damages that have occurred as a result of the additional height. Thus, the research problem that forms the basis of this study is to identify whether there would be an impact on South Africa's economy if the regulation governing the vehicle height restriction were not amended to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6-metres. If the regulation is not amended to allow the additional height of 0.3-metres, high cube containers will become illegal to use on South Africa's roads. This, in turn, would have a negative impact for the fruit industry. Secondly, the research aimed to identify possible financial or

operational impacts if the legislation were not to be passed, and thirdly, it would suggest potential solutions to the problem.

1.4. Aim and objectives of the study

The aim of this study is to determine the impact of the moratorium expiring on the South African fruit industry should the regulation governing vehicle height restriction not be adjusted to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6-metres. In addition, the study highlighted the industries that would be the most effected as well as possible challenges associated with the supply of the equipment to the market.

1.4.1. Research Objectives

The objectives and related research questions of this thesis are shown in Table 1-1.

Table 1-1: Research objectives and related research questions

Research Questions	**Research Objectives**	**Addressed in Chapter**
What will the potential impact of the high cube container regulation be on South Africa's economy, if the legislation is not amended?	To research and understand the process of impact analysis in freight regulation by providing an understanding of the extent of the impact and to research the stakeholder analysis process and provide an overview of the stakeholders.	Four and Six
Who are the key role players involved in the high cube container legislation?	To conduct a Stakeholder Analysis to identify all the stakeholders involved with the vehicle height regulation, to analyse the stakeholder relationships and to develop a stakeholder strategy for engagement and communication.	Four and Six
What are potential consequences industry could face, if the legislation is not amended?	To understand each stakeholder's perspective of the outcome and why, and to understand whether the outcome is desirable or undesirable.	Six

Research Questions	Research Objectives	Addressed in Chapter
What will the impact of the current regulation likely be on the operations of the fruit export industry, if not amended? What will the possible impact of the current regulation be on the productivity of the fruit export industry, if not amended?	To identify the consequences that the various industries will encounter if the legislation is not amended by determining whether there will be an effect on industry's productivity and on the efficiency of operations within industry.	Six
What international best practices could be implemented to ensure road users safety while at the same time helping to grow the economy?	To identify what international best practices could be implemented to ensure road users safety and increase the growth of the economy.	Three and Six
All research questions.	To gather the necessary data, analyse the data, and provide a conclusion on the likely impact should the legislation not be amended.	Five, Six and Seven

Source: Compiled by the researcher for the purpose of this study

1.5. Research Questions

To achieve the desired aim and objectives of this study, the following research questions are investigated:

1. What will the potential impact of the high cube container regulation be on South Africa's economy if the legislation is not amended?
2. Who are the key role players involved in the vehicle height restriction for the transportation of high cube containers?
3. What are potential consequences the fruit export industry could face, if the legislation is not amended?
4. What will the impact of the current regulation likely be on the operations of the fruit export industry, if not amended?
5. What will the possible impact of the current regulation be on the productivity of the fruit export industry, if not amended?
6. What international best practices could be implemented to ensure road users safety while at the same time helping to grow the economy?

1.6. Data sources

The research design for the study is an explorative case analysed through a mixed method research approach. This study consists of both primary and secondary research methods to provide an analysis of the impact of the moratorium of the regulation governing vehicle height restriction on South Africa's economy. Data collection was conducted during the months of September and October 2019.

The researcher conducted primary research by contacting the fruit industry, the shipping industry, Government officials, the road transport industry, rail transport industry and various stakeholders to identify their ideas and solutions to the regulation of high cube containers. The means of contacting these industry experts was via telephone, email and sending out a survey to gain more insight into the moratorium and the regulation governing vehicle height restriction.

Secondary qualitative information was collected through the use of a content analysis on articles and reports obtained from the internet. In addition, secondary research was conducted using the Internet to investigate websites, annual reports, academic publications and articles in the form of the literature review. The research that was gathered helped answer the research questions and identify possible areas whereby future research can be done.

1.7. Conceptual framework

The research is based on the conceptual framework illustrated in Figure 1-1. The figure demonstrates the flow of the research. The research was guided by the fruit industry's concern of the impact that the regulation governing vehicle height restriction would have on South Africa's economy.

The framework was used to guide the researcher during the research process and aims to provide the reader with a background on how the research was conducted. The conceptual framework is used to connect all phases of the study. The research objectives and questions were derived from the research problem and the current gap in knowledge that exists.

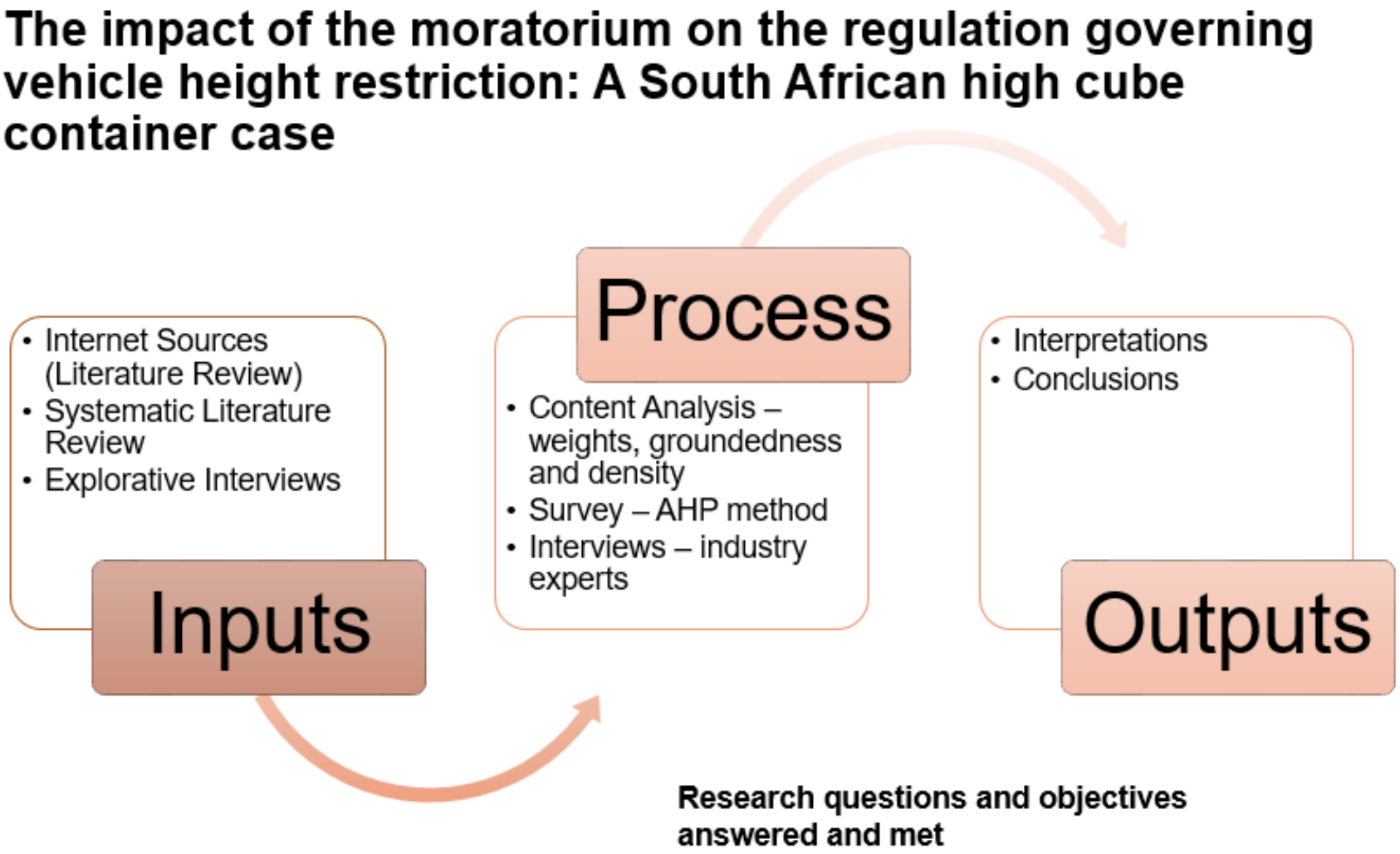


Figure 1-1: Conceptual Framework

Source: Compiled by the researcher for the purpose of the study

1.8. Outline of the study

The remainder of this study is divided into the following chapters:

- Chapter 2 discusses the literature review containing various sub-sections that forms the basis of this study. Firstly, it provides an overview of international trade and globalisation. It gives an overview of how trade amongst countries started. In addition, it discusses the South African fruit industry, including the export figures and the size of the country. Secondly, containerisation is explained as well as how the container market has developed to date. Thirdly, it discusses the standardisation of containers, so that the reader has an understanding as to how the sizes of containers came about. Next, it discusses the various types of containers that exist, but mainly focuses on the reefer container and high cube container. It continues on to discuss the various container manufacturers and the top ten shipping lines used in South Africa's fruit industry.
- Chapter 3 discusses the South African road transport industry. The Department of Transport and the National Road Traffic Act are examined, which indicates the role the DoT plays in the regulation governed on vehicle height restriction as well as the axle mass and dimensions. Next, the Road Freight industry is discussed depicting the important role they play in South Africa's economy alongside the Road Freight Association. Lastly, international best practices are discussed to provide possible solutions to South Africa's vehicle height restriction and the regulation in place.
- Chapter 4 contains a discussion on conducting a stakeholder analysis and an impact analysis. It describes theoretical and practical undertakings of these two analyses.
- Chapter 5 discusses the research design and methodology used in this study. This chapter explains how the study was conducted, how the data was collected, it points out potential problems in the data collected, the primary and secondary data used for the research and the methods used to analyse the data.
- Chapter 6 focuses on the data analysis. It discusses the findings of the study as well as the data extracted from the results found. It also explains the methods that were used.
- Chapter 7 interprets the findings of the study to clarify what the results mean.
- Chapter 8 contains the conclusions and recommendations of the study. It also includes possible suggestions for future studies or potential gaps that have arisen in the study.

Chapter 2 : South African fruit exports within the international context

2.1. Introduction

This literature review aims to link the topic to previous studies. Various sources of literature provide the reader with a greater context surrounding the research area and highlight the importance of the topic. The data collected for this research is an addition to the literature review. The literature review provides an overview of international trade and globalisation, with how trade amongst countries first started. It continues to discuss the South African fruit industry, including export figures and the size of the country. In addition, this chapter explains containerisation, how it has developed and made the container market into what it is known as today. The standardisation of containers is discussed to ensure the reader understands how the sizes of the containers came about. Next, it discusses the various types of containers that exist, but mainly focuses on the reefer container and high cube containers. It continues on to discuss the various container manufacturers and the top ten shipping lines used in South Africa's fruit industry.

2.2. International trade and globalisation

International trade dates back centuries, with the first age-old practice of trade amongst different people known as bartering (Encyclopaedia Britannica, 2019). International trade is the exchange of goods and services across two or more international borders or territories, which could involve governments or individuals (Van Rensburg, 2018). International trade allows a nation to exchange commodities that it lacks from nations that produce it in abundance (Encyclopaedia Britannica, 2019). From this, a nation's standard of living increases and it promotes freer trade amongst nations. The impact of trade was not limited to economics, but fuelled political and social ambitions (Management Study Guide, 2019).

International trade plays a significant role in the Gross Domestic Product (GDP) of different countries. There are many new opportunities for growth beyond the borders of a country, and this is made possible through international trade. South Africa is quite open to international trade as it represents 58.2% of the country's GDP (Santander Trade, 2019). International trade saw two 'Golden Age' periods. The 'First Golden Age' period was from 1890 to World War I. This was the period where there were improvements in transport. The 'Second Golden Age' started at the end of World War II. During the Second Golden Age, there were tariff reductions. Moreover, with the shipping container being invented, goods could be moved more cheaply. From this, world trade grew after 1950 in dollar terms and as

a ratio of GDP (Feenstra & Taylor, 2014). Therefore, transport and communication sectors have been highly stimulated due to international trade taking place.

The expansion of international trade over the years has been a result of globalisation (Surugiu & Surugiu, 2015). Mason, Lansdale and the Institute of Chartered Shipbrokers (ICS) (2013:13) stated that globalisation meant that the source of raw materials and the point of consumption could originate from completely different countries. The first "wave of globalisation" started in the 19th century and the second one after World War II. After the wave of globalisation, international trade grew faster than ever (Ortiz-Ospina, Beltekian & Roser, 2018). Goods and services can now be sourced from anywhere in the world, as the world is independent, because of international trade (Surugiu et al. 2015). It is believed that without the “container revolution”, the global economy would not have developed as far and as fast as it has (Mason, et al., 2013:14).

South African ports are regarded as being the gateway to Southern Africa and this is mainly dependent on international trade, as well as, oceanic transportation, as 96% of the country’s exports are transported via sea (PwC, 2012). Through international trade, the agricultural sector of South Africa has connected with the rest of the world. During 2016, the reefer market declined by 3%, because of the drought, yet the refrigerated container trade still made up 19% of South Africa’s total container exports, whereby 90% of the total reefer exports consisted of fruit (Conroy, 2017). South Africa operates in a world where 793.26 million TEUs were shipped in 2018 of which South Africa shipped 2.74 million TEUs and two thirds were 40-foot containers (UNCTAD, 2019). Many sources have stated that there is an unknown number of high cube containers in South Africa. UNCTAD (2019) states that high cube containers are a growing trend worldwide.

The shipping industry is of utmost importance as 90% of all international trade, in terms of weight, and 85% in terms of value is transported by deep-sea transport (Gubbins, 1986). In accordance with Gubbins, the International Chamber of Shipping (2019) stated that the international shipping industry carries 90% of the world’s trade and that without shipping, the imports and exports of affordable goods would not be possible. The shipping industry allows links between the producer and the consumer for the collection and distribution of commodities. Global containerised trade increased by 3.1% in 2016, with estimated volumes of 140 million 20-foot equivalent units (TEUs) (UNCTAD, 2017). Many challenges face the industry, which caused many of the shipping lines to merge with one another, for instance, Maersk acquired Hamburg Süd in 2017. According to Alphaliner (2019), the top 10 shipping lines in the world have a combined global share of 81.8% in container volumes. Table 2-1 provides a list of the top 10 shipping lines in the world.

Table 2-1: Top ten shipping lines in the world

Rank	Operator	TEU	Share
1	APM-Maersk	4.081.341	17.90%
2	Mediterranean Shipping Co.	3.305.720	14.50%
3	COSCO Group	2.790.100	12.20%
4	CMA CGM Group	2.634.204	11.50%
5	Hapag-Lloyd	1.644.565	7.20%
6	ONE (Ocean Network Express)	1.525.952	6.70%
7	Evergreen Line	1.216.674	5.30%
8	Yang Ming Marine Transport Co.	636.369	2.80%
9	Hyundai M.M	424.742	1.90%
10	PIL (Pacific Int. Line)	418.489	1.80%

Source: Alphaliner, 2019

International trade allows containers to be easily transported to any part of the world. One could consider a container to be a low-tech innovation, but this low-tech innovation has had a significant impact globally. Globalisation has been a result of international trade and international trade has increased due to containerisation. Therefore, inadvertently containerisation has had an important role in globalisation.

2.3. South African Fruit Industry

The South African fruit industry's roots date back to 1952 when Jan Van Riebeek planted the first apple seeds in Cape Town (Hortgro, 2019). Gradually many small farmers started to experiment with other top fruit crops and supplied the fruit to the ships passing the Cape and for local consumption. In 1892, Percy Molteno "founded' South Africa's fruit export industry when he successfully exported a small consignment of peaches to the United Kingdom (Hortgro, 2019). Thereafter, the fruit export market blossomed.

For fruit farming, South Africa is believed to have the ultimate location due the climate. South Africa has constantly been the world leader in providing fresh produce in a vastly competitive world market (Department of Agriculture, Forestry and Fisheries, 2018). The majority of fruit that is exported via reefer containers consists of citrus and deciduous fruits as well as subtropical fruits. Conroy (2017) states that citrus fruits form the bulk of the fruit trade from South Africa, accounting for about 58%, whereas deciduous fruit accounts for about 35%. Figure 2-1 depicts the regions in which the cultivars are grown.

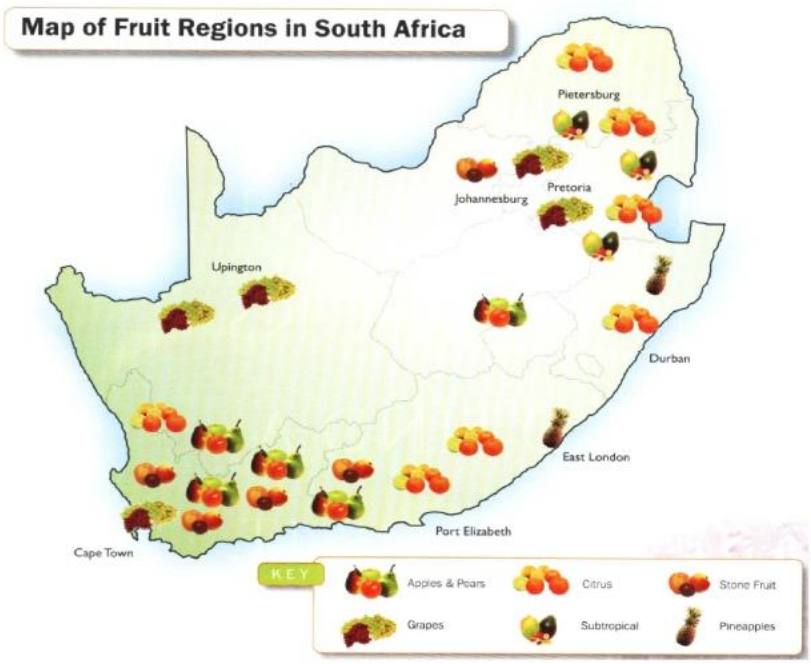


Figure 2-1: Regions in South Africa where fruit is produced

Source: van Dyk & Maspero, 2004

South Africa produces fruit of a high quality and often more than what can be absorbed and consumed, resulting in the fruit being exported. Northern hemisphere countries receive South African fruit with open hands due the excellent quality and it being available in opposite seasons (van Dyk & Maspero, 2004). South Africa is one of largest fresh fruit producers and the largest contributor to the country's agricultural exports (National Agricultural Marketing Council (NAMC) & Department of Agriculture, Forestry and Fisheries (DAFF), 2017). This industry is a job creating industry accounting for an excess of 400 000 jobs throughout the value chain (Uys, 2016) and is important for the sustainability of the fruit industry as a whole.

The export industry of South Africa is reliant on shipping as a driver of economic development. Approximately 90% of South African fruit is exported to international markets via refrigerated containers (and to lesser extent reefer vessels) and the remaining portion is consumed locally. During transhipment, refrigerated containers preserve the fruit for the entire shipment cycle to ensure the delivery of good quality products to the client. Exporters benefit from the additional 15% space high cube containers provide (Webmaster, 2015). South Africa's fruit exports account for 50% of the agricultural exports with a value of R45.5 billion (Department of Agriculture, Forestry and Fisheries, 2018). South Africa produces 4.7 million tons of fruit on an annual basis (Liphadzi, 2015). The agricultural sector contributes 2.5% to the country's GDP, stipulating that the fruit industry is a key contributor to South

Africa's economy and jobs (Liphadzi, 2015). Thus, containers play a vital role in the fruit export industry.

Subsequently, South Africa derives more than 50% of its earnings from its exports. Liphadzi (2019) states that approximately 60% of fruit is traded to the export markets, ensuring South Africa is competing in the international arena. Figure 2-2 shows the main destinations the fresh fruit is exported to.

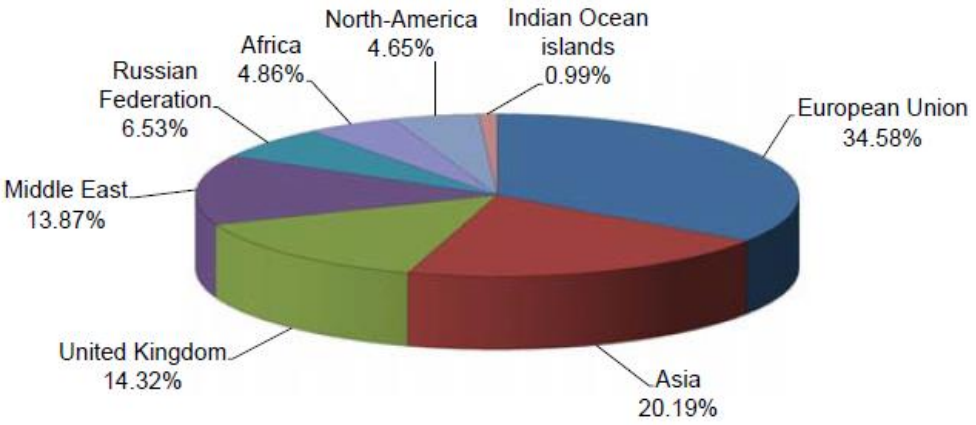


Figure 2-2: Main destinations of South Africa's fresh fruit exports for 2016/2017 season

Source: Department of Agriculture, Forestry and Fisheries, 2018

According to Figure 2-2, the European Union receives the greatest percentage of the fresh fruit exports from South Africa, as a result of the market being open to a variety of fruits and more opportunities exist to supply that market with a wide diversity (Uys, 2016). The Asian market is the second main destination that fresh fruits are being transhipped to. This market is important for the expansion of fruit exports. It is increasing and has the potential to overtake South Africa's traditional reefer trade lanes to Europe.

It would be worthwhile for South African fruit exporters to explore new trade routes. However, by doing so, the exporters could be presented with challenges pertaining to cultural differences and the transit times being longer than usual (Infrastructure News, 2015). It is important that the exporters understand how these challenges impact doing business in these regions, as different countries have different ways of conducting business. Infrastructure News (2015) states that for South Africa's fruit producers to meet the growing demand, it would be viable to partner with specialists who make use of containers that are technologically advanced and sensitive to temperature.

Webmaster (2015) states that exporters benefit from the additional 15% space and volume that high cube containers provide. It is suggested that there would be a similar financial impact between the standard container and high cube container. The reason is that one has

to consider the waiting time at the port, the port congestion impact, port levies and handling, export duties and the road congestion of the trucks en-route to the port. On average, a truck carrying a high cube container has a turnaround time of three hours, but when the port is congested, the turnaround time increases to eight to twelve hours. The majority of fruit is exported duty free, thus the costs are approximately the same. The one difference that exists is that a high cube container can stack more produce, which decreases the unit cost per carton. Furthermore, Braun (2019) states that there is no difference in costs between transporting produce using a standard container versus a high cube container. Table 2-2 depicts the estimated costs of transporting a high cube container from the Port of Cape Town to the Port of Rotterdam.

Table 2-2: Estimated costs of transporting a High Cube Container

No. of packages	1	Package Type	1 x 40' HC Container
Actual weight (kg)	n/a	Volume (cbm)	n/a
Estimated charges:			
Description		ROE	ZAR Amount
Cargo Dues			1 144.86
THC			2 820.00
Cartage			4 550.00
Ocean Freight		14.89	8 189.50
Container Release			1 675.00
MBL Fee		14.89	670.05
EFF		14.89	3 588.49
Security Fee		14.89	595.60
Certificate of Origin			240.00
Solas VGM Fee			950.00
Container storage if applicable per day			100.00
Standing time if applicable per hour			450.00
Container lift on/off per lift			400.00
Cross haul to port if applicable		-	1 000.00
Clearance and Delivery (excl. Duties & Taxes)		-	-
Currency Adjustment Fee			-
Cartage and rigging			-
Other			-
DNF Charges (Agency, Docs)			2 438.68
Finance Charges (Optional for 30-day accounts)			659.34
		Total ZAR	29 471.51

Source: Braun, 2019

According to Braun (2019), the dimensions, sizes and weight per carton varies greatly, including how high the pallet is packed. The researcher uses a 4.5kg carton with dimensions of 300mm x 400mm x 120mm in the example below. Twenty (20) pallets can be packed in a

container. According to Brink (2019) and Moelich (2019), an average of 160 4.5kg cartons are packed per pallet with a total of 3200 cartons for a standard 40-foot container. In addition, 180 4.5kg cartons can be packed per pallet with a total of 3600 cartons for a 40-foot high cube container. Based on the information provided by Brink (2019) and Moelich (2019), the researcher determined the following calculations:

Calculation 1: A standard 40-foot container

Cost per carton (160 cartons): R29 471, 51 / 160 = R184.20

Calculation 2: A 40-foot high cube container

Cost per carton (180 cartons): R29 471.51 / 180 = R163.73

The above calculations include the transportation of grapes in the standard 40-foot and high cube container. Therefore, the cost per carton can vary between R163.73 and R184.20 when transported in a standard and high cube container. Furthermore, it is shown with the costs that the more cartons packed on a pallet in a container, the lower the unit costs of the carton will be.

2.4. Containerisation

Cargo handling methods remained unchanged for centuries as goods were been handled manually (Mason et al., 2013:4). Many experiments with containers have been done since the beginning of commercial history. Merchants, long ago, took the first steps towards containerisation, as it is known today, by trying to improve cargo handling and protection by placing parcels of a similar size together. Cargo was carried or hand trucked from the quayside to the ship's hold and stowed manually (Mason et al., 2013:4). Over the years, cargo was simplified into large standardised parcels. Changes started to occur in 1955 when United States businessman Malcolm McLean, the father of containerisation, believed that individual pieces of cargo only needed to be handled twice from the origin to the destination (Chadwin, Pope & Talley, 1990). Malcolm McLean developed the first intermodal shipping container that changed trade for the better. He developed the metal shipping container that had replaced the traditional break bulk method of handling dry goods and revolutionised the transport of goods and cargo worldwide. Containerisation is regarded as the greatest revolution in sea transport (Ingpen, 2015).

There are large gains in productivity when making use of containerisation to transport goods. There are several advantages to using a container to transport goods. These include (Gubbins, 1986):

- The reduction in time to transport goods;

- Packaging costs are reduced; and
- Lower labour costs, as there is a reduction in manpower required.

Containerisation resulted a worldwide transportation system and the containers needed to be standardised in order to be efficient and reliable for the distribution channels. Therefore, the International Organisation for Standardisation (ISO) was established in 1947 and has members in 164 countries all over the world (ISO, 2019). Container shipping was quite different from conventional shipping, as the sizes varied amongst the containers. Thus, in 1961, the ISO set standard sizes for the containers. By packing commodities inside a standard container, it allowed protection, rapid intermodal transfers and made mechanical handling possible (Mason et al., 2013:4).

Containerisation brought about modern supply chains, especially reefer containerisation. The first “reefers” were the porthole containers, which were insulated containers with two holes or ports in the end wall (Goedhals-Gerber, 2018). This prevented the necessary airflow in the container, thus immediate improvement was needed, so that the temperatures could be regulated for the exporting of fresh fruit. Due to perishable products being sensitive to temperature changes, it is of utmost importance that each product is cooled exactly to their own scientific temperature. Therefore, container technology needed to be improved. Soon after, integral containers were invented, which contained a built-in cooling mechanism. Each of these containers allowed the temperature of every container to be controlled individually. Having electrical power on the ship or in the terminal allowed for door-to-door maintenance of the cold chain, as the containers were carrying temperature sensitive commodities (Mason et al., 2013:7). This advancement in containers allowed for South African produce to be made available to international markets.

Containerisation introduced intermodal transportation, as the shipment of a container could use various modes of transport, for example, ship, rail or road, without handling the cargo when changing modes. Container volumes increased by 9.5% year-on-year to 2.96 million twenty-foot equivalent units (TEUs) for the years 2017/2018 in the Port of Durban. Of this, container imports grew by 10% and exports by 17% (Bulbulia, 2019).

The scenario of containers has completely changed. Container shipping has had a massive influence on the loading costs. Before containerisation, the loading cost was $5.86 per ton, which after containerisation changed to $0.16 per ton. The time that it took to load containers has changed from 1.3 tonnes per hour to 10000 tonnes per hour. Singh (2016) stated that once containerisation was in full force, cost and time were reduced and there were increases in the efficiency of trade. Thus, international trade is responsible for globalisation, but it was boosted by containerisation (Singh, 2016).

South Africa had to join the world-wide movement towards containerisation and in 1977, container ports were opened in Cape Town, Durban, Port Elizabeth and City Deep (an inland port) (O'Leary & Braun, 2018). High cube containers used throughout the world are higher in height than the containers that were introduced when containerisation was first adopted by the world. This led to the issue surrounding the transport of high cube containers. O'Leary and Braun (2018) state that there has been safe and successful movements of high cube containers on the roads of many countries as well as competent loading and unloading of loaded and empty high cube containers at various ports.

Containerised cargo attracts most of the attention in the ports. The Port of Durban finished with a throughput of 2.975 million TEU's in 2018 (Hutson, 2019). There has been an increase in containers handled at 5.3% nationally, with the total handled for all ports reaching 4.833 million TEU's. Although, there is a decline in the number of ships that arrive at the country's ports, this is not linked to a decline in TEUs handled, but rather the fact that larger container vessels are being used.

2.5. Standardisation of containers

Malcolm McLean predicted that a problem would arise in terms of the sizes of containers. Thus, since the 1970s, the main vessel type used for the liner trade has been the container ship, as it dominated the business world due to the opportunities for rationalisation of transport and handling cargo, which followed the international standardisation of shipping containers (Mason et al., 2013:23). Goods packed in a standard container allows protection to be provided. Intermodal transfers and mechanical handling are made possible through using a container. Intermodal refers to different modes of transport being used in the movement of cargo, which can be many or varied (Mason et al., 2013:23).

The industry was in need of standardisation in the container trade and this is when it turned to the ISO. The ISO is a United Nations organisation based in Geneva (Branch, 2007). The ISO is a non-governmental organisation and through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges (ISO, 2019). This organisation is the leading developer of international standards and identifies what standards business and government require. These standards are respected and accepted publicly and privately all across the world. The ISO ensures that products and services are safe, reliable and of a good quality.

When industry needed to rationalise the container sizes, industry approached the ISO and formed an agreement that the length of the container ought to be based off the multiples of

20-foot containers with a width of 8 feet and a height of 8 feet (Mason et al., 2013:23). An optional height of 8 feet 6 inches was agreed upon (which is the standard size), as well as, the emergence of the high cube or super cube container of 9 feet 6 inches (Mason et al., 2013:23).

As mentioned previously, containers of 10, 20, 30 and 40 feet in length were used initially, but the general sizes used now are the 20 and 40-foot containers. South Africa makes use of 20, 40 and 40-foot high cube refrigerated containers (Goedhals, 2003).

2.6. Types of containers

Container units are an important part of the shipping industry. These containers are able to store various kinds of products that can be shipped all around the world (Smita, 2019). Containers vary in structure, dimension and materials; therefore, the shipping industry makes use of various types of containers to accommodate the different types of cargo that needs to be handled. The ISO have standard sizes and type codes, which assist in recognising units. The following types of containers are used in the industry (Mason et al, 2013:94-96):

I. **Standard ‘dry van’ General Purpose container**
   Available in both 20 and 40-foot containers. They are usually made of steel construction. They have panels made from aluminium or glass fibre re-enforced plywood and have container doors at one end only.

II. **High Cube containers**
   A 40-foot container is 9’6’’ high for the carriage of light and bulky commodities.

III. **Bulk containers**
   A 20-foot container for the carriage of dry bulk cargoes. This container may have hatches in the roof for top loading and it may have an inner lining, which is usually made of plastic.

IV. **Open-top containers**
   This is a container for heavy, bulky and over height cargo. It is available in both 20- and 40-foot containers, which can be loaded by a crane from above and through the doors, if the removal header bar is fitted. They are supplied with a tarpaulin ‘tilt’ cover. Open top units usually have a removable steel roof that is known as a Hardtop container.

V. **Half-height 20-foot open top container**
   This type of container is used for heavy cargo where the deadweight requires limited cubic capacity. It can be stowed two high in the same space as a standard height container.

VI. **Platforms**

This container is used for awkwardly shaped or heavy break-bulk cargo and are available in both 20- and 40-foot containers. This unit has no sides or top, it just has a base with lashing points and lifting lugs.

VII. **Flat racks**

This container has a platform with ends that enable the units to be stacked on top of each other. The ends may be collapsible to enable the units to lock together for ease of return when empty.

VIII. **Ventilated containers**

Generally, 20-foot containers for commodities such as coffee and cocoa beans. This type of container is also known as a passive ventilated or coffee container. This container provides ventilation openings at the top and bottom side rails (Transport Information System, 2019) and need to be used in transit for goods that need to be ventilated. They are designed to allow air to exchange between the interior of the container and the outside atmosphere.

IX. **Tank containers**

Typically used to transport bulk liquids. They are in the form of an oval tank held in a skeletal regular rectangular frame. This container can be heated for the carriage of certain liquid cargoes that need to be kept in fluid state for unloading.

X. **Refrigerated (reefer) container**

Typically, in 20- and 40-foot containers. They are equipped with a refrigeration unit that is plugged into an electrical supply on the ship or in the terminal. Other reefers have their own diesel generator set, but those with their own integral refrigeration unit are fully flexible and can be moved any distance by any mode of transport after transhipment. They are much more costly. This container is mainly used by the fruit industry, as it maximises the volume of fruit that can be transhipped all across the world.

XI. **Insulated containers 20- and 40-foot**

This is another type of reefer container that has no integral refrigeration unit that relies on cold air being blown through portholes in the end of the container from a central cold air ducted system in the vessel. This type of container is used to reduce temperature variation without specific refrigeration.

In 2012, the composition of the global fleet of containers consisted of 31.5 million TEUs (Rodrigue, 2019). The 40-foot container consists of both the standard and high cube container. This container is the most common container, as it accounts for 68% of all TEUs (Rodrigue, 2019). In addition, 49% of all dry TEUs out there are 40-foot high cube

containers and 7% are reefer containers. Thus, for the purpose of this study, the focus is on the 40-foot high cube refrigerated container, as it is the most frequently used container in the fruit industry. Exporters were experiencing a shortage in shipping space, so manufacturers developed 40-foot reefers and soon after 40-foot high cube reefers. Goedhals (2003) stated that the most commonly used refrigerated containers in South Africa are the 20-foot (6m), 40-foot (12m), and the 40-foot (12m) high cube.

2.7. The refrigerated (reefer) container

A refrigerated (reefer) container is a shipping container that has a cooling system that has to be plugged into an external power source. Reefer containers are used to transport perishable cargo. Reefer containers are designed to meet ISO standards and, therefore, have a similar shape and size as the general-purpose container. The reefer container depends on external power from an electrical power point when on a land site or a diesel-powered generator set (genset) when transported by truck to run the cooling unit.

The reefer container plays an important role in the fruit industry, as the majority of the fruit exporters make use of reefer containers to maintain the freshness and quality of the fruit as well as to deliver a good quality products to the client. Reefer cargo is usually carried from the production areas in the Southern Hemisphere to the industrialised countries in the Northern Hemisphere (Hamburg Süd, 2016). Therefore, it is crucial to ensure that the reefer containers are working properly and are set at the correct temperature for the fruit being transported.

Reefer containers are equipped with automatic drains that can open and close automatically to release any excess water that might accumulate inside the container and they can prevent outside water from entering the container (Hamburg Süd, 2016). Suggested relative humidity levels for fresh fruit vary, but generally fall between 65% and 95%, depending on the type of fruit. These high humidity levels are formed in a reefer container due to the concurrence of the above-mentioned factors, and the reefer container requires no further humidity control (Hamburg Süd, 2016).

Most fresh fruit requires air circulation. Reefer containers maintain internal air circulation for prescribed temperatures. Reefer containers have a ‘bottom air supply’ that allows air to flow through the container from the bottom to the top, thus removing the warm air inside the container. In this case, air takes the path of least resistance and ensuring that air can circulate under, over and to each side and end of the stow throughout the load (Hamburg Süd, 2016). Figure 2-3 provides a visual representation of the airflow within a container.

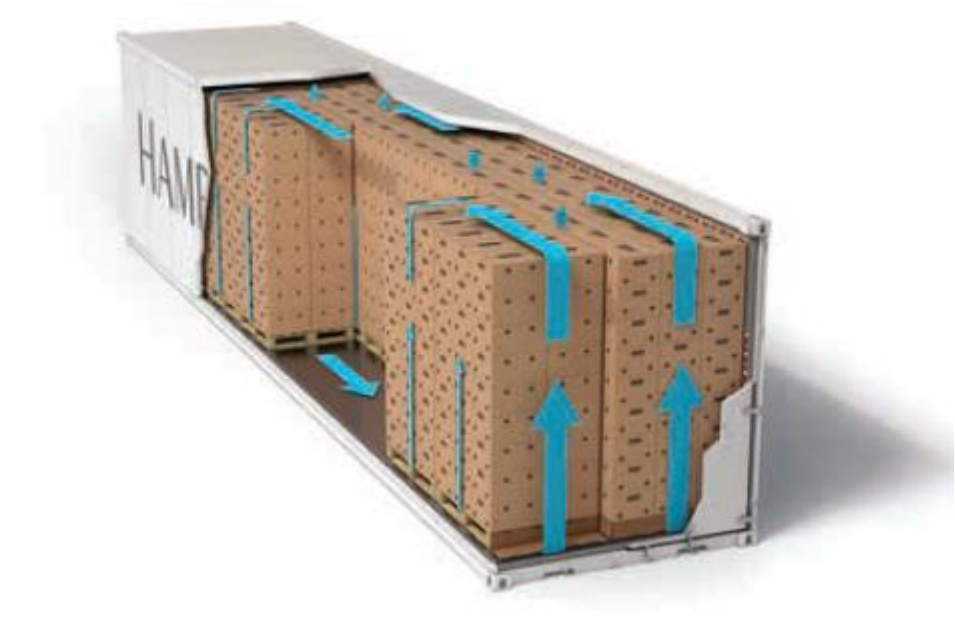


Figure 2-3: Airflow inside a container

Source: Hamburg Süd, 2016

To guarantee proper distribution of temperature-controlled air, the floor inside the reefer container is manufactured with gratings (T-floor), which takes its name from the T-shaped cross-section of aluminium extrusions that form the floor (Hamburg Süd, 2016). The forced cold air circulation helps to chill the fruit, preventing the fruit from ripening and thus, allowing for a longer shelf life. Table 2-3 depicts the specifications of the 40-foot high cube container.

Table 2-3: 40-foot high cube container specifications

Specifications	**40-foot high cube standard reefer**
Temperature range:	-30°C to +30°C
Humidity range:	65% - 85%
Maximum payload:	29.790 kg
Imperial Dimensions:	40’ × 8’ × 9’6”

Source: Maersk, 2019

A standard 40-foot container can carry 20 standardised pallets, whereas the 40-foot high cube container can carry 20 pallets stacked to a higher level, as the container is approximately one foot higher than the standard 40-foot container (Edwards, 2018). The use of the high cube container, thus, offers exporters the possibility of increasing their economies of scale.

Matthew Conroy, Maersk Line Southern African Trade Manager and a member of the Maersk Group, stated that the reefer trade connects South Africa to the rest of the world. It is believed that the refrigerated container trade makes up approximately 19% of the total of South Africa's container exports (Conroy, 2017). Therefore, high cube refrigerated containers are beneficial for the fruit export industry.

2.8. Main manufacturers of containers

This research identified the main manufacturers of containers, specifically for the 40-foot high cube reefer containers. A manufacturer of containers will have to consider many factors to have a profitable business, for example, the cost of manufacturing and the market-selling price. The evolution of the shipping industry and the innovations of these manufacturers have resulted in the furthering of trade. The following manufacturers were identified:

2.7.1. Singamas Container Holding Ltd

Singamas Container Holding Ltd., founded in 1988, is a marine cargo handling company with their main headquarters in Hong Kong, China. Singama is one of the leading container manufacturers and a major operator of container depots and terminals in the Asian-Pacific region. Their manufacturing business operates nine production facilities and eleven container depots (Singamas Container Holding Limited, 2018). Singamas has an annual production output of 835 920 TEU's, which sets a new high record for this Group and had a total revenue of US $1,807,819 at the end of 2018 (Singamas Container Holding Limited, 2018).

2.7.2. CXIC Group Containers. Co. Ltd

CXIC Group Containers Company Limited was founded in 1996 with their main headquarters in Changzhou, China. CXIC Group is a privately owned enterprise that encompasses manufacturing, transportation, trading, research and development. The group has numerous fully owned companies with major or minor shares located in Changzhou (Jiangsu prov.), Ningbo (Zhejiang Prov.), Qingdao (Shandong Prov.), Ninghe (Tianjin) and Jiashan (Zhejiang Prov.) (CXIC Group Containers. Co. Ltd, 2018).

Their annual production capacity is 800 000 TEU's of ISO containers and 90% of all their manufactured containers are exported to over 40 countries and regions across the world (CXIC Group Containers. Co. Ltd, 2018). This corporation has total assets of RMB 7 billion.

2.7.3. China COSCO Shipping Co. Ltd (COSCO)

China COSCO Shipping Co. Ltd (COSCO) was established after a merger between China Shipping Container Lines (Founded in 1997) and COSCO Shipping lines in February 2016 (COSCO Shipping, 2017), with the headquarters situated in Shanghai, China. COSCO provides a wide variety of containers and is one of the major logistics service providers. COSCO is the fourth largest shipping liner company in the world behind Maersk, MSC and CMA CGM.

2.7.4. Maersk Container Industry (MCI)

Maersk Container Industry (MCI) was founded in 1990 with their headquarters situated in Copenhagen, Denmark. Maersk manufactures refrigerated containers and refrigeration machines. Maersk is continuously motivated to improve on efficiency and performance of the reefer containers. The main aim of Maersk Container Industry is optimum care and achieving lowest energy costs. MCI is on the forefront of innovation and implementing energy efficient and cost saving technology (Maersk Container Industry, 2019).

2.7.5. China International Maritime Containers Group Co. Ltd (CIMC)

China International Maritime Containers Group Company Limited (CIMC) was founded in 1980 with their headquarters in Shenzhen, China. CIMC is a world leading equipment and solution provider in the logistics and energy industries and is engaged in the manufacturing and export of containers. CIMC was one of the first container manufacturers in China. The Group's main container manufacturing business deals with the standard dry container, reefer containers and special containers. CIMC had a sales revenue of RMB 93.498 billion and net profits of RMB 3.38 billion in 2018 (CIMC, 2019) and has over 20 production sites throughout North, South and East China (CIMC, 2019). CIMC is one of the biggest manufacturers with the largest product variety and has over 50% market share of all the refrigerated containers globally (China International Marine Containers (Group) Ltd, 2019).

2.9. Top 10 shipping lines in South Africa

Container shipping is known for being the most cost-effective and flexible way of reaching international markets. Therefore, a single container or multiple containers can be shipped anywhere in the world. Thus, to ensure that the goods being transported within these various types of containers are protected and not damaged throughout transit, the top ten shipping liner companies that service South Africa are discussed.

2.9.1. APM – Maersk

The Maersk line is the world's largest container shipping company and is the global leader in shipping services. Maersk is an integrated container logistics company that operates in 130 countries and employs approximately 76 000 people (Maersk, 2019). The Maersk Line includes Safmarine, Seago line, Sealand, MCC Transport and Hamburg Süd. This company is able to move 12 million containers every year to various parts of the world (Maersk, 2019). In 2018, Maersk had a revenue increase of USD 8.1 billion with a 29% increase in ocean activities due to Maersk including Hamburg Süd (Maersk, 2018). Maersk carries approximately 80% of all global trade (Maersk, 2018).

2.9.2. MSC

Mediterranean Shipping Company (MSC) is the second largest shipping line in South Africa. Most brands trust MSC to fulfil the shipping and logistics needs, as they provide great choice and flexibility to enable a long-term partnership (MSC, 2019). Over the past 45 years, MSC has provided fast and reliable transit, as they understand the importance of global port coverage, equipment availability, connectivity and scheduling. They have a fleet of more than 510 vessels sailings 200 routes to 500 ports in 155 countries (MSC, 2019). In 2018, MSC transported over 1.6 million TEUs of reefer cargo (MSC, 2019). MSC provides a door-to-door service, as they have a complete intermodal network.

2.9.3. CMA CGM

This shipping line is the third largest in South Africa. CMA CGM is reinventing their entire shipping experience to provide a seamless maritime, ports and logistics service (CMA CGM, 2019). This shipping group delivers on their customer experience by having value-added services, cutting-edge eco-technologies as well as start up support and incubation. CMA CGM is constantly trying to simplify and optimise the container shipping and transport throughout the supply chain. This shipping group is present in more than 160 countries through 755 agencies and has approximately 110 000 employees (CMA CGM, 2019). They are a young and diverse fleet of 509 vessels and serve over 420 of the world's 521 ports (CMA CGM, 2019).

2.9.4. Evergreen

The Evergreen Line is the given name to the four shipping companies in the Evergreen Group, namely Evergreen Marine in Taiwan, UK and Hong Kong as well as Italia Marittima S.p.A (Evergreen Line, 2019). Evergreen Line has a fleet of 190 ships with a capacity of

approximately 850 000 TEUs (Evergreen Line, 2019). Evergreen calls at 240 ports in 80 countries worldwide.

2.9.5. Hapaq-Lloyd

Hapag-Lloyd is the fifth leading global shipping company in South Africa. Their fleet consists of 237 modern ships with 11.9 million TEUs being transported per year in 129 countries (Hapag-Lloyd, 2019). This shipping company can ensure fast and reliable connections between more than 600 ports worldwide (Hapag-Lloyd, 2019).

2.9.6. Maritime Carrier Shipping (MACS)

Maritime Carrier Shipping has had customers in Southern Africa, the UK, Europe and USA/Mexico for over the past 35 years (MAC Ship, 2019). MACS provides specialised shipping solutions that can carry any load and have a multipurpose fleet (MAC Ship, 2019). Their vessels are equipped to lift any capacity of up to 240 tonnes, which allows them to load and unload cargoes effectively and safely.

2.9.7. Mitsui-OSK Line (MOL)

Mitsui-OSK Line is the largest and oldest of Japan's international shipping companies (Moverdb, 2019). This shipping line operates 896 vessels and is able to handle 544 817 TEUs annually (Moverdb, 2019).

2.9.8. China Ocean Shipping Company (COSCO)

China Ocean Shipping Company, also known as COSCO, is a China-State-Owned shipping and logistics company. COSCO SHIPPING Lines Co. Ltd can also be referred to as COSCO SCOSCO Shipping Lines Co. Ltd, as it is affiliated with the COSCO Shipping Group. It is an integrated container business of CSCL and its predecessor COSCO, and has been operational since 1 March 2016 (COSCO Shipping, 2017). The company is known for engaging in both international and domestic container shipping, related services as well as business (COSCO Shipping, 2017). By the end of 2018, this shipping line had 376 container vessels and a total capacity of 2.1 million TEUs (COSCO Shipping, 2017).

2.9.9. Safmarine

Maersk acquired this shipping company, however, it operates and functions on its own. Due to the takeover, Safmarine follows all the same values as Maersk. Safmarine is well known in South Africa due to their reliability and efficiency and are often the preferred choice for exporting fruit from South Africa. The shipping line exported 38 963 containers in 2017

(Simpson, 2018). Safmarine focuses on trading in Africa and West Central Asia (Safmarine, 2019).

2.9.10. Hamburg Süd

This shipping company is a strong brand in the international logistics service sector. In 2017, Hamburg Süd formed part of Maersk line (Hamburg Süd, 2019). The Brazilian subsidiary Aliança ensured Hamburg Süd to be a leading shipping line serving the important South American trade lanes. It is their focus to meet their customer needs and ensure that the brand represents quality, reliability and flexibility (Hamburg Süd, 2019). Hamburg Süd has a fleet of 177 ships in service all around the world and has approximately 6300 employees (Hamburg Süd, 2019).

2.10. Conclusion

This chapter shows that the fruit industry is a crucial contributor to South Africa's economy. An overview of international trade, globalisation and containerisation is discussed depicting the importance of various types of containers being used to transhipp over international waters. Many countries prefer the high cube container for the movement of fresh fruit. South Africa produces a high quality of fruit and often more than what can be absorbed and consumed, resulting in the fruit being exported via the high cube container.

Chapter 3 : South African road transport industry

3.1. Introduction

This chapter discusses the road transport industry of South Africa. The Department of Transport and the National Road Traffic Act are examined, which indicates the role that the Department plays in the regulation governed on vehicle height restriction, as well as, the axle mass and dimensions. In addition, the Road Freight industry is discussed depicting the important role they play in South Africa's economy alongside the Road Freight Association. Lastly, international best practices are discussed to provide possible solutions to South Africa's vehicle height restriction and the regulations in place.

3.2. Department of Transport

The Department of Transport (DoT) is the authority of regulation and coordination of transportation in South Africa, namely Road Transport, Public Transport, Rail Transportation, Civil Aviation, Maritime Transport and Integrated Transport Planning (ITP) (Department of Transport, 2019). The DoT believes that transport is the heart of South Africa's economic growth and social development. It is the DoT's mission to lead the development of efficient integrated transport systems by creating a framework of sustainable policies and regulations; and implementable models to support government strategies for economic, social and international development (Department of Transport, 2018).

In 2016/2017, the DoT had set aside R56.3 billion for various transport programmes and initiatives. By 2017/2018, it was expected to increase to R59.3 billion or by 11% (Department of Transport, 2018). As mentioned before, the DoT has six branches that it is composed of, but for the purpose of this study, the researcher will only look at road transport.

South Africa has a road network of 750 000km's, which is the tenth longest network in Africa and has the 18th longest Paved Road Network in the world (Department of Transport, 2018). The road network of South Africa has a replacement cost estimated at R2.75 trillion (Businesstech, 2019). The DoT established the South African National Roads Agency Limited (SANRAL), one of four agencies, to reduce the direct investment with the provision of infrastructure, operations and services.

SANRAL mandates the handling of the national road network, flowing from legislative and policy instruments. During 2017/2018, the road network was 22 213 kms of roads throughout South Africa, that SANRAL had control over (SANRAL, 2018). The national road network represents 2.85% of the total network of 750 000 kms and has an estimated 30% of all vehicle kilometres in South Africa. SANRAL's mandate is the management, control,

planning, development, funding, maintenance and rehabilitation of the proclaimed South African national road network, as determined by the SANRAL Act, No. 7 of 1998 (SANRAL, 2018). SANRAL's purpose is to deliver a safe, reliable, efficient and resilient transport system that will benefit all South Africans. In 2017/2018, a total revenue of R16.285 billion was recorded by SANRAL.

3.2.1. National Road Traffic Act

Transportation is the movement of people and goods from one place to another through various means (Encyclopaedia Britannica, 2019). Transport ensures trade amongst people and countries. Brand South Africa (2017) stated that government has emphasized the transport sector as a key contributor to South Africa's competiveness in global markets. It is crucial for economic growth and social development.

The DoT is responsible for the regulation and coordination of transportation in South Africa, namely Public Transport, Rail Transportation, Civil Aviation, Maritime Transport and Road Transport (Department of Transport, 2019). The Department of Transport implemented Regulation 224 (b) of the National Road Traffic Regulations 2000 under the National Road Traffic Act of 1996. Regulation 224 (a & b) is drawn from Part 3, the Dimensions of vehicles from Chapter 5, Fitness of vehicles. It states in this section the following (Department of Transport, 2019):

> *Overall height of vehicle and load*
> *No person shall operate on a public road a motor vehicle together with any load thereon, the overall height of which—*
> *(a) In the case of a double-deck bus exceeds four comma six five metres; and*
> *(b) In the case of any other motor vehicle exceeds four comma three metres.*

During the last twenty years, the global shipping industry moved away from standard general purpose and refrigerated 12 metre containers with an external height of 2.591 metres to high cube containers with an external height of 2.896 metres, with all other dimensions remaining (Fruit South Africa, 2018). High cube containers represent 50% of all container movements in South Africa (Fleet Watch, 2010). The history of high cube containers came with an increased rating of 30 tons, which increased from 25 tons (Fleet Watch, 2010). In conjunction with this, the non-trailer container market went through changes with high axle ratings (8.2 tons to 9.0 tons) as well as the tyre size and axle tracks increased. Fleet Watch (2010) stated that this led to the advent of the super link to accommodate both the 6 metre and 12 metre container on one vehicle.

In South Africa, a fifth wheel height of 1.320 metres is most commonly used. The fifth wheel is allied to various technical and engineering considerations. South African trailers, semi-trailers and skeletal trailers are designed to couple with fifth wheel equipped truck tractors having a deck height of 1.55 metres and 1.6 metres. When transported, high cube containers on the standard 1.6 metre deck height trailer results in the height being 20 centimetres over the legislated limit, which is 4.5 metres (Fruit South Africa, 2018). Therefore, a moratorium was instituted into effect to exempt any vehicle transporting ISO containers that exceeded the height limits. The researcher started this research where the moratorium was in place for seven years and had been extended to 1 January 2020. It has been mentioned that the moratorium has now been extended to June 2021 (Venter, 2019).

In South Africa, the Road Traffic Act, 1996 (Act No. 93 of 1996), and the Road Traffic Regulations (made in terms of this Act) determines the maximum mass limits of vehicles used on public roads (Department of Transport, 2004). The minimum combinations of three different factors calculate the gross vehicle mass (GVM). The GVM is the total mass of the vehicle and the load that it is designed to carry. These factors are the manufacturing ratings of the truck, the permissible tyre ratings, and the road loading and bridge loading stated in the legislation (Fleet Watch, 2001). The GVM includes any possible item that imposes a load on the tyres of the vehicles and is seen as being important for when judging where the product liability begins.

The operators of weigh bridges are responsible for calculating the mass load carrying capacity in accordance with the Bridge formula *(Permissible mass = [L × 2100] + 18 tonnes)* (Department of Transport, 2004). The bridge formula is a formula that is used to determine the permissible loads of axle groups to avoid damages to the bridges. Figure 3-1 depicts understanding the bridge formula and how to apply it.

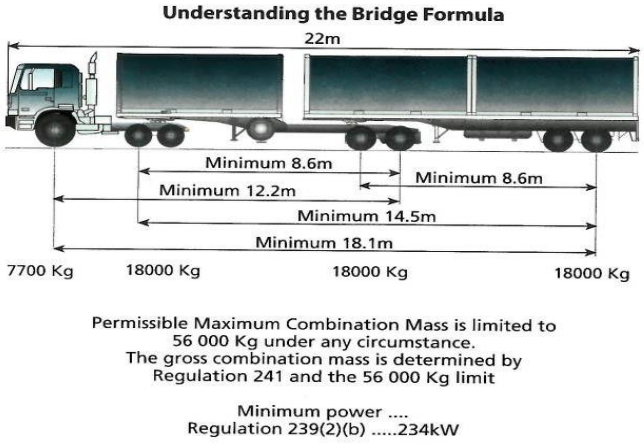


Figure 3-1: Understanding the bridge formula

Source: The South African Trailer Guide and Handbook, [s.a.]

South Africa's legislation of GVM of vehicles stipulates that a maximum permissible combination mass of 56 000 kilograms is allowed, with an overall vehicle length of 18.50 metres and a maximum vehicle height of 4.3 metres. The maximum axle weight allowed on vehicles with single steering axles is 7 700 kilograms, while 8 000 kilograms is allowed on axles with a non-steering axle (Department of Transport, 2004). Furthermore, the overall width of vehicles is restricted to 2.60 metres for vehicles with a GVM of 12 kilograms or more. Table 3-1 depicts the axle mass loads and the dimensions, as stated in the legislation.

Table 3-1: Axle mass loads and dimensions

AXLE MASS LOADS AND DIMENSIONS	
AXLE MASS RESTRICTIONS	
Single axle (steering) – single tyres	7 700kg
Single axle – single tyres	8 000kg
Single axle – dual tyres (four tyres)	9 000kg
Tandem axle unit – single tyres	16 000kg
Tandem axle – dual tyres	18 000kg
Tandem axle unit – singles or duals	24 000kg
Maximum permissible combination mass	56 000kg
MAXIMUM DIMENTIONAL RESTRICTIONS	
Overall length	
Any vehicle including a semi-trailer	12.5m
Articulated unit	18.5m
Full trailer excluding drawbar (GVM exceeds 12 000kg)	12.5m
Full trailer including drawbar (GVM does not exceed 12 000kg)	12.5kg
Overall length excluding drawbar, of a trailer with one axle/axle unit other than a semi-trailer *(i)* GVM exceeds 12 000kg *(ii)* GVM does not exceed 12 00kg	 11.3m 8.0m
Overall width	
Overall vehicle width (GVM is 12 000kg and over)	2.6m
Overall vehicle width (GVM is under 12 00kg)	2.5m
Overall height	

Maximum vehicle height	4.3m
Wheelbase	
Semi-trailer	10.0m
All other vehicles	8.5m
Front overhang	
In the case of a front-axle unit, the front overhang is measured from the foremost axle and not the centre of the axle unit. Semi-trailer	1.8m
Goods vehicle, 60% of wheelbase, or *a)* If the driver seat is not more than 1.7m from the front end, 6.2m minus half the wheelbase *b)* Any other goods vehicle (including a trailer) 5.8m minus half the wheelbase. In the case of the front-axle unit, the front overhang is measured from the foremost axle and not the centre of the axle unit	
Rear overhang (measured from the rearmost axle)	
Refuse collectors, roadmaking and road construction vehicles, buses and farming vehicles, 70% of wheelbase	
A trailer with one axle or one axle unit(excluding a semi-trailer) 50% of body length	
Any goods vehicle 60% of wheelbase	
Load projections	
Load projections must not be confused with overhang. Basically, overhang is part of the vehicle, whereas projection is that part of the load extending beyond the front end and/or rear end of the vehicle	
Maximum load projections	
Side load projection – in the case of a goods vehicle with a GVM exceeding 12 000kg maximum in each side of the longitudinal centre line In the case of any other goods vehicle	1.3m 1.25m
Front load projections on all goods vehicles – the projection of the load beyond the front of the vehicle OR the front overhangs plus the front load projection must not exceed the front overhang as prescribed in regulation 356 (1) (b)	300mm
Rear load projection on all goods vehicles – the projection of the load beyond	1.8m

the rear end of the vehicle	
Note: the combined length of a vehicle or combinations of vehicles plus the front or rear load projections must not exceed the prescribed overall length of the vehicle or combination	
Drawbar length	
Maximum length of conventional drawbar	2.0m
Length of an underslung drawbar – the maximum drawbar length is not prescribed, but the maximum distance between the rear end of the towing vehicle and the front end of the trailer must not exceed	2.5m
Maximum axle mass loads and dimensions of busses	
Maximum length of a rigid bus	15m
Maximum length of a train bus	22m
Maximum length of a Rapid Transport Bus train	26m
Maximum width of a bus (front wheel track must not exceed 1.9m)	2.6m
Maximum axle mass load of a Rapid Transport Bus train (dual wheel – non-steering)	13 000kg
Maximum axle mass load on a Rapid Complimentary or Trunk Bus (dual wheels – non-steering)	12 000kg
Maximum axle mass load on any other bus (dual wheels – non-steering)	10 200kg

Source: The South African Trailer Guide and Handbook, [s.a.]

Brooke (2018) stated that a proposal has been sent to the Department of Transport to amend the regulation as follows:

> *No person shall operate on a public road a motor vehicle together with any load thereon, the overall height of which—*
> *(a) In the case of a double-deck bus* ***and ISO containers*** *exceeds four comma six five metres; and*
> *(b) In the case of any other motor vehicle exceeds four comma three metres.*

3.3. Road freight industry

The road freight sector is a significant contributor to South Africa's economy. It provides speed, flexibility and adaptability. South Africa's demand for freight transport is expected to increase between 200% and 250% over the next 15 to 20 years (FDK Transport, 2019). Eighty percent (80%) of all freight is transported via road compared to any other mode of transport. This industry consists of both public and private transportation, including trucks

moving goods in transit to and from the airports; to and from rail; to and from clients and from pipeline distribution centres to petrol stations (Transport Education Training Authority, 2018). The number of employees in this industry is approximately 70 000. There is a constant movement of freight and the industry has experienced an increase in the volume of goods being transported. The road freight market totals about 640 million tonnes of traffic per annum.

Logistics costs in 2016 made up to 11.8% of South Africa's GDP and amounted to approximately R499 billion (Venter, 2016). Transport costs formed the largest portion of the logistics sector at 55%, with land freight transport volumes at 856 million tonnes by the end of 2016. It is believed that South Africa is the leading country in transport and logistics amongst middle income countries. Havenga, Simpson, King, de Bod and Braun (2016) stated that the agricultural sector is responsible for approximately 76% of the land freight volume.

The Road Freight Association, also known as the RFA, was established in 1975 to support members of the road freight industry. The RFA is a facilitating body that influences the state of the industry, rates, upkeep of the road infrastructure, road safety, and freight security, driver interests, cross-border transport, development funding for emerging operators, education, health, the fuel price, law enforcement, labour relations and many other issues pertaining to road freight transport (Road Freight Association, 2019). The RFA has approximately 445 members consisting of small and medium sized trucking companies, family-owned businesses, owner-operators and many of South Africa's large trucking companies. These members of the RFA derive from all sectors of the trucking industry. It is of utmost importance that these members comply with the Code of Conduct in adherence of the highest standards of professionalism. By adhering to the Code of Conduct, it ensures protection of the credibility, image and sustainability of the road freight industry.

3.3.1. Semi-trailer truck

South Africa makes use of the semi-trailer truck to transport containers on the roads. A semi-trailer truck is a truck that only supports itself on the rear axle(s). Either another trailer or a truck or semi-truck supports the front of this truck. A large proportion of the weight of a semi-trailer is supported by a road tractor or by a detachable front axle assembly known as a dolly or by the tail of another trailer (The South African trailer guide and handbook, [s.a.]). A semi-trailer is generally equipped with legs, which can be lowered when it is uncoupled. It has a kingpin that attaches to the fifth wheel of a semi-truck (tractor) (Bowen, 2018). Semi-trailers are normally used for a full load going to single destination with a single combination with the

tractor. The South African trailer guide and handbook ([s.a.]) states that it is designed that at least 15% of the tare is super-imposed on and borne by a vehicle drawing this trailer.

This truck is designed to couple with fifth wheel equipped truck tractors resulting in a deck height of 1.55 metres and 1.6 metres. These semi-trailer trucks consist of either a tandem or a tridem axle. A tandem axle is a trailer with two axles. These axles are one behind the other. This allows the trailer truck to travel in a straight line more easily and it absorbs more shock, producing less bounce and keeps the cargo more secure. A tridem axle is a trailer with three consecutive axles that are spaced out evenly over a distance and over the whole width of the truck.

South Africa makes use of four types of semi-trailer trucks to transport containers all across the country. These trucks are namely: the flat deck trailer, flat deck interlink trailers, skeletal trailers and skeletal interlink trailers. The dimensions of these trailers are shown in Figures 3-2 to 3-5.

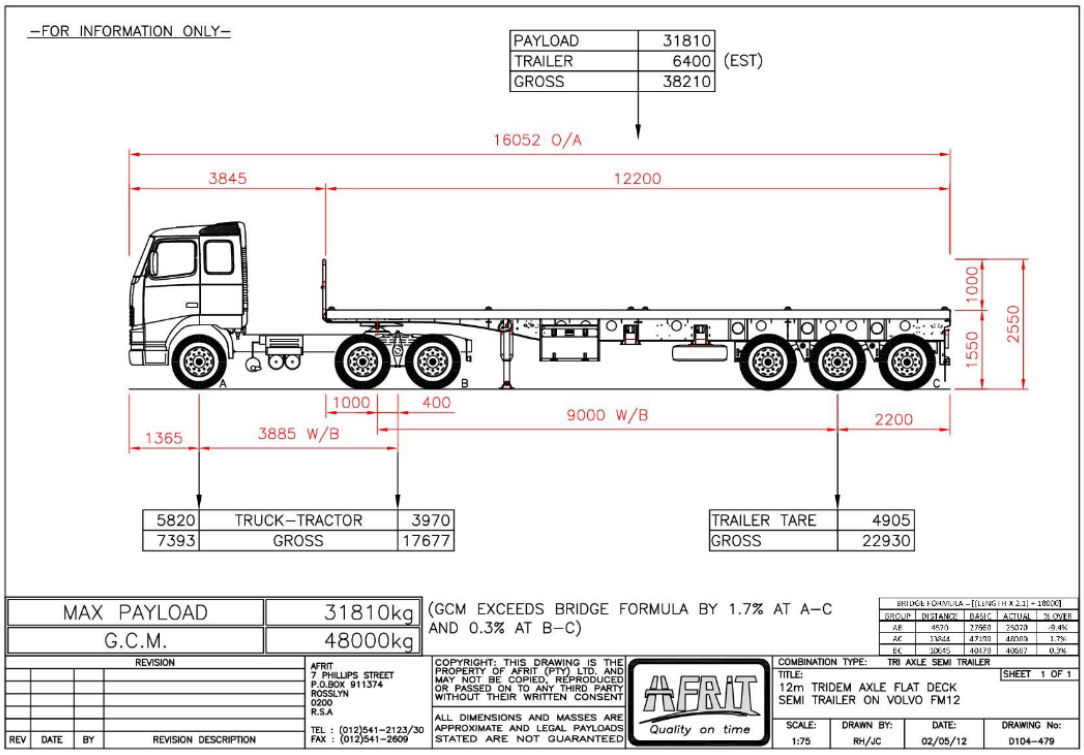


Figure 3-2: Flat deck trailer

Horne, 2019

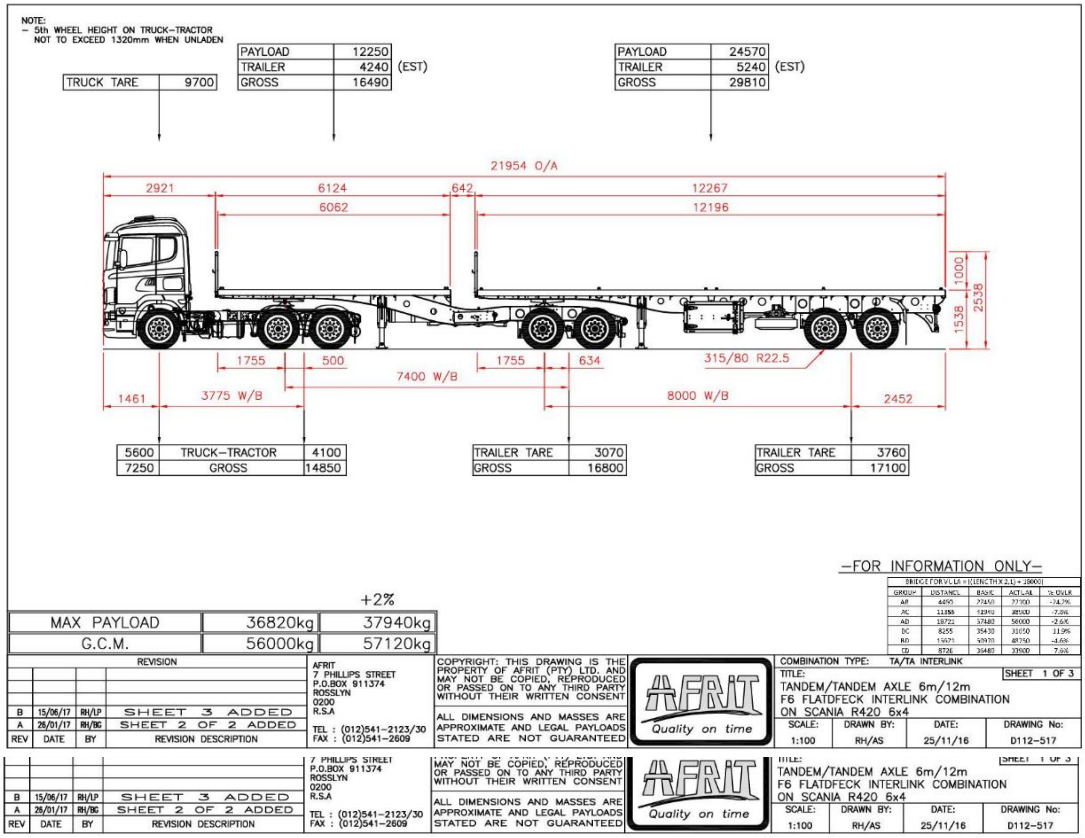


Figure 3-3: Flat deck interlink combination

Source: Horne, 2019

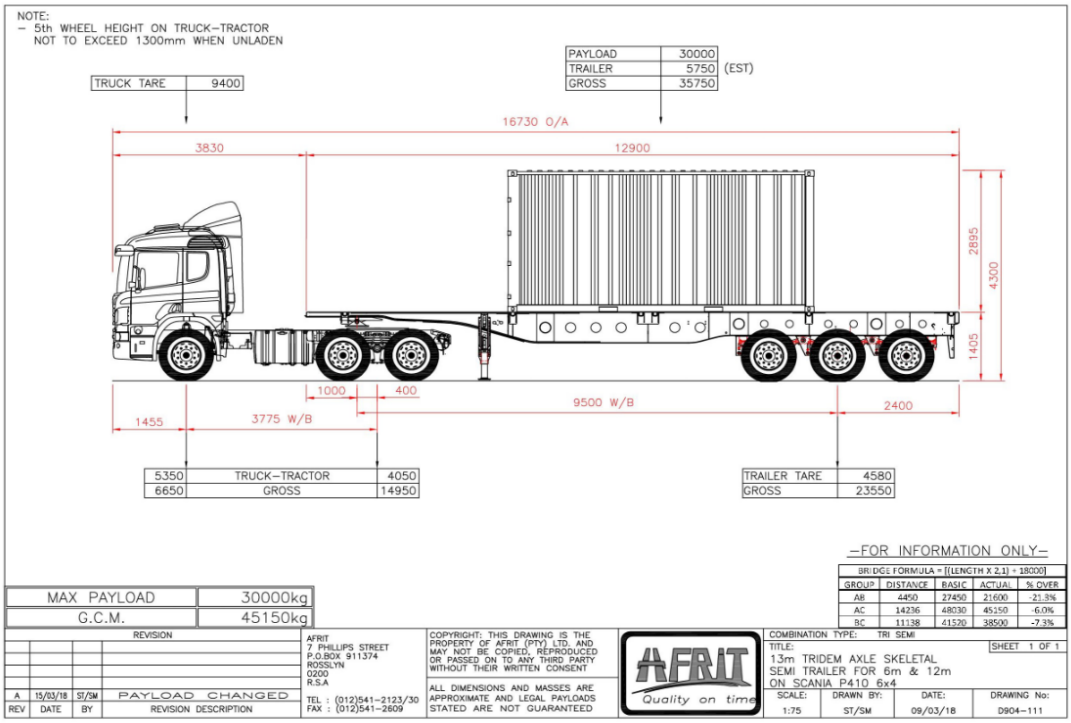


Figure 3-4: Skeletal trailer (shown with single 20-foot container)

Source: Horne, 2019

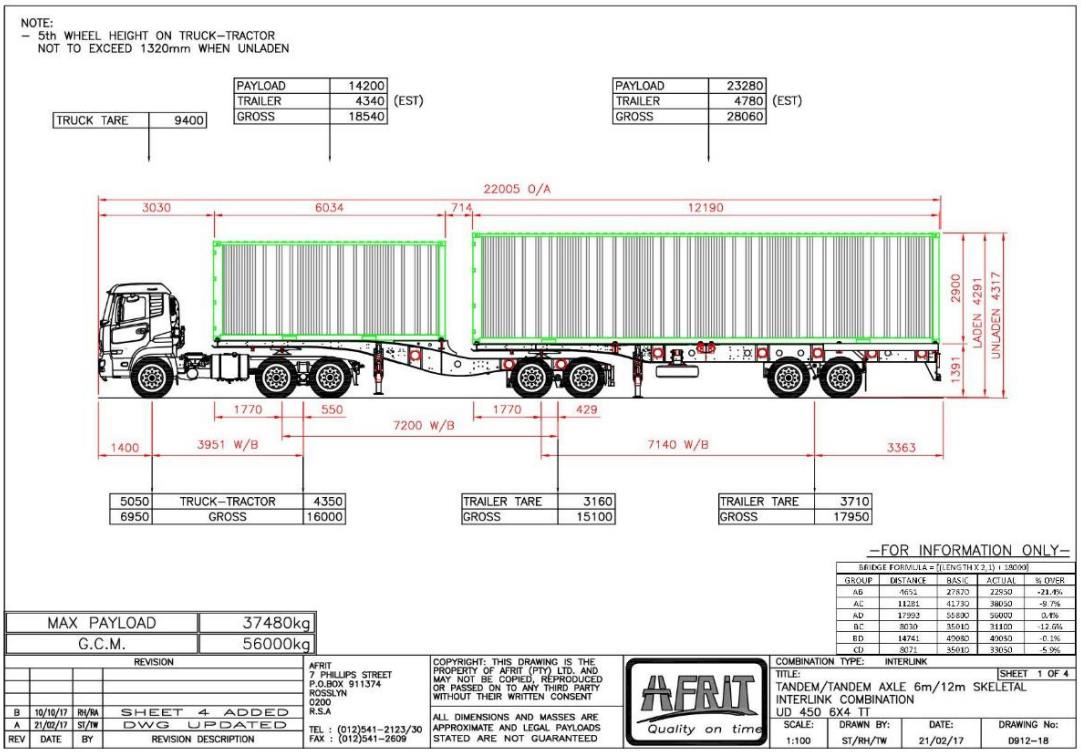


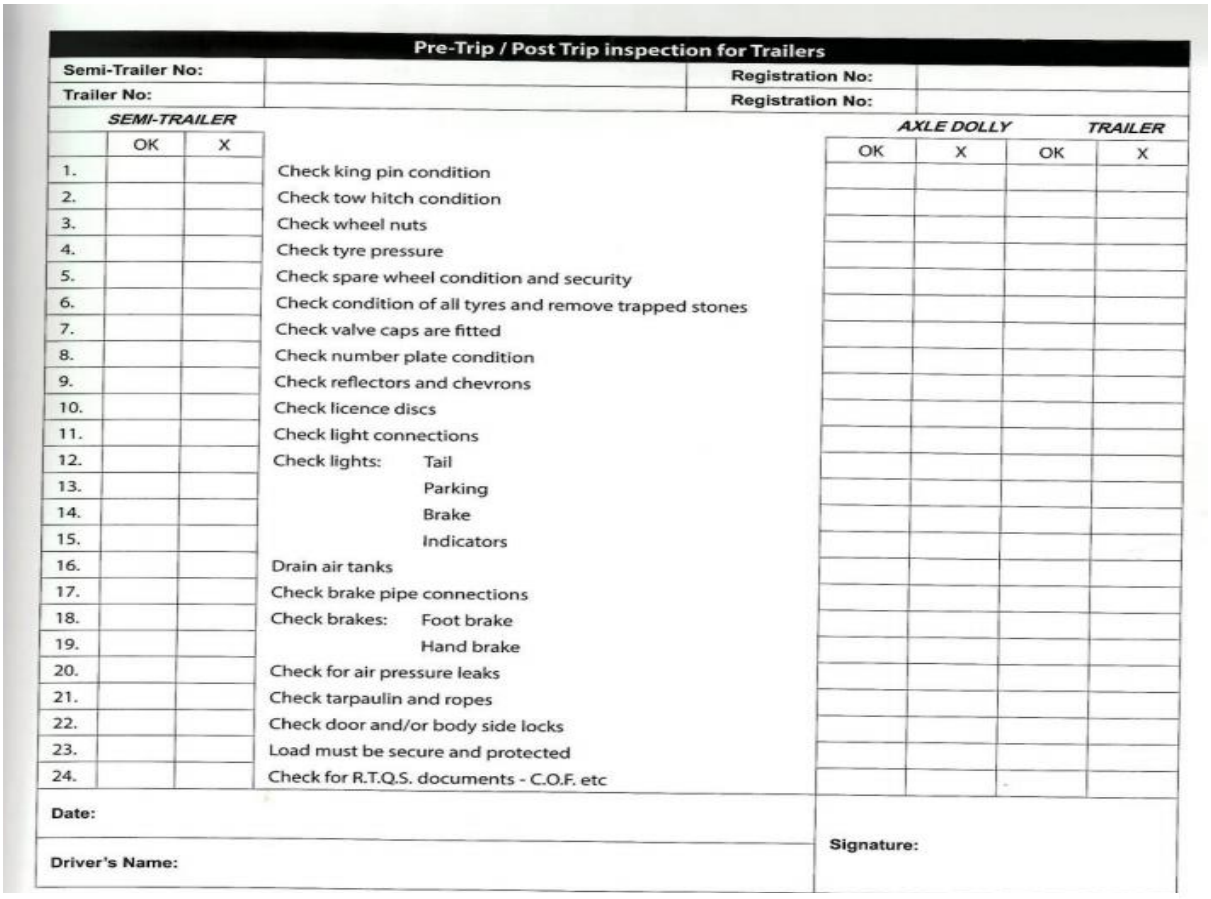
Figure 3-5: Skeletal interlink combination (shown with 20-foot and 40-foot high cube container)

Source: Horne, 2019

3.3.1.1. Pre-trip Inspection

South Africa does not rank a pre-trip inspection high and most of the time transport companies do not plan to introduce it (The South African Trailer Guide and Handbook, [s.a.]). Pre-trip inspection is conducted to ensure that the vehicle is roadworthy. The intention is to prevent any accidents that could endanger the safety of the driver and other road users. It is necessary and lessens hassles, time and money in the end. For safe operation of any vehicle, vehicle inspection, repair and maintenance standards are critical. A pre-trip inspection is designed to prevent accidents, injuries and fatalities from unsafe vehicles operating on roads.

The pre-trip checklist has to be completed before a truck or trailer is used for the day and has to be repeated every day. A pre-trip check list should incorporate the basic truck and trailer features. Therefore, during an inspection, if a vehicle defect is detected, it could save an operator the time of a problem later. The vehicle could have a breakdown on the road, which will cost the operator time and money or an accident could take place. Constant pre-trip inspections will make the vehicle safer to drive and prevent unnecessary costs. Figures 3-6, 3-7 and 3-8 depict the all documents that are required to undertake the pre-trip inspection.



Pre-Trip / Post Trip inspection for Trailers

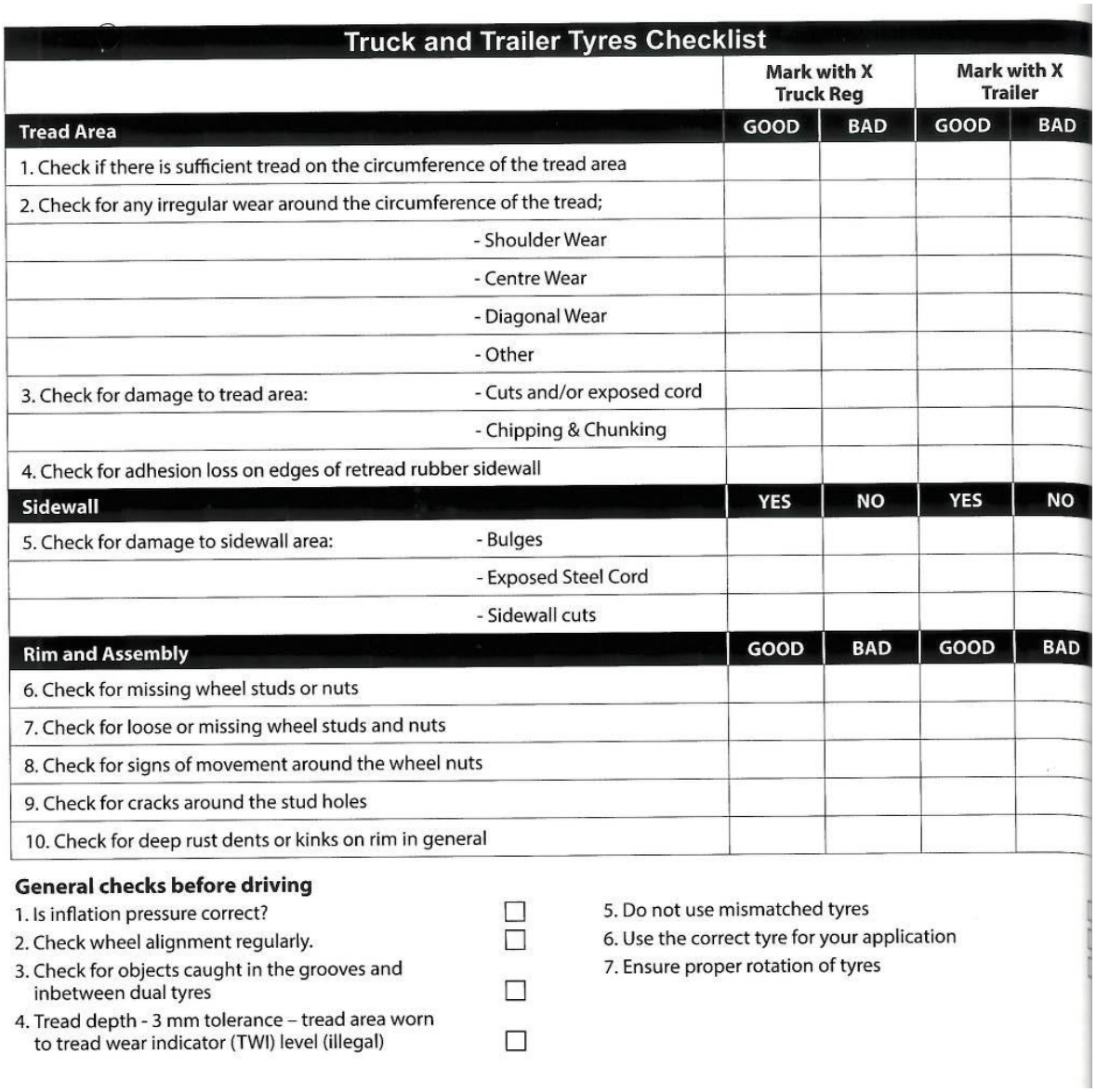
Semi-Trailer No:				**Registration No:**				
Trailer No:				**Registration No:**				
	SEMI-TRAILER			***AXLE DOLLY***		***TRAILER***	
	OK	X		OK	X	OK	X
1.			Check king pin condition				
2.			Check tow hitch condition				
3.			Check wheel nuts				
4.			Check tyre pressure				
5.			Check spare wheel condition and security				
6.			Check condition of all tyres and remove trapped stones				
7.			Check valve caps are fitted				
8.			Check number plate condition				
9.			Check reflectors and chevrons				
10.			Check licence discs				
11.			Check light connections				
12.			Check lights: Tail				
13.			Parking				
14.			Brake				
15.			Indicators				
16.			Drain air tanks				
17.			Check brake pipe connections				
18.			Check brakes: Foot brake				
19.			Hand brake				
20.			Check for air pressure leaks				
21.			Check tarpaulin and ropes				
22.			Check door and/or body side locks				
23.			Load must be secure and protected				
24.			Check for R.T.Q.S. documents - C.O.F. etc				

Date: **Signature:**

Driver's Name:

Figure 3-6: Pre-trip and post-trip inspection for trailers

Source: The South African Trailer Guide and Handbook, [s.a.]



Truck and Trailer Tyres Checklist

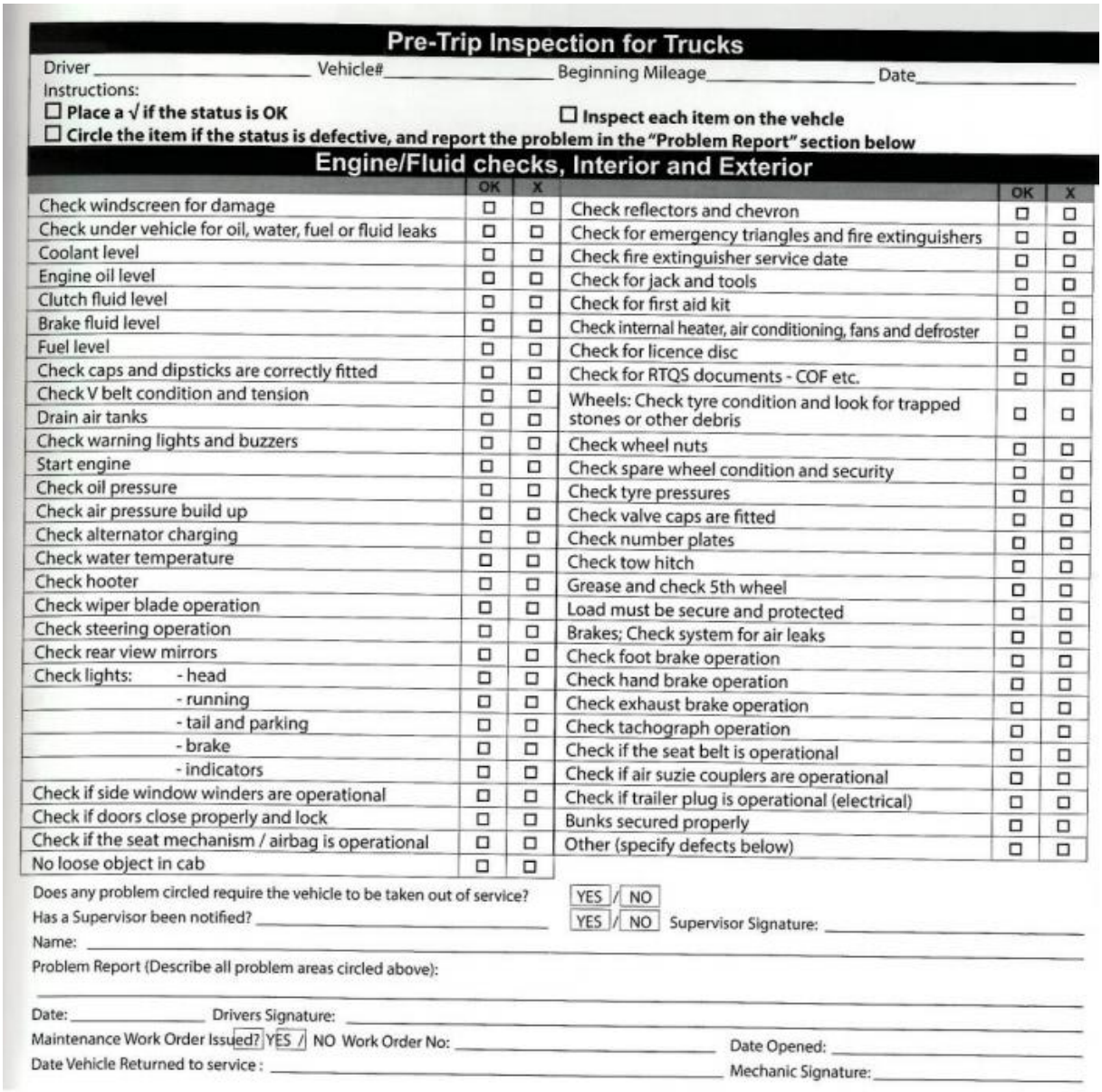
		Mark with X Truck Reg		Mark with X Trailer	
Tread Area		**GOOD**	**BAD**	**GOOD**	**BAD**
1. Check if there is sufficient tread on the circumference of the tread area					
2. Check for any irregular wear around the circumference of the tread;					
	- Shoulder Wear				
	- Centre Wear				
	- Diagonal Wear				
	- Other				
3. Check for damage to tread area:	- Cuts and/or exposed cord				
	- Chipping & Chunking				
4. Check for adhesion loss on edges of retread rubber sidewall					
Sidewall		**YES**	**NO**	**YES**	**NO**
5. Check for damage to sidewall area:	- Bulges				
	- Exposed Steel Cord				
	- Sidewall cuts				
Rim and Assembly		**GOOD**	**BAD**	**GOOD**	**BAD**
6. Check for missing wheel studs or nuts					
7. Check for loose or missing wheel studs and nuts					
8. Check for signs of movement around the wheel nuts					
9. Check for cracks around the stud holes					
10. Check for deep rust dents or kinks on rim in general					

General checks before driving

1. Is inflation pressure correct? ☐
2. Check wheel alignment regularly. ☐
3. Check for objects caught in the grooves and inbetween dual tyres ☐
4. Tread depth - 3 mm tolerance – tread area worn to tread wear indicator (TWI) level (illegal) ☐
5. Do not use mismatched tyres
6. Use the correct tyre for your application
7. Ensure proper rotation of tyres

Figure 3-7: Truck and trailer tyres checklist

Source: The South African Trailer Guide and Handbook, [s.a.]



Pre-Trip Inspection for Trucks

Driver _____ Vehicle#_____ Beginning Mileage_____ Date_____

Instructions:

☐ Place a √ if the status is OK ☐ Inspect each item on the vehcle

☐ Circle the item if the status is defective, and report the problem in the "Problem Report" section below

Engine/Fluid checks, Interior and Exterior

	OK	X		OK	X
Check windscreen for damage	☐	☐	Check reflectors and chevron	☐	☐
Check under vehicle for oil, water, fuel or fluid leaks	☐	☐	Check for emergency triangles and fire extinguishers	☐	☐
Coolant level	☐	☐	Check fire extinguisher service date	☐	☐
Engine oil level	☐	☐	Check for jack and tools	☐	☐
Clutch fluid level	☐	☐	Check for first aid kit	☐	☐
Brake fluid level	☐	☐	Check internal heater, air conditioning, fans and defroster	☐	☐
Fuel level	☐	☐	Check for licence disc	☐	☐
Check caps and dipsticks are correctly fitted	☐	☐	Check for RTQS documents - COF etc.	☐	☐
Check V belt condition and tension	☐	☐	Wheels: Check tyre condition and look for trapped stones or other debris	☐	☐
Drain air tanks	☐	☐			
Check warning lights and buzzers	☐	☐	Check wheel nuts	☐	☐
Start engine	☐	☐	Check spare wheel condition and security	☐	☐
Check oil pressure	☐	☐	Check tyre pressures	☐	☐
Check air pressure build up	☐	☐	Check valve caps are fitted	☐	☐
Check alternator charging	☐	☐	Check number plates	☐	☐
Check water temperature	☐	☐	Check tow hitch	☐	☐
Check hooter	☐	☐	Grease and check 5th wheel	☐	☐
Check wiper blade operation	☐	☐	Load must be secure and protected	☐	☐
Check steering operation	☐	☐	Brakes; Check system for air leaks	☐	☐
Check rear view mirrors	☐	☐	Check foot brake operation	☐	☐
Check lights: - head	☐	☐	Check hand brake operation	☐	☐
- running	☐	☐	Check exhaust brake operation	☐	☐
- tail and parking	☐	☐	Check tachograph operation	☐	☐
- brake	☐	☐	Check if the seat belt is operational	☐	☐
- indicators	☐	☐	Check if air suzie couplers are operational	☐	☐
Check if side window winders are operational	☐	☐	Check if trailer plug is operational (electrical)	☐	☐
Check if doors close properly and lock	☐	☐	Bunks secured properly	☐	☐
Check if the seat mechanism / airbag is operational	☐	☐	Other (specify defects below)	☐	☐
No loose object in cab	☐	☐			

Does any problem circled require the vehicle to be taken out of service? YES / NO

Has a Supervisor been notified? _____ YES / NO Supervisor Signature: _____

Name: _____

Problem Report (Describe all problem areas circled above):

_____

Date: _____ Drivers Signature: _____

Maintenance Work Order Issued? YES / NO Work Order No: _____ Date Opened: _____

Date Vehicle Returned to service : _____ Mechanic Signature: _____

Figure 3-8: Pre-trip inspection for trucks

Source: The South African Trailer Guide and Handbook, [s.a.]

In conjunction with the pre-trip inspection, South Africa has not experienced any accidents or fatalities with the transportation of high cube containers (The South African Trailer Guide and Handbook, [s.a.]). There have, however, been a number of road accidents typically with oncoming traffic and reckless driving (Kwalar, 2019). Kwalar (2019) states that a few accidents resulted from collisions with the bottom of bridges, but these accidents did not include the fruit industry or any container cargo. There is not an official report or any document that stipulates any link between high cube containers and accidents or a link between high cube containers and any overloading and/or damages to the road surface or bridges.

3.4. Rail transport industry

Rail transport has the potential to provide a cost effective freight transport option, making the economy more efficient and provide access for freight and passenger movements (Department of Environmental Affairs, [s.a.]). The majority of freight in South Africa is transported by road rather than rail, however, it would be a viable option to move the transportation of freight from road to rail transport. South Africa's current rail network is the eleventh-largest in the world at 22,387 route-km or 30,400 track-km (Kneale, 2017). Kneale (2017) states that it comprises of 12.801 km of national network, 7.278 km of branch lines and 2.228 km of narrow gauge urban network, as well as 80 km of standard gauge regional rapid transit network.

Traditionally, rail transport was the preferred method of transporting freight in South Africa, but following the deregulation of the transport sector, the rail market share had progressively decreased (Department of Environmental Affairs, [s.a.]). This led to a decrease in infrastructure investment, which in turn posed significant challenge; namely the shortage of rail capacity. High cube containers cannot be accommodated on rail safely due to structure gauge restrictions (Transnet, 2016). The capacity requirements beyond that provided for by 150-wagon intermodal trains will require a large-scale intervention such as the construction of a third line or a change of track gauge to permit double-stacking of containers. Transnet (2016) states that the overhead traction equipment will limit the vertical height of moving loads and constrain double stacking of containers unless it is raised as has been done in other parts of the world. The narrow track gauge also limits centre-of-gravity height, thereby rendering the double stacking of containers unsafe. Thus, the necessary rail infrastructure in terms of intermodal rail terminals and rolling stock do not currently exist to allow the transportation of high cube containers on rail, and more so to double stack these containers. Therefore, it would be necessary for upgrades to be made to South Africa's rail infrastructure before this becomes a viable option.

3.5. International best practices

South Africa could implement an international best practice in terms of regulating high cube containers. Best practice is an industry-wide agreement that standardises the most effective and efficient way to accomplish a desired outcome (Techopedia, 2019). This ensures that there is minimal problems or complications that could arise.

Most international countries have a maximum permissible height of 4 metres, including Belgium, Germany and Italy. Brazil, on the other hand, has a maximum permissible height of

4.40 metres. South Africa could consider changing the container equipment to a low bed skeletal trailer, apply for an abnormal permit or implement a PBS standard.

3.5.1. Low bed skeletal trailers

A challenge with transporting containers is that the containers come in different sizes, therefore, containers require special vehicles for transportation (ANSTER, 2019). Many companies require a transport solution that is able to adapt to different sizes and types of containers. A low bed trailer is designed to accommodate specialised loads on roads without being hazardous. A low bed trailer has a low deck that is able to accommodate tall cargo without exceeding legal road restrictions (Truck & Trailer, 2018).

South Africa could consider making use of low bed skeletal trailers with a deck height of 1.40 metres (Brooke, 2015). These trailers can predominately be used in the fruit industry on long distance routes. These low deck trailers have a tare mass of approximately 5.2 tons, which compensates for the fitting of Genset units that power the reefer container during transit. When transporting containers on South Africa's roads, the trailer height of 1.40 metres is exceeded. This would be a viable solution for South Africa to meet the legislative height of 4.3 metres.

However, there is a financial cost attached to this trailer. The cost of such a trailer will be approximately R500 000, which will be depreciated over ten years (Brooke, 2015). Brooke (2015) stated that an average payload factor per year is roughly 200 loads (seasonality of fruit exports being 20 weeks with an average of 10 loads per week for a year) equates to an additional R495 per load to absorb the cost of the new equipment. Thus, transporters will forgo any opportunity to transport general freight goods in addition to the containers out of season. These trailers will only be able to transport containers and be subject to seasonality of container traffic (Brooke, 2015). This will, therefore, increase the cost of transporting containers drastically in South Africa.

3.5.2. Abnormal load permit

South Africa's road freight industry could consider making use of an abnormal load permit to transport high cube containers on the roads. Container transport is an extremely dynamic activity that does not depict which vehicle will be used to transport a specific container. Container terminals require that containers be removed as they are received, and delays in the collection of these containers could affect the efficiency within the terminal.

An abnormal load permit is also known as an exemption permit that includes any vehicle or load which does not comply with the requirements of the National Road Traffic Act, 1996

(ACT 93 OF 1996). In certain circumstances, a vehicle or a load that exceeds the legal or regulated heights, weights and dimensions, could have an abnormal load permit issued to them authorising the operation of a vehicle for a specific period. Foresight Publications (2019) stated that permits would only be granted for indivisible loads, meaning loads that cannot, without disproportionate effort, cost or risk of damage, into two or more loads. In addition, a permit is not usually granted if a load can be legally transported on another vehicle, which complies with the regulations.

Moving an abnormal load is often considered to have an economic or social interest in the country, which provide operators the opportunity to transport the load on South African roads. Abnormal vehicles, whether in terms of dimensions and/or mass, operate outside the criteria used for the structural design of road infrastructure (Department of Transport, 2017). An abnormal vehicle operating on the road, therefore, creates additional risks in terms of damage to the road infrastructure and the safety of other road users. Figure 3-9 depicts an articulated abnormal vehicle that is used for the conveyance of abnormal loads.

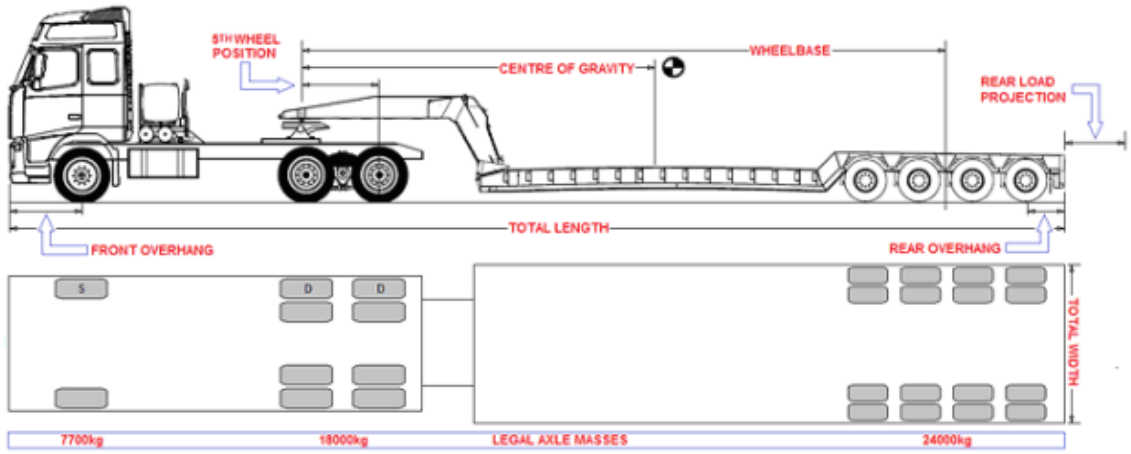


Figure 3-9: Articulated abnormal vehicle

Source: PCF Transport Advisors, 2019

The permissible dimensions for the above vehicle are as follows:

- Length: 18 500mm (including any projection)
- Width: 2600mm
- Height: 4300mm (loaded height)
- Wheelbase: 10 000mm

The permitted axle masses for the above vehicle are as follows:

- Mass on front/steer axle of 7700kg or manufacturers rating - the lesser will apply
- Mass on drive axles (group) of 18000kg
- Mass on trailer axles (group) of 24000kg
- Gross combination mass (GCM) of 56000kg, with the above three bullets added together will still apply.

Once an operator has applied for an abnormal load permit and has received it, it is up to the operator to adhere to the guidelines. The original permit must be in the vehicle and the person responsible for the load or vehicle must at all times sign the permit. All the conditions pertaining to the permit must be explained to the driver. Red flags measuring at least 600mm in diameter must be placed at the outer corners of the load or vehicle (PCF Transport Advisors, 2019). The widest point of the load, if the load is wider than the vehicle, is normally be the point where the flags should be mounted. The abnormal warning boards must be manufactured to the prescribed requirement and appear on the rear and front of the vehicle. The board size must adhere to a length of 2000mm and a height of 300mm. The vehicle should contain amber warning lights to indicate that the vehicle is abnormal. In addition to the usage of an abnormal vehicle transporting an abnormal load and the fact that it has to carry an abnormal permit, there are fees attached that have been effective since February 2016. Table 3-2 shows the fees that are payable for an abnormal load permit.

Table 3-2: Abnormal Load Permit Fees

Basic fee (unrecoverable) for engineering input such as route clearance, combinations over 125 000 kg GCM or 5 m wide	R810,00
Basic fee (unrecoverable) application fee	R300,00
Any changes to permit (up to 3)	R240,00
1 month area permit (including empty leg)	R340,00
3 month area permit (including empty leg)	R680,00
6 month area permit (including empty leg)	R1 360,00
12 month area permit (including empty leg) Old generation car carriers registered pre April 2013	R750,00
12 month height permit (up to 4,6 m high, country wide) PBS car carrier	R1 500,00
12 month area/period	R2 720,00
12 month Smart Truck (PBS) with mass	R32 500,00
12 month Smart Truck (PBS) with no mass	R16 250,00

Fax fee	R100,00
Certified copy of permit	R120,00
Abnormal vehicle sequence registration	R800,00
Abnormal vehicle combination registration (initial and 5-year renewal)	R800,00
Abnormal vehicle combination registration (other/recalculation/etc)	R270,00
Congestion factor (width/length)	6,8 c/km
Mass factor	71 c/km
Provincial escorting fee/vehicle	R11,20/km
Provincial escorting fee/vehicle	R21,00/km
Provincial escorting fee/hour/officer	R185,00/hr
Minimum escorting fee/vehicle	R725,00
Weekend escorting fee per km (if requested by applicant - not refundable if cancelled after the weekend)	R21,00/km
Minimum mass fee per axle	R15,8c/km
Additional fee for weekend permits (allowed at the discretion	R620,00
Copy of TRH11 (Guidelines for the Conveyance of Abnormal Loads	R90,00

Source: Foresight Publications, 2019

For a vehicle to be considered abnormal, the dimensions and masses have to exceed the above mentioned criteria, and all fees need to be paid accordingly.

3.5.3. Performance-Based Standard (PBS)

The Performance-Based Standards or “Smart Truck” pilot project is a national research initiative that is trialling the introduction of high productivity road freight transport in South Africa (Nordengen, 2018). The DoT and Council for Scientific and Industrial Research (CSIR) have identified South Africa as a research area as a result of the possible benefits in terms of transport efficiency, road/vehicle safety, emissions reduction, and the protection of road infrastructure. Nordengen (2018) states that the PBS approach includes setting standards to specify the performance required from the operation of a vehicle on a network and then determining the achieved performance level.

These “Smart Trucks” are developed and regulated according to a Performance-Based Standards (PBS) framework, which has proven highly effective in Australia, New Zealand,

Canada and parts of Europe (Nordengen, 2018). The pilot project was initiated in 2004, and has since grown to consist of 245 demonstration vehicles in various industries, which are closely monitored for impact and performance. The timeline of the PBS pilot project is shown in Figure 3-10.

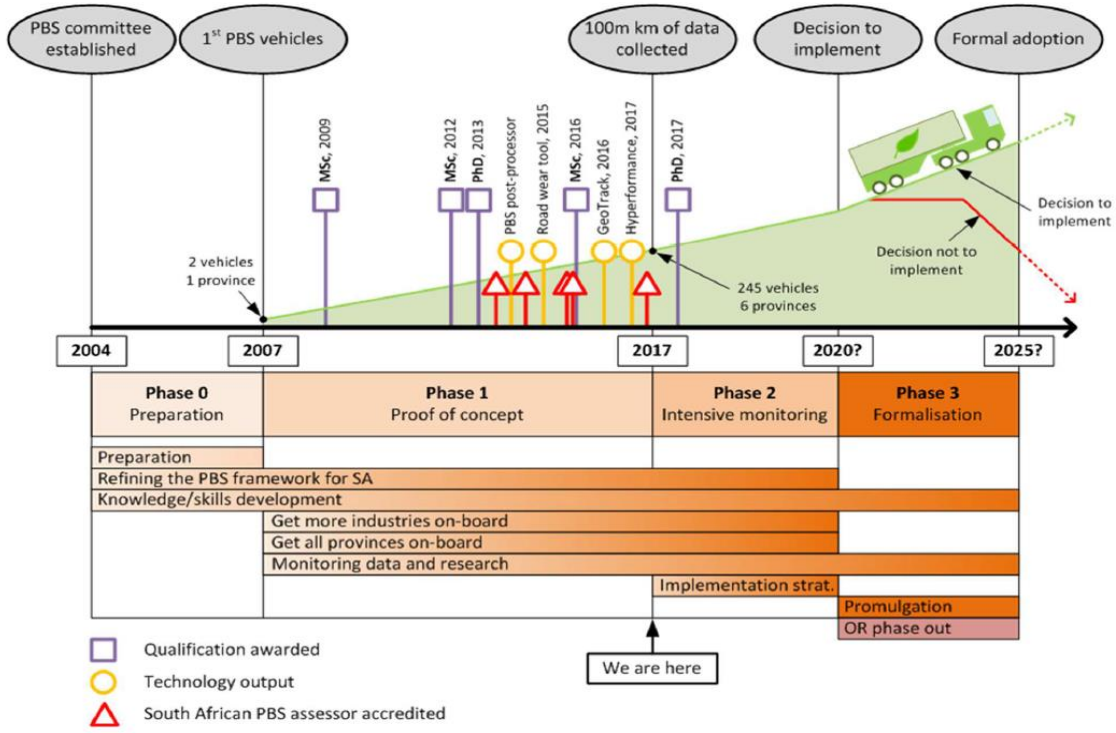


Figure 3-10: Timeline of the Smart Truck project and important timeline

Source: Nordengen, 2018

Over 100 million kilometres of data have been collected and processed to date, specifying the overall net benefits of the PBS framework, resulting in: a 12% decrease in fuel use and emissions; a 13% reduction in road wear impact; a 39% reduction in road crashes; and 22% fewer truck kilometres travelled on South African roads. The PBS project is on the verge of transitioning from Phase 1, which is the proof of concept and initial data collection into Phase 2, which is the increased participation and data collection and formalisation of an implementation strategy (Nordengen, 2018). Figure 3-11 depicts the number of PBS vehicles used in the South African provinces.

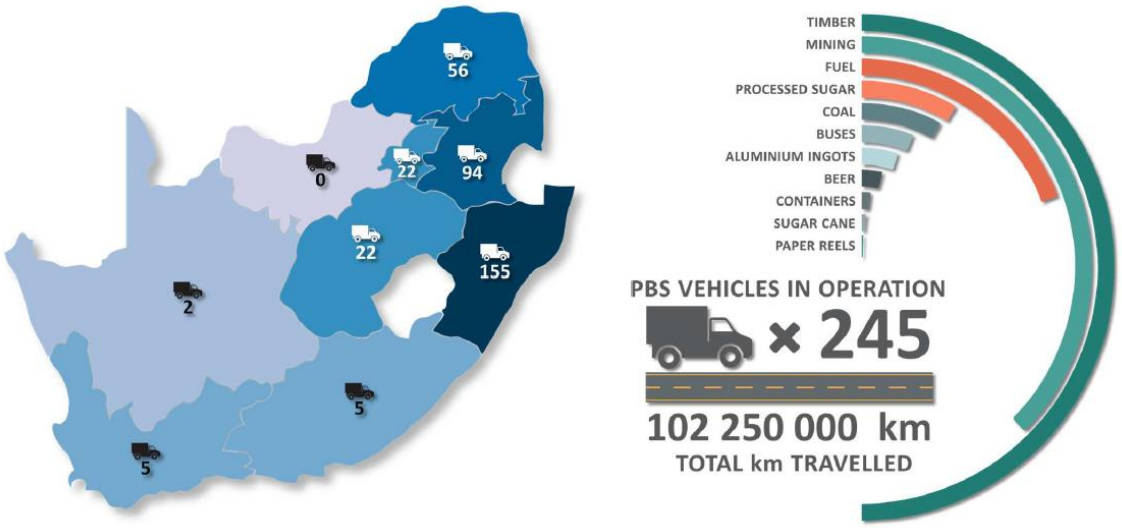


Figure 3-11: Overview of PBS pilot project operations per province and commodity

Source: Nordengen, 2018

In Figure 3-11, the 245 PBS vehicles are mainly operating in the provinces of KwaZulu-Natal (155), Mpumalanga (94) and Limpopo (56), with a limited number operating in Gauteng (22), Free State (22) and Eastern Cape (5). The PBS vehicles operating in the Northern and Western Cape are road trains operating in remote areas as part of mining operations, which both have five PBS vehicles operating there. The PBS pilot project in South Africa has been running for approximately ten years and the following benefits have been highlighted (Nordengen, 2018):

- Reduced number of heavy vehicle trips on the road network
- Reduced crash rates
- Reduced fuel use resulting in a reduced cost per tonne.km of payload transported
- Reduced greenhouse gas emissions (CO_2) per tonne.km of payload transported
- Reduced overloading and speeding
- Improved driver skills and training

The PBS project has had its challenges as most of the vehicles are longer and heavier than the maximum lengths and masses permitted in the regulation. For the project to be a success in the future, real-time monitoring, such as route speed and mass compliance, are critical. There has been progress in developing the framework, policy and procedures, but there is a need to formalise these and develop recommendations for possible national implementation.

3.6. Conclusion

This chapter highlights the importance of the Department of Transport and the road freight industry, thus, indicating the role the Department plays in the regulation governing the vehicle height restriction. Lastly, international best practices were discussed to provide possible solutions to South Africa's vehicle height restriction and the regulations in place. Thus, objectives four and five were highlighted in this chapter and were met.

Chapter 4 : Stakeholder analysis and impact analysis

4.1. Introduction

This study focuses on the likely impact on the fruit industry if the regulation governing vehicle height restriction is not amended to allow road transport operators to transport high cube containers on normal trailers at a total height of 4.6 metres. The researcher conducted a stakeholder analysis to determine the important stakeholders involved in the legislation governing the vehicle height restriction. In addition, an impact analysis was conducted to determine the various impacts that could result from the regulation being amended or not.

4.2. Stakeholder analysis

Venter and Oosthuizen (2018:317) are of the opinion that a stakeholder can be internal or external, but is central to the success of any project. A stakeholder in an organisation is (by definition) any group or individual who can affect or is affected by the achievement of the organisation's achievements (Venter & Oosthuizen, 2018:318). These stakeholders may or may not have legitimate claims, but might nonetheless have influence on or be influenced by the organisation. In the case of this study, the government or the fruit industry could possibly influence other potential stakeholders.

A stakeholder analysis is a vital technique for identifying and analysing stakeholders and their needs. The research makes use of a stakeholder management process that:

1. Identifies the stakeholders,
2. Analyses the relationships of stakeholders,
3. Develops a stakeholder strategy and
4. Engages and communicates with the stakeholders.

This process will remain flexible and it is likely that the relationships with the stakeholders could possibly change. Each step in the process is covered.

Step 1: Identify the stakeholders

Stakeholders are often identified according to their relevant importance to the outcome. A stakeholder is regarded as important based on their ability to influence the outcome. The levels of power and interest were determined by who would be affected by the regulation. These stakeholders were identified based on the regulation itself and the various stakeholders who work directly with high cube containers. Table 4-1 identifies the stakeholders for this study.

Table 4-1: Stakeholders related to the use of high cube containers in South Africa

Stakeholders	Definition	Power and interest
Shipping Lines	The shipping lines moved towards the use of high cube containers approximately 30 years ago. It is the most cost-effective and flexible way of transporting containers to international markets via transhipment. The fresh produce needs to be protected and handled at the correct temperature throughout the transportation leg.	Low levels of power High levels of interest
Freight forwarders	A freight forwarder is a business that arranges the storage and shipping of goods on behalf of the shipper. They arrange the importing and exporting.	Low levels of power High levels of interest
Logistics Service Providers (LSP's)	A logistics service provider (LSP) is a third party to whom logistics operations are outsourced. These LSPs provide logistics services, such as warehousing, inventory management, cross docking, transportation and freight forwarding.	Low levels of power High levels of interest
Infrastructure builders	Infrastructure builders are important stakeholders as they play an important role in the building of bridges. If the legislation were to be amended to 4.6m, and roads were to be damaged, infrastructure builders would build on top of the already existing tarred roads. Thus, decreasing the height.	Low levels of power High levels of interest
Government – Department of Transport (DoT),	The DoT is the most important stakeholder, as it has the authority of the regulation and coordination of transportation in South Africa. They will determine whether the legislation will remain the same or whether it will be amended. They will also need to consider the impact of the outcome of their decision, after the moratorium is removed.	High levels of power High levels of interest
Government - Department of Public Enterprises (DPE)	The DPE aims to drive investment, productivity and transformation that will unlock growth, drive industrialisation, create jobs and develop skills. Improving the delivery and maintenance of infrastructure.	Low levels of power High levels of interest
Government - Department of Trade and Industry (DTI)	The DTI is a dynamic industrial, globally competitive economy, which aims to include growth and development and provide employment for all citizens. It aims to pursue a more targeted investment strategy.	Low levels of power High levels of interest
Fruit Industry, i.e. exporters	The fruit industry has a vested stake in the research, as this industry contributes significantly to South Africa's economy. Approximately 90% of South African fruit is exported to international markets via refrigerated containers. Sixty percent of South Africa's fruit exports	Low levels of power High levels of interest

	are transhipped internationally.	
Container Manufacturers	A container manufacturer has to consider many factors when wanting to have a profitable business. This stakeholder is involved as it has long-term trends that it needs to take into account. The manufacturers have allowed for the furthering of trade from their various interventions.	Low levels of power Low levels of interest
Warehouse Operators and pack house operators for the fruit industry	This stakeholder is crucial, as it will affect the loading and offloading docks height and equipment that will be needed to transport containers. These operators handle the containers or the pallets of fruit from the truck to the storage, until they need to be delivered.	Low levels of power High levels of interest
Road Freight Association (RFA)	This sector is an important contributor to the economy; it provides speed, adaptability and flexibility. This industry plays a vital role, as they would need to consider changing the equipment if the legislation is not amended. It also affects the transport of high cube containers on South African roads. The RFA is a facilitating body that influences the state of the industry, rates, upkeep of the road infrastructure, road safety, and freight security, driver interests, cross-border transport, development funding for emerging operators, education, health, the fuel price, law enforcement, labour relations and many other issues pertaining to road freight transport	Low levels of power High levels of interest
Insurance Companies	These companies manage survey reports on insurance claims and provide a policy perspective. These companies are important, as it will allow the researcher to determine whether there have been any accidents with the transportation of high cube containers on South African roads.	Low levels of power Low levels of interest
FPT Port Operator within the fruit industry	FPT offers a broad and diverse range of landside and port logistical services, which include handling, packing/unpacking and storage. FPT owns and operates terminals in Southern Africa, situated in the ports of Port Elizabeth and Durban. These terminals handle close to 500,000 pallets of fruit. This is an important stakeholder has they do the handling of the containers with fruit inside the port.	Low levels of power High levels of interest

Perishable Products Export Control Board (PPECB)	The PPECB is an independent service provider of quality certification and cold chain management services for producers and exporters of perishable food products. It seeks to enhance the credibility of the South African export certificate.	High levels of power High levels of interest
Department of Agriculture, Forestry and Fisheries (DAFF)	DAFF ensures food security for all and economic prosperity. It focuses on advancing food security and transformation of the sector through innovative, inclusive and sustainable policies, legislation and programmes.	High levels of power High levels of interest
Farmer groups: CGA	The Citrus Growers Association (CGA) represents the interests of the producers of export citrus. There are approximately 1400 growers throughout Southern Africa.	Low levels of power High levels of interest
Farmer groups: Hortgro	Hortgro focuses on production, research and technology, markets and transformation within the deciduous fruit industry.	Low levels of power High levels of interest
Farmer groups: SATI	The South African Table Grape Industry (SATI) aims to position South Africa as the preferred country of the origin for the world's best tasting table grapes.	Low levels of power High levels of interest
Farmer groups: Subtropical Fruit	Subtrop is an association of the associations that manage the affairs of South African Avocado (SAAGA), litchi (SALGA), Macadamia (SAMAC and Mango (SAMGA) growers associations.	Low levels of power High levels of interest
Port Authority - TNPA	Transnet National Ports Authority (TNPA) is a division of Transnet Limited and is authorised to control and manage all eight commercial ports. TNPA owns, operates and controls SA's ports system.	High levels of power High levels of interest
Port Operator - TPT	Transnet Port Terminals (TPT) is a division of Transnet SOC Limited; South Africa's state-owned freight transport company which owns and operates 16 terminal operations situated across seven South African ports and is responsible for commercial handling services of sea-route freight across imports, exports and transhipments in containers, bulk, break-bulk and automotive.	High levels of power High levels of interest
Transnet Freight Rail	Transnet Freight Rail is the largest division of Transnet and is a heavy haul freight rail company that specialises in the transportation of freight. The company maintains an extensive rail network across South Africa that connects with other rail networks in the sub-Saharan region. This could be a possible stakeholder as government and the fruit industry could consider moving containers via rail to the ports.	Low levels of power Low levels of interest

SANRAL	SANRAL mandates the handling of the national road network, flowing from legislative and policy instruments. It has a road network of 22 213 kms that SANRAL has control over. SANRAL's mandate is the management, control, planning, development, funding, maintenance and rehabilitation of the proclaimed South African national road network.	Low levels of power High levels of interest

Source: Compiled by the researcher for the purpose of this study

Step 2: Analysing stakeholder relationships

After identifying the stakeholders, the researcher analyses the relationship between the amendments of the legislation with the stakeholders. Important assessments of the power and interest of each stakeholder are analysed. Figure 4-1 illustrates the different types of stakeholders highlighted by a stakeholder analysis.

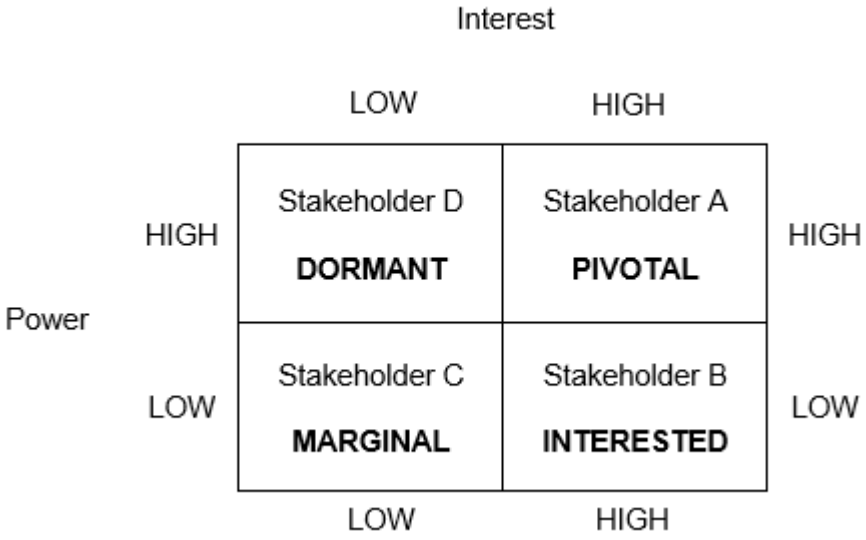


Figure 4-1: Different stakeholders highlighted by stakeholder analysis

Source: Venter & Oosthuizen, 2018:326

There are four types of stakeholders, namely pivotal, interested, marginal and dormant. Venter and Oosthuizen (2018:326) defined these stakeholders as:

(a) *Pivotal stakeholders*: These are stakeholders with a high power and high level of interest and they play a significant role in the project, for this study, the legislation. If these stakeholders have a favourable attitude they are proponents and if they have an unfavourable attitude then they are opponents. For the purpose of this study, the pivotal stakeholders are Government, PPECB, DAFF and the Port Authorities.

(b) *Interested stakeholders*: These are stakeholders with high levels of interest, but low levels of power. These stakeholders are regarded as supportive if they have a

favourable attitude and non-supportive, if they have an unfavourable attitude. The interested stakeholders in this study are the shipping lines, the freight forwarders and logistics service providers, infrastructure builders, the fruit industry, and warehouse and pack house operators, the RFA, FPT port operators, the farmer groups and SANRAL.

(c) *Marginal stakeholders*: These stakeholders have relatively low levels of power and low levels of interest. These stakeholders are not concerned about most issues and operate independently. The marginal stakeholders in this study are the container manufacturers, insurance companies and Transnet Freight Rail.

(d) *Dormant stakeholders*: These stakeholders have high levels of power, but low levels of interest. This stakeholder is the most distressing to deal with and can be quite difficult to manage. Though the interest is low, they have a significant amount of power to influence the decision-making. There are not any stakeholders who are classified as dormant, but this could possibly change.

Step 3: Develop the stakeholder strategy

Once the researcher has identified and analysed the stakeholders, these insights can be used to develop stakeholder strategies. The following strategies are used in response to the power and interest of the stakeholder. Venter and Oosthuizen (2018:328) define these strategies as the following:

(a) Collaborate with pivotal stakeholders

Stakeholders with high levels of power and interest are best managed with collaboration. This will require upfront negotiation to ensure that there is maximum alignment between the stakeholders' interests and the legislation as defined and structured.

(b) Keep the interested stakeholder informed

These stakeholders need to be kept informed of major decisions and developments and they could possibly be included by participating in the decision-making.

(c) Monitor the marginal stakeholders

These stakeholders require minimal effort to manage, as they have low levels of power and interest, but this can change.

(d) Keep the dormant stakeholder satisfied

These stakeholders should be kept satisfied. Their interest will be kept low, as long, they are satisfied. If these stakeholders become dissatisfied, their interest could increase, they would them become pivotal stakeholders. These stakeholders should be kept informed and should be consulted before any major decisions are made.

Step 4: Engage and communicate with the stakeholder

The fourth and final step of the process is to engage and communicate with the stakeholders. This step entails ensuring that the strategies developed, as previously mentioned, are being implemented. These strategies would need to be implemented carefully as the relationship with these possible stakeholders is likely to change.

A stakeholder analysis is a technique used to understand the various stakeholders' interest and these groups of individuals and organisations are a great asset to the amendment of the legislation or the advancement of equipment to adjust to the legal height on South Africa's roads. These stakeholders are explained in more detail in Chapter two and three.

4.3. Defining an impact analysis

Markless and Streatfield (2009) define impact as any effect of the service (or of an event or initiative) on an individual or group, and argued that an impact could be positive or negative. Research shows that an impact can also be intended or accidental and an impact is about identifying and evaluating change (Markless & Streatfield, 2009). Subsequently, an impact analysis is the process by which research and new ideas enter application and appear to make a lasting difference in the direction of later thinking and practice (Larwood & Gattiker, 1999). It is a conventional way of collecting data and is a theory that is in support of the pros and cons of change or any disruption. An impact analysis is a method of identifying strategies, providing preventative methods and a means to mitigating any impact to a business or economy (Cameron, 2018). By conducting an impact analysis, it allows for a better understanding before taking action and can assist in providing an understanding of the costs involved and how to move forward.

An impact analysis can be conducted on a global, national or local scale. For the purpose of this study; an impact analysis is conducted on a national level with a specific focus on the fruit industry only. There are three main reasons for collecting impact evidence (Markless & Streatfield, 2009):

1. It is to show whether projects are being conducted effectively, in order to learn from and improve project activities;
2. To determine whether the program is making a difference to people, groups, organizations or communities; and
3. To use that evidence of impact to advocate for continued support and/or funding from relevant stakeholders.

Research shows that the best way to conduct an impact analysis is to divide it into quantitative and qualitative effects (Cameron, 2018). In the case of the vehicle height

restriction, the quantitative effect would be from a money in/money out perspective, specifically focusing on the cost of changing the equipment and the increase in transportation costs as well as the infrastructure costs, if the legislation is not amended. The qualitative assessment has to do with how the economy will be affected, how it will affect the fruit export industry and other relevant industries and how the current operations and productivity of these industries will be influenced, should the legislation not be amended. The regulation governing vehicle height restrictions will have an impact on the economy, whether it is amended or not.

South Africa is one of largest fresh fruit producers globally and fresh fruit is the largest contributor to the country's agricultural exports (NAMC & DAFF), 2017). South Africa exports around 60% of all fruit produced, amounting to approximately 2.7 million tonnes annually (PPECB, 2018). Liphadzi (2015) states that 4.7 million tons of fresh fruit are produced on an annual basis. The agricultural sector contributes 2.5% to the country's GDP. According to Fruit South Africa (2018), the fruit industry will encounter a price increase in the cost of transport if the legislation is not amended, due to the severity of seasonal production and export volume flows. A transporter would need to use a skeletal trailer at a height of 1.4 meters, which would in turn force them to forgo any opportunity to transport non-containerised cargo. Walwyn (2019) states that if the regulation were to be enforced, the cost of a new trailer would amount to R300 000 each, thus requiring an investment of approximately R45 billion. Therefore, a transporter would have to forgo any opportunity to transport non-containerised goods. A container would then only be used for specific transport opportunities. As a result of container volumes' seasonality, there could be periods where the supply of transport would be greater than the demand for transport (Fruit South Africa, 2018). Therefore, whether the regulation is enforced or not, this study supports the need to conduct an economic impact analysis.

An impact analysis is a relevant tool for this specific study, as it will help the various stakeholders to focus on what is required to support the decision-making process. In addition, it will specify how the impacts were achieved or not achieved. It will also take into account any unintended results. With this analysis, change is inevitable, thus, it can reduce the risks that will accompany the change.

4.4. Three types of an impact analysis

There are three types of impact analyses that can be considered, namely economic, social and environmental. Social and environmental impact analyses are not the main focus of this study, but a brief background is provided. This study focuses on an economic impact analysis technique.

4.4.1. Environmental impact analysis

An environmental impact analysis (EIA) is used to assess the potential impact a proposed development project will have on the natural and social environment (The Environmental Literacy Council, 2014). This may include an assessment of both the short- and long-term effects on the physical environment, such as air, water and/or noise pollution; as well as effects on local services, living and health standards and aesthetics. Glasson, Therivel and Chadwick (1994:4) state that an EIA is an assessment of the impact of a planned activity on the environment.

An EIA ensures that the environment is taken into consideration when planning and making decisions. This analysis suggests the environmental consequences that could result from implementing a project. This analysis is not applicable to this study. The possible amendment of the regulation governing vehicle height restriction is the main focus of this study. This analysis is not applicable to the study, as new developments are not arising, but the possible amendment of the regulation on vehicle height restriction. However, the amendment of the regulation does affect the environment, for example, if there are more tonne kilometres being required to transport the fruit.

4.4.2. Social impact analysis

Social impact analysis (SIA) includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programmes, plans, projects) and any social change processes invoked by those interventions (International Association for Impact Assessment, 2019). Its main purpose is to bring about a more sustainable and equitable biophysical and human environment. The International Association for Impact Assessment (2019) states that a SIA brings about a more ecological, socio-culturally and economically sustainable and equitable environment. A SIA is best understood as an umbrella framework that evaluates all impacts on humans and how individuals interact with socio-cultural, economic and biophysical surroundings as well as analysing the social effects of infrastructural changes.

Therefore, this analysis is not relevant to this study, as it is not focused on the broader society and community, but specifically focused on those industries that will be affected or impacted by the regulation being amended or not.

4.4.3. Economic impact analysis

An Economic Impact Analysis (EcIA) is a methodology for evaluating the impacts of a project, programme or policy on the economy of a specified region (Economic Development

Research Group, 2019). It is an important analysis tool for decision-making and provides a measure of strategic goal achievement that complements the analysis of efficiency analysis and financial feasibility. An EcIA is useful to show the impact on jobs, income, operating costs, productivity and competitiveness among industries, regions and individuals over time.

An EcIA serves three purposes; firstly, to define whether the value of the benefits of a project or a policy can be defined in an economically valid and systematic way. Secondly, it estimates the economic impacts of the project or policy and thirdly, it measures the overall contribution to the economy at a regional, provincial and national level providing estimates of industries (PwC, 2012).

Economic impact studies use financial and economic data to generate estimates of output, GDP, employment and tax revenues linked to changes in the level of economic activity resulting from the project or industry being analysed. Economic impacts can be estimated at the direct, indirect and induced levels. These three levels of economic impact are used to assess any business, organisation or sector that contributes to the national economy (Oxford Economics, 2018). Table 4-2 defines direct, indirect and induced impacts to measure economic impact.

Table 4-2: Definitions of direct, indirect and induced impacts

Direct impacts	These impacts are related to the sectors that are directly affected by the local expenditure of a company, industry or the economy. The first round of suppliers would receive the expenditure and revenues
Indirect impacts	This impact is a result of the “first round” suppliers of the affected company, industry or economy, purchasing goods and services and hiring additional workers to meet the increased demand.
Induced impacts	This impact results from a change in spending on goods and services, due to change in incomes of employers in both the directly and indirectly affected sectors/industries, company or economy.

Source: Oxford Economics, 2018

The reasons that these impacts are relevant to this study are, because the researcher would like to identify the impact, whether it is direct, indirect or induced, if the regulation is not amended and if it were to be amended, how this would impact the economy.

A study done by the Connecticut Academy of Science and Engineering (2013) analysed the economic impacts of transportation projects. This study was conducted in order to analyse the transportation investments, which promoted economic activity and economic development in the Connecticut region. In addition, this study investigated the three impact levels, mentioned above, pertaining to transportation investments.

The Connecticut Academy of Science and Engineering (2013) state that the direct impacts are referred to as the primary impacts. These impacts resulted from an improvement to the economic efficiency of end users including households, business and industries and their travel choices. Indirect impacts were identified as secondary impacts. Indirect impacts were an estimate of the level of economic activity of businesses and households to provide the inputs needed to meet the direct impacts (The Connecticut Academy of Science and Engineering, 2013). Lastly, the induced impacts were a set of economic impacts that resulted from the additional income earned by employees due to the direct and indirect impacts.

If the regulation on vehicle height restriction were not to be amended to the height of 4.6m, the economy would experience these impacts. In terms of direct impacts, the supply of new trailers would be needed, as well as, dock levellers would need to be manufactured to specific requirements, resulting in a capital investment. This would increase the demand for the manufacturing sectors as new solutions would need to be provided for loading and unloading. Indirect impacts would increase the demand for materials, plants and equipment and the manufacturing sector would have to expand to fit the increase in operational investments by contracting contractors and other companies to provide inputs such as goods and services. Finally, induced impacts would be generated from the increase in personal spending as a result of the direct and indirect impacts of creating jobs and increasing incomes. In addition, households and individuals will increase their spending at local businesses, thus injecting money into the economy.

However, if the regulation were to be amended to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6 metres, the economy would encounter these impacts as well. Firstly, direct impacts would involve the increase in capital investment, as the bridges on the roads would need to increase in height to allow the transportation of high cube containers, thus creating jobs. Indirect impacts would involve the increase in the materials and labour needed to build the bridges. Finally, induced impacts would include an increase in spending, as employment would be created and there would be an increase in income. Even though the economy will encounter these impacts, businesses and the economy would continue as usual.

For the purpose of this study, the researcher researched the following techniques to conduct an economic impact analysis and determine the most viable one for this study. These techniques are a cost-benefit analysis, a cost-effectiveness analysis and a multi-criteria decision analysis.

4.5. Techniques of an economic impact analysis

4.5.1. Cost-benefit analysis

The first analysis that was researched is a cost-benefit analysis (CBA). This method is developed to evaluate public policy issues (Nas, 1996:2). The prospective gains and losses from a proposal are identified, converted into monetary units and a comparison is drawn based on whether it will be desirable from a society's point of view. In the case of a CBA, the benefits are summed up and the costs are subtracted from them to determine the desirability. The CBA is a highly detailed and comprehensive analysis. It is designed to analyse public projects and is evaluated based on the public's interest. Nas (1996:2) states that the costs and benefits are measured in terms of the social utility gains and losses rather than cash and revenue flows. Kenton (2019) argues that the outcome of the analysis determines whether the project is financially feasible or if another project outcome should be pursued. Table 4-3 depicts the advantages and disadvantages of a cost-benefit analysis.

Table 4-3: Advantages and disadvantages of CBA

Advantages	Disadvantages
A comprehensive analysis	Fails to take into account financial concerns
Determines desirability	Not for large projects with a long-term time horizon
Avoids any subjective tendencies	Potential of omitting and quantifying costs and benefits
Simplicity	Could result in a misleading analysis

Source: Compiled by the researcher for the purpose of this study

Therefore, a cost-benefit analysis ensures that any risks can be minimised and any potential gains can be maximised (Landau, 2018). This method would be feasible for this study as a CBA provides many options and offers the best approach to achieve the goals while saving on the investment. In addition, this method would allow both government and industry to come to a consensus and ensure that both sides receive a saving from either amending the legislation or the legislation remaining the same. In turn, the impact on the economy will be made clear. This method will determine whether the study is sound, justifiable and feasible by determining whether the benefits are greater than the costs (Landau, 2018).

4.5.2. Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) is an evaluation technique used either to select a project that would yield the least cost production of a given output or to choose a project that would

yield the maximum output at a given cost (Nas, 1996:64). With this analysis, projects are ranked in terms of the quantities of output yielded at a given fixed budget. What makes this analysis different from a CBA is it focuses on technological efficiency, whereas a CBA focuses on economic efficiency. Other than that, the analysis for cost-effectiveness analysis is essentially the same as that used for a CBA. The cost and effectiveness are quite important and need to be integrated (Nas, 1996:64). Table 4-4 shows the advantages and disadvantage of a cost-effectiveness analysis.

Table 4-4: Advantages and disadvantages of a CEA

Advantages	Disadvantages
Unambiguous solutions	No ultimate endpoint
No monetary values	

Source: Compiled by the researcher for the purpose of the study

Research shows that a CEA is an alternative to a CBA. It is a technique comparing the relative costs to the outcomes (effects) of two or more courses of action (Kaplan, 2014). Therefore, this method would not be feasible for the study. A CEA is useful when researchers and analysts encounter constraints, which prevent a cost-benefit analysis from being conducted, for example, in the health sector. Kaplan (2014) states that a common constraint is the inability for a researcher to monetise the benefits. Similar to a CBA, a CEA allows a comprehensive analysis to be conducted. This method examines the cost per case and provides useful information to make a decision. For the purpose of this study, this method would not be viable, as it does not produce a definitive endpoint (Muennig & Khan, 2002:6).

4.5.3. Multi-criteria decision analysis

Multi-criteria decision analysis is a tool that is applied to complex decisions. The practice of multi-criteria decision analysis (MCDA) is concerned with the evaluation of a set of possible courses of action or alternatives (Durbach & Stewart, 2012). This evaluation may use various methods for the analysis, such as selecting the favoured and preferred alternative, ranking the alternatives from best to worst and then sorting the alternatives into an ordered class, which could be either good or bad. Durbach & Stewart (2012) state that the set of alternatives may be both explicitly defined and discrete in number or implicitly defined via constraints in a mathematical programming formulation.

This analysis is a useful decision support tool. It ensures to focus on what is important. It is logical and consistent, and an easy tool to use (Natural Resources Leadership Institute, 2011). MCDA, at its core, is useful for three points; (1) dividing the decision into smaller,

more understandable parts, (2) analysing each part and (3) integrating the parts to produce a meaningful solution (Natural Resources Leadership Institute, 2011). Most decisions and decision-making can be improved by disintegrating the overall evaluation of alternatives into evaluations on a number of usually conflicting criteria. Criteria should be linked with a measurable attribute that provides a quantitative or qualitative scale for measuring performance on the underlying criterion. Multi-criteria methods differ primarily according to how they (a) evaluate performances on each attribute, and (b) aggregate evaluations across attributes to arrive at an overall or global evaluation (Durbach & Stewart, 2012). The following common methods used for multi-criteria decision analysis are discussed. These methods are multi-attribute utility theory, fuzzy theory, case-based reasoning, data envelopment analysis and the analytic hierarchy process.

4.5.3.1 Multi-Attribute Utility Theory (MAUT)

Multi-attribute utility theory (MAUT) is a utility theory that decides the best course of action in a given problem by assigning a utility to every possible consequence and calculates the best possible utility (Velasquez & Hester, 2013). It is a comprehensive theory and is akin of cost-benefit analysis, as it specialises in prospective evaluation depicting which alternative is better before any of them have been carried out (Mohr, 1995:279). Table 4-5 depicts the advantages and disadvantages of MAUT.

Table 4-5: Advantages and disadvantages of MAUT

Advantages	Disadvantages
Considers uncertainty	This theory is data intensive
Can incorporate preferences	Decision maker's preferences need to be precise
It is convenient	The level of input and amount of data may not necessarily be available
	Relatively subjective

Source: Mohr, 1995:279; Velasquez & Hester, 2013

Therefore, this method is not feasible for this particular study, as it can be difficult to precisely apply and can be quite subjective. In addition, strong assumptions are made as the weights are assigned to various consequences; therefore, uncertainty is prevalent in this method. This method is particularly data intensive, as a significant amount of input is required at every step of this method in order to record the decision maker's preferences. This method is usually applied in economic, financial, actuarial, water management, energy management, and agricultural problems, hence it has not been used in public policy or regulation decision-making.

4.5.3.2 Fuzzy Theory

Fuzzy set theory is an extension of classical set theory that allows loads of problem solving, which is related to dealing with imprecise and uncertain data (Velasquez & Hester, 2013). L.A. Zadeh initially formulated it in 1965. This theory is based on the recognition that certain sets have imprecise boundaries (Maiers & Sherif, 1985). Table 4-6 shows the advantages and disadvantages of the fuzzy theory.

Table 4-6: Advantages and disadvantages of the Fuzzy theory

Advantages	Disadvantages
Takes into account the insufficient information and available knowledge	It is a complex theory
It allows imprecise input	It is difficult to develop
	This theory embraces vagueness
	Requires a number of tests to be done

Source: Velasquez & Hester, 2013

This method is not feasible for the study being conducted, as the information needs to be complete and precise for the study. The fuzzy set theory thrives on the vagueness and imprecise or incomplete data and uncertainty. Fuzzy set theory is established and has been used in applications such as engineering, economic, environmental, social, medical, and management (Velasquez & Hester, 2013). This theory could result in open-ended questions to arise, as it could provide a fuzzy result. This method has not been used in public policy decision-making.

4.5.3.3 Case-Based Reasoning (CBR)

Case-based reasoning (CBR) is a method that recovers cases similar to a problem from an existing database of cases, and recommends a solution to a decision-making problem based on similar cases (Velasquez & Hester, 2013). It is a knowledge learning and solution deducing method. There are advantages and disadvantages to this method. Table 4-7 shows the advantages and disadvantages of a case-based reasoning method.

Table 4-7: Advantages and disadvantages of a CBR method

Advantages	Disadvantages
Requires little effort in acquiring additional data	It is sensitive to inconsistencies in data
Requires little maintenance as the database is in existence already	Requires many cases

This method can improve overtime	
It can adapt to changes in the environment	

Source: Velasquez & Hester, 2013

This method is not feasible for the current study being conducted, as there are no similar or previous case files that this study could use to provide a solution or provide direction for which way the study should lean. If there was a similar case, it may not be the most accurate to solve the study at hand. In addition, inconsistencies in the data can result as well as sensitivity. Velasquez and Hester (2013) state that all of these instances have set stockpiles of “databases”, which can be large enough to combat inconsistency in cases. CBR is used in industries where a considerable number of cases already exist. This includes evaluations of businesses, vehicle insurance, medicine, and engineering designs, and not public policy or legislation.

4.5.3.4 Data Envelopment Analysis (DEA)

Charnes, Cooper and Rhodes (1978) developed data envelopment analysis (DEA), which assesses the performance of a set of similar decision-making units (DMUs) that consist of multiple inputs and outputs. This analysis uses a linear programming technique that measures the relative efficiencies of alternatives (Velasquez & Hester, 2013). It rates the efficiencies of alternatives against each other, with the most efficient alternative having a rating of one with all other alternatives being a fraction of one. Table 4-8 depicts the advantages and disadvantages of this analysis.

Table 4-8: Advantages and disadvantages of a DEA

Advantages	Disadvantages
This method has the capability of handling many inputs and outputs	This method does not deal with imprecise data
Efficiency can be analysed and quantified	It assumes all inputs and outputs are known
It can uncover relationships that may be hidden with other methods	

Source: Velasquez & Hester, 2013

This method would not be feasible for this study, as DEA is used to compare efficiency. The model itself is quite successful in ranking the projects while allowing new projects to be added in without altering the ranking order (Velasquez & Hester, 2013). The results of this model are sensitive to the inputs and outputs provided. In addition, the researcher is not concerned with the efficiency of the study, but the impact that the study will have on the economy and the fruit industry.

4.5.3.5 Analytic Hierarchy Process (AHP)

There are many multi-criterion decision analysis methods that can be used for an impact analysis, but the Analytic Hierarchy Process (AHP) is the most favoured technique to use (Sipahi & Timor, 2010). AHP is a systematic decision making approach developed by Thomas L. Saaty in 1971 (Tendayi & Fourie, 2014). It is a theory of measurement, in which pairwise comparisons are drawn from and the judgements of experts are derived from for priority scaling (Velasquez & Hester, 2013). It is the more popular method of multi-criteria decision methods. This method is easy to use and allows decision makers to weigh the coefficients and compare alternatives easily. Tendayi and Fourie (2014) state that this method is so widely used, because of its simplicity, ease of use and flexibility. Tendayi and Fourie (2014) state that the AHP approach was used to evaluate the judgements from a survey to determine the consistency and give the criteria for the importance weighting that is required. This method generates a weight for each evaluation criterion based on the decision maker's pairwise comparisons. The higher the weight, the more important the criterion. This allows for a better performance of the option with respect to the criterion. Table 4-9 depicts the advantages and disadvantages of using AHP.

Table 4-9: Advantages and disadvantages of AHP

Advantages	Disadvantages
Easy to use	Problems due to interdependence between criteria and alternatives
It is scalable	It can lead to inconsistencies between judgment and ranking criteria
Hierarchy structure can easily adjust to fit many sized problems	Rank reversal
It is not data intensive	

Source: Velasquez & Hester, 2013

AHP has four steps that should be followed in order to solve any problem. These steps are namely (Zhu, Xu, Zhang & Hong, 2015):

(1) **Modelling**: determining a top-to-bottom form as a hierarchy with different levels of criteria, sub-criteria and alternatives. It begins with the alternatives, and is then grouped with the simplest sub-criteria until all objectives are determined in each level.

Figure 4-2 illustrates the three levels to the modelling of an AHP. This figure provides the criteria and alternatives to the three levels.

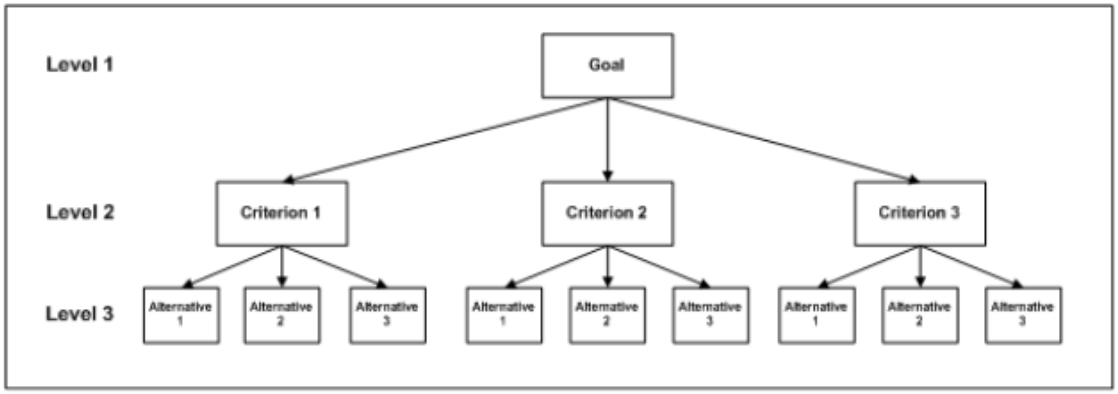


Figure 4-2: Analytical Hierarchy Process levels

Source: Tendayi & Fourie, 2014

(2) **Evaluation**: constructing comparison matrices based on a 1–9 scale. This provides judgments over the paired comparisons of objectives with respect to a criterion in an upper level. By having the 1-9 scale, it allows assigning numbers to the judgements made. Table 4-10 shows the fundamentals of the 1-9 scale with definitions and explanations.

Table 4-10: Fundamentals of 1-9 scale

Intensity of importance	Definition	Explanation
1	Equal importance	Two objectives contribute equally to the objective.
3	Moderate importance	Experience and judgement slightly favour one objective over another.
5	Strong importance	Experience and judgement strongly favour one objective over another.
7	Very strong or demonstrated importance	An objective is favoured very strongly over another, its dominance demonstrated in practice.
9	Extreme importance	The evidence favouring one objective over another is of the highest possible order of affirmation.
2,4,6,8	For compromise between the abbreviations	Sometimes one needs to interpolate a compromise judgement numerically, because there is no good word to

		describe it.
Reciprocals of above	If objective i has one of the above non-zero numbers assigned to it when compared with objective j, then j has the reciprocal value when compared with i.	A comparison mandated by choosing the smaller objective as the unit to estimate the larger one as a multiple of that unit.
1.1 – 1.9	For tied objectives	When objectives are close and nearly indistinguishable; moderate is 1.1 and extreme is 1.9

Source: Zhu, Xu, Zhang & Hong, 2015

(3) **Prioritisation**: using prioritisation methods to derive local priorities of objectives in each level of the hierarchy.

(4) **Synthesis**: utilizing aggregation procedures to synthesise the local priorities into global priorities of alternatives.

The AHP approach has been used in the manufacturing, construction and transport industries. The manufacturing industry has made use of AHP for supplier selection, supply chain evaluation, location selection, system selection or evaluation, and strategy evaluation. The AHP method has been applied for dealing with the ambiguities involved in assessment of ERP alternatives and relative importance weightings of attributes. In addition, the AHP method has been utilized to assign weights and relate supply chain criteria such as operating cost, service level and resources utilization.

The construction industry has made use of the AHP method for technical assessment, construction safety, project evaluation, project risk analysis, and intelligent building design evaluation. The AHP method has been used for the assessment of risk involved in international projects. Sipahi and Timor (2010) state that an international project, with a risk assessment, is a complicated task due to the sensitivity of the projects success that is related to the country-specific risks and the project risks.

From all the industries, the transport industry uses the AHP method to utilise improving ship registry, passenger security checks in airports, port security, and transportation investments. The system approach consists of political risk factor identification, risk measurement, and assessment processes identifying which evaluation technique that would be the most suitable.

Therefore, AHP method is deemed the most favoured method of the multi-criteria decision methods, as it provides the researcher with the necessary tools to determine the importance of judgements and it provides more accurate importance weightings. AHP is a system approach that allows for the identification of risks, how to measure these risks and then assesses it in order to determine the best technique to use. In addition, this method helps in assisting managers to make decisions on real-life situations. AHP is used in performance-type problems, resource management, corporate policy and strategy, public policy, political strategy, and planning (Velasquez & Hester, 2013). AHP has the ability to handle large problems, which makes it ideal to handle problems that compare performance among alternatives. Resulting in it being the best-suited method to conduct an impact analysis. Table 4-11 provides a summary of the advantages and disadvantages of all methods discussed above.

Table 4-11: Impact analyses methods with advantages and disadvantages

Method	Advantages	Disadvantages	Applicable
Cost-benefit analysis	• A comprehensive analysis • Determines desirability • Avoids any subjective tendencies • Simplicity	• Fails to take into account financial concerns • Not for large projects with a long-term time horizon • Potential of omitting and quantifying costs and benefits • Could result in a misleading analysis	Yes
Cost-effectiveness analysis	• Unambiguous solutions • No monetary values	• No ultimate endpoint	No
Multi-attribute utility theory (MAUT)	• Considers uncertainty • Can incorporate preferences • It is convenient	• This theory is data intensive • Decision maker's preferences need to be precise • The level of input and amount of data may	No

		not necessarily be available • Relatively subjective	
Fuzzy theory	• Takes into account the insufficient information and available knowledge • It allows imprecise input	• It is a complex theory • It is difficult to develop • This theory embraces vagueness • Requires a number of tests to be done	No
Case-based reasoning	• Requires little effort in acquiring additional data • Requires little maintenance as the database is in existence already • This method can improve overtime • It can adapt to changes in the environment	• It is sensitive to inconsistencies in data • Requires many cases	No
Data envelopment analysis	• This method has the capability of handling many inputs and outputs. • Efficiency can be analysed and quantified. • It can uncover relationships that may be in hidden with other methods.	• This method does not deal with imprecise data. • It assumes all inputs and outputs are known.	No
Analytic hierarchy process	• Easy to use • It is scalable • Hierarchy structure	• Problems due to interdependence between criteria and	Yes

	can easily adjust to fit many sized problems. • It is not data intensive.	alternatives. • It can lead to inconsistencies between judgement and ranking criteria. • Rank reversal	

Source: Velasquez & Hester, 2013; Mohr, 1995:279

4.6. Conclusion

From the discussion, a stakeholder analysis is conducted to determine which individuals will be impacted or will have a crucial role in the legislation being amended or it remaining as is. An economic impact analysis conducted with the use of the AHP method of the multi-criteria decision methods is determined as the best approach to use in this study. This method provides the necessary tools to determine the importance of judgements and the importance weightings.

Chapter 5 : Research Design and Methodology

5.1. Introduction

This chapter outlines the research design and methodology undertaken in this study. A research design was formulated in order to determine the data required and methods of collection used in this study. The methodology of collecting the data is discussed, followed by the constructs and variables of the study. Lastly, the limitations of this study is outlined.

5.2. Research Design

This research was conducted as a partial desktop study that was built upon by the use of surveys and interviews. This research design set the foundation on which the research questions were answered. This research followed a deductive approach, making use of qualitative and quantitative research, resulting in a mixed methods approach. The qualitative research included a content analysis of articles or annual reports of the various industries that will be impacted if the regulation is not amended using a qualitative software analysis tool. The quantitative research of this study included the numerical coding obtained for the qualitative software analysis.

With regards to classification, this study is exploratory in nature, which is a valuable means of determining what is happening and to seek new insights (Saunders, Lewis, Thornhill, 2009:139). This type of classification ensures clarity in understanding what the problem is. This study is classified as cross-sectional in nature and encompasses data from publically available documents discussing the regulation governing vehicle height restriction.

5.3. Research Methodology

A research method is a technique for collecting data and can be associated with different research designs (Bryman & Bell, 2015:28). This sub-section outlines the primary and secondary research conducted, followed by the sample design of the study, the measurement instruments used and lastly, three phases of data analysis, and the techniques used to analyse the data.

5.3.1. Primary and Secondary Research

This study consists of both primary and secondary research methods to provide an analysis of the impact of the moratorium of the regulation governing vehicle height restriction on South Africa’s economy.

The primary research method that was utilised includes the use of content analysis on articles and reports obtained from the internet. Bryman and Bell (2015:219) states that a content analysis is the analysis of documents and texts that seek to quantify content in terms of predetermined categories and in a systematic and replicable manner. Primary research was also conducted by contacting the fruit industry, the shipping industry, Government officials, the road transport industry, rail transport industry and various stakeholders, who have an interest in the matter, to identify their ideas and solutions to the regulation of high cube containers. The means of contacting these industry experts was via telephone, email and sending out a survey to determine if these individuals have a plan in place and to gain more insight into the moratorium and the regulation governing vehicle height restriction.

Secondary research was conducted using the Internet to investigate websites, annual reports, academic publications and articles in the form of the literature review. The research that was gathered helped answer the research questions and identify possible areas whereby future research can be done.

5.3.2. Sample Design

The targeted population for this study is all the organisations and stakeholders in South Africa that have a particular interest and concern with the regulation governing vehicle height restriction. Therefore, the fruit industry, the shipping industry, Government officials, the road transport industry, rail transport industry, independent consultants and various stakeholders were included in the sample. The stakeholder groups and number of responses in each group are shown in Table 5-1.

Table 5-1: Stakeholder groups, total number of stakeholders contacted and number of responses in each group

Stakeholder Group	**Total number of stakeholders contacted**	**Number of responses in each group**
Shipping industry	43	11
Road Transport industry	81	14
Government officials	23	4
Fruit industry	41	19
Rail Transport industry	24	2
Independent consultants	13	12

Other	22	15
Total	247	77

Source: Compiled by the researcher for the purpose of this study

A non-probability form of purposive sampling was used to select the sample units for this study. According to Bryman and Bell (2015:319), purposive sampling is to sample cases or participants in a strategic manner, with the purpose that those who are sampled are relevant to the research questions that are being posed. This sampling technique was best suited for this study as it prevented random bias and ensures the research goals were kept in mind.

The total number of stakeholders that represents the sample, included in this study was 247. However, the response rate for the data analysis conducted in this study was 77 stakeholders. There was a response rate of 31.2% for the survey. This is due to stakeholders not answering the survey within the given deadline. Thus, all analysis and answers are based on the 31.2% response rate. The breakdown of the sample size by the stakeholders is shown in Table 5-2.

Table 5-2: Breakdown of stakeholders in the study

Stakeholder groups	Number of responses	Percentage of responses per group
Shipping industry	11	14.3%
Road freight industry	14	18.2%
Government officials	4	5.2%
Fruit industry	19	24.7%
Rail transport industry	2	2.6%
Independent consultants	12	15.6%
Other	15	19.5%
Total	**77**	**100%**

Source: Compiled by the researcher for the purpose of the study

The fieldwork of this study was conducted by searching the Internet for articles related to the regulation governing vehicle height and the transportation of high cube containers on South African roads for the years 2011 to 2019. Adding to this, the researcher conducted eleven semi-structured interviews with various stakeholders in the above mentioned stakeholder groups. There was no need to continue conducting interviews as the results were saturated across the stakeholder groups.

5.3.3. Measurement Instruments

There were three measurement instruments utilised for this study. The first measurement instrument is a systematic literature review, which established to what extent existing research has progressed towards the regulation governing the vehicle height restrictions. The second measurement instrument is the content analysis done using the qualitative software analysis tool Atlas.ti. The content analysis was based on establishing a list of keywords that related to the regulation of the high cube container, and moratorium thereof. The third and final measurement instrument was the AHP method used in order to conduct an impact analysis on the findings of the research.

5.3.4. Data Analyses

There were three phases of analysis for this study. The first phase was the systematic literature review. A systematic literature review is defined as a replicable, scientific and transparent process that aims to minimise bias through exhaustive literature searches of published and unpublished studies (Bryman & Bell, 2015:77). This type of review is a piece of research in its own right. In order for the literature review to be considered fair and reliable, a systematic review is undertaken to reduce bias in the review stages.

The search strategy used to identify primary studies, which included the resources and databases to be searched as well as the specific keywords that were used. The researcher used the following keyword combinations for a systematic review:

- (Regulation OR legislation) AND "high cube container" AND transport AND ("height restriction" OR "height limit" OR “height”).
- (Regulation OR legislation) AND “high cube container” AND “fruit” AND “shipping” (“height restriction” OR “height limit” OR “height”).
- (Regulation OR legislation) AND “high cube container” AND “container” AND “fruit” AND “shipping” AND “department of transport” AND “transport developments” (‘height restriction” OR “height limit” OR “height”).
- “Double-decker buses” AND (regulation OR legislation).
- “Double-decker buses” AND (regulation OR legislation) AND (“height restriction” OR “height limit”).
- “Double-decker buses” AND (regulation OR legislation) AND (“height restriction” OR “height limit”) AND “transport”.

- “Double-decker buses” AND (regulation OR legislation) AND (“height restriction” OR “height limit”) AND “transport” AND “department of transport”.

To only use one database for this review would not be adequate. It is important to note that more than one database must be used for the review to ensure that the selection bias is minimised. Both peer-reviewed and grey literature was included in the search. Table 5-3 depicts the databases used to conduct the systematic review.

Table 5-3: Databases that was searched

Database	Reason for Inclusion
Creamer Media’s research channel: Africa	Creamer Media provides accurate reporting on economic, industrial and mining developments.
Scopus	Scopus is the largest abstract and citation database of peer-reviewed literature in major subject fields.
Academic Search Premier	A well-known scholarly resource providing full-text academic journals covering major areas of academic research.
Emerald	Emerald currently publishes over 300 journals andall research journals are peer-reviewed to ensure the highest quality.
Science Direct	Science Direct publishes scholarly research of a high-quality and has a large database of medical and scientific research. Provides access to over 3500 academic journals.

Source: Compiled by the researcher for the purpose of this study

When using these databases and searching for the keyword combinations used above, there were 27 documents identified. All 27 were irrelevant to this study and were excluded. Therefore, the systematic review concluded that there hasn’t been any research published that is relevant to this topic, over a very wide array of sources.

The second phase was a qualitative content analysis. A qualitative content analysis is described as searching-out the underlying themes in the various materials that will be analysed (Bryman & Bell, 2015:219). The content analysis was based on establishing a list of keywords that relate to the regulation governing vehicle height restriction of the high cube

container, and moratorium thereof. In addition, the researcher identified five documents that covered the regulation governing vehicle height restriction and the transportation of high cube containers. These five documents were relevant as it discussed the transportation of high cube containers in depth and great detail. Table 5-4 shows the list of keywords used in the content analysis.

Table 5-4: Keywords used in content analysis

Keywords
Regulation
Moratorium
High cube containers
Containers
Fruit industry
Department of Transport
Shipping industry
Height restrictions
Height Limits
Legislation
Double-decker buses

Source: Compiled by the researcher for the purpose of this study

The content analysis tool that was used is Atlas.ti. Atlas.ti is a workbench for qualitative analysis of large bodies of textual, graphical, audio and video data (Atlas.ti, 2019). This software ensures that the researcher is offered a set of tools and features that allow the most complex data materials to be analysed. This analysis tool can assist in the process of qualitatively analysing data, which was collected through semi-structured methods of data collection. Atlas.ti software was used to do a content analysis on the impact of the moratorium on the regulation of high cube containers in South Africa. This software contains a network/visualisation function as well as allows the researcher to code and annotate the primary data materials (Atlas.ti, 2019).

The third phase of analysis was the AHP method. This method was used to measure pairwise comparisons drawn and the judgement of experts through priority scaling. This method is the more favoured method as it provides objectivity on the researchers end and prevents any subjectivity or bias towards the research. A basic AHP method was used. The AHP method has four steps that were followed, namely:

(1) **Modelling**. This allowed the researcher to determine the top-to-bottom form as a hierarchy of different criteria, sub-criteria and alternatives. The main criterion for this research was the impact analysis. From this, the researcher identified two sub-criteria, namely: financial impact and transportation risk. Each of the sub-criteria was

taken into account for the three height alternatives. The three height alternatives consisted of the current legal height of 4.3m, the recommended height of 4.6m and any height between 4.3m and 4.6m. These three height alternatives were used as the first three questions of the survey covered the three heights. In addition, the researcher conducted explorative interviews where the three height alternatives were considered. Figure 5-1 depicts the modelling hierarchy followed for this study.

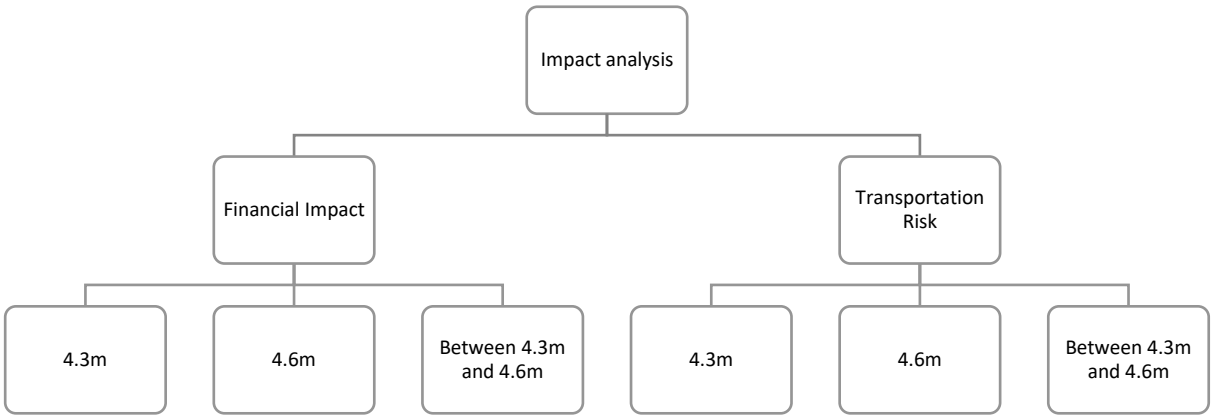


Figure 5-1: Modelling hierarchy

Source: Compiled by the researcher for the purpose of the study

(2) **Evaluation**. The second step in the process is the evaluation of the judgements received from the stakeholders and respondents and how they ranked the importance of certain statements in the survey. The 1-9 scale was used to construct comparison matrices. It provides unbiased judgements and the 1-9 scale allows the researcher to determine what the stakeholders and respondents deem important. The researcher made use of one, five and nine to assign numbers to the judgements. Table 5-5 shows the importance ratings used to measure the judgements of the respondents.

Table 5-5: Importance ratings used to measure the judgments

Intensity of importance	Definition	Response
1	Equal importance	Neutral
5	Strong importance	Normally agree/disagree
9	Extreme importance	Strongly agree/disagree

Source: Compiled by the researcher for the purpose of the study

These three importance ratings were used to show a greater spread of the data collected and not have the ratings and answers close to each other. The inverse of five and nine was used when the respondent answered normally disagree or strongly disagree.

(3) **Prioritisation**. Prioritisation methods were used to provide the priorities of objectives in each level of hierarchy. The researcher assigned one, five and nine as well as the inverse thereof to determine the preference of the respondents. Table 5-6 depicts the scale used to assign the numbers to responses.

Table 5-6: Scale used for answers

Answer	Scale
Strongly disagree	0.11
Disagree	0.2
Neutral	1
Agree	5
Strongly agree	9

Source: Compiled by the researcher for the purpose of the study

(4) **Synthesis**. The data was then synthesised to provide aggregates to the priorities of the alternatives. Once the scale was assigned to the responses, the researcher determined the average of each stakeholder group to provide the pairwise comparison matrices. The questions of the survey were grouped according to financial impact and transportation risk. From this, the two groupings were subtracted from each other to ensure the distance between the two to prevent granularity. The results obtained from this were inserted into the pairwise comparisons matrices to determine the preference weight to each stakeholder group.

After identifying how the data was analysed, the researcher was able to provide possible consequences of two of the three known outcomes. There is no specific way of conducting an impact analysis, therefore, the researcher highlighted possible consequences that could arise once the data had been collected and identified the files and documents that would need to be modified.

The two outcomes known are the amendment of the legislation to 4.6m or the legislation remaining the same. The researcher looked at the first outcome, followed by the second outcome.

Amending the regulation to 4.6m

By amending the regulation to 4.6m, not much will change, as the industries have been operating at this height for the past seven years. There are more benefits to the regulation being amended. Table 5-7 depicts the costs and benefits if the regulation were to be amended. The costs would essentially be zero and the benefits, while not quantifiable, as it would remain the same as the status quo, would be certainty and the maintenance costs. The maintenance costs in question would be ensuring the upkeep of the vehicle itself and the trailer.

Table 5-7: Costs and benefits associated with the legislation being amended

Costs	Benefits
No costs incurred	Certainty
	Maintenance costs

Source: Compiled by the researcher for the purpose of this study

However, there would be documents and files that would need to be updated and amended. The file and document that would need to be modified would be Regulation 224 (b) of the National Road Traffic Regulations 2000 under the National Road Traffic Act of 1996. Regulation 224 (a & b) is drawn from Part 3, the Dimensions of vehicles from Chapter 5, Fitness of vehicles. It states (in this section) the following:

> *Overall height of vehicle and load*
> *No person shall operate on a public road a motor vehicle together with any load thereon, the overall height of which—*
> *(a) In the case of a double-deck bus exceeds four comma six five metres; and*
> *(b) In the case of any other motor vehicle exceeds four comma three metres.*
>
> (Department of Transport, 2019)

A proposal has been sent to the Department of Transport to amend the regulation to state the following:

> *No person shall operate on a public road a motor vehicle together with any load thereon, the overall height of which—*
> *(a) In the case of a double-deck bus* ***and ISO containers*** *exceeds four comma six five metres; and*
> *(b) In the case of any other motor vehicle exceeds four comma three metres.*
>
> *(Brooke, 2018)*

The legislation remaining 4.3m

If the vehicle height remains at 4.3m, there could be an increase in safety, meaning that there would be a reduction in accidents. According to Mike Walwyn (2019), an industry expert, it is estimated that approximately 150 000 trailers are used annually to carry containers at a height greater than 4.3m. Therefore, approximately 400 trailers are used daily.

These trailers have an operating life of roughly 20 years. If the regulation were to be enforced, the cost of a new trailer would be R300 000 each, thus requiring an investment of approximately R45 billion (Walwyn, 2019). The affordability of this is questioned. Walwyn (2019) argues that any unplanned investment by road carriers would lead to an increase in the tariffs.

In terms of the infrastructure costs, to compensate for the potential of low deck height trailers, dock levellers would have to be lowered to a height of 1.40 m. This would result in an estimated cost to the industry of R30 000 per dock (Brooke, 2015). Brooke (2015) states that the fruit industry would have the burden of R27 million to lower the container stations to the height of 1.40m.

With the regulation remaining as the status quo, this could potentially increase the amount of CO_2 emissions, as there would be an increase in the number of trucks being used on the road network. In turn, this will affect the maintenance costs of the roads, as more trucks will be used. Table 5-8 depicts the costs and benefits of conforming to the regulation. These costs are high, and the benefits, if any, are minimal to none.

Table 5-8: Costs and benefits associated with the legislation not being amended

Costs	Benefits
Transport costs	No benefits incurred
Infrastructure costs	
Maintenance costs of the road	

Source: Compiled by the researcher for the purpose of this study

With this, no documents or files would need to be amended, as the legislation will remain as the status quo.

Therefore, once the AHP method is used to determine the various stakeholders point of view with regards to the amendment of the regulation or whether the regulation should remain as is, it will allow the researcher to determine the impacts of the two outcomes and how it will affect or influence the economy.

5.4. Constructs and variables

A construct is an abstract idea inferred from specific instances that are thought to be related (Leggett, 2011). It must be observable or measurable. The construct that this study focuses on is the regulation and the moratorium of the high cube container, if not amended.

A variable is presented in the research questions and hypothesis (Legget, 2011).The variables in the case of this study are cost, preference, risk, modal shift, whereby various industries could consider to move away from road transport, and an alternative road solution.

5.5. Reliability and Validity

There are two prominent criteria's for the evaluation of research, namely: reliability and validity. The researcher has to determine that the research methods utilised in the study ensure reliability and validity.

According to Bryman and Bell (2015:28), reliability is concerned with the question of whether the results of the study are repeatable. The term is commonly used to measure whether or not the concepts are consistent and reliability in research refers to the stability of the results. This allows the researcher to be confident in the results and little variation occurs over time in the results obtained.

According to Bryman and Bell (2015:109), validity is concerned with the integrity of the conclusions that are generated from a study. Validity gauges whether a concept really measures that concept.

Therefore, the research objectives of the study aimed to identify whether there would be an impact on South Africa's economy if the regulation governing the vehicle height restriction were not amended to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6 metres. The research methodology followed in the study included conducting a survey and semi-structured interviews. Following the correct methodology and research design ensured the validity and reliability of the study.

5.6. Limitations

There were two limitations that affected the data collection process in this study. The first limitation is linked to the lack of data received from Government officials on the regulation governing vehicle height restriction and that of transporting high cube containers. The second limitation is that not all the stakeholders that responded to the survey work directly with high cube containers.

5.7. Conclusion

The study consisted of both primary and secondary research utilising the Internet to collect articles and academic publications, in addition to conducting a systematic literature review, a content analysis and analytical tests. Due to the nature of this study, a combination of qualitative and quantitative research was needed to determine the relevant data and obtain reliable results.

The sample for this study included stakeholders from the fruit industry, the shipping industry, Government officials, the road transport industry, rail transport industry, independent consultants and various other stakeholders. Atlas.ti allowed the extraction of relevant data from the academic publications and articles and the AHP method was used to determine the importance weights of the respondents' answers to determine the preference of either 4.3m, 4.6mor between 4.3m and 4.6m. The limitations of this study were related to data availability and stakeholders not responding to the survey.

Chapter 6 : Results

6.1. Introduction

This chapter discusses the analyses of the qualitative data received from two different forms of measurements. The following sections answer all the research questions and objectives stated in Chapter one. The methodology and how the data was analysed, that relates to the results in this chapter, were mentioned in the previous chapter in Section 5.3.4.The first section discusses the systematic literature review and the data obtained from the literature review. The second section discusses the results of the related keywords and qualitative findings from the content analysis of existing articles obtained from the Internet. This data determines the number of times a certain keyword was mentioned in the documents retrieved from the Internet. The third section analyses the data received from the survey sent to the various stakeholders through the use of the AHP method. The data contains the preference stipulated towards the height of 4.3m and 4.6m or a height between 4.3m and 4.6m. The fourth section discusses the data obtained through the interviews held with specific industry representatives. The data sets were combined for the analyses and are illustrated in the form of tables and figures in this chapter.

6.2. Systematic literature review

A systematic literature review was conducted to determine whether there has been any peer reviewed, academic research published linked to the topic of this study and to minimise any biasness. The search strategy used to identify primary studies included the resources and databases to be searched as well as the specific keywords that were used. The detail of this systematic literature review methodology was explained in Section 5.3.4. Twenty-seven documents were identified and all 27 were irrelevant to this study. In addition, the researcher relaxed the search strategy to include double-decker buses. However, the literature search still did not identify any academic research linked to the topic of study. Thus, by conducting the systematic literature review, the researcher could conclude that there has not been any peer reviewed, academic research published related to this study.

6.3. Qualitative content analysis

This section discusses the results obtained from the qualitative content analysis using the content analysis tool Atlas.ti. As mentioned previously, Bryman and Bell (2015:219) state that a qualitative content analysis is described as searching-out the underlying themes in the various materials that will be analysed. A list of keywords was established that related to the regulation governing vehicle height restriction of the high cube container, and moratorium

thereof. In addition, the researcher identified five documents that covered the regulation governing vehicle height restriction and the transportation of high cube containers. These five documents were relevant as they discussed the transportation of high cube containers in depth. Table 6-1 depicts the keywords used in the content analysis. These keywords were used as codes in Atlas.ti.

Table 6-1: Keywords used in content analysis

Keywords
Regulation
Moratorium
High cube containers
Containers
Fruit industry
Department of Transport
Shipping industry
Height restrictions
Height Limits
Legislation
Double-decker buses

Source: Compiled by the researcher for the purpose of this study

The keywords “regulation” and “legislation” are separate keywords as these words are used interchangeably in different documents. Atlas.ti was used to analyse the documents, create codes, provide a word cloud and create a network diagram. In Atlas.ti, five documents were analysed resulting in eleven codes being yielded and then grouped into four code groups. Table 6-2 depicts the details of the articles used in the content analysis.

Table 6-2: Details of the five articles used in the content analysis

Title	Author	Publication	Date
Update on High Cube Container Transport: Developments in South Africa.	Mitchell Brooke	SA Fruit Journal	April/May 2015
Submission-iro-Impact-of-Transport-Regulation-on-High-Cube-Container-	Fruit South Africa	Fruit South African	May-2018

Transportation			
180413-CGA-CEO-Newsletter-15	Justin Chadwick	Citrus Growers' Association	April 2018
Media Statement	Minister of Transport – Dr. Blade Nzimande	All media	October 2018
Industry prepared for battle over high cube container restriction	Liesl Venter	Freight & Trade Weekly	December 2017

Source: Compiled by the researcher for the purpose of the study

These five documents were relevant as they discussed the transportation of high cube containers in depth. From these five documents, many links were established, and a network was created. Figure 6-1 depicts the list of codes, groundedness, density and the code groups.

Code	Grounded	Density	Code Groups
High Cube Containers	29	5	Containers
Regulation	23	5	Regulation
Moratorium	16	1	Regulation
Department of Transport	15	2	Regulation
Height limit	11	3	Height
Containers	9	1	Containers
Legislation	9	1	Regulation
Height restriction	8	1	Height
The fruit industry	8	1	The Fruit Industry
Fruit industry	5	1	The Fruit Industry
Double-decker buses	1	2	Regulation
Shipping industry	1	1	Containers

Figure 6-1: List of codes, groundedness, and density and code groups

Source: Compiled by the researcher for the purpose of the study

The groundedness refers to how many quotations were associated with a code throughout the five documents. The density refers to how many links a particular code has with another code in the study. For example, high cube containers have a groundedness of 29 and a density of 5. The codes were put into groups as well, allowing the data to be organised better. From this, many links (densities) were established and a network was created. Figure 6-2 depicts the network diagram. As a result, a relationship was created between each code and a code hierarchy was established.

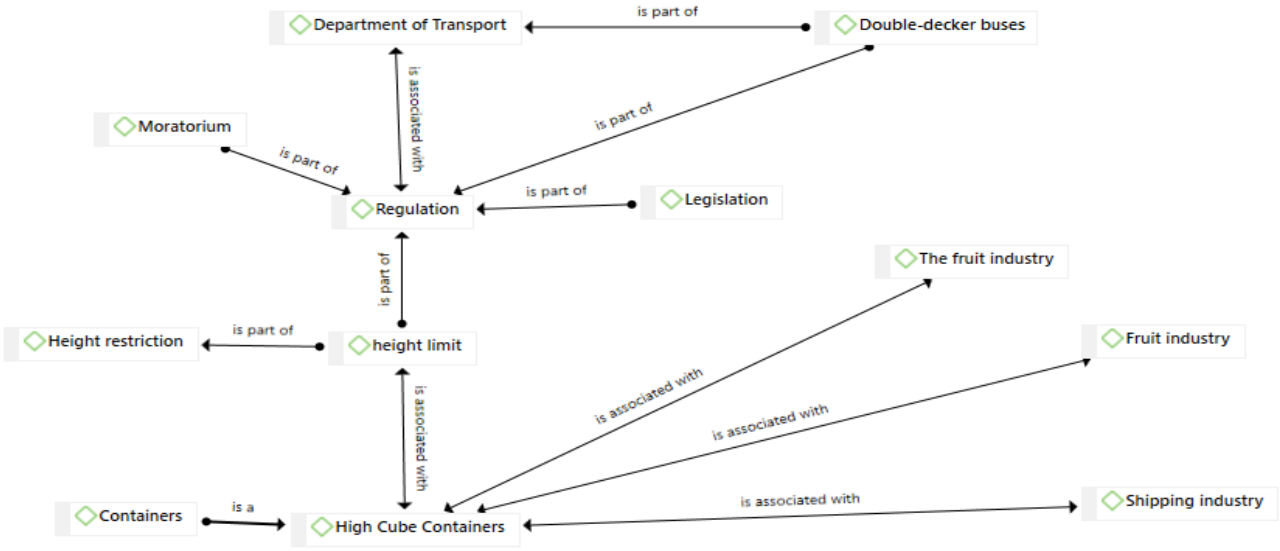


Figure 6-2: Network diagram created in Atlas.ti

Source: Compiled by the researcher for the purpose of the study

The network diagram allows connections to be drawn between the different codes. The main keywords (codes) that were established were based on the words that appeared the most in all documents and linked with each other. As shown in Figure 6-2, “legislation” and “moratorium” are a part of “regulation” as these words are used simultaneously and are a part of “regulation” as the different keywords and codes are used interchangeably. “Regulation” has a density of four as it has four links with “moratorium”, “legislation”, “Department of Transport” and “height limit” and the groundedness is 24. “Height restriction” is a part of “height limit” as different documents use these two codes to explain the regulation governing vehicle height restriction. “Height limit” is associated with “high cube containers” as this study focuses on these two aspects. The link between “containers” is “high cube containers” as they are often generalised in the five articles mentioned in Table 6-2. The “shipping industry” and “fruit industry” are associated with “high cube containers” as these two industries will be impacted if the regulation remains as 4.3m. Furthermore, the fruit industry is mentioned on a couple of occasions in the network diagram above as it is phrased differently in different documents.

The researcher conducted a cross tabulation analysis to analyse the relationship between the codes. By conducting cross tabulation, it showed the correlations change between each code to another code, and the data was investigated and analysed on a granular level by the researcher. Table 6-3 depicts the correlation between the codes within the documents. There are five columns depicting the five documents and eleven rows for the eleven codes.

There are a total of 135 connections shown. Table 6-4 indicates the colour related to the correlation.

Table 6-3: Code Document Table

	FruitSA-Submission-iro-Impact-of-Transport-Regulation-on-High-Cube-Container-Transportation-May-2018 Gr=37	150400-SA-Fruit-Journal-Update-on-High-Cube-Container-Transport-Developments-in-South-Africa Gr=16	180413-CGA-CEO-Newsletter-15 Gr=9	Media Statement Gr=8	FTW-15-December-2017 Gr=15	Totals
○ Containers Gr=9	3	3	1	0	2	9
○ Department of Transport Gr=15	4	5	3	2	1	15
○ Double-decker buses Gr=1	0	0	1	0	0	1
○ Fruit industry Gr=5	0	2	2	0	1	5
○ Height limit Gr=11	3	0	3	2	3	11
○ Height restriction Gr=8	1	1	0	0	6	8
○ High Cube Containers Gr=29	11	7	4	2	5	29
○ Legislation Gr=9	2	1	2	1	3	9
○ Moratorium Gr=16	4	2	3	2	5	16
○ Regulation Gr=23	13	2	6	2	0	23
○ Shipping industry Gr=1	0	1	0	0	0	1
○ The fruit industry Gr=8	5	0	2	0	1	8
Totals	46	24	27	11	27	135

Source: Compiled by the researcher for the purpose of the study

Table 6-4: Key to indicate colour

Colour	Description
	No correlation between the codes
	Little to no correlation between the codes
	Sufficient correlation between the codes
	Greater correlation between codes

Source: Compiled by the researcher for the purpose of the study

The blue depicts that there is no correlation between the codes in the documents. The grey blue shows that there is little to no correlation in the codes and the dark orange colour

indicates that there is a slight correlation. As the colour shifts to the lighter orange, the correlation has increased and is greater. Thus, Table 6-3 shows that “regulation” and “high cube containers” have a greater correlation than the rest.

Co-occurrence allows the consistency of research to be represented in images. Table 6-5 depicts the co-occurrence codes in the margins. From this, the analysis counts the number of times that a given code occurs in particular relation to another code. As a result, Table 6-5 provides a pairwise comparison matrix and Table 6-6 represents the colour to indicate the co-occurrence between the codes.

Table 6-5: Co-occurrence between the codes

	○ Containers Gr=9	○ Department of Transport Gr=15	○ Double-decker buses Gr=1	○ Fruit industry Gr=5	○ Height limit Gr=11	○ Height restriction Gr=8	○ High Cube Containers Gr=29	○ Legislation Gr=9	○ Moratorium Gr=16	○ Regulation Gr=23	○ Shipping industry Gr=1	○ The fruit industry Gr=8
○ Containers Gr=9	0	0	0	0	4	1	7	1	2	2	0	0
○ Department of Transport Gr=15	0	0	1	2	2	1	3	3	6	3	0	2
○ Double-decker buses Gr=1	0	1	0	1	1	0	1	1	1	1	0	1
○ Fruit industry Gr=5	0	2	1	0	3	1	2	2	2	2	0	3
○ Height limit Gr=11	4	2	1	3	0	3	8	4	3	3	0	3
○ Height restriction Gr=8	1	1	0	1	3	0	2	0	2	0	0	1
○ High Cube Containers Gr=29	7	3	1	2	8	2	0	4	6	6	1	3
○ Legislation Gr=9	1	3	1	2	4	0	4	0	3	3	0	2
○ Moratorium Gr=16	2	6	1	2	3	2	6	3	0	5	0	2
○ Regulation Gr=23	2	3	1	2	3	0	6	3	5	0	0	2
○ Shipping industry Gr=1	0	0	0	0	0	0	1	0	0	0	0	0
○ The fruit industry Gr=8	0	2	1	3	3	1	3	2	2	2	0	0

Source: Compiled by the researcher for the purpose of the study

Table 6-6: Key to indicate co-occurrence colour

	No co-occurrence occurs
	Codes co-occurred once
	Codes co-occurred twice
	Codes co-occurred three times
	Codes co-occurred four times
	Codes co-occurred five times
	Codes co-occurred six times
	Codes co-occurred seven times
	Codes co-occur eight times

Source: Compiled by the researcher for the purpose of the study

Co-occurrence is when two codes are either coding exactly the same quotations or part of the quotations. Co-occurrence informs one about the context of the information. This pertains to the context within which individuals refer to certain things. In Table 6-5, it can be said that when one is speaking about “containers”, one is referring to “high cube containers” and vice versa. Subsequently, when one speaks about “height limit”, one is referring to “high cube containers”. In addition, when one speaks about “regulation”, one is referring to “high cube containers” and vice versa. The exact same thing can be said about when “moratorium” is mentioned, individuals are referring to the “high cube containers” and vice versa as well. Including, when one speaks about “The Department of Transport”, one is referring to “moratorium”. This indicates that there are spatial associations, which is the connectedness or relationship between or among the codes when it is mentioned to refer to certain codes. This indicates that the distributions are similar. Where there is a zero, there is no co-occurrence between the codes on the left with certain codes on top of the columns.

6.4. AHP method

The AHP method was used to identify whether there would be an impact on South Africa’s economy if the regulation governing vehicle height were not amended to allow road transport operators to transport high cube containers on normal trailers at a height of 4.6 metres. The following questions were used in the survey:

1. I would prefer the regulation to remain at 4.3 metres.

2. I would prefer the regulation to be amended to 4.6 metres.
3. I would like the High Cube Container to be exempt from the 4.3 metre limit as long as it does not exceed 4.6 metres.
4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.
5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.
6. Buyers in numerous markets specify the use of the High Cube Container.
7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.
8. It would be viable to move containers via railways due to railway sidings being available.
9. An abnormal load permit could be a possible solution.
10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.

These ten questions were used in the AHP method and were classified accordingly in Table 6-7.

Table 6-7: Classification of questions

Questions	Classification
1,2,3	Outcomes
4,7	Financial Impact
5,6,8,9,10	Transportation Risk

Source: Compiled by the researcher for the purpose of the study

Theoretically, there is a negative financial impact if the regulation remains at 4.3m. This is since all major stakeholders would be impacted. The loading dock height and the trailers would have to be changed and that is a significant investment for everyone involved. It is believed that transporters would have to replace their fleet, but it will cost each transporter approximately R300 000 per trailer, with an estimate of R2 billion to be spent on trailers alone. Changing the dock heights to suit the loading and unloading of containers is also a significant capital cost for the industries involved.

As mentioned in chapter 5, the researcher assigned the 1-9 scale to construct comparison matrices (Table 5.5 and 5.6).The comparison matrices provide objective judgements and the

1-9 scale allowed the researcher to determine what the stakeholders and respondents deem important. The researcher made use of one, five and nine to assign numbers to the judgements and the inverse of those numbers as well to indicate the preference of the respondents. The method behind the AHP is discussed in the research design and methodology of this study. The financial impact of transporting high cube containers on South African roads has a preference weight of 0.72 at the height of 4.3m. In addition, the financial impact of transporting high cube containers at the height of 4.6m has a preference weight of 0.06 and transporting high cube containers between the heights 4.3m and 4.6m has a preference weight of 0.22. Table 6-8 depicts the relevant literature impacts of transporting a high cube container.

Table 6-8: Relevant literature impacts

A	***Financial impact***			**Normalise**	***Financial impact***				
	4.3	**Between**	**4.6**		**4.3**	**Between**	**4.6**	**Preference weight**	
4.3	1	5	9	**4.3**	0.76	0.81	0.60	**4.3**	0.72
Between	0.20	1	5	**4.6**	0.15	0.16	0.33	**Between**	0.22
4.6	0.11	0.2	1	**Between**	0.08	0.03	0.07	**4.6**	0.06
Sum	1.31	6.2	15						
A	***Transportation risk***			**Normalise**	***Transportation risk***				
	4.3	**Between**	**4.6**		**4.3**	**Between**	**4.6**	**Preference weight**	
4.3	1	0.20	0.11	**4.3**	0.07	0.03	0.08	**4.3**	0.06
Between	5	1	0.2	**Between**	0.33	0.16	0.15	**Between**	0.22
4.6	9	5.00	1	**4.6**	0.60	0.81	0.76	**4.6**	0.72
Sum	15	6.20	1.31						

Source: Compiled by the researcher for the purpose of the study

The second impact that was considered was a transportation risk. To many of the industries surveyed, this is not the main concern as to date there is no known or recorded evidence that gives rise to the fact that the transportation of ISO high cube containers poses a risk (Brooke, 2015). No information as to risk incidents related to high cube containers could be found in internet searches. As shown in Table 6-8, transporting at a height of 4.6m is deemed where the transportation risk would be the highest as currently many industries are transporting high cube containers at a height of 4.5m. Theoretically, transporting at 4.3m has a preference weight of 0.06 as it is believed to pose no risk to any individual, container or road infrastructure. Transporting between 4.3m and 4.6m has a preference weight of 0.22, which is higher than 4.3m, but it does not pose a significant risk.

From the data obtained via the Internet as well as the survey conducted, the two impacts considered were a financial impact and a transportation risk. From this, the researcher looked at what the impact would be at a height of 4.3m, any height between 4.3m and 4.6m and a height of 4.6m. These three height alternatives were used as the first three questions

of the survey covered the three heights. Subsequently, the researcher conducted explorative interviews where the three height alternatives were considered, and these were the three possible outcomes identified. Table 6-9 depicts the three outcomes identified from the survey.

Table 6-9: Outcomes of the survey

Outcome	Height
1	4.3m
2	Between 4.3m and 4.6m
3	4.6m

Source: Compiled by the researcher for the purpose of the study

A comparison was drawn between the articles from the Internet to the results obtained from the survey. The survey also asked respondents from various industries to provide their viewpoints on the outcomes and impacts. The following tables represent the various industries' viewpoints on the two impacts.

6.4.1. The Shipping Industry

The shipping industry was the first industry to be analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders in the shipping industry. Table 6-10 shows the responses and the numbers assigned to each question in the shipping industry.

Table 6-10: Shipping industry's responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	9.00	9.00	9.00	9.00	0.11	0.11	9.00

2	9.00	9.00	9.00	9.00	0.11	0.11	9.00
3	9.00	5.00	9.00	9.00	1.00		9.00
4	9.00	9.00	9.00	9.00	0.11	1.00	9.00
5	9.00	9.00	9.00	9.00	0.11	0.11	9.00
6	9.00	9.00	9.00	9.00	0.11	0.11	9.00
7	9.00	9.00	9.00	9.00	9.00	5.00	9.00
8	5.00	9.00	9.00	9.00	1.00	0.20	5.00
9	5.00	5.00	5.00	5.00	0.20	0.20	5.00
10	0.20	0.20	5.00	0.20	9.00	0.20	0.20
11	9.00	9.00	9.00	9.00	5.00	0.20	5.00

Source: Compiled by the researcher for the purpose of the study

All questions that are applicable to financial impact and transportation risk were grouped accordingly. Therefore, as shown in Table 6-10, questions four and seven are grouped in financial impact and questions five, six, eight, nine and ten are grouped according to transportation risk. If a respondent did not supply an answer to a question, it was left blank and not given a zero as that would have skewed the results. Figure 6-3 depicts the process used to calculate each respondent's weights for the financial impact and transportation risk shown in Table 6-10.

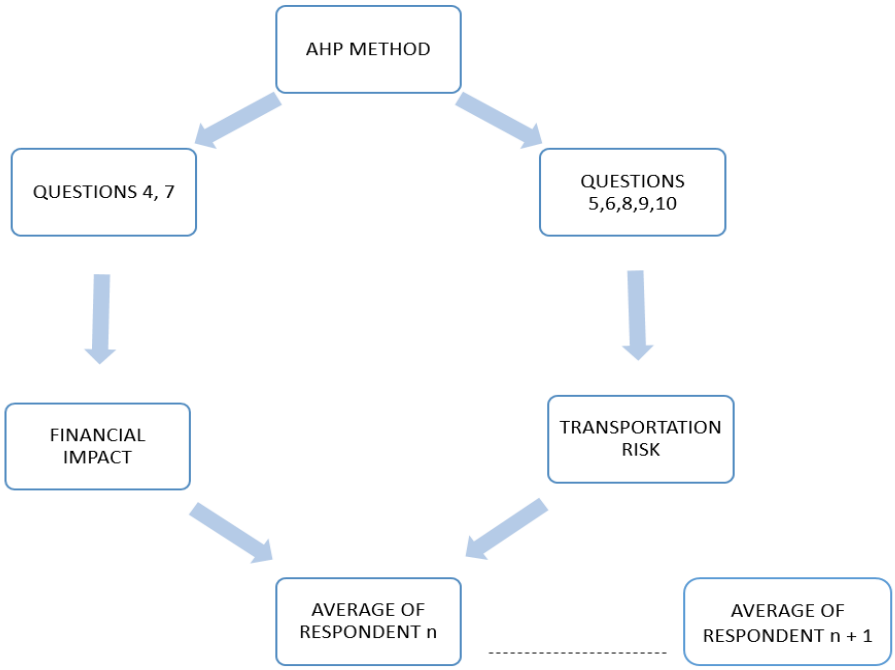


Figure 6-3: AHP method applied for each respondent

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 2.37, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 6-11 shows the average number of the results for the shipping industry.

Table 6-11: Average results for the shipping industry

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
9.00	5.44	cost is normally preferred	3.56
9.00	5.44	cost is normally preferred	3.56
9.00	6.00	cost is normally preferred	3.00
9.00	5.62	cost is normally preferred	3.38
9.00	5.44	cost is normally preferred	3.56
9.00	5.44	cost is normally preferred	3.56
9.00	8.20	cost is normally preferred	0.80
7.00	4.84	cost is normally preferred	2.16
5.00	3.08	cost is normally preferred	1.92
0.20	2.92	risk is normally preferred	-2.72
9.00	5.64	cost is normally preferred	3.36
			2.37

Source: Compiled by the researcher for the purpose of the study

Therefore, the eleven respondents from the shipping industry are more than twice as concerned about the financial impact as with the transportation risk. Table 6-12 depicts the shipping lines preference weight. Due to the shipping lines being twice as concerned about the financial impact as with the transportation risk, their financial impact preference weight is 0.70, indicating that there would be a negative financial impact.

Table 6-12: Shipping lines preference weight

A	**Combined opinion**		**Normalise**	**Combined opinion**			
	Financial impact	**Transportation risk**		**Financial impact**	**Transportation risk**	**Preference weight**	
Financial Impact	1	2.37	**Financial Impact**	0.70	0.70	**Financial Impact**	0.70
Transportation risk	0.42	1.00	**Transportation risk**	0.30	0.30	**Transportation risk**	0.30
Sum	1.42	3.37					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the shipping lines preference weights in Table 6-12, the final score, in terms of the regulation governing vehicle height restriction, keeping the vehicle height restriction at 4.3m would have a negative impact on South Africa's economy. Therefore, the shipping lines would prefer the height between 4.3m and 4.6m as the vehicle height regulation, because it has the lowest financial impact. Table 6-13 shows the final scores for the three height restriction options.

Table 6-13: Shipping lines final scores

Height	Final score
4.3m	0.53
Between	0.22
4.6m	0.26

Source: Compiled by the researcher for the purpose of the study

The shipping industry was the first industry to be analysed and is used as an example for all the industries as the same methodology was used to calculate the values for each industry. In addition, the lowest final score determines the preference of the stakeholder groups as it has the lowest negative financial impact. The industry responses and average results for the remaining industries are shown in Appendix A.

6.4.2. Road Transport Industry

The 14 respondents from the road transport industry are twice as concerned about the financial impact as with the transportation risk. Table 6-14 depicts the road transport industry's preference weight. The road transporters have a preference weight of 0.67 and the financial impact is of greater concern than the transportation risk.

Table 6-14: Road transporters preference weight

A	**Combined opinion**		**Normalise**	**Combined opinion**			
	Financial impact	**Transportation risk**		**Financial impact**	**Transportation risk**	**Preference weight**	
Financial Impact	1.00	2.00	**Financial Impact**	0.67	0.67	**Financial Impact**	0.67
Transportation risk	0.50	1.00	**Transportation risk**	0.33	0.33	**Transportation risk**	0.33
Sum	1.50	3.00					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the road transport industry's preference weights in Table 6-14, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the road transport industry would prefer the height between 4.3m and 4.6m as the vehicle height regulation, as it has the lowest financial impact on the economy. Table 6-15 shows the final scores of the three height restriction options.

Table 6-15: Road transport industry's final scores

Height	Final score
4.3m	0.50
Between	0.22
4.6m	0.28

Source: Compiled by the researcher for the purpose of the study

6.4.3. Government officials

The four respondents from the government officials are twice as concerned about the financial impact as with the transportation risk. Table 6-16 depicts the government official's preference weight. A large portion of government were not willing to participate in the survey due to a conflict of interest; therefore, this is a poor representation of government. The four government officials that answered the survey consider that there is a preference weight of 0.68 and there is a greater financial impact than a transportation risk.

Table 6-16: Government officials' preference weight

A	Combined opinion		Normalise	Combined opinion			
	Financial Impact	Transportation Risk		Financial impact	Transportation Risk	Preference weight	
Financial Impact	1	2.17	Financial Impact	0.68	0.68	Financial Impact	0.68
Transportation Risk	0.46	1	Transportation Risk	0.32	0.32	Transportation risk	0.32
Sum	1.46	3.17					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the government officials' preference weights in Table 6-16, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the government would prefer the height between 4.3m and 4.6m as the vehicle height regulation, as it has the lowest financial impact on the economy. Table 6-17shows the final scores of the three height restriction options.

Table 6-17: Government officials' final score

Height	Final score
4.3m	0.51
Between	0.22
4.6m	0.27

Source: Compiled by the researcher for the purpose of the study

6.4.4. Fruit Industry

The 19 respondents from the fruit industry are almost four times as concerned about the financial impact as with the transportation risk. Table 6-18 depicts the fruit industry's preference weight. The fruit industry states that there is preference weight of 0.79 and there is a greater financial impact than a transportation risk.

Table 6-18: Fruit industry preference weight

A	Combined opinion		Normalise	Combined opinion			
	Financial impact	Transportation risk		Financial impact	Transportation risk	Preference weight	
Financial Impact	1	3.85	Financial Impact	0.79	0.79	Financial Impact	0.79
Transportation risk	0.26	1	Transportation risk	0.21	0.21	Transportation risk	0.21
Sum	1.26	4.85					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the fruit industry's preference weight in Table 6-18, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the fruit industry would prefer a height of 4.6m as the vehicle height regulation as it has the lowest financial impact on the economy. Table 6-19 shows the final scores of the three height restriction options.

Table 6-19: Fruit industry's final score

Height	Final score
4.3m	0.59
Between	0.22
4.6m	0.20

Source: Compiled by the researcher for the purpose of the study

6.4.5. Rail Transport Industry

The two respondents from the rail transport industry are almost twice as concerned about the financial impact as with the transportation risk. Table 6-20 depicts the rail transport industry's preference weight. The rail transport industry states that there is a preference weight of 0.61 and there is a greater financial impact than a transportation risk.

Table 6-20: Rail transport industry preference weight

A	Combined opinion		Normalise	Combined opinion			
	Financial impact	Transportation risk		Financial impact	Transportation risk	Preference weight	
Financial Impact	1	1.56	Financial Impact	0.61	0.61	Financial Impact	0.61
Transportation risk	0.64	1	Transportation risk	0.39	0.39	Transportation risk	0.39
Sum	1.64	2.56					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the rail transport industry's preference weight in Table 6-20, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the rail transport industry would prefer a height between 4.3m and

4.6m as the vehicle height regulation as it has the lowest financial impact on the economy. Table 6-21 shows the final scores of the three height restriction options.

Table 6-21: Rail transport industry's final score

Height	Final score
4.3m	0.46
Between	0.22
4.6m	0.32

Source: Compiled by the researcher for the purpose of the study

6.4.6. Independent Consultants

The twelve respondents from the independent consultants are three times as concerned about the financial impact as with the transportation risk. Table 6-22 depicts the independent consultants' preference weight. It is stated that the independent consultants' have a preference weight of 0.77 and there is a greater financial impact than a transportation risk.

Table 6-22: Independent consultants' preference weight

A	**Combined opinion**		**Normalise**	**Combined opinion**			
	Financial impact	**Transportation risk**		**Financial impact**	**Transportation risk**	**Preference weight**	
Financial Impact	1	3.37	**Financial Impact**	0.77	0.77	**Financial Impact**	0.77
Transportation risk	0.30	1	**Transportation risk**	0.23	0.23	**Transportation risk**	0.23
Sum	1.30	4.37					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the independent consultants' preference weight in Table 6-22, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the independent consultants would prefer a height of 4.6m as the vehicle height regulation, as it has the lowest financial impact on the economy. Table 6-23 shows the final scores of the three height restriction options.

Table 6-23: Independent consultants' final score

Height	Final score
4.3m	0.57
Between	0.22
4.6m	0.21

Source: Compiled by the researcher for the purpose of the study

6.4.7. Other Stakeholders

The 15 respondents from the other stakeholders are almost three times as concerned about the financial impact as with a transportation risk. Table 6-24 depicts the other stakeholders'

preference weight. It is stated that the other stakeholders have a preference weight of 0.73 and there is a greater financial impact than a transportation risk.

Table 6-24: Other stakeholders' preference weight

A	Combined opinion		Normalise	Combined opinion			
	Financial impact	Transportation risk		Financial impact	Transportation risk	Preference weight	
Financial Impact	1	2.73	Financial Impact	0.73	0.73	Financial Impact	0.73
Transportation risk	0.37	1	Transportation risk	0.27	0.27	Transportation risk	0.27
Sum	1.37	3.73					

Source: Compiled by the researcher for the purpose of the study

Based on the relevant literature preference weights in Table 6-8 and the other stakeholders' preference weight in Table 6-24, the final score, in terms of the regulation governing vehicle height restriction, 4.3m would have a negative impact on South Africa's economy. Therefore, the other stakeholders would prefer a height between 4.3m and 4.6m as the vehicle height regulation, as it has the lowest financial impact on the economy. Table 6-25 shows the final scores of the three height restriction options.

Table 6-25: Other stakeholders' final score

Height	Final score
4.3m	0.55
Between	0.22
4.6m	0.24

Source: Compiled by the researcher for the purpose of the study.

6.4.8. Summary AHP results across stakeholder groups

The AHP method allowed the researcher to determine a score for how 'valuable' the choices are as well as to determine a score for how the decision maker's 'feel' about the choices. By conducting the AHP method to do the analysis, objectivity and unbiased results were obtained. Many industries are concerned with the financial impact that would be posed on their industry. Table 6-26 depicts a summary of all the stakeholders' final scores.

Table 6-26: Summary of all the industries' final scores

Stakeholder group	4.3m	Between	4.6m	Height Preference
Shipping industry	0.53	0.22	0.26	Between
Road transport industry	0.50	0.22	0.28	Between
Government officials	0.51	0.22	0.27	Between
Fruit industry	0.59	0.22	0.20	4.6
Rail transport industry	0.46	0.22	0.32	Between
Independent consultants'	0.57	0.22	0.21	4.6
Other	0.55	0.22	0.24	Between

Source: Compiled by the researcher for the purpose of the study

The summary of the stakeholder responses indicates that most of the stakeholders are gravitating towards a height somewhere between 4.3m and 4.6m and a height of 4.6m. However, the researcher determined that the preferred height is somewhere between 4.3m and 4.6m as many transporters are operating at a height of 4.5m, which is between the 4.3m and 4.6m preference.

6.5. Data obtained from interviews

As mentioned in the previous chapter, the researcher conducted eleven semi-structured interviews with various stakeholders from the stakeholder groups. The data received was saturated as similar answers were provided. The interview guide is shown in Appendix B. This section looks at the data obtained from the interviews conducted with the stakeholders.

The researcher identified that many of the stakeholder groups are concerned about the financial impact of the legislation remaining at 4.3m. The reason is that transporters would need to replace their trailers to meet the new legislation, but each trailer costs approximately R300 000, which is a substantial investment. These trailers could be replaced over a time horizon of 10 to 15 years. In addition, all loading bays and docking stations where companies load and unload containers have dock heights that are aligned to loading and unloading of high cube containers. If the legislation is kept at 4.3m, many of these loading and unloading docks would have to be lowered to access trailers and containers, which is another significant capital cost. Consequently, there would be a negative financial impact on South Africa's economy. In addition, all the selected industry experts mentioned that there

are no positives to the regulation remaining as is. Figure 6-4 depicts the cause and effect of the regulation remaining as is.

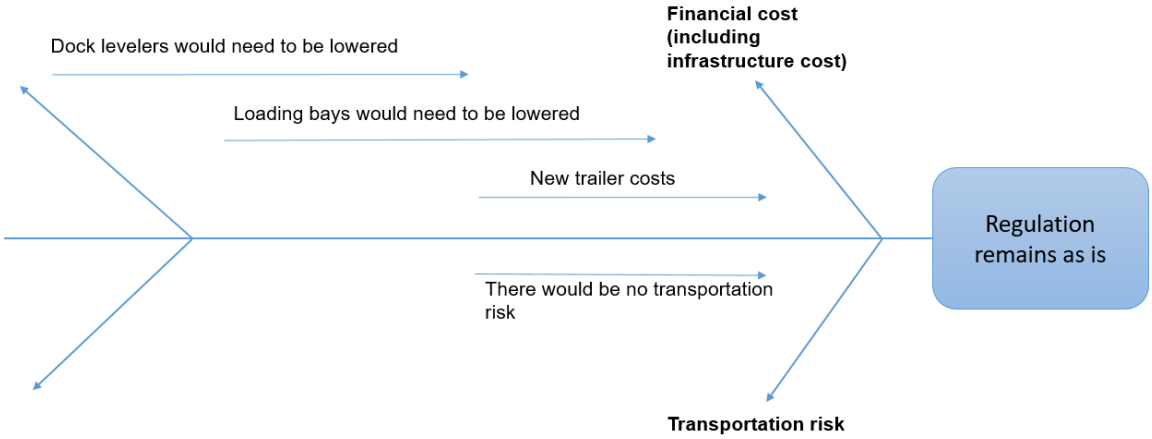


Figure 6-4: Cause and effect of the regulation remaining as is

Source: Compiled by the researcher for the purpose of the study

In Chapter two, a stakeholder analysis was conducted to determine the most important stakeholders that would be impacted by the regulation governing the vehicle height restriction on South African roads. The researcher determined that the most important stakeholders involved are the government, the fruit industry and the trucking or road transport industry. Essentially, the whole supply chain would be impacted, including the everyday road user. The shipping lines would be impacted as they provide the container to the exporters and importers and the exporters of perishables do not want to spend more money since high cube containers provide more volume than the standard container. Thus, South Africa's trade would be negatively impacted if it is illegal to transport high cube containers on the roads.

Many of the industry experts are certain that South Africa as a country can adapt to any outcome. However, if the legislation remains at 4.3m, productivity within the fruit industry would decrease significantly, including the efficiency and product flow. This is since the legislation was established when high cube containers were not manufactured and used in South Africa. The operations and productivity of the fruit industry would be negatively impacted and incur additional costs. Most of the companies would fail to benefit and have a decrease in profitability. Therefore, the costs are significant and could result in the various industries crippling.

It is the opinion of these experts that a low bed trailer would allow transporters to transport high cube containers within the legal height of 4.3m, but it would take 10 to 15 years to acquire the necessary equipment. Transporters would need to change their fleet, which are

their assets for the old trailers to be phased out and the new trailers to be phased in. At present, the trailer manufacturing industry would not be able to handle the capacity of trailers needed by the deadline stipulated by Government. In addition, the transport industry is doing away with standard containers as the high cube container demand is growing and is becoming the norm in the industry. Standard containers provide 15% less space and volume than a high cube container.

In addition, a suggested interview outcome was identified that South Africa should implement a smart trucking project or performance-based standard (PBS) nationally where the stability of the vehicle is evaluated. PBS is purely a descriptive approach, but it does specify the maximum height. Through implementing the standard nationwide, there would be a reduction in road crashes and fewer truck kilometres travelled on the roads. This in turn will decrease any risk posed on the everyday driver. South Africa is the fourth country in the world to look at PBS for heavy vehicles. Other countries such as Canada, Australia and New Zealand started observing PBS and by setting performance standards to specify how a vehicle is required to operate on the road network will lead to the specified performance level achieved. With this, a trailer with a high cube container on it, transporting at a height of 4.5m, passes the performance standards of roll over and high-speed manoeuvres.

Industry experts stated that while transporting high cube containers, there have not been any recorded accidents or incidents that occurred directly as a result of the height of the high cube container. However, there have been containers that tipped over due to the fact that it was loaded incorrectly, or the load shifted during transit. The height of 4.6m has been used for 30 years when transporting high cube containers and has not posed any specific threat or risk to individuals on the roads.

A suggestion was provided that high cube containers be transported by rail. This would be a viable option as any truck on the road is a risk to road users. Another problem with this approach is that the high cube containers still need to be transported to and from the rail terminals, and for this, skeletal trailers or changed legislation would be needed. Therefore, if less trucks are used to transport high cube containers, the roads will become safer and the costs of maintaining all roads will be reduced. However, the necessary rail infrastructure does not currently exist. Therefore, it is necessary for upgrades to be made to South Africa's rail infrastructure before this becomes a viable option.

6.6. Conclusion

From this chapter, all research objectives have been met. A systematic literature review was conducted and concluded that there has not been any peer reviewed, academic research

published that is related to this study. Atlas.ti was used to conduct a content analysis. Groundedness and density was shown between the codes, and documents as well as a cross tabulation analysis was conducted. The results from the content analysis depicted that a co-occurrence does exist between the codes. The AHP method showed that the financial impact outweighs the transportation risk. Many of the respondents and the interviewees are concerned about the costs involved in changing all the equipment to align with the current legal height of 4.3m. Thus, it would take 10 to 15 years to replace the necessary equipment.

Chapter 7 : Interpretation of results

7.1. Introduction

In this chapter, the interpretation of the results in Chapter 6 are discussed to answer the research questions. This chapter identifies the main findings of the study.

7.2. Main findings of the study

7.2.1. Financial impact

Based on relevant literature, there is a negative financial impact if the regulation remains at 4.3m. If the regulation were to be enforced without any phasing in, the cost of a new trailer is approximately R300 000 each, which is a substantial investment. The local trailer manufacturing industry would not have the capacity to build all the new trailers required by 1 January 2020.

Subsequently, the researcher collected data regarding the financial impact of the regulation governing vehicle height restriction. The 77 respondents of the survey and the eleven semi-structured interviews all concluded that it would have a negative financial impact and be of a significant cost to the economy. In terms of the preference weightings, the fruit industry has the highest preference weight of the financial impact as they are concerned about South Africa's exports as international countries use high cube containers to transport perishable goods. The independent consultants have the second highest preference weight, followed by other stakeholders', shipping lines, government officials, road transport industry and finally, the rail transport industry. The government has now extended the moratorium for a further period of 18 months. Whilst the regulation remains as is, the financial impact could have a debilitating effect on the South African economy if the extension is allowed to expire on 30 June 2021. Thus, government needs to consider all inputs from the various industries and determine what would be the best course of action for the whole economy.

Furthermore, the fruit industry is concerned with whether a high cube container becomes illegal to transport on the roads. Due to the fact that to transport fruit in cartons in a standard 40-foot container costs the industry a significant amount of money, whereas to transport fruit in a high cube container, the unit cost per carton of fruit would be lower as more cartons can be packed on a pallet.

7.2.2. Transportation risk

With a 2.9 metre container on a flat deck trailer standing at a 1.60 metre deck height, it results in an overall height of 4.5 metres, which is the height at which most high cube containers are being transported at currently. The moratorium, which expired on 1 January 2019, provided evidence that for approximately the past 7 years that it was allowed, showed little to no instances of issues when transporting high cube containers on the roads. In addition, to date there has been no known or recorded evidence that links to the fact that transporting of ISO High Cube Containers poses a risk to any individual.

The researcher could not collect any direct data specifically related to high cube containers and accidents as there has not been any recorded accidents or incidents related to the height of transporting high cube containers. However, accidents have occurred on the roads due to reckless driving, the load shifting during transit and the high cube container being loaded incorrectly. Further research that specifically investigates a transportation risk related to the height of transporting high cube containers on the roads could be valuable for the industry.

7.2.3. Best practices

The challenge with transporting containers is that containers come in different sizes. Therefore, many companies require a transport solution that is able to adapt to different sizes and types of containers. Most countries have adjusted their road legislation and raised the height to accommodate the inevitable growth of high cube container movements. South Africa has yet to determine a solution to the issue. Within a larger transport system, one has to decide whether to pack the containers at the port, change the vehicles, which would allow for phasing in of changes in the regulation or change the regulation, but containers cannot be banned from South Africa.

A solution for South Africa could be a smart trucking project or performance-based standard (PBS), where standards are set to specify the performance required when operating a vehicle. This will ensure the stability of the vehicle is evaluated, including transport efficiency, road safety and road infrastructure being protected. Therefore, a trailer with a high cube container on it transporting at a height of 4.5m, passes the performance standards stipulated.

7.2.4. Rail Transportation

South Africa has the best rail infrastructure in Africa. However, rail (freight and passenger) capacity shortages remain a severe constraint in South Africa’s trade. Rail transportation

could be a suggested alternative to move high cube containers off the roads, but last and first mile movements to and from terminals will still be done by road trucks. This is due to the risk posed by a truck to a road user. Thus, in order for roads to be safer, fewer trucks could be used to transport high cube (and other) containers. As such, the costs associated with maintaining roads would be reduced. However, the necessary rail infrastructure in terms of rail-road terminals does not currently exist. Therefore, it is necessary for upgrades to be made to South Africa's rail infrastructure before this becomes a viable option.

7.2.5. Summary of main findings

There is a significant cost and negative financial impact on the economy of South Africa if the regulation remains at the status quo. In addition, to date there has been no recorded accidents related to the height of transporting high cube containers, which indicates that there is no transportation risk posed to any individual as high cube containers are currently being transported at a height of 4.5m. South Africa could consider implementing PBS as a best practice and contemplate moving high cube containers via rail transport. Table 7-1 summarises the main findings of this study.

Table 7-1: Summary of main findings in the study

Findings	
1	There is an industry perceived negative financial impact of transporting high cube containers at the height of 4.3m.
2	No evidence of transportation risk is visible as high cube containers have been transported at a height of 4.5m for 7 years.
3	Implementation of a smart trucking project or performance-based standards as a best practice to mitigate any potential risk of operating above 4.3m.
4	In the future, move high cube (and other) containers via rail transport.

Source: Compiled by the researcher for the purpose of the study

7.3. Causes of or reasons for the main findings of the study

7.3.1. Finding one: There is an industry perceived negative financial impact of transporting high cube containers at the height of 4.3m

The main reason is that transporters would need to replace their trailers to meet the new legislation, but each trailer costs approximately R300 000, which is a significant investment.

In addition, all loading bays and docking stations have dock heights that are aligned to loading and unloading of containers at the height of the current trailer configurations. If the legislation is kept at 4.3m, many of these loading docks would have to be lowered to adjust from current trailer heights and to accommodate high cube containers. This would be another significant capital cost and would lead to implications of the current efficiency of an integrated system.

7.3.2. Finding two: No evidence of transportation risk is visible as high cube containers have been transported at a height of 4.5m for 7 years

Many of the stakeholders surveyed and interviewed are not concerned about the transportation risk as high cube containers have been used in South Africa without any risk or threat being posed during the transportation process. However, government wants to uphold the regulation as a result of side sway instability that could lead to tipping over and due to bridge or structural height safety issues that could pose a risk to the ordinary road user. While, South Africa has been transporting high cube containers for approximately 30 years, there have not been any recorded accidents or incidents that occurred directly as a result of the height of the high cube container.

7.3.3. Finding three: Implement a smart trucking project or performance-based standards as a best practice to mitigate any potential risk of operating above 4.3m

South Africa has yet to determine a solution to the issue of transporting high cube containers. Therefore, the reason for implementing a smart trucking project or PBS would provide companies and industries with a transportation solution for transporting high cube containers. By implementing this standard, it could improve the safety of all citizens on the roads, the stability of the vehicle, reduce the number of heavy vehicle trips on the roads, reduce the number of crashes and reduce overloading of containers.

7.3.4. Finding four: Move high cube (and other) containers via rail transport

By moving high cube (and other) containers from road to rail transport, less trucks would be on the national roads (highways). This would improve road safety, decrease the cost of maintaining the roads, the economy would be more efficient and provide an environmentally sustainable transport solution. However, the necessary intermodal rail terminal and rolling

stock infrastructure does not currently exist. Hence, it is necessary for upgrades to be made to South Africa's rail infrastructure before this becomes a viable option.

7.3.5. Summary of causes and reasons of the main findings

This section identified possible causes and reasons for the main findings that were found in this study. Determining the reasons for these findings is a step in the right direction and could benefit the fruit industry and all other relevant industries involved in the transportation of high cube containers. Table 7-2 depicts the reasons for the main findings in this study.

Table 7-2: Reasons for main findings in the study

Findings	Reasons
1	Replacing trailers and equipment to align with the current regulation of 4.3m, including the height of loading and unloading bays would have to change and would carry a significant cost and investment.
2	Various stakeholders suppose that there is no risk or threat being posed during the transportation process as there has been no recorded accidents as a result of the height of transporting high cube containers on the roads.
3	PBS could improve the stability of vehicles on roads, and thus the safety of citizens.
4	The infrastructure required for rail transport does not currently exist.

Source: Compiled by the researcher for the purpose of the study

7.4. Conclusion

South Africa's government needs to consider the views of all stakeholders involved in the regulation governing vehicle height restriction and the transportation of high cube containers. The main findings of the study have concluded that there is a greater financial impact on the economy. Although, government has stated its claims, there have not been any recorded accidents or incidents related to the height of high cube containers. Thus, improvements need to be conducted in order for high cube containers to be moved via rail transport and for performance-based standards to be established.

Chapter 8 : Conclusions and Recommendations

8.1. Introduction

This chapter discusses the conclusions and recommendations of the study and which future research projects would be recommended. This section also determines whether the literature review, data analysis and interpretations chapter met the research objectives and answered the research questions.

8.2. Conclusions

8.2.1. Did the study meet the research objectives?

This sub-section states each specific research objective and determines whether the study met them.

1. *To research and understand the process of impact analysis in freight regulation by providing an understanding of the extent of the impact, and to research the stakeholder analysis process and provide an overview of the stakeholders.*

Chapter 4 identified the three types of impacts and discussed them to determine the method in which the data was analysed. Chapter 6 depicted the results of the survey and identified the two main impacts of the regulation governing vehicle height.

2. *To conduct a Stakeholder Analysis to identify all the stakeholders involved with the vehicle height regulation, to analyse the stakeholder relationships and to develop a stakeholder strategy for engagement and communication*.

Chapter 4 identified all the stakeholders involved in the vehicle height regulation. Various representatives of these stakeholders were approached to conduct a survey and interview with. Chapter 6 showed the responses from the stakeholder groups in relation to the survey.

3. *To understand each stakeholder's perspective of the outcome and why, and to understand whether the outcome is desirable or undesirable.*

The data analysis (Chapter 6) identified the stakeholders' perspectives and provided their preference weight of the regulation governing vehicle height restrictions. This allowed the researcher to understand the various perspectives objectively and determined that either a height between 4.3m and 4.6 or a height of 4.6m can be desirable.

4. *To identify the consequences the various industries will encounter if the legislation is not amended by determining whether there will be an effect on the fruit industry's productivity and on the efficiency of operations within industry.*

Chapter 5 and 6 identified possible consequences encountered by the industries if the legislation is not amended. The operations and productivity of the fruit industry would be negatively impacted and incur additional costs. As a result, most of the companies would fail to benefit and have a decrease in profitability. Therefore, the costs are significant and could result in the various industries crippling. This, in turn, would affect the economy as a whole.

5. *To identify what international best practices could be implemented to ensure road users safety and increase the growth of the economy.*

Chapter 3 and Chapter 6 identified possible international best practices that the South African government should consider implementing. By implementing one of these strategies, it would eliminate the chances of potential decline of the economy and remove any obstacles that would hinder the growth of the economy.

6. *To gather the necessary data, analyse the data, and provide a conclusion on the likely impact should the legislation not be amended.*

Chapter 5, 6 and 7 indicated how the data was collected, how it was analysed and what techniques were used to analyse the data. These chapters provided the conclusions of the stakeholders' perspectives to the study and provided solutions to the problem that the study identified.

8.2.2. Did the study answer the research questions?

This section states each specific research question and determines whether this study answered them successfully.

1. *What will the potential impact of the regulation governing vehicle height restriction be on South Africa's economy if the legislation is not amended?*

Chapter 6 identified the two main impacts of the regulation governing vehicle height and discussed it and, therefore, answered this question successfully.

2. *Who are the key role players involved in the vehicle height restriction for the transportation of high cube containers?*

Chapter 4 identified the most important stakeholders involved in the regulation governing vehicle height restriction. These stakeholders were approached to answer a survey on the topic and from this, certain industries representatives were approached to conduct an interview as the answers provided were saturated and, therefore, answered this question successfully.

3. *What are potential consequences the fruit export industry could face if the legislation is not amended?*

Throughout the document this research question was discussed, but Chapter 5 and 6 highlighted the potential consequences of the legislation remaining at 4.3m and, therefore, answered this question successfully.

4. *What will the impact of the current regulation likely be on the operations of the fruit export industry, if not amended?*

The data analysis (Chapter 6) identified that the operations of the fruit export industry would be negatively impacted and carry additional costs if the regulation governing vehicle height restriction is not amended and, therefore, answered this question successfully.

5. *What will the possible impact of the current regulation be on the productivity of the fruit export industry, if not amended?*

The data analysis (Chapter 6) identified that there would be a negative impact on the productivity of the fruit export industry, including the efficiency and product flow within the industry if the regulation governing vehicle height restriction is not amended and, therefore, answered this question successfully

6. *What international best practices could be implemented to ensure road users safety while at the same time helping to grow the economy?*

Chapter 3 and Chapter 6 identified possible international best practices that the South African government should consider implementing. By implementing one of these strategies, it would eliminate the chances of possible decline of the economy and, therefore, answered this question successfully.

8.3. Recommendations

This section provides recommendations that may help the key role players to solve the problem.

8.3.1. Amend the regulation governing vehicle height restriction

Many industries and stakeholders are concerned about the regulation remaining as the status quo. The reason is that there would be a greater financial impact on the economy and the various stakeholders to change all the necessary equipment and loading and unloading dock heights to meet the current legislation. From the data collected, government could consider to amend the regulation to a height of 4.5m or 4.6m, as the fruit industry currently operates at the height of 4.5m. The main reason to consider these two options is that it would have the lowest financial impact on the stakeholders, the industries and government. Thus, the economy would not lose out on trade with other countries and not lose money as a

result. The operations and productivity would continue as per normal for all stakeholders involved in the regulation governing vehicle height restriction. Likewise, the fruit industry is concerned about the transportation of high cube containers becoming illegal on the roads as to transport fruit in a standard 40-foot container costs the industry a substantial amount of money. However, the unit cost per carton of fruit transported inside a 40-foot high cube container is lower as more cartons can be packed on a pallet in a high cube container.

8.3.2. Extend the moratorium by ten years

The government has now extended the moratorium for a further period of 18 months until 30 June 2021 (Venter, 2019). The extension of the moratorium will allow the DoT to commission a study on the safety of transporting high cube containers. This would ensure that the study would be completed and recommendations would be made to the Minister of Transport. However, the researcher recommends that the moratorium be extended by ten years. The ten years could be broken down as follows:

- 18 months to conduct an investigation on the regulation and PBS design projects and define the PBS policy;
- 18 months be allocated to pass the policy into practice; and
- Seven years to allow for gradual phase-in of any new equipment and infrastructure that has to adhere to the PBS standards during this time.

This would allow industries to operate efficiently for the time-being, but also obtain the necessary new equipment gradually to meet the current legislation, should it remain as is after the moratorium expires. Once the moratorium has expired, the regulation must stipulate that all new equipment brought into the industry and economy must align with the regulation. The regulation must also enforce any new vehicle to meet the new criteria to operate within the legal height.

8.3.3. Future work

This study investigated what the impact on South Africa's economy would be if the regulation governing vehicle height restriction were not amended to allow road transport operators to transport high cube containers on normal trailers at a height of up to 4.6 metres. The researcher determined two main impacts of transporting high cube containers at the current height of 4.3m, namely: financial impact and transportation risk. The financial impact was of more concern than the transportation risk. Further research could be conducted on the transportation risk of transporting high cube containers on South Africa's roads and would be valuable to all stakeholders involved.

8.4. Value to the industry

The survey and interviews conducted during this research managed to identify the potential impacts that the regulation governing vehicle height restriction would have on South Africa's economy, the fruit industry and various other industries as well. Furthermore, the study was able to provide possible solutions to the problem, which may increase the quality of trade for the economy and increase productivity and the efficiency of operations for all stakeholders. This information is valuable for the SA fruit industry, government and other stakeholders, and can help improve the economy's competitiveness.

8.5. Conclusion

The study accomplished its aim and purpose by meeting its objectives and answering the research questions. Possible recommendations were provided to improve the problem areas identified in this study. The researcher managed to identify an idea for future research from the study, which specifies the feasibility of the study and could contribute to current knowledge and help South Africa continue to trade internationally and improve its competiveness.

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Appendixes

Appendix A

The Road Transport industry

The road transport industry was analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders in the road transport industry. Table 10-1 shows the responses and the numbers assigned to each question in the road transport industry.

Table A-1: Road Transport industry responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	0.20	0.20	0.20	0.20	0.20	5.00	0.20
2	9.00	9.00	5.00	9.00	0.11	0.20	0.11
3	9.00	9.00	9.00	9.00	9.00	0.11	0.11
4	9.00	9.00	9.00	9.00	0.11	1.00	0.20
5	9.00	9.00	9.00	9.00	0.11	1.00	0.11
6	9.00	9.00	9.00	9.00	0.11	9.00	0.11
7	9.00	9.00	9.00	9.00	1.00	0.11	0.11
8	0.20	9.00	5.00	0.20	0.20	5.00	5.00
9	5.00	5.00	5.00	5.00	0.11	0.20	0.20

10	5.00	5.00	1.00	5.00	5.00	5.00	
11	5.00	5.00	9.00	9.00	5.00	5.00	9.00
12	9.00	9.00	9.00	9.00	9.00	1.00	9.00
13	5.00	5.00	5.00	9.00	1.00	5.00	1.00
14	0.11	0.11	9.00	9.00	0.11	0.11	9.00

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 2.00, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-2 shows the average number of the results for the road transport industry.

Table A-2: Road transport industry average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
0.2	2.12	risk is normally preferred	-1.92
9	4.66	cost is normally preferred	4.34
9	7.22	cost is normally preferred	1.78
9	4.82	cost is normally preferred	4.18
9	5.62	cost is normally preferred	3.38
9	7.22	cost is normally preferred	1.78
9	5.62	cost is normally preferred	3.38
0.2	3.88	risk is normally preferred	-3.68
5	3.06	cost is normally preferred	1.94
5	4.00	cost is normally preferred	1.00
7	4.82	cost is normally preferred	2.18
9	5.62	cost is normally preferred	3.38
7	3.40	cost is normally preferred	3.60
4.56	1.89	cost is normally preferred	2.67
			2.00

Source: Compiled by the researcher for the purpose of the study

Government officials

The government officials were analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders. Table 10-3 shows the responses and the numbers assigned to each question for the government officials.

Table A-3: Government officials' responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	5.00	5.00	5.00	5.00	5.00	0.20	0.20
2	1.00	1.00	0.20	1.00	5.00	1.00	1.00
3	5.00	1.00		1.00	5.00	0.20	0.20
4	9.00	5.00	1.00	9.00	1.00	5.00	

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 2.17, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-4 shows the average number of the results for the government officials.

Table A-4: Government officials' average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
5	3	cost is normally preferred	2
1	2	risk is normally preferred	-1

3	2	neutral	1
9	3	cost is strongly preferred	6
			2.17

Source: Compiled by the researcher for the purpose of the study

Fruit industry responses

The fruit industry was analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders in the fruit industry. Table 10-5 shows the responses and the numbers assigned to each question in the fruit industry.

Table A-5: Fruit industry's responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	9.00	5.00	9.00	9.00	9.00	5.00	0.11
2	9.00	9.00	9.00	9.00	0.11	0.11	1.00
3	5.00	9.00	9.00	9.00	0.11	0.11	0.11
4	9.00	9.00	9.00	9.00	0.11	0.20	0.11
5	9.00	5.00	9.00	9.00	0.20	5.00	5.00
6	9.00	9.00	9.00	9.00	0.11	0.20	0.11
7	9.00		9.00	9.00	0.11	1.00	1.00
8	5.00	9.00	5.00	9.00	0.20	1.00	0.20

9	9.00	9.00	9.00	0.20	0.20	0.20	0.20
10	5.00	5.00	9.00	5.00	9.00	5.00	5.00
11	9.00	5.00	9.00	9.00	0.20	1.00	1.00
12	9.00	9.00	9.00	9.00	0.11	5.00	0.11
13	9.00	1.00	9.00	9.00	9.00	0.20	5.00
14	9.00	1.00	9.00	9.00	0.11	1.00	0.11
15	9.00	9.00	9.00	9.00	0.20	0.11	0.11
16	0.20	5.00	5.00	5.00	5.00	5.00	5.00
17	9.00	9.00	9.00	9.00	1.00	1.00	0.11
18	9.00	9.00	9.00	9.00	0.20	5.00	0.11
19	9.00	5.00	5.00	5.00	5.00	1.00	0.20

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 3.85, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-6 shows the average number of the results for the fruit industry.

Table A-6: Fruit industry's average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
9	5.62	cost is normally preferred	3.38
9	3.84	cost is strongly preferred	5.16
7	3.67	cost is normally preferred	3.33
9	3.68	cost is normally preferred	5.32
9	4.84	cost is strongly preferred	4.16
9	3.68	cost is strongly preferred	5.32
9	2.78	cost is strongly preferred	6.22
7	3.08	cost is normally preferred	3.92
4.6	3.72	neutral	0.88
5	6.60	neutral	-1.60
9	3.24	cost is strongly preferred	5.76
9	4.64	cost is normally preferred	4.36
9	4.84	cost is strongly preferred	4.16

9	2.24	cost is normally preferred	6.76
9	3.68	cost is normally preferred	5.32
2.6	5.00	risk is normally preferred	-2.40
9	4.02	cost is normally preferred	4.98
9	4.66	cost is normally preferred	4.34
7	3.24	cost is normally preferred	3.76
			3.85

Source: Compiled by the researcher for the purpose of the study

Rail Transport Industry

The rail transport industry was analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders in the rail transport industry. Table 10-7 shows the responses and the numbers assigned to each question in the rail transport industry.

Table A-7: Rail transport industry's responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	9	9	5	9	5	0.2	0.2
2	5	9	1	1	9	5	1

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 1.56, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-8 shows the average number of the results for the rail transport industry.

Table A-8: Rail transport industry's average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
9	3.88	cost is normally preferred	5.12
3	5	risk is normally preferred	-2
			1.56

Source: Compiled by the researcher for the purpose of the study

Independent consultants

The independent consultants were analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders. Table 10-9 shows the responses and the numbers assigned to each question to the independent consultants.

Table A-9: Independent consultants' responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	9.00	9.00	9.00	9.00	0.11	0.20	0.20
2	5.00	1.00	5.00	5.00	5.00	0.20	0.20

3	9.00	9.00	9.00	9.00	1.00	0.11	0.11
4	9.00	9.00	9.00	9.00	9.00	0.11	0.11
5	9.00	1.00	5.00	5.00	1.00	5.00	1.00
6	9.00	9.00	9.00	9.00	0.11	0.20	0.11
7	5.00	1.00	5.00	5.00	1.00	1.00	0.20
8	5.00	9.00	5.00	9.00		0.11	0.20
9	9.00	0.11	1.00	9.00	0.20	9.00	0.20
10		0.20	5.00			0.11	0.20
11	9.00	9.00	9.00	9.00	5.00	5.00	1.00
12	1.00	0.20	0.20	0.20	0.20	5.00	5.00

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 3.37, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-10 shows the average number of the results for the independent consultants.

Table A-10: Independent consultants' average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
9.00	3.70	cost is normally preferred	5.30
5.00	2.28	cost is normally preferred	2.72
9.00	3.84	cost is normally preferred	5.16
9.00	5.44	cost is normally preferred	3.56
7.00	2.60	cost is strongly preferred	4.40
9.00	3.68	cost is normally preferred	5.32
5.00	1.64	cost is normally preferred	3.36
7.00	3.58	cost is normally preferred	3.42
9.00	2.10	cost is strongly preferred	6.90
	1.38	risk is normally preferred	-1.38
9.00	5.80	cost is normally preferred	3.20
0.60	2.12	risk is normally preferred	-1.52
			3.37

Source: Compiled by the researcher for the purpose of the study

Other stakeholders

The other stakeholders were analysed. Therefore, one, five and nine, including the inverse of these numbers were applied to the responses of the stakeholders. Table 10-11 shows the responses and the numbers assigned to each question for the other stakeholders.

Table A-11: Other stakeholders' responses

Respondent	4. There will be a significant financial impact on the economy, if the regulation remains as the status quo.	5. There is no risk in transporting High Cube Container at a height of 4.6 metres on suitable, approved trailing equipment before declaring them illegal.	6. Buyers in numerous markets specify the use of the High Cube Container.	7. The country would encounter a significant loss in income and well-being if High Cube Containers were deemed illegal to transport.	8. It would be viable to move containers via railways due to railway sidings being available.	9. An abnormal load permit could be a possible solution.	10. There will be loading or unloading problems due to incompatible dock heights, if the legislation is not amended and industry is forced to switch to low level trailers.
1	9.00	0.11	9.00	9.00	0.11	0.11	0.11
2							
3	5.00	1.00	1.00	5.00	0.11	5.00	0.20
4	5.00	5.00	1.00	5.00	0.11	5.00	5.00
5	9.00	9.00	9.00	9.00	0.11	0.11	0.11
6	9.00	9.00	9.00	9.00	0.11	0.11	0.11
7	5.00	0.20	1.00	0.20	0.20	5.00	0.20
8	5.00	0.20	5.00	5.00	0.20	0.20	0.20
9	9.00	5.00	9.00	9.00	0.20	5.00	0.11
10	9.00	9.00	9.00	9.00	5.00	5.00	0.11
11	1.00	0.11	1.00	0.20	1.00	1.00	1.00
12	0.20	5.00	1.00	5.00	0.11	0.20	0.11
13	5.00	5.00	5.00	5.00	5.00	5.00	0.20

14	0.20	0.20	1.00	5.00	5.00	0.20	0.20
15	1.00	0.20	9.00	1.00	5.00	0.20	0.11

Source: Compiled by the researcher for the purpose of the study

The average of the groupings for each respondent is shown below. In order to obtain the score of 2.73, the researcher subtracted the transportation risk number from the financial impact number for each respondent and then averaged the results accordingly. Table 10-12 shows the average number of the results for the other stakeholders'.

Table A-12: Other stakeholders' average results

4,7 (impact)	5,6,8,9,10 (risk)		Impact - risk
9.00	1.89	cost is strongly preferred	7.11
5.00	1.46	cost is normally preferred	3.54
5.00	3.22	cost is normally preferred	1.78
9.00	3.67	cost is normally preferred	5.33
9.00	3.67	cost is normally preferred	5.33
2.60	1.32	risk is normally preferred	1.28
5.00	1.16	cost is normally preferred	3.84
9.00	3.86	cost is normally preferred	5.14
9.00	5.62	cost is normally preferred	3.38
0.60	0.82	risk is normally preferred	-0.22
2.60	1.28	risk is normally preferred	1.32
5.00	4.04	neutral	0.96
2.60	1.32	cost is normally preferred	1.28
1.00	2.90	risk is normally preferred	-1.90
			2.73

Source: Compiled by the researcher for the purpose of the study

Appendix B

Interview guide

A semi-structured interview was conducted with eleven industry experts. The following questions served as the interview guide for the researcher:

1. What could the positive and negative impacts/outcomes of the high cube container regulation be on South Africa's economy if the legislation is not amended?
2. Who are the potential key role players/stakeholders that should be involved in the high cube container legislation?
3. What are potential consequences the fruit industry could face, if the legislation is not amended?
4. What could the financial impact be on the fruit industry should the legislation not be amended?
5. What could the impact of the current regulation be on the operations of the industry, if the legislation is not amended?
6. What could the impact of the current regulation be on the productivity of the industry, if the legislation is not amended?
7. In your opinion, how many years would it take to replace the current equipment with new equipment to meet the legal height of 4.3m?
8. What international best practices could be implemented to ensure road users safety while at the same time helping to grow the economy? (What are international countries doing that they are able to transport high cube containers on the roads at the legal height?).
9. What procedures could be implemented for a smooth transition, if the legislation is not amended?
10. How many trailers are in use that can carry high cube containers at the height of 4.3m?
11. When the vehicle is fully loaded, is it adequately stable under all conditions of road transport? (For example, have accidents occurred, tipping over of the vehicle or damage to infrastructure).
12. Instead of using skeletal trailers, what could be recommended to industry to use to transport containers in order to be within the legal height restriction?
13. What steps could be taken to ensure the country does not lose billions in exports to assist farmers, producers and others from retrenching workers and cutting production?
14. Would you recommend high cube containers to be transported by rail to ports or not? Explain.