# Determining the market accessibility of South African exports

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## SUMMARY

In the New Growth Path (NGP) and the National Development Plan (NDP) the South African government has put forth plans to increase economic growth in South Africa and to eliminate large-scale and persistent unemployment that the country currently experiences. The South African government specifically regards growth in exports and export diversification as the solution to achieve macroeconomic goals, including an increase in regional trade and exports in other fast-growing economies.

However, exporters constantly face trade impediments or trade costs that inhibit trade to foreign markets. In addition, the South Africa Department of Trade and Industry emphasises that, in order to help address current account deficits and the high unemployment rate, the country should pay more attention to the trade impediments that South African exporters may face in foreign markets. Although studies were done by international organisations, such as the World Economic Forum and the World Bank, to measure the trade costs faced in different countries around the world, none of these studies were conducted from a particular exporting country's point of view. This study is therefore a first in its field because it investigates the market accessibility of different markets around the world from a South African point of view. Investigating the trade impediments that South African exporters face in different world countries, can provide export promotion organisations and exporters with a better view with regard to markets that are more accessible for exports from South Africa.

The main objectives of this study were: (i) to determine global market accessibility for South African exports; (ii) to identify from relevant literature the different impediments to trade or trade costs that influence the market accessibility of markets; (iii) to analyse the impact that trade impediments has on international trade by reviewing literature; (iv) to collect data on trade impediments that are quantifiable and to compare the size of trade impediments faced by South Africa in different world regions; (v) to develop a market accessibility index for South African exports in countries around the world; (vi) to determine whether member countries of the Southern African Development Community (SADC) are indeed amongst the countries to which South Africa has the highest market access due to proximity and regional trade agreements; (vii) and lastly, to make recommendations to South African exporters and export promotion organisations on the

typical trade impediments they are facing in different world regions and specific countries in order for them to plan their export endeavours and policy recommendations accordingly.

The literature study focused on defining and identifying different impediments to trade and their influence on trade. Trade impediments are viewed as any part of trading processes that increase the costs of trade. This study focused on the impediments experienced during the transit of goods and specifically included transportation costs, transportation times, the efficiency of logistics, customs administration, border administration and infrastructure (including both telecommunications and physical infrastructure).

An equal weights method (variables are weighted equally within each category and amongst categories) and a principal component analysis (PCA) (a statistical procedure that makes use of a linear transformation to convert different variables into a smaller set of values of linearly uncorrelated variables) were chosen and compared to calculate South Africa's market accessibility index.

The results revealed that Western Europe, South-Eastern Asia and Northern Europe are the most accessible regions to South Africa while Singapore, Hong Kong and Malaysia are the most accessible countries for South African exporters. Additionally, it was expected that Southern African Development Community (SADC) member countries would be amongst the countries in which South Africa has the highest market access due to proximity and regional trade agreements with South Africa. This, however, was not the case since SADC member countries lack logistics, customs and infrastructure performance.

It is recommended that South African trade promotion organisations, industry organisations and other export councils use the results of this study to plan their export endeavours and policy negotiations.

*Keywords:* market accessibility, trade impediments, transportation costs, transportation times, logistics, customs, infrastructure, South Africa.

## OPSOMMING

In die *New Growth Path* (NGP) en *National Development Plan* (NDP) het die Suid-Afrikaanse regering planne voortgestel om die ekonomiese groei van Suid-Afrika te bevorder en om die grootskaalse en voortslepende werkloosheid wat die land tans ervaar, te verminder. Die regering beskou spesifiek uitvoer en uitvoerdiversifikasie as noodsaaklik om die makro-ekonomiese doelwitte van die land te bereik. Dit sluit onder andere verhoogde streekshandel en die uitvoer na ander vinnig groeiende ekonomieë in.

Uitvoerders staar aanhoudend handelhindernisse of handelkostes in die gesig wat handel met buidelandse mark belemmer. Boonop beklemtoon die Suid-Afrikaanse Departement van Handel en Nywerheid dat die land aandag moet skenk aan die handelsbeperkings wat uitvoere na buitelandse markte kortwiek om sodoende by te dra om die tekort op die handelsbalans en hoë werkloosheid in die land aan te spreek. Alhoewel studies deur internasionale organisaises soos die Wêreld Bank en die Wêreld Ekonomiese Forum uitgevoer is om handelskostes van verskillende lande te meet, het geen een van hierdie studies nog gefokus op een spesifieke uitvoerland se perspektief wanneer dit kom by marktoeganklikheid nie. Hierdie studie is dus die eerste in sy soort en ondersoek marktoeganklikheid na verskeie lande regoor die wêreld vanuit ‘n Suid-Afrikaanse perspektief. ’n Ondersoek oor Suid-Afrika se buitelandse handelsbeperkings kan dus uitvoerbevorderingsorganisasies en uitvoerders help om meer toeganklike markte vir Suid-Afrikaanse uitvoere te identifiseer.

Die hoofdoelwitte van hierdie studie was: (i) om die globale marktoeganklikheid van Suid-Afrikaanse uitvoere te bepaal; (ii) om vanuit relevante literatuur verskillende handelsbeperkings of handelskoste wat marktoeganklikheid beïnvloed, te identifiseer; (iii) om die impak wat handelsbeperkings op internationale handel het, te analiseer; (iv) om meetbare data in te samel op handelbeperkings en dit te vergelyk met die struikelblokke wat Suid-Afrikaanse uitvoere in die buiteland teëkom; (v) om ’n marktoeganklikheidsindeks vir Suid-Afrikaanse uitvoere in die buiteland te ontwikkel; (vi) om vas te stel of lidlande van die SADC wel meer toeganklik is vir uitvoere vanweë hulle nabyheid aan Suid-Afrika en streekhandelsooreenkomste; (vii) om Suid-Afrikaanse uitvoerders en uitvoerbevorderingsorganisasies met aanbevelings te verskaf oor tipiese

handelsbeperkings wat hulle teëkom in verskillende wêrelddele en in spesifieke lande ten einde hulle uitvoeraktiwiteite en -beleide dienooreenkomstig aan te pas.

Die literatuurstudie het daarop gefokus om verskillende handelsbeperkings te definieer en om die impak daarvan op handel te identifiseer. Hierdie handelsbeperkings sluit enige deel van die handelsproses in wat handelskoste verhoog. Die studie het gefokus op handelsbeperkings wat gedurende die verskeping van produkte voorkom en sluit spesifiek in: vervoerkostes, vervoertyd, logistieke effektiwiteit, doeane-administrasie, grensadministrasie en infrastruktuur (beide telekommunikasie- en fisieke infrastruktuur is ingesluit).

'n Equal weights metode (veranderlikes dra dieselfde gewig binne elke kategorie) en 'n factor analysis ('n statistiese prosedure wat gebruik maak van lineêre transformasie om verskillende veranderlikes te omskep in 'n kleiner stel waardes van lineêr ongekorreleerde veranderlikes) is gebruik en met mekaar vergelyk om Suid-Afrika se marktoeganklikheidsindeks te bereken.

Wes-Europa, Suidoos-Asië en Noord-Europa word beskou as die toeganklikste streke vir Suid-Afrika terwyl Singapoer, Hong Kong en Maleisië weer die toeganklikste lande vir Suid-Afrikaanse uitvoerders is. Daar was aanvanklik verwag dat lidlande van die Suidafrikaanse Ontwikkelingsgemeenskap (SADC) meer toeganklik sou wees, weens hulle afstand van en handelsooreekomste met Suid-Afrika. Dit is egter nie die geval nie, aangesien SADC lidlande 'n tekort aan logistiek, doeane- en infrastruktuurprestasie het. Daar word dus aanbeveel dat Suid-Afrikaanse uitvoerbevorderingsorganisasies, bedryfsorganisasies en ander uitvoerrade die bevindings van hierdie studie gebruik om hulle uitvoeraktiwiteite en beleidsdokumente daarvolgens te beplan.

*Sleutelwoorde:* marktoeganklikheid, handelsbeperkings, vervoerkostes, vervoertyd, logistiek, doeane, infrastruktuur, Suid-Afrika.

## ABBREVIATIONS

| | |
|---|---|
| APEC | Asia-Pacific Economic Cooperation |
| ETI | Enabling Trade Index |
| EU | European Union |
| FCL | Full Container Load |
| FDI | Foreign Direct Investment |
| GATT | General Agreement on Tariffs and Trade |
| GCI | Global Competitiveness Index |
| GDP | Gross Domestic Product |
| GEA | Global Express Association |
| GSM | Global System for Mobile Communication |
| HS | Harmonised System |
| ICT | Information and Communications Technology |
| IPAP | Industrial Policy Action Plan |
| ITC | International Trade Centre |
| ITU | International Telecommunication Union |
| KMO | Kaiser-Meyer-Olkin |
| LPI | Logistics Performance Index |
| MAI | Market Accessibility Index |
| NDP | National Development Plan |
| NGP | New Growth Path |
| NIPF | National Industrial Policy Framework |
| NTBs | Non-Tariff Barriers |
| NVOCC | Non-Vessel Operating Common Carrier |
| PCA | Principal Component Analysis |
| SADC | Southern African Development Community |

| | |
|---|---|
| UNCTAD | United Nations Conference on Trade and Development |
| USR | Uniform Sampling Randomised approach |
| VOCC | Vessel Operating Common Carrier |
| WDI | World Development Index |
| WTO | World Trade Organization |

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# CHAPTER 1: INTRODUCTION

## 1.1 Background and motivation for the study

No matter where you find yourself in the world today, governments are constantly seeking to improve their involvement in international trade and, more specifically, to develop small-sized and medium-sized export companies (Viviers & Calof, 1999). In general, exports lead to better allocation of resources, accumulation of foreign exchange, knowledge spillovers, economies of scale and ultimately, economic growth (Foster, 2006).

Exports can improve production efficiency and tend to raise the quality of service delivery and technological standards in organisations (Girma *et al.*, 2004; Leonidou, 2000). Furthermore, exports utilise idle operating capacities and offer a better profit base to reward employees and shareholders (Rabino, 1980). Exports produce more funds for economic growth and investments, and spread business risks by operating in several markets simultaneously (Leonidou, 2000).

Export promotion − as a generator of economic growth and development – is, therefore, usually included in the economic policies of governments (Matthee & Krugell, 2012). South Africa is no exception (Edwards *et al.*, 2008). Since 2010, the South African government has launched new policy documents and plans for economic growth and development (Matthee & Krugell, 2012). These policy documents include the Industrial Policy Action Plan (IPAP), the National Industrial Policy Framework (NIPF), the New Growth Path (NGP) and the National Development Plan (NDP).

The Industrial Policy Action Plan aims at restructuring the economy with the goal to set it on a more labour-intensive, value-adding and environmentally sustainable growth path (Department of Trade & Industry, 2013). The National Industrial Policy Framework seeks to accelerate growth of the gross domestic product (GDP) to over 6% from 2010 onwards, to reduce poverty and unemployment by 50% and to further intensify industrialisation towards a more knowledge-based economy beyond 2014 (Department of Trade & Industry, 2010).

The New Growth Path has put forth plans to boost the economic growth rate of South Africa with up to 7% per year over the next 20 years and aims to eliminate large-scale

and persistent unemployment that South Africa currently experiences (Matthee & Krugell, 2012). The main goal of the National Development Plan is to reduce inequality and to eliminate poverty by 2030 (Department of Trade & Industry, 2011). There are three main priorities in the National Development Plan that stand out, namely: (i) increasing employment through faster economic growth; (ii) improving the quality of education, innovation and skills development; and (iii) building the capacity of South Africans to play a transformative and developmental role in the economy (Department of Trade & Industry, 2011).

Furthermore, it has been highlighted in both the New Growth Path and the National Development Plan that for South Africa's economy to grow, an increase in exports is needed. The Southern African region and other fast-growing economies are highlighted in these two documents as priority export markets (South Africa, 2010).

It is important to take into account that a country's export performance is influenced by supply-side capabilities as well as impediments companies experience when expanding their export activities and entering foreign markets (Hollensen, 2007). It is, therefore, very important that decision-makers in both the private and public sectors fully understand their production capabilities and impediments that companies experience when exporting (Rameseshan & Soutar, 1996).

The National Industrial Policy Framework supports the above-mentioned statement by expressing that South Africa should pay more attention to trade impediments in order to address current account deficits and unemployment rates (Department of Trade and Industry, 2010).

To summarise, the South African government views growth in exports and export diversification as important key points in achieving their macroeconomic goals. The government also emphasises that, in order to help address current account deficits and the high unemployment rate, the country should pay more attention to the trade impediments that South African exporters may face in foreign markets. This involves establishing market access or ease of trading with different countries by evaluating and comparing the trade costs that are involved when exporting to these countries.

Examining the costs linked to international trade and ranking countries according to the different trade impediments faced when trading with them, provides important information

that can enable countries to make better decisions and plan their export promotion efforts to benefit from trade in the future (World Economic Forum, 2012).

The above-mentioned information can also serve as a guideline for the South African government and the private sector in overcoming specific trade impediments in a specific region or country (World Economic Forum, 2012).

Trade impediments can be viewed as any element in trading processes that increases the cost of trade (Anderson & Van Wincoop, 2004). Trade costs do not only have an impact on a country's decision-making in selecting trading partners, but also the selection of goods that are exported and imported (Deardorff, 2004). Trade costs also affect the direction, volume and pattern of trade (World Trade Organization, 2013). The higher trade costs are, the less trade takes place (Hoekman & Nicita, 2008). For example, a 10% increase in trade costs can reduce trade volumes up to 20% whereas a 10% decrease in trade costs raises imports by 50% and intra-regional exports by more than 60% (World Bank, 2009). Hoekman and Nicita (2008) also claim that if low-income countries reduce their trade costs to the average maintained by middle-income countries, their imports can increase by 7.4%.

In addition, higher trade costs increase prices that make the export of products uncompetitive. According to Leonidou (1995) higher trade costs keep companies from initiating, developing or maintaining global activities. Higher trade costs can even cause companies to completely withdraw from foreign operations (Leonidou, 2000). Highly productive non-exporters are more likely to consider exporting when trade costs are reduced (Bernard *et al.*, 2006). Existing exporters increase their exports in response to lower trade costs (Bernard *et al.*, 2006).

## 1.2 Problem statement

Exporters face trade impediments that inhibit trade into foreign markets and influence international market selection processes.

The South African government views growth in exports and export diversification as key aspects to achieve their macroeconomic goals. They recognise the importance of paying attention to trade impediments that exporters face in foreign markets in international market selection processes in order to reach their macroeconomic goals.

International organisations, such as the World Economic Forum and the World Bank, have undertaken studies to measure trade-enabling environments, logistic performances and ease of trading across borders in different countries around the world (World Bank, 2007; 2009; 2013; 2014a; 2014b; World Economic Forum, 2012; 2013; 2014). However, none of these studies were conducted from a particular exporting country's point of view. This study specifically investigated the market accessibility of different markets around the world from a South African point of view.

By investigating trade impediments that South African exporters face in different world countries, export promotion organisations and exporters are provided with a better view on markets that are more (or less) accessible for exports from South Africa.

The following research questions were formulated based on the above-mentioned description of the research problem:

- Given the various impediments to trade or trade costs, which countries are more (or less) accessible for South African exports?
- Are the SADC[1] member countries indeed amongst the countries with the highest access as expected due to the proximity? If not, why?

In order to answer the above-mentioned research questions, the following research objectives were set.

## 1.3 Research objectives

### 1.3.1 Primary objective

The primary objective of this study was to determine the global market accessibility for South African exports.

[1] SADC (Southern African Development Community) is a regional organisation consisting of 15 Member Countries (Angola, Botswana, Congo (DR), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe). Seychelles is still in the process of ratifying the SADC Treaty.

### 1.3.2 Secondary objective

In order to reach the primary objective, a number of secondary objectives were formulated:

- Identify from relevant literature the different impediments to trade or trade costs which influence the market accessibility of countries.
- Analyse from literature the impact that trade impediments have on international trade.
- Collect data on trade impediments that are quantifiable and compare the size of these trade impediments faced by South Africa in different world regions and countries.
- Develop a market accessibility index for South Africa's exports in countries around the world.
- Determine whether SADC member countries are indeed amongst the countries in which South Africa has the highest market access due to proximity.
- Make recommendations to South African exporters and export promotion organisations on typical trade impediments they face in different world regions and specific countries in order for them to plan their export endeavours accordingly.

## 1.4 Research methodology

The research methodology included a literature study and an empirical study.

### 1.4.1 Literature study

The literature study included a discussion of different impediments to trade and the impact thereof on international trade flows. The typical trade impediments that were focused on in the literature study included tariff and non-tariff measures, transportation times and costs, logistical impediments to trade, customs administration, border administration, infrastructure (including telecommunications and physical infrastructures) and distance.

### 1.4.2 Empirical study

The empirical study measured the market accessibility of South African exports into other world countries by means of an index. An equal weights method and a principle component analysis (PCA) were used to construct an index. One would expect that SADC

member countries would be amongst the countries with the highest access due to their proximity to South Africa. The results of the study proved otherwise. The empirical study also provided recommendations to South African exporters and export promotion organisations on existing impediments South Africa face in different world regions. This information is valuable in planning export promotion efforts and during multilateral and bilateral trade negotiations.

## 1.5 Demarcation of the study

Anderson and Van Wincoop (2004) and the World Trade Organization (2008) describe trade costs as any costs that involve getting goods to their final destination, excluding the marginal costs involved in producing the goods themselves. Trade costs include policy impediments (tariffs and non-tariff impediments), transportation costs (freight and time costs), contract enforcement costs, communication costs, local distribution costs (wholesale and retail costs), information costs, legal and regulatory costs and costs linked with the use of different currencies.

Market access refers to the openness of the markets of importing countries to foreign imports and how trade costs and trade impediments occurring during the transit of goods inhibit an ability to gain market shares in exporting countries. The trade costs involved in exporting to more accessible markets are, therefore, lower.

This study was demarcated to the trade impediments or costs occurring during the transit of goods. The main trade impediments fitting this demarcation identified in literature include tariffs, non-tariff barrier transportation costs, trade time, logistic efficiency, customs and border administration, infrastructure and distance.

## 1.6 Outline of the study

Chapter 1 provides an introduction to the study by presenting the background, the problem statement, motivation and objectives of the study.

Chapter 2 provides an overview of literature with regard to trade costs and impediments and the impact that these impediments have on international trade.

Chapter 3 provides a description of the research methodology and the data analysis techniques.

Chapter 4 analyses the results on the market accessibility of South African exports.

Chapter 5 provides a summary of the study, including a discussion of managerial and theoretical implications of the results of this study that contribute to recommendations and directions for export promotion organisations of South Africa and for further research in the field of market access.

# CHAPTER 2: LITERATURE OVERVIEW ON TRADE IMPEDIMENTS

## 2.1 Introduction

Even though global economic integration is underlined by the success of the fastest growing economies in the world, many countries remain isolated and fail to achieve integration (Behar & Venables, 2010). This can be explained by the considerable amount of trade impediments traders face when exporting (Behar & Venables, 2010; World Trade Organization, 2015).

Trade impediments are well-documented, as theories and politics have underlined these impediments for many years (Anderson & Van Wincoop, 2004; Arteage-Ortiz & Fernández-Ortiz, 2010). Since 1981, the number of studies has grown significantly due to the increase of globalisation and internationalisation (Behar & Venables, 2010; Kotabe & Helson, 1998; Ray, 1981) and the fact that trade impediments are viewed as imperative with regard to trade (Sharkey *et al.*, 1989).

The majority of studies highlight the importance of understanding trade impediments and the impact of impediments on export activities (Arteage-Oritz & Fernández-Oritz, 2010). This literature review focuses on studies that succeeded in the theoretical grounding, quantifying and determining the impact of certain trade impediments on trade.

Although the importance of different trade impediments relative to each other cannot be determined with certainty, studies on individual trade impediments and their impact on trade do exist and it will be discussed in this chapter. This study will focus on the trade impediments occurring during the transit of goods (see section 1.5) and include tariffs and non-tariff measures, transportation costs, trade time, the efficiency of logistics, customs and border administration, infrastructure (physical and telecommunications infrastructures) and distance.

## 2.2 Types of trade impediments

### 2.2.1 Tariffs

Since the initiation of the General Agreement on Tariffs and Trade (GATT) in 1948, tariffs have been gradually reduced and bounded (World Trade Organization, 2012). Although

some tariffs remain significant impediments to trade, attention in the past few years has shifted more towards non-tariff measures as a significant impediment to trade (Malouche *et al.*, 2013). Still, tariff and non-tariff measures remain to have a negative effect on trade (Hoekman & Nicita, 2008).

Over the years, there have been a number of studies that investigated the impact of tariffs on trade. They all seem to find the same result − increased tariffs lead to lower levels of trade (Haveman *et al.*, 2003; Stutz & Warf, 2007).[2]

To shed more light on this issue, Hummels (1999) undertook studies in Argentina, Brazil, Chile, New Zealand, Paraguay and the United States of America and found that if tariffs increase by 10%, trade decreases by 56% on average.[3] Haveman *et al*. (2003) established that tariffs reduce trade flows by an average of 5.5% in the 15 most developed importing countries worldwide.

Wilson, Mann, and Otsuki (2004) found that if the world average *ad valorem* tariff is reduced by 1% (for instance, from 8.5% to 7.5%), trade flows increase by 1.1%. Interestingly, Hoekman and Nicita (2008)[4] found that if low-income countries reduce their tariffs to an average of 10%, their imports increase by 8.4% on average. They also found that if exporters incur 1% less tariffs than competitors, 3.5% higher exports are experienced. In fact, Baier and Bergstrand (2001)[5] claim that tariff reductions explain the 25% average world trade growth since World War II.

The negative effects non-tariff impediments have on trade (Havemen *et al*., 2003) are discussed in the following section.

### 2.2.2 Non-tariff measures

Non-tariff measures,[6] which tend to be less transparent than tariffs, have increasingly become policy measures through which governments affect trade (Dee & Ferrantino,

[2] Tariffs have progressively been reduced since the establishment of the GATT in 1948 (Stutz & Warf, 2007; World Trade Organization, 2008).
[3] Take note that this average is calculated over 62 goods. View Hummels (1999b) for more detail.
[4] Hoekman and Nicita (2008) found tariff and non-tariff impediments to be the main sources of trade restrictiveness.
[5] Interestingly, Baier and Bergstrand (2001) found that a tariff reduction of 1% has less effect on trade growth than a 1% reduction in transport cost.
[6] Non-tariff impediments include all types of trade policies − other than tariffs − that directly or indirectly affect global trade (Malouche *et al*., 2013).

2005; Malouche *et al*., 2013). According to Papadopoulos, Chen and Thomas (2002), non-tariff measures impede trade more than tariffs.

While most non-tariff barriers (NTBs) respond to the rising public demand for protection against health and environment risks, some non-tariff barriers are imposed for the purpose of protecting local industries, which tend to increase trade costs, penalise small exporters and diverts managerial attention (Freudenberg & Paulmier, 2005; Malouche *et al*., 2013; World Trade Organization, 2012).

According to most studies, non-tariff barriers play an important role in trade restrictiveness (World Trade Organization, 2012). For instance, Kee *et al.* (2008) found that non-tariff barriers on average add 87% more restrictiveness to trade than what is already imposed by tariffs. More recent evidence suggests that non-tariff barriers are almost twice as restrictive on trade as tariffs (Malouche *et al*., 2013; World Trade Organization, 2012). Andriamananjara *et al.* (2003) found that the removal of worldwide non-tariff barriers on processed foods, wearing apparel and footwear increases world trade and welfare significantly.[7]

Similarly, Andriamananjara *et al*., (2004) found that in the European Union (EU), Canada and the United States of America prices in the agricultural sector increased by 66%, 25% and 15% respectively, due to the presence of non-tariff barriers. In Japan, South Asia[8] and Southeast Asia,[9] paper products were found to be 199%, 119%, and 67%, respectively, more expensive due to non-tariff barriers (Andriamananjara *et al*., 2004). Non-tariff barriers also increased the prices of leather shoes in Japan by 39% and in Mexico by 80%. In the agricultural sector, non-tariff barriers on vegetable oils and fats caused prices in South Africa to increase by 90%, in Southeast Asia by 49% and in Mexico by 30% (Andriamananjara *et al*., 2004).

Ferrantino (2006) found that non-tariff barriers generally lead to higher domestic prices and a decrease in imports. The author also found that by reducing the *ad valorem* tariff

[7] Andriamananjara *et al*. (2003) used a standard simulation model to determine the impact non-tariff measure liberalization has on world trade. They focused on three sectors, namely processed foods, wearing apparel and footwear. Results showed that the removing of non-tariff measures increased wearing apparel imports by more than 242% ($297 billion). World trade in footwear was estimated to increase by about 6% ($5 billion). For more details, see Andriamananjara *et al*. (2003).
[8] The South Asian countries include Bangladesh, India, Sri Lanka, and Pakistan.
[9] Southeast Asian countries included are Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

equivalent (AVE)[10] of non-tariff barriers by half (for instance, from 8% to 4%), trade is increased by as much as 2% to 3%.[11] Hoekman and Nicita (2011) found that the use of non-tariff barriers increases as the level of economic development in countries increases. Kee *et al.* (2008) agree with this finding as they also found that non-tariff barriers restrict[12] developed countries more than developing countries.

In section 2.2.3, the impact of transportation costs on international trade is investigated.

### 2.2.3 Transportation costs

The entire process of transferring goods from the point of production to importers includes large transportation costs (Christ & Ferrantino, 2009; Coughlin, 2004; World Trade Organization, 2015). Transportation costs have an impact on the direction, volume and pattern of trade (Behar & Venables, 2010; World Trade Organization, 2013). In fact, transformation costs determine where the line between tradable and non-tradable goods is drawn, which companies are competent in trade participation and shape how production is organised internationally.

Traditionally, international economic analyses did not focus on the importance of transportation costs (Finger & Yeats, 1976). This approach was created and possibly stemmed from the assumption that transportation costs are small compared to other impediments. However, Hoffman (2002) and the World Trade Organization (2004) established that transportation costs have similar effects on trade as tariffs. Overall, a reduction in transportation costs stimulates trade (Hoffman, 2002).

Conversely, an increase in transportation costs has a noteworthy negative effect on trade volumes, but do not necessarily change the composition of trade (World Trade Organization, 2004). High transportation costs even have the ability to price countries out of export markets (United Nations Conference on Trade and Development, 2009). This is especially true in situations where transportation costs represent a large part of the final

[10] AVE refers to the level of an *ad valorem* tariff which has an equivalent trade restricting effect as NTBs in question (World Trade Organization, 2012). For instance, if a country imports 1 kg of cheese for which the import unit value is R280, and the specific tariff is R70 per kilogram, the *ad valorem* equivalent is 25% of the import price.

[11] The study was conducted using 115 exporters and 115 importers. View Hoekman and Nicita (2011) for more detail.

[12] It has also been found that as World Trade Organization members become richer, the trade restrictiveness of NTBs is relative to increases of tariffs (World Trade Organization, 2012).

price of products. Examples include natural resource-based activities and high value-added or labour-intensive industries or sectors (United Nations Conference on Trade and Development, 2009).

High transportation costs also have an impact on the competitiveness and trade performance of companies (United Nations Conference on Trade and Development, 2009; World Trade Organization, 2015). These costs increase the prices of imported goods, including capital goods, food and intermediate inputs, which again inflate the costs of domestic production (Stutz & Warf, 2007; United Nations Conference on Trade and Development, 2009; World Trade Organization, 2015). In fact, high transportation costs specifically have a negative effect on the competitiveness of manufactured exports consisting of large import content (United Nations Conference on Trade and Development, 2009).

Transportation costs have almost similar effects on trade as tariffs, given that transportation costs can also affect the competitiveness of countries (United Nations Conference on Trade and Development, 2009). However, the difference between transportation costs and tariffs[13] is that transportation costs have become increasingly important for export competitiveness while tariffs have declined on average over time (Hoffman, 2002). It seems as if transportation costs contribute relatively more towards effective trade protection (Limão & Venables, 2001). In fact, protection offered by transportation costs is in many cases even more than the protection offered by tariffs (World Trade Organization, 2004, World Trade Organization, 2015). This issue makes the minimising of transportation costs a significant factor when importers have to choose between trading partners (Hummels, 1999).

According to Limão and Venables (2001), a 10% increase in transportation costs reduces trade volumes up to 20% worldwide, whereas a 10% decrease in transportation costs

[13] Transportation costs further differ from tariffs in relation to the following: (i) Transportation costs are not a simple fixed proportion (*ad valorem*) of the prices of products. Transportation costs represent a per unit component that has key implications for the composition of the exports of countries. Transportation costs are never product-neutral due to this per unit component, causing higher penalties for products that are more transport intensive, not only in the sense of having low price-to-weight rations, but also because of higher costs related to inventory-holding and depreciation. (ii) Transportation costs are not fixed by fiat, but respond to variables such as the level of competition in the transportation industry, the quality of the infrastructure and trade flows of countries. Decreasing transportation costs thus goes well beyond the political economy of protection and requires a more complex set of policy actions relative to those included in typical trade liberalisation (World Trade Organization, 2015).

increase trade volumes (both exports and imports) by more than 20% (Martìnez-Zarzoso & Nowak-Lehmann, 2007). There appears to be a 1:2 ratio (negative) between transportation costs and trade. However, Limão and Venables (2001) indicate that a doubling in transportation costs decreases trade volume by 45%, indicating a 1:2.25 ratio. This signifies that economies of scale (the cost advantages that companies experience due to the scale, output or size of operations) exist. The more transportation costs decrease, the larger the ratio of increased trade.

Moreira e*t al.* (2008) provided estimates based on the diversification arising from a reduction in transportation costs for nine Latin American countries (Argentina, Brazil, Colombia, Chile, Ecuador, Paraguay, Peru, Bolivia and Uruguay). They found that a 10% reduction in transportation costs results in a 10% increase in the number of goods exported and a 9% increase in the amount of goods imported.

Clark *et al.* (2004) investigated the determinants of shipping costs to the United States of America from different ports around the world. Using a sample of 43 countries,[14] they found that a reduction in a country's inefficiencies associated with transportation costs, from the 25th to the 75th percentile, increases bilateral trade by almost 25%. Whereas an increase in a country's transportation costs from the 25th to the 75th percentile, is associated with a 22% reduction in bilateral trade (Clark *et al*., 2004).

Another study by Elbadawi *et al.* (2001) documented that the lower the transportation costs, the higher supplier access of domestic companies. Equally, the lower the international transportation costs, the higher the foreign market access of domestic producers, given international market prices (Elbadawi *et al*., 2001).[15]

Egger (2005) investigated the impact transportation costs have on the ease of trading or trade openness and found that for each 1% reduction in transportation costs, trade openness increases by 0.6%. The author also found that a decline in transportation costs

[14] The 43 countries include: Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Colombia, Costa Rica, Germany, Denmark, Ecuador, Egypt, Spain, Finland, France, United Kingdom (UK), Greece, Hong Kong, Indonesia, India, Ireland, Iceland, Italy, Japan, Republic of Korea, Mexico, Mauritius, Malaysia, Netherlands, New Zealand, Peru, Philippines, Poland, Portugal, Senegal, El Salvador, Sweden, Thailand, Turkey, Taiwan, Venezuela and Vietnam (Clark *et al*., *2004)*.

[15] Higher domestic transportation costs represent higher input prices and higher free on board (f.o.b.) prices for exports, which again leads to poorer market access and poorer supplier access (Elbadawi *et al*., 2001).

has an effect on trade openness and that this has grown over time. This indicates that a reduction of transportation costs is becoming more and more important.

From the above-mentioned discussion, it is clear that high transportation costs have a negative impact on international trade. However, the question that arises is which factors lead to an increase/decrease in transportation costs?

There are several factors that affect transportation costs. The types of products transported, economies of scale, trade imbalances, the value of goods, port charges, infrastructure, energy prices, transport modes, competition, regulations, frequency and size of shipments, trade facilitation, distance, the number of liner shipping services and private sector participation in port investments are amongst the most important factors explaining differences in transportation costs across countries (Behar & Venables, 2010; Clark *et al*., 2004; Egger, 2005; Hoffman, 2002; Limão & Venables, 2001; Martínez-Zarzoso *et al.*, 2003; Martínez-Zarzoso *et al.*, 2004; Martínez-Zarzoso & Nowak-Lehmann, 2007; Micco & Pérez, 2001; United Nations Conference on Trade and Development, 2009; World Trade Organization, 2013; World Trade Organization, 2015).

Hoffman (2002) indicates that as the value of goods increases, the costs of transporting the goods become higher − shippers are willing to take out better insurance cover and to pay more for safer packaging and faster delivery. Hoffman (2002) estimated that a 1% increase in the value of goods can be associated with a 0.358% increase in transportation costs.

Another important geographical feature affecting transportation costs is the distance of countries to other markets and to other transport routes (see section 2.2.8). Estimates in fact show that distance has a high and persistent negative impact on trade volumes (World Trade Organization, 2013; World Trade Organization, 2015).

Hoffman (2002) explains that economies of scale exist when the availability of liner shipping services between two trading partners increases. With more liner shipping services available, exporters have more options to choose from. Increasing the amount of liner shipping services available from 5 to 20, for example, is associated with a 12% decrease in insurance and freight costs.

However, when countries are landlocked, they are dependent on the political stability, institutional quality and infrastructure of their neighbouring or transit countries (Arvis *et al.*, 2007; World Trade Organization, 2015). The most salient geographical feature is access to an ocean or ocean-accessible sea (World Trade Organization, 2013).

Radelet and Sachs (1998) used the difference between f.o.b. (free on board)[16] and c.i.f. (cost, insurance and freight)[17] values as a measure of transportation costs and they found that landlocked countries experience 63% higher costs. Paraguay, for example, is a landlocked country and their cost to import is almost twice as much as other Latin American countries that have access to the Pacific or Atlantic Ocean (Moreira *et al*., 2008).

Using a different measure to determine transportation costs, namely shipping rates,[18] Limão and Venables (2001) found that being landlocked raises transportation costs by 55%, which is equivalent in magnitude to the estimates found by Radelet and Sachs (1998) who estimated that being landlocked decreases trade volumes by approximately 40% on average.

Limão and Venables (2001) further found that the transportation costs of landlocked countries are 50% higher than that of coastal countries, which consequently leads to landlocked countries trading 60% less. This can be explained by the fact that landlocked countries do not have access to their own seaports and need to transport consignments over a greater distance than coastal countries (World Trade Organization, 2015). A 50% improvement in the infrastructure of landlocked countries can help them to overcome more than half of the disadvantages associated with being landlocked (Limão & Venables, 2001).

In other words, infrastructure deterioration results in an increase in transportation costs, which again affects trade negatively (World Trade Organization, 2015). In the same study, Limão and Venables (2001) found that land transportation is approximately seven times

[16] Free on board (f.o.b.) is a contractual term that refers to the requirement that the seller deliver goods at the seller's cost via a specific route to a destination designated by the buyer.
[17] Cost, insurance and freight (c.i.f.) is a trade term requiring the seller to arrange for the carriage of goods by sea to a port of destination, and provide the buyer with documents necessary to obtain goods from the carrier.
[18] For example, quotes obtained from transport operators.

more expensive than sea transportation. In fact, they established that an additional 1000 kilometres via sea transportation increases these costs by $190 whereas inland transportation increases these costs by $1380.[19]

Despite the difficulty in obtaining data on inland transportation costs (World Trade Organization, 2004), the United Nations Conference on Trade and Development (2009) provides examples of inland transportation costs for selected routes in Africa. It is estimated that one kilometre on the route from Douala to N'djamena, for instance, is three times more expensive compared to the same distance on the route from Maputo to Johannesburg (see Table 2-1).

Table 2-1: Estimating unit road transportation costs for container and selected routes in Africa

| Route | Distance (km) | Cost ($ per km) | Road quality index |
|---|---|---|---|
| Douala-N'Djamena | 1900 | 4.2 | 0.5 |
| Dar es Salaam-Bujumbura | 1750 | 3.0 | 2.0 |
| Dar es Salaam-Kigali | 1650 | 3.0 | 2.1 |
| Mombasa-Kampala | 1440 | 2.3 | 1.0 |
| Lomé-Niamey | 1234 | 2.6 | 2.1 |
| Lomé-Ouagadougou | 1000 | 2.6 | 2.5 |
| Maputo-Johannesburg | 561 | 1.4 | 3.4 |

Source: United Nations Conference on Trade and Development (2009).

Other studies also found large costs differences across transportation routes. For instance, the cost of transporting goods from Durban to Lusaka (Zambia) − 1600 km away − is $2500 while the costs of transporting goods from Durban to Maseru − only 347 km away − is $7500 (Limão & Venables, 2001).

This is an indication that the quality of the road infrastructure of countries and their transit road infrastructure are important factors affecting inland transportation costs (World Trade Organization, 2004). To conclude, it is evident that there is a negative relationship

[19] Limão and Venables (2001) used a sample of 20 landlocked countries. They used both the costs of shipping to ports and the full cost of transportation to landlocked destinations (for instance, the cost of shipping from Baltimore to Durban and from Baltimore to Harare via Durban). This enabled them to look at the determinants of incremental costs linked with the final stage of these journeys.

between inland transportation costs and the quality of infrastructure (World Trade Organization, 2004; World Trade Organization, 2015).

Section 2.2.4 focuses on the relationship between time and trade.

### 2.2.4 The relationship between time and trade

Time to market has an impact on trade in two distinct ways. First, it determines whether or not manufacturers will enter specific markets (Nordås *et al.*, 2006). Secondly, time affects the volume of trade as soon as market entries are made (Djankov *et al.*, 2006).

Hummels (2001) investigated whether direct estimates of time are equivalent to tariffs. According to this study, the cost of one day in transit is equivalent to a tariff rate of 0.8%, which in turn amounts to a 16% tariff rate for a 20 day transit route. This estimation exceeds both the average freight rate and average tariff rate of the United States of America (Nordås & Piermartini, 2004). Hummels (2001)[20] also states that time in transit is directly linked with customs procedures (see section 2.2.6), port quality and port services. In contrast, Nordås and Piermartini (2004) argue that transit time generally depends on the quality of infrastructure.

It has been determined that for every day in transit, the probability of countries exporting to the United States of America declines by 1% for all goods and 1.5% for manufactured goods (Hummels, 2001; Hummels & Schaur, 2012). Similarly, for each day in transit, the costs of products increase by 0.5%, which is almost 30 times more compared to the costs linked with pure-inventory holdings (World Trade Organization, 2004).[21]

In terms of time affecting trade volumes, a 10% increase in time is associated with a 5-8% decrease in trade volumes (Djankov *et al*., 2006; Hausman *et al.*, 2005). Doubling shipping times also reduces trade volumes by almost one quarter to one third (Hummels,

[20]Hummels (2001) identified a number of costs that are linked with shipping time. Lengthy shipping times cause companies to incur deprecation and inventory costs. Inventory-holding costs include the costs of financing goods and also the costs of maintaining bigger inventories at final destinations to accommodate variations in arriving times. An example of depreciation, includes any reason to prefer newer products to older ones, the spoilage of products (fresh produce), products with timely information content (newspapers), including products with characteristics whose demand is difficult to predict (fashion apparel).

[21] There is in fact, a trade-off between costs and time in the demand for transportation networks. The reason being that lengthy shipping time leads to increased costs which again impede trade. Importers are, therefore, willing to pay more to avoid these costs. This explains why a great deal of trade occurs by air despite air transportation being much more expensive than sea transport (World Trade Organization, 2004).

2001). Nordås *et al*. (2006) argue that these studies suffer from a downward bias, given that they ignored zero trade flows. These authors found that if zero trade flows are taken into account, the reduction in trade value ranges between 5-25% for every 10% increase in trade time.[22]

Hummels (2001) states that trade reformers spend too much time trying to reduce tariffs instead of minimising delays. The focus should rather shift from reducing tariffs to reducing delays. For instance, in Africa, delay costs are four times higher than the tariff payments African exporters are facing (World Bank, 2007).

Furthermore, consignments delayed for one week can decrease the volume of exports by 7% or elevate the delivered price of products by 16%. In the case of time-sensitive goods, such as components and parts, the volume can be decreased by 26% (World Trade Organization, 2013). A 10% delay reduction in time-sensitive goods is also associated with a 30% increase in exports (Djankov *et al*., 2006). In fact, export consignments delayed for one day, can be viewed as the same as countries being 85 km away from their export destinations, which again is the same as reducing trade by 1% (Djankov *et al*., 2006).[23]

Time costs have been reduced over time through more effective multi-modal transportation, faster ships and reduced air transportation costs (Coughlin, 2004; Nordås *et al*., 2006; World Trade Organization, 2004). For instance, air transportation costs have declined by approximately 40% between 1990 and 2004 (Harrigan, 2005) and the average shipping time of the United States of America[24] has decreased from 40 to 10 days from 1950 to 1998 (Hummels, 2001). Coughlin (2004)[25] also found that faster transportation between 1958 and 1998 was equivalent to tariff reductions on manufactured goods from 32% to 9%.

[22] The data included a panel of 192 countries covering the period 1996-2004. The sectors focused on were electronics, intermediate goods and fashion clothing. View Nordås *et al*. (2006) for more detail.
[23] Djankov *et al*. (2006) used a data set on the time it takes to move containerised goods from factory gates to ships in 98 countries. For more detail view Djankov *et al*. (2006).
[24] Shipping time is calculated by the average weight of ocean shipping and air freight.
[25] Coughlin (2004) documented that transportation and time costs in general have increased, because of the terrorist attacks on September 11, 2001. Insurance rates, especially for transportation in the Middle East, have raised sharply.

All things considered, delays in transit seem to represent costs that affect trade, investment choices, comparative advantage and ultimately GDP (World Trade Organization, 2004; World Trade Organization, 2015).

The following section focuses on logistics as a trade impediment and its impact on international trade is determined.

### 2.2.5 Efficiency of logistics

Within international logistics, there are several participants, such as sellers, buyers, carriers, middlemen or intermediaries and governments (Wood *et al.*, 1995). Logistics also consist of several important activities, such as cargo consolidation, transportation, payment systems, country distribution, border clearance and warehousing, which all involve public and private agents (Arvis *et al.*, 2012).

All of these participants and activities add to the complexity and time associated with international trade logistics (Wood *et al*., 1995).[26] This explains why competitive networks of international logistics are referred to by Arvis *et al*. (2012) as the backbone of global trade.

International transport networks can suffer due to inadequate cross-country coordination, such as customs delays, non-integrated time schedules, inadequate flows of information regarding delays or incompatible standards, but logistics networks help to solve these problems (World Trade Organization, 2004; World Trade Organization, 2015). For instance, logistics networks help clients to save costs by favouring information sharing amongst operators, by concentrating cargo flows and by reducing the ratio of empty voyages.

According to the World Trade Organization (2004), efficient logistics play an important role in determining the competitiveness of countries. Efficient logistics do not only reduce the time and costs of transportation, but also reduce production costs. If logistics networks

[26] A study by Wood *et al*. (1995) examined the main problems that companies experience when exporting. These problems include: (i) export documentation (23%), (ii) the cost of transportation (20%), (iii) high import duties (17%), (iv) not finding foreign representatives with suitable knowledge on how to market products (16%), (v) the delay in transfering funds (13%), (vi) currency fluctuations (12%), (vii) language barriers (10%), and (viii) the difficulty to service products (10%). Several of these aspects form part of logistics.

are insufficient, companies are expected to maintain higher inventories at each phase of the production chain and this process requires extra working capital and bigger warehouses to stock up larger inventories (World Trade Organization, 2004). A study by Gaush and Kogan (2001) found that developing countries can reduce production unit costs by almost 20% if inventory holdings are reduced by 50%.

In addition, the logistics performance index (LPI) is the first global benchmarking tool that specifically measures the transport and trade facilitation friendliness of countries (Arvis *et al*., 2012). This index was constructed by making use of a principal component analysis based on six measures, namely (i) the efficiency of the clearance process by customs and other border agencies; (ii) the transport and information technology infrastructure; (iii) the competence of the local logistics industry; (iv) the ease and affordability of international shipments; (v) the facility to track and trace shipments; and (vi) the timeliness with which shipments reach their destination. It, therefore, captures a broad spectrum of factors which influence transport costs (Behar & Venables, 2010).[27]

Lately, countries have been focusing more on improving their logistics performance due to the large impact logistics has on economic activities (Arvis *et al*., 2012). Evidence from the 2007 and 2010 LPIs indicate that an improved logistics performance is strongly linked with export diversification, trade expansion, economic growth and the ability to attract foreign direct investments (FDIs). In fact, countries with the same level of per capita income, but their logistics performance is better experience an additional 1% growth in GDP and a 2% growth in trade (Arvis *et al*., 2012). Countries with inefficient logistics usually have higher average export and import times which explain why improved logistics lead to faster trade (Arvis *et al*., 2012).

A study by Hoekman and Nicita (2008) suggested that a higher LPI[28] has a direct positive impact on bilateral trade. They also found that if low-income countries can increase their LPIs to the average of middle-income countries, their imports can increase by approximately 15%. Coefficient estimates for the LPI also shows that a 1% increase in a LPI score raises trade volumes (exports and imports) by almost 50%. Similar results were

[27] The information was obtained by surveying more than 10000 logistics operators worldwide (see LPI report 2014).
[28] An LPI score shows the performance of countries on the six most important trade areas by using a five-point scale, for example one equals the lowest score and five the highest.

found by Portugal-Perez and Wilson (2008) who indicated that if Ethiopia improved its logistics quality to half of that of South Africa, Ethiopia will benefit the amount equivalent to a 7.5% tariff cut leading to an expansion of their current trade.

A case study from Yemen documented that fresh tuna exported to Asia carried a price of $1 per kilogram while frozen tuna exported to Germany carried a price of $4 per kilogram (Nordås *et al*., 2006). In the end, almost 20% of the exports were sold in Asia even though these exports could have been sold in Germany for four times more. Yemen faces a number of transport and infrastructure delays when exporting to Germany and these problems have a direct impact on their export prices. The lost net income amounted to $480 per ton of exports compared to the total sales revenue of $4000 per ton in Germany (Nordås *et al*., 2006).

Port efficiency is another logistical matter that, according to Nordås and Piermartini (2004), can have a significant positive impact on trade. Clark *et al.* (2004) indicated that if countries, such as Turkey or Peru, improved their sea port efficiency equivalent to the efficiency of Australia or Iceland, they can increase their trade by almost 25%.

In addition, port efficiency also describes bilateral trade patterns better than preferential margins. In terms of air transport, a doubling in the number of paved airports (per square kilometres) in countries increases imports by 14% (Nordås & Piermartini, 2004). Bilateral trade can increase by an additional 15% if exporting countries have twice as much airports (Nordås & Piermartini, 2004). Clark *et al.* (2004) studied the relationship between transportation costs and port efficiency. They constructed a port efficiency index by using survey estimates drawn from the World Economic Forum's Global Competitiveness Report. Clark *et al.* (2004) determined that an improvement in the port efficiency of countries from the 25th to the 75th percentile will reduce its shipping costs by 12%, which in turn lead to a 25% increase in bilateral trade.

However, Blonigen and Wilson (2008) used a similar approach as Clark *et al.* (2004) and found that the impact of port infrastructure itself is much less than suggested by Clark *et al.* (2004). Blonigen and Wilson (2008) documented that a change in port efficiency from the 25th percentile to the 75th percentile leads to a more modest 5% increase in trade. Furthermore, their critique included that the study by Clark *et al.* (2004) included the

characteristics of countries that are not directly linked to port efficiency, for example, export policies and inland infrastructure.

Abe and Wilson (2009) focused on the growing difficulty of port congestion in East Asia. Port congestion has not only increased due to the rapid growth in East Asia's trade, but also because a great deal of that trade is seaborne. They found that port congestion leads to bottlenecks, which again increase the cost of transporting merchandise from and to East Asia. Their analysis suggested that by expanding facilities in East Asia's ports can cut congestion by 10%, which in turn can reduce transportation costs by as much as 3%.

In the following sections, the effects of customs and border administration and infrastructure on trade are specifically addressed.

### 2.2.6 Customs and border administration

The Organization for Economic Cooperation and Development (2005a) identified border and customs procedures[29] as one of the most problematic impediments that developing countries face. However, this inefficiency is not only experienced by developing countries, but also by developed countries (Organization for Economic Cooperation and Development, 2005b). An understanding of border and customs procedures has, therefore, become imperative to many countries.

One way to look at the effect of border and customs procedures is to say that it slows or complicates the trading process. Border and customs procedures are unavoidable, but sometimes more is required than what is actually needed to move goods through borders (Wilson, 2007). The moving of goods through borders should be consistently in line with local policy objectives, but trade is often impeded due to cumbersome border and customs procedures which thickens borders (Wilson, 2007). When cumbersome borders are appropriately addressed, trade flows increase.

An analysis by Wilson (2007) presented metrics obtained from a World Bank survey with regard to border and customs procedures. Comparing countries based on these metrics, Wilson (2007) established that the borders of developing countries are overall more cumbersome than the borders of developed countries. Wilson (2007) further used these

[29] A study by Wilson (2007) provided quantitative evidence that border and customs procedures inhibit trade.

metrics in statistical models and documented that the degree of improvement in border and customs procedures boosts trade flows directly. Wilson (2007) found that all countries can benefit from more efficient border and customs procedures with the greatest benefits for those countries with less efficient border and customs procedures. However, to gain maximum benefit from more effective border and customs procedures, efforts from trading partners are needed even if these efforts are not always equal.

Nordås and Piermartini (2004) found that an increase in the average number of days needed for customs clearance − from five to seven days − decreases trade by more than 40%. In the most efficient countries concerning the time needed for customs clearance, namely Lithuania or Estonia, customs clearance procedures only takes one day (see Table 2-2) while in the least efficient country, Ethiopia, customs clearance takes an average of 30 days, which literally eliminates trade.

Table 2-2: Days required at borders for customs clearance

| Most efficient countries | Days required for customs clearance | Least efficient countries | Days required for customs clearance |
|---|---|---|---|
| Lithuania | 1 | Ethiopia | 30 |
| Estonia | 1 | Cameroon | 20 |
| Czech Republic | 2 | Nigeria | 18 |
| Croatia | 2 | Malawi | 17 |
| Georgia | 2 | Haiti | 15 |
| Singapore | 2 | Ecuador | 15 |
| Italy | 2 | Uganda | 14 |
| Slovakia | 2 | Tanzania | 14 |
| Sweden | 2 | Kenya | 14 |
| Slovenia | 2 | Venezuela | 11 |

Source: Micco and Pérez (2001).

The challenges imposed by border and customs procedures can be reduced. Setting up new electronic data interchange systems for processing and submitting documents can help to improve the time needed to clear goods at customs (World Bank, 2009). Guyana, Benin, Mali, Uganda and Haiti cut their customs clearance time by three days when they applied new systems (World Bank, 2009).

India launched an electronic system for exporters to submit their cargo documentation,[30] which allows the clearance process to start before ships arrive. These modifications helped exporters to reduce time delays by seven days (World Bank, 2007). Colombia also upgraded their roads that led to ports. They implemented selective cargo inspections at customs and increased operating hours at ports. These upgrades resulted in terminal handling cut by two days and documentation preparation by five days (World Bank, 2007).

The implementation of a new customs clearance system in Cameroon also resulted in more efficient revenue collection, trade facilitation and a reduction in corruption (Cantens *et al.*, 2010).

Moreover, estimates indicate that not only geographical aspects, speed and routes play a role in the time that is necessary to complete trade transactions, but also efficient border administration and the coordination of different agencies involved in border clearance (Christ & Ferrantino, 2009). Delays caused by factors, such as administrative procedures (for instance border and customs administration), have similar effects on exporting to specific regions as shipping time (Hummels, 2001). The World Trade Organization (2004) agree with this as they found that when the completion of administrative procedures with regard to border crossings is ineffective, it has a large negative influence on trade.

Deardorff (2001) established that border delays can make time-sensitive industries even more expensive than a formally levied tariff or explicit transport costs. Arvis *et al*. (2012) found that delays and unexpected problems in health, sanitary, phytosanitary, quality and standard inspections have just as much potential as customs procedures to generate supply chain problems and poor overall logistics performances.

Furthermore, just as there is scope for reducing time during customs procedures, there are also ways to reduce time across all stages of border processes − especially on the side of imports (Arvis *et al*., 2012). By reducing red tape and paper work, irregular payments and discretionary measures throughout the entire importing and exporting process are reduced (World Economic Forum, 2014). A study completed by the World Economic Forum (2014) also indicates that improvements in border administration lead

[30] This includes border and customs administration such as the issuing of certificates.

to advantages for governments by reducing costs linked with duty collection and profit margins are, therefore, increased.

The Philippines government, for example, launched a national single window system for trade. This system allows traders to access the system online – firstly, to submit and pay for permit applications and secondly, to track approval and clearance (Arvis *et al*., 2012). By launching this system, the Philippines government reduced the time spent by traders on obtaining licenses and permits significantly.

In addition, the Indonesian government implemented a national single window system that connects the country's customs system with as many as 25 government agencies (Arvis *et al*., 2012).[31] The new system highlights conflicting trade regulations issued by different governments over time, revealing that time-related regulations should be more regularly reviewed and coordinated (Arvis *et al*., 2012).

This system also constructed a mechanism for regular private sector consultation that was originally created to fix shortages in system implementation, but the consultation mechanism quickly developed into a more general forum where traders now discuss trade regulations with government officials (Arvis *et al*., 2012). These discussions have resulted in regulations being simplified and others repealed. Even though Indonesia is using a different coordination mechanism than the Philippines, they still improved their border administration significantly without any expensive organisational restructuring (Arvis *et al*., 2012).

It is important that countries take a more holistic approach in clearing goods. A holistic approach should include better collaboration amongst border administrations; sanitary, phytosanitary and standard inspections; transport; veterinary agencies; and modern approaches to regulate compliances (Arvis *et al*., 2012).

Estimates, however, indicate that if government agencies persevere in routine physical inspections of all products and if these inspections are not automated, improvements with regard to following a holistic approach will have little effect (McLinden *et al.*, 2011).

[31] There is usually a higher level of satisfaction with customs relative to other border agencies.

Nearly 70% of imported cargo containers are opened and inspected during customs clearance that further delays import processes. Every container is opened in Burkina Faso, Malawi, Mali and Nepal (United Nations Conference on Trade and Development, 2009).

Roadblocks also constitute a serious hurdle for African trade by causing both delays and increased costs. *The Economist* reported that in Cameroon − a transit developing country − there were 47 roadblocks between Douala and Bertoua, a distance of about 500 km (Limão & Venables, 2001).

### 2.2.7 Infrastructure

An extensive body of research points to the importance of infrastructure needed for trade integration and the trade performance of developing countries (Clark *et al*., 2004; Limão & Venables, 2001; Wilson, Mann, & Otsuki (as cited by Bagai & Wilson, 2006); World Trade Organization, 2015). These studies show that the elimination of infrastructure constraints can facilitate the process of shifting resources to more productive sectors − allowing for product specialisation which again is important to promote economic growth. In other words, infrastructure plays an important role in facilitating international trade.

The following section focuses on two infrastructure sectors, namely a physical infrastructure and a telecommunications infrastructure.

#### 2.2.7.1 Physical infrastructure

Poor infrastructure causes higher transport costs (Limão & Venables, 2001; World Trade Organization, 2004), which in turn reduces the volume of trade (Martìnez-Zarzoso *et al.*, 2008; Portugal-Perez & Wilson, 2008).

Wilson *et al*. (as cited by Bagai & Wilson, 2006)[32] and Clark *et al*. (2004) agree with this finding as both determined a positive relationship between the quality of infrastructure and trade volumes. The differences in infrastructure quality and volume across countries can be attributed for variations in transportation costs, which can be the reason for

[32] Wilson *et al*. (2003) completed a study based on Asia-Pacific and found that an increase in airport and port efficiency has a large positive impact on intra-trade with regard to Asia-Pacific Economic Cooperation (APEC).

variations in competitiveness (Bougheas *et al.*, 1999; World Trade Organization, 2004; World Trade Organization, 2015).

A study done by Yeaple and Golub (2002) indicated that variations in the quality of public infrastructure amongst countries can also be responsible for variations in total factor productivity. Moreover, because sectors vary in how intensively they use services linked with infrastructure and how they depend on good infrastructure, the impact of infrastructure quality on total factor productivity varies amongst sectors (Nordås & Piermartini, 2004). Yeaple and Golup (2002) found that the quality of road infrastructure is particularly important for the production of apparel and textiles and growth in the transport equipment sector. The quality of infrastructure has, therefore, an impact on international trade and patterns of specialisation (Nordås & Piermartini, 2004).

Limão and Venables (2001) found that if countries increase their infrastructure level by 25 percentiles, costs can be reduced by an equivalent amount of 419 km of overland travel and 3,466 km of sea travel. Trade volumes can increase by 68%, which is equivalent to being 2,005 km closer to other countries (Limão & Venables, 2001). For landlocked countries, poor infrastructure accounts for 60% of predicted transportation costs, compared to 40% for coastal countries. A 50% improvement in the infrastructure of landlocked countries helps them to overcome more than half of their disadvantages for being geographically isolated (Limão & Venables, 2001).

Limão and Venables (2001) further state that it is particularly important for developing countries to enhance their level of infrastructure as developing countries usually export low value-added products. Estimates show that infrastructure has the largest impact on low value-added sectors (Martìnez-Zarzoso *et al*., 2008).

Table 2-3 illustrates the average kilometres of rail lines, paved roads and roads (calculated as the sum of both paved and dirt roads) per 100 square kilometres for low-income, middle-income and high-income countries.[33] It is clear that the gap in infrastructure between low-income and high-income countries is large. Available data on paved roads show that high-income countries have on average 13 times more kilometres of paved roads per 100 square kilometres than low-income countries. For instance,

[33] The definition of low-income, middle-income and high-income countries used in this section, follows the World Bank definition used in the WDI of 2003.

Belgium has almost 350 kilometres of paved roads per 100 square kilometres, relative to El Salvador that only has about 9.5 kilometres per 100 square kilometres (World Trade Organization, 2003).

Table 2-3: Quality of infrastructure for land transportation (kilometres per 100 square kilometres of countries)

| Country type | Rail lines | Paved Roads | Roads |
|---|---|---|---|
| Low-income countries | 0.7 | 2.9 | 17.7 |
| Middle-income countries | 0.7 | 6.5 | 12.3 |
| High-income countries | 2.5 | 36.7 | 41.7 |
| **World average** | **0.9** | **9.0** | **20.7** |

Source: World Trade Organization (2003).

Nordås and Piermartini (2004) found that when the kilometres of paved roads (per 100 square kilometres) are doubled, trade is increased by 13%. It is, therefore, evident that low-income countries are at a substantial disadvantage regarding their quality of inland transportation infrastructure, which consequently affects their competitiveness and efficiency.

Freund and Rocha (2010) considered African exports and they found that the uncertainty of road transport has a significant and large impact on the ability of countries to export. They further estimated that in order for Africa to stimulate their exports, increased improvements in road networks are urgently needed − especially infrastructure, policies and security that improve competition in trucking (Freund & Rocha, 2010).

Blyde (2010) and Volpe *et al.* (2012) studied the impact of increased investments of Latin American countries in road infrastructure. They established that reduced domestic transportation costs in Colombia can considerably improve the prospect of exporting. Regions in Colombia with lower transportation costs (for instance, regions in the 25th percentile) export roughly 2.3 times more compared to regions with higher transportation costs (for example, regions in the 75th percentile).

Blyde (2010) simulated a reduction in transportation costs by means of a scenario that improved all of the identified regular and bad road conditions to good, as defined by the National Road Authority. He found that the simulated improvements in road conditions

decreased average transportation costs by 12% while average exports inflated by almost 9%.

Volpe *et al*. (2012) measured the impact that newly constructed roads had on the exports of Peruvian companies between 2003 and 2010. The authors concluded that the exports of companies whose routes were shortened due to newly constructed roads were approximately two-thirds higher than those whose route-length remained unchanged. Overall, additional road infrastructure investments led to Peruvian exports being 20% higher in 2010 relative to what they would have been without the development of new roads (Volpe *et al*., 2012).

Equally important is the role telecommunications infrastructure plays in international trade and is discussed in the following section.

#### 2.2.7.2 Telecommunications infrastructure

One significant characteristic of a telecommunications infrastructure is positive network externalities (Pradhan *et al.*, 2014; World Trade Organization, 2015). The more the people that join the network, the larger the value obtained by other users. Positive externalities are not found in other forms of infrastructure, such as ports, bridges, roads, sewage and transit systems (Pradhan *et al*., 2014). Investment returns are, therefore, expected to be larger in telecommunications infrastructures compared to other forms of public infrastructure (Chakraborty & Nandi, 2011).

Pradhan *et al*. (2014) are of the opinion that a telecommunications infrastructure has the ability to increase economic development by creating new innovation opportunities, by reducing transactions and capital costs, by closing regional discrepancies in productivity and incomes, by providing access to human capital and to new markets and finally, this kind of infrastructure has the ability to generate positive externalities (Pradhan *et al*., 2014; World Trade Organization, 2015).

In addition, effective telecommunications also offer a low-cost channel for the search for, gathering and exchanging of information, which in turn has an imperative impact on all economic activities (World Trade Organization, 2004; World Trade Organization, 2015).[34]

[34] During the past few decades technological developments in the telecommunications sector have been significant, including rapid technology diffusions. Countries that have lagged in technological and economic

Telecommunications are necessary for operating businesses today. For a number of industries, telephones still serve as a primary selling technique while the internet is viewed as an increasingly important channel for marketing and even for sales in some industries (World Trade Organization, 2004).

According to the World Trade Organization (2004) cross-border trade in services rely largely on telecommunications as the main channel for transactions. Freund and Weinhold (2002) found that internet penetration of trading partners has a large impact on the imports of United States of American businesses and technical and professional services. However, there seems to be no significant relationship between internet penetration and the exports of services from the United States of America. This can be explained by the fact that it is generally customers (importers) who decide the mode of communication and supply that are used (Freund & Weinhold, 2002). Because of the high rate of internet penetration in the United States of America, it is likely that importers prefer the internet as the channel for exchanging services and information and tend to consider suppliers (countries) which are able to provide services via the internet (World Trade Organization, 2004).

However, the use of the internet has a negative impact on poorer countries since these countries generally lack proper telecommunications networks, which again increases costs and reduces trade overall (Limão & Venables, 2001; Nordås & Piermartini, 2004; World Trade Organization, 2004; World Trade Organization, 2015).

Nevertheless, new technologies appear to create impediments amongst countries that are connected and those that are not (World Trade Organization, 2004; World Trade Organization, 2015). Exporters in Ghana usually travel to suppliers of agricultural products in other countries to buy supplies – these suppliers do not necessarily make use of the internet (Nordås & Piermartini, 2004). More recently, these exporters started to use

developments, are now able to change to the most recent technologies at fairly low adoption costs (World Trade Organization, 2004). In Africa, 95% of mobile lines were GSM (Global System for Mobile Communication) in 2001, which was well above the world average of 70%. The Republic of Korea has the highest broadband penetration rate in the world, having nearly twice as much line per 100 inhabitants as Canada, which is ranked second. Furthermore, the digital gap appears to be smaller and narrowing faster compared to the income gap amongst rich and poor countries. Although the GDP per capita grew at roughly the same tempo in low-income and high-income countries during 1995 to 2001, the amount of mobile phones per 100 inhabitants increased about twice as much as in low-income countries (World Trade Organization, 2004).

mobile phones to contact suppliers beforehand to confirm what they have to offer (Nordås & Piermartini, 2004; World Trade Organization, 2004).

In some cases, these exporters have even stopped visiting countries who cannot be contacted with mobile phones (Overa, 2004). The use of telephones vastly improved efficiency and reduced transportation times, but some networks of suppliers and exporters are dependent on countries connected to telecommunications lines (Overa, 2004).[35]

Having a good telecommunications infrastructure is imperative to the trade advantages of countries and, therefore, affects the pattern of international specialisation and trading in merchandise (World Trade Organization, 2004; World Trade Organization, 2015).

The following section sheds light on the impact distance has on trade.

### 2.2.8 Distance

A number of studies have generated the estimates of the sensitivity of exporters to distance or made use of more specific terminology − the distance elasticity of trade (Berthelon & Freund, 2008; Disdier & Head, 2008). These studies found, not surprisingly, that an increase in distance leads to an increase in transport costs[36] that affects trade negatively (Disdier & Head, 2008) (see section 2.2.3).

Even though there is a relationship between distance and trade, studies by Limão and Venables (2001) and Martìnez-Zarzoso and Nowak-Lehmann (2007) showed that distance was a proxy in determining transport costs. According to them, distance on its own explains only 10% of transport costs variation compared to almost 50% when the remaining measures of infrastructure and geography are added (Limão & Venables, 2001).

[35] The same phenomenon is experienced as related services and infrastructures have improved in other areas. For instance, improved roads can induce the adoption of larger trucks, which generally would bypass villages with an inadequate road infrastructure. The same goes for improved port facilities – larger ships stop that would normally bypass ports with insufficient facilities.

[36] Martìnez-Zarzoso *et al*. (2008) found that the negative impact distance has on transportation costs is more on high value-added sectors than on low value-added sectors. In addition, studies by Papadopoulos *et al*. (2002) and Berthelon and Freund (2008) found that distance has a significant impact on the transportation costs of bulky and high tariff goods, such as cement and steel.

Martìnez-Zarzoso and Nowak-Lehmann (2007) maintain that for both road and maritime transportation, the conditions of transport are a strong factor when transportation costs are calculated. Maritime transportation costs in particular, are influenced by factors, such as efficiency and service quality (Martìnez-Zarzoso & Nowak-Lehmann, 2007). These studies explain why distance fails to influence a significant part of variations in transportation costs (Limão & Venables, 2001).

Apart from the negative influence physical distance[37] has on transportation costs alone, there are more reasons why countries situated closer to each other, trade more with each other. Firstly, it is more expensive to build trade relationships and to gain market access into countries further away (Coughlin, 2004).[38] Secondly, transportation options increase (other than air and sea transportation) as physical distance decreases. This again leads to more competition and a reduction in transportation prices, which explains why countries closer to one another can trade at lower costs (Hoffmann, 2002). Increased trade generates economies of scale by reducing transportation costs even further (Hoffmann, 2002).

Countries closer to one another generally have analogous languages, histories and cultures − making communication and trade easier (Hoffmann, 2002). This explains why distance on its own does not influence transportation costs, but there is speculation that cultural differences can be a reason why distance is imperative in trade negotiations (Disdier & Head, 2008; Ghemawat, 2001).

## 2.3 Summary

Chapter 2 included a discussion of different trade impediments and the impact of these impediments on international trade. Trade impediments are found to be any part of trading processes that increase the cost of trade. The trade impediments focused on in this chapter include tariffs, non-tariff measures, transportation costs and time, logistics and port efficiency, customs and border administration, infrastructure and distance.

[37] By making use of disaggregated bilateral trade data, Berthelon and Freund (2008) found that the elasticity of trade to distance increased with about 10% (in absolute value) since 1985.

[38] The impact distance has on trade can be reduced. According to Coughlin (2004), a decline in transportation costs (for example, if shipping rates go down) can reduce the costs drawback of trading more with distant countries and trade is increased when more negotiations take place with countries further away than close by.

Literature explains the negative consequences of tariffs on trade and that a reduction in tariffs increases trade. The contribution of non-tariff impediments to overall trade restrictiveness is quite large, and in some cases non-tariff barriers are far more trade restrictive than tariff impediments. Non-tariff impediments seem to become more and more important as the concerns of countries about sanitary and environmental risks are increasing.

Transportation costs are negatively associated with trade. It was also found that transportation costs depend on many complex details of infrastructure, geography and administrative impediments. Transportation costs increase export prices that result in uncompetitive priced export products. These costs also increase the prices of imported goods which in turn increase the costs of domestic production.

Trade time is found to be an important competitive factor and can, therefore, be viewed as a trade impediment in its own right. Time does not only affect the volume of trade, but also the ability of companies to enter export markets. Furthermore, it was found that the longer it takes to ship goods, the more expensive merchandise becomes, which again leads to uncompetitive export prices. The cost of time can be reduced over time with more effective multi-modal transportation, reduced air transport costs and faster ships.

Efficient logistics were found to not only reduce the cost and time of transportation, but also the cost of production. Countries have more recently begun to increase their focus on improving their logistics performance, given the major impact logistics has on economic activities. Logistics includes customs and border procedures, the quality of infrastructure and port efficiency.

Excessive customs and border procedures inhibit trade. Improving customs and border procedures can increase trade, but contributions of both trading partners are needed even if contributions are not equally provided. Efficient border administration and coordination of different agencies involved in border clearance are also found to be increasingly important in trading processes. Delays caused by factors, such as administrative procedures, have similar effects on exporting as delays in shipping time. Border delays also tend to increase the prices of goods in transit. There is, however, scope for reducing time at customs and at all stages of border processes.

The quality of infrastructure was found to have a significant and relatively large effect on bilateral trade flows. Infrastructure includes both physical transportation infrastructures, such as port facilities, road and rail networks and telecommunications infrastructure. Improved infrastructures were found to reduce trade costs and time while poor infrastructures result in increased trade costs.

Despite distance not being a good proxy to measure transportation costs (as distance explains only 10% of variations in transportation costs), it was still found to have a considerable negative effect on trade. This can be because countries situated closer to each other usually share analogous languages, histories and cultures, which are good for trade relations. The larger the cultural gap between countries, the higher the trade costs. However, cultural costs can be decreased or eliminated through learning more about the religion, language, norms and values of other countries.

High trade costs restrict a number of developing countries from taking full advantage of the opportunities created by a bilateral trading system. Obsolete or ill-adapted infrastructures, cumbersome and time-consuming border procedures, costs and the complexity of meeting an ever broader set of standards − all serve to keep too many countries from international trade negotiations.

While trade costs alone do not explain the development pathways of individual economies, these costs are key factors in clarifying why some economies are unable to diversify or grow. Developing countries bear an uneven share of global trade costs, despite the fact that they have become more integrated into the world economy in recent years. Some middle-income countries have been successful in reducing high trade costs, but low-income countries still struggle with obstinately high trade costs.

Overall, the competitive advantages of countries remain unexploited while they struggle to convert their market access into a market presence. The following table summarises the relationships amongst the different trade impediments.

Table 2-4: The relationships amongst the different trade impediments

| | |
|---|---|
| **1. Transportation costs** | |
| **Transportation costs and time**<br><br>Time has an impact on transportation costs − an increase in time leads to an increase in transportation costs (see section 2.2.4). For example, a consignment delayed for one week can increase the price of products by 16% (World Trade Organization, 2013). | **Transportation costs and logistics**<br><br>Logistics affect transportation costs. An increase in the efficiency of the logistics of countries leads to a decrease in transportation costs (see section 2.2.5). For example, effective multi-modal transportation and faster ships can reduce the costs associated with transporting (Nordås *et al*., 2006). |
| **Transportation costs and infrastructure**<br><br>Infrastructure has an effect on transportation costs, because an increase in the efficiency of the infrastructure of countries reduces the costs of transporting (see section 2.2.7). For example, if countries increase their infrastructure level by 25 percentiles, it will reduce costs by an equivalent amount of 419 km of overland travel and 3,466 km of sea travel (Limão & Venables, 2001). | **Transportation costs and distance**<br><br>Distance has an impact on transportation costs, because an increase in distance leads to an increase in transportation costs (see section 2.2.3 and 2.2.8). For instance, Clark *et al*. (2004) found that if the distance between the United States of America and a trading partner is increased by 100%, maritime transportation costs will increase by almost 20%. |
| **2. Time** | |
| **Time and logistics**<br><br>Logistics have an impact on time − a decrease in logistics leads to an increase in time (see section 2.2.4 and 2.2.5). For example, more effective multi-modal transportation and faster ships can reduce the time of exports (World Trade Organization, 2004). In addition, less time spent at harbours to load or unload containers generally leads to a reduction in travel time (Coughlin, 2004). | **Time and infrastructure**<br><br>Infrastructure has an impact on time, because a decrease in the quality of infrastructure leads to an increase in time (Nordås & Piermartini, 2004) (see section 2.2.4). |
| **Time and customs and border administration**<br><br>Customs and border administration has an impact on time − an increase in the efficiency of customs and border administration leads to a reduction in time (see section 2.2.4 and 2.2.6). For instance, by improving inspection efficiency at customs can reduce the time spent at terminals (World Bank, 2007). | |
| **3. Distance** | |
| **Distance and transportation costs**<br><br>A decline in transportation costs (for example, if shipping rates go down) can reduce cost disadvantages of trading with more distant countries in contrast with trade negotiations with nearby countries (Coughlin, 2004) (see section 2.2.8). | |

Source: Bondesio, 2016

Chapter 3 provides an overview of the research methodology and the data analysis techniques used in this study.

# CHAPTER 3: RESEARCH METHODOLOGY

## 3.1 Introduction

From the literature review in chapter 2, it is clear that there are several factors that inhibit or impede international trade. Trade impediments are found to be significant determinants of international trade.

The main objective of the study was to determine the world-wide market accessibility of South African exports. This information can enable policymakers and exporters to make better decisions and plan their export promotion efforts to overcome specific trade impediments and benefit from trade in the future (World Economic Forum, 2012). The information can also be used in analyses of South Africa's trade data.

Since 2008, the World Economic Forum biannually compiles an enabling trade index (ETI) with relevant obtained information for specific countries. This index assesses the extent to which economies have institutions, policies, infrastructure and services in place to facilitate the free flow of goods over borders to their various destinations. These trade-enabling factors are organised into four main pillars (or categories) (World Economic Forum, 2014):

I. Market access (extent and complexity of the tariff regimes of countries).
II. Border administration (the quality, transparency and efficiency of border administration).
III. Infrastructure (the availability and quality of transport infrastructures).
IV. Operating environments (the quality of key institutional factors impacting the business of importers and exporters).

The World Economic Forum highlights that trade is enabled by reducing trade barriers, which in turn increases economic growth, reduces poverty and provides a means to achieve sustainability (World Economic Forum, 2012).

This study aimed to contribute specifically to the growth and development of exports for the South African economy by examining the trade barriers faced by South African exporters specifically. The ETI is not compiled from a specific exporting country's point of

view and therefore this study attempted to compile a South African market accessibility index.

Firstly, the quantifiable variables (trade impediments) that can be used in such an index are listed and explained. The variables used in the ETI were considered in conjunction with other quantifiable trade impediments found in literature. Also, where applicable, the data were gathered from a South African exporting point of view. It is important to note that this study was demarcated to trade impediments/costs/barriers that occur during the transit of the goods (see section 1.5 for more details).[39]

After the data were collected, the question was how to compile the data into a composite index. Firstly, the researcher followed an ETI methodology that groups variables into main categories and made use of an equal weights method throughout the process to arrive at a composite market accessibility index. Secondly, a PCA approach was used and the results were compared to an equal weights method.

This chapter is organised as follows: section 3.2 provides a data description of the quantifiable trade impediments found in literature that can be used to build a market accessibility index. Section 3.3 provides more detail on the inspection and standardisation of the data. Section 3.4 focuses on data standardisation. In section 3.5, the calculation of the South African market accessibility index is explained while section 3.6 concludes with a summary of the chapter.

## 3.2 Data description: quantifiable trade impediments faced by South Africa

The following variables were found in literature that measure different obstacles to trade that occur during the transit of goods (see section 2.2):

- Tariffs
- Non-tariff barriers
- Transportation costs
- Trade time
- Efficiency of logistics
- Customs and border efficiency

[39] The operating environment that was considered in pillar 4 of the ETI is not included in this study.

- Infrastructure
- Distance

A search for data that measure each of the above-mentioned obstacles to trade was undertaken and a description of each of these obstacles follows in the next subsections.

### 3.2.1 Tariffs

This variable determines the tax or duty levied on imported goods. More specifically, it can be explained as a fee charged by governments on imported and exported goods (Wilson *et al*., 2004). Tariffs tend to restrict trade and to increase prices for consumers (see section 2.2.1 for more details on how tariffs affect trade). Three tariff variables were considered in this study and are explained in more detail below.

(i) The average tariff charged by destination countries on products imported from South Africa

Average tariffs can be measured as a simple average[40] across product categories or can be weighted by import volumes. Although average tariffs are used to measure the degree of protection or openness of countries, these tariffs have limitations.

The simple average tariff can overstate the level of protection in countries. For example, when most of the imports of countries fall in only a few product categories with zero tariffs,[41] but these countries charge high tariffs on many other product categories, the simple average tariff is higher than the trade weighted tariff (Suranovic, 2007).

On the other hand, the use of trade-weighted tariff averages can lead to an underestimation of tariff restrictiveness (Kee *et al.*, 2008). For example, small weights are awarded to the tariffs of products which are not traded regularly − in many cases irregular trade is caused by high tariffs (Suranovic, 2007).

For the purposes of this study, the average tariff rate charged by each destination country of South Africa was obtained from the International Trade Centre's Market Access Map

[40] A simple average tariff means the unweighted average of effectively applied rates for all products subjected to tariffs. In other words, the same weight is given to all products without taking into account how much these products are traded (World Bank, 2015).
[41] Zero tariffs simply mean that no tariffs are levied on imported goods.

(International Trade Centre, 2015)[42] on a harmonised system (HS) 6-digit product level. A simple average over all the AVE tariffs on the HS 6-digit product level was calculated to arrive at the average tariff charged by destination countries on products imported from South Africa. The data available for 2014 or the most recent year was used.

(ii) Tariff complexity

Tariff complexity is calculated as the average of (a) tariff dispersions, (b) tariff peaks, (c) specific tariffs and (d) the number of distinct tariffs applied by particular importing countries. The data on tariff complexity were gathered and compiled by the World Economic Forum (2014) which obtains raw data from the International Trade Centre's Market Access Map (International Trade Centre, 2015):

(a) Tariff dispersions reflect differences in tariffs across product categories in the tariff structures of countries. Variances were calculated across all of the tariffs on imported merchandise goods at the 6-digit level of the HS.

(b) Tariff peaks are the ratio of the number of tariff lines exceeding three times the average domestic tariff (across all products) to the most-favoured nation tariff schedule. The tariff schedule is equal to the total number of tariff lines for each country.[43]

(c) Specific tariffs are the ratio of the number of HS tariff lines with at least one specific tariff to the total number of HS tariff lines. A specific tariff is a tariff rate charged on a fixed amount per quantity.

(d) The number of distinct tariffs reflects the number of distinct tariff rates applied by countries to its imports across all sectors (World Economic Forum, 2014).

(iii) Zero percentage tariffs

A zero percentage tariff refers to products or services that are exempt from import tariffs. In other words, no tax or duty is levied on imported goods (Bach & Martin, 2001). This

[42] The International Trade Centre's Market Access Map (*MacMap)* is unique and extremely accurate in measuring the tariff levels faced by individual country exports due to the fact that it accounts for bilateral, regional and preferential tariff systems.
[43] These tariffs are revised on an annual basis.

initiative is generally implemented by specific countries to increase trade with partnering countries.

Additionally, zero tariffs lead to lower domestic prices, an increase in production and more foreign investments (Baier & Bergstrand, 2007). However, zero tariffs can also lead to the outsourcing of employment, a reduction in tax revenue and economic instability (Edge, 2010).

The three above-mentioned tariff variables needed to be combined to arrive at a single measurement to include in further analyses. Because these variables are not in the same unit of measurement, they were standardised[44] and the average was used to arrive at a tariff index per destination country.

### 3.2.2 Non-tariff barriers

According to the Global Enabling Trade Report of the World Economic Forum (2012), non-tariff measures are generally qualitative in nature and often do not relate directly to trade. This makes it difficult to compile comprehensive data on non-tariff measures and to estimate the restrictiveness of these measures on trade. Data on non-tariff measures are thus limited and generally out-dated (World Economic Forum, 2012). In fact, the World Economic Forum has not used non-tariff barriers (NTBs) in their ETI calculations since 2010. Nonetheless, the International Trade Centre (ITC) is in the progress of gathering non-tariff barriers data, but to date data are only available for 90 countries (International Trade Centre, 2015; World Economic Forum, 2012).[45] Non-tariff barriers as a variable was, therefore, not included in this study. lags

### 3.2.3 South African transportation costs

The cost of both the (i) international legs of transportation from South Africa to destinations and (ii) inland transportation and procedures in destination countries were considered in determining the total transportation cost.

[44] A zero score was calculated for each value by subtracting the average of all the observations of variables and dividing the answer by the standard deviation over these observations.
[45] See http://www.macmap.org/SupportMaterials/DataAvailabilityNTM.aspx for countries.

(i) International costs of transporting goods from South Africa (ocean freight)

The international ocean freight costs to transport goods were determined from the Durban harbour, South Africa, to the main or busiest ports in various destination countries around the world. Since international transportation costs are added to domestic costs to import from destination countries to arrive at a total cost per destination country, the same specifications were used for both these variables.

The World Bank Doing Business Report includes a trading across borders section in which the costs to import are determined per importing country. The costs to import variable includes inland transportation costs and all fees charged for technical control, customs clearance, customs broking and terminal handling of a 20 foot, full container load (FCL) of general cargo (ocean freight) to the value of $20 000 (World Bank, 2014b). These cargo specifications and the ports used by the World Bank Doing Business Report[46] were used to gather international shipping costs.

The data were gathered from the world freight rates website.[47] World freight rates is a free online freight calculator for rail, truck or ocean freight. The calculator aims to connect users with shippers and freight forwarders. In fact, it covers a total of 155 different freight forwarders, about 4700 Non-Vessel Operating Common Carrier (NVOCC)[48] companies, 49 of the top banks in the world, 50 of the top logistics companies, 180 Vessel Operating Common Carrier (VOCC)[49] companies and about 117 worldwide insurance adjusters.

(ii) Import domestic costs

As described above, domestic transport costs or costs to import were gathered from the World Bank Doing Business Report (2014b) and included the costs from arrival at ports to warehouses in importing countries. These costs include the fees charged for technical control and customs clearance, custom brokerage, terminal handling and inland transportation.

[46] This information was made available to the researcher by the World Bank.
[47] World freight rates were obtained from www.worldfreightrates.com.
[48] Non-vessel operating common carriers are companies or persons who organise shipments for individuals or corporations to transport goods from producers or manufacturers to customers, markets or final points of distribution.
[49] Vessel operating common carriers are companies that operate their own vessels.

The standardised specifications used to determine the costs of both ocean freight and inland transportation made it possible to add international and domestic costs to arrive at the total transportation cost per destination country.

### 3.2.4 South African trade time

This variable measured the total number of days necessary for transportation and compliance with regard to the necessary procedures to export goods from South Africa to each destination country (for which data are available) (see section 2.2.4 for more details on how transportation time affects trade). In order to determine the total transport time for each destination country, the time necessary for both the (i) international and (ii) domestic legs of shipments were included. These international and national legs of shipments are explained in detail below.

(i) International time to transport goods from South Africa (ocean freight)

The international time to transport goods was determined from the Durban harbour, South Africa, to the various destination countries around the world. The World Bank Doing Business Report also calculates the time to import from specific countries, which includes the average time it takes for inland transportation, handling, customs and obtaining documentation (World Bank, 2014b). The same cargo specifications and ports were used as for the cost to import variable described in section 3.2.3. In order to add international and domestic transport times, information on the ocean freight time for a 20 foot, FCL of general cargo worth $ 20 000 from the Durban port to the ports used by the World Bank for each destination country was obtained. In the case of landlocked countries, the World Bank determined the shipping time from the nearest or most likely ports.

The data for international shipping times were obtained from Searates.[50] Searates is an online tool for calculating distances between sea ports. It provides port-to-port or door-to-door transit times and distances and also takes inland transportation time into consideration when calculating transit times. Data on the transit time of shipping lines were based on the information obtained from container tracking services. Sea rates

[50] Sea rates were obtained from www.searates.com.

provide an accessible and cost-effective way of searching and booking containers for transporting goods.

(ii) Import domestic time

As mentioned above, import domestic times are calculated by the World Bank (2014b) and refer to the time necessary for inland handling and transport, the time to obtain documents, customs clearance and inspections and terminal and port handling time in destination countries. Import domestic times exclude ocean shipping times and are recorded in days. Additionally, in calculating the transport times for each country, the World Bank (2014b) made the assumption that no time was wasted and that the completion of all procedures took place without delays.

The total transport time was calculated by adding international times (ocean shipping times) and domestic times (import times).

### 3.2.5 Efficiency of logistics in importing countries

This variable measures the relative ease and efficiency with which goods can be moved into and from countries (see section 2.2.5 for more details on how logistics affect trade). Five quantifiable variables that measure different dimensions of the efficiency of logistics were found from different sources. Four of these variables were obtained from the World Bank's biannual publication of the LPI and one from the World Economic Forum's executive opinion survey.

Firstly, the LPI measures on-the-ground efficiency of trade supply chains and logistical performances of countries (World Bank, 2014a). These measurements are done by means of surveys in the form of a standardised questionnaire which includes two sections, namely an international section and a domestic section. For the international section respondents measure six key areas of the performance of logistics in eight of their main overseas markets.[51] The eight major countries with which other countries trade are

[51] The method used to select the group of countries rated by respondents varies according to the characteristics of the country where respondents are located. Respondents take the survey online. The survey engine builds a set of countries for the respondents and incorporates the Uniform Sampling Randomised (USR) approach to gain the most possible responses from underrepresented countries. After 200 surveys, the USR approach is introduced into the engine's process for country selection. For each new survey respondent, the USR approach solicits a response from a country chosen at random but with non-uniform probability with weights chosen to evolve the sampling towards uniform probability. For example,

chosen based on the most important export and import markets of countries where respondents are located. For landlocked countries, trading partners are chosen based on neighbouring countries that form part of the land bridge connecting them with international markets. As for the domestic section,[52] respondents provide qualitative and quantitative data on the logistics environment from the country where they work (for instance, information, such as time and costs in a typical supply chain).

The 2014 LPI data were based on a survey answered by 1000 respondents at international logistics companies in 143 countries. 40% of the respondents dealt with multimodal transport, 24% with maritime transport, and 15% with air transport. 35% of the respondents usually oversee both international and domestic operations and another 32% deal exclusively with international shipping (both exports and imports). 24% work with most of the world's regions while others concentrate on work in Asia (27%), Europe (25%) or America (13%) (World Bank, 2014a).

The performance of each country was determined by using a 5-point scale (1 for the lowest score and 5 for the highest score) based on their experience in international logistics and in line with generally accepted industry standards or practices. Furthermore, the 2014 LPI was compiled using aggregated weights[53] between the four indexes from 2007 to 2014. Scores in the 2014 LPI were given a weight of 53.3%, followed by 26.7% for 2012, 13.3% for 2010 and 6.7% for 2007. These weights made it possible to compare the logistics performances of 160 countries.

Secondly, the World Economic Forum's executive opinion survey was used to compile the forum's Global Competitiveness Report. This report assesses the competitiveness landscape of countries and provides insight into the drivers of their productivity and prosperity. The report remains the most comprehensive assessment of national competitiveness worldwide (World Economic Forum, 2013). The report contains the global competiveness index (GCI) which ranks countries according to their production

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a country (*i*) is chosen with a probability (N–*ni*) / 2N, where *ni* is the sample size of country *i* so far and *N* is the total sample size. All scores are then normalised by subtracting the sample mean and dividing it by the standard deviation before conducting a PCA. The output from the PCA is a single indicator. In other words, the LPI is the weighted average of those scores (World Bank, 2014a).

[52] The domestic section contains more detailed information regarding the logistics environment of countries, core logistics processes and institutions as well as performance times and costs.

[53] Aggregated weights between the four indexes are used to reduce the variation of countries' scores from one LPI survey to another.

competitiveness. The index consists of different components of competitiveness. These components are grouped into twelve categories known as the pillars of competitiveness. One of these pillars, infrastructure, assesses the quality of air transport infrastructure. The quality of port infrastructure was used in this study to determine the availability and quality of transport infrastructures (see section 3.2.7 and Figure 3-1). Other variables obtained from the executive opinion survey relevant for this study include: irregular payments made in exports and imports, the efficiency of transport mode changes and time predictability of import procedures (see section 3.2.6).

The data of the World Economic Forum's executive opinion survey were gathered from 14 059 respondents, covering 150 economies. The survey is translated into more than 30 languages to maximise its reach. Each country's performance is measured as an index value on a scale of 1 to 7 (1 for the lowest score and 7 for the highest score).

Given the background on the surveys from which the data were obtained, the five variables included in this study to measure the efficiency of logistics of a country are subsequently discussed.

(i) Ease and affordability of shipments

One of the key areas assessed in the LPI include the ease and affordability of arranging shipments. Respondents of LPI survey of the World Bank were asked to evaluate the ease and affordability associated with arranging international shipments to or from eight major trading partners with which the respondent's country conducts business.

Performance was determined on a 5-point scale (1 for the lowest score and 5 for the highest score) based on their experience in international logistics and in line with generally accepted industry standards or practices. The data represented the 2014 survey and were obtained from the World Bank LPI of 2014 (World Bank, 2014a).

(ii) Logistical competence

The LPI analysis of the World Bank also measures the logistical competence of different countries around the world. Logistical competence refers to the competence of local industries for trucking, forwarding and customs brokerage (the quality of logistical

services delivered). The data were obtained from the World Bank LPI of 2014 (World Bank, 2014a).

(iii) Tracking and tracing ability

The ability to track and trace shipments of countries is also assessed in the LPI survey. For this assessment to take place, respondents were asked to evaluate the ability of countries to track and trace international shipments when shipping to or from their eight major trading partners. The data used in this study were gathered from the World Bank LPI 2014 (World Bank, 2014a).

(iv) Timeliness of shipments in reaching their destinations

Another component that is evaluated in the LPI is the frequency with which shipments reach consignees within scheduled or expected delivery times (timelines). Respondents were asked to evaluate the timeliness of shipments in reaching their destinations when arranging shipments for their eight major trading partners. The data used in this study represented the World Bank's LPI of 2014 (World Bank, 2014a).

(v) Efficiency of transport mode changes

This variable was obtained from the World Economic Forum's executive opinion survey and measures how efficient changes are between different modes of transport within countries (for instance, from airports to roads or ports to rail). It is calculated as an index value − 1 to 7 based on a scale (a score of 1 indicates inefficiency and 7 indicates extreme efficiency). The data used in this study represented the weighted averages of 2012 and 2013. The data were gathered from the World Economic Forum's Executive Opinion Survey, the 2012 and 2013 edition (World Economic Forum, 2014).

The five logistical efficiency variables described above needed to be combined to arrive at a single measurement tool to be included in further analyses. Because these variables are not all on the same scale, they were standardised[54] and the average of the five variables was used to arrive at a logistics efficiency index.

[54] A zero score was calculated for each value by subtracting the average over all of the observations of variables and dividing this answer by the standard deviation over these observations.

### 3.2.6 Customs and border administration in importing countries

This variable measures the extent to which the administration at borders facilitates the entry or exit of goods (see section 2.2.6 for more details on how customs and border administration affect trade). Data from the World Bank LPI survey and the World Economic Forum's executive opinion survey described in section 3.2.5 were again consulted for measuring the efficiency of customs and border administration. Four quantifiable variables that measure different dimensions of customs and border administration were found from different sources. These variables are subsequently discussed.

(i) Efficiency of customs clearance processes

The World Bank LPI survey also assesses the efficiency and effectiveness of customs clearance in countries. Respondents of the LPI survey were asked to evaluate effectiveness and efficiency in terms of preparing and submitting documentation necessary for importing and exporting goods (World Bank, 2014a). Data were obtained from the World Bank LPI survey (see section 3.2.5).

(ii) Documents to import goods

This variable from the trading across borders section of the World Bank Doing Business Report takes into consideration all the documents required to import goods that are recorded (World Bank, 2014b). It is assumed that contracts have already been agreed upon and signed by both parties. These documents include import licenses, port filing documents, customs declarations and clearance documents, bank documents and other official documents exchanged between respective parties. Documents that are filed simultaneously are considered different documents, but scored within the same time frame.

(iii) Irregular payments in exports and imports (bribes)

This variable measures how common it is for companies in countries to make undocumented extra payments or bribes associated with exports and imports (World Economic Forum, 2014). The data were gathered from the executive opinion survey of the World Economic Survey (see section 3.2.5).

(iv) Time predictability of import procedures

Also included in the executive opinion survey of the World Economic Survey (see section 3.2.5) is the time predictability of import procedures. This variable measures to what extent time is required for border clearance fluctuations in countries when goods are imported (World Economic Forum, 2014).

Based on literature indicating that customs and border administration is one of the key aspects influencing the accessibility of markets, the four variables described above measuring the efficiency of customs and border administration needed to be combined to arrive at a single indicator for further analyses. Because these variables are not all on the same scale, this variable was standardised[55] and averaged to arrive at a single customs and border administration index.

### 3.2.7 Infrastructure in importing countries

This variable takes into consideration whether countries have the necessary transport and communication infrastructure in place to facilitate the movement of goods within and across borders (see section 2.2.7 for more detail on how infrastructure affects trade). Two quantifiable variables that measure infrastructure were obtained from different sources. These variables are subsequently discussed.

(i) Availability and quality of transport infrastructure

This variable measures the availability and quality of domestic infrastructures for each of the four main modes of transport, namely air, road, port and railroad. Connectivity of both air and sea freight is assessed in the survey.

This variable was obtained from the World Economic Forum's Enabling Trade Index publication (World Economic Forum, 2014). This variable combines or averages information from different sources into one measure for the availability and quality of transport infrastructures.[56] The World Economic Forum gathers this information from the

[55] A z-score was calculated for each value by subtracting the average over all observations of the variable and dividing this answer by the standard deviation over these observations.

[56] The following indicators fall under the availability and quality of transport infrastructure: (i) liner shipping connectivity index (sourced from UNCTAD's Transport Section, Trade Logistics Branch), (ii) quality of port infrastructure (sourced from the WEF executive opinion survey), (iii) paved roads (sourced from the World

United Nations Conference on Trade and Development (UNCTAD); the World Economic Forum's 2012/2013 Executive Opinion Survey; and the World Bank development indicators.

(ii) Availability and quality of information and communication technologies

This variable measures the availability and quality of information and communication technologies in countries as a proxy of internet and mobile use by the population at large, governments for interacting with citizens and by companies for business transactions. It also takes into consideration the quality of internet access, as broadband access has become the norm to fully leverage the potential of the internet.

This variable was obtained from the ETI of the World Economic Forum (World Economic Forum, 2014). It combines or averages information from different sources into one measure.[57] The World Economic Forum gathers the information on the availability and quality of information and communication technologies from the International Telecommunication Union (ITU); the ICT Indicators Database (2013 edition); and the United Nations E-Government 2012 Survey (World Economic Forum, 2014).

The two infrastructure variables, namely (i) availability and quality of transport infrastructure, and (ii) availability and quality of information and communication technologies were once again standardised and averaged to arrive at a single measurement for the availability and quality of information and communication technologies.

### 3.2.8 Distance

For the purposes of this study, distance was assumed to be encapsulated in trade costs and time. Even if countries are further away, direct and frequent shipping to those

Bank Development Indicators), (iv) quality of roads (sourced from the WEF executive opinion survey). For more details on these sub-indicators, see the World Economic Forum's Enabling Trade Report (2014).

[57] The following indicators fall under the availability and quality of telecommunications infrastructure: (i) mobile telephone subscriptions (sourced from the ITU ICT Indicators Database); (ii) internet users (sourced from the ITU); (iii) fixed broadband subscriptions (sourced from the ITU); (iv) active mobile broadband subscriptions (sourced from the ITU); and (v) the Government Online Service Index (sourced from the United Nations E-Government Survey of 2012).

countries can cause costs to be lower than to other countries located nearer.[58] Border delays and poor infrastructure in nearby countries can cause higher costs than countries further away (Steenkamp *et al.*, 2009) (see also section 2.2.3 and 2.2.4).

In other words, domestic costs and time incurred by exporters in importing countries are considered in this study, which − as opposed to distance − take the time and costs into account with regard to infrastructure, documentation, inland transportation and handling, customs clearance and inspections and lastly, port and terminal handling. As a result, distance was not used as a variable to measure market accessibility in this study.

After collecting the data on the different variables suitable to measure market accessibility in this study, the next step was to inspect and describe the data.

## 3.3 Data inspection and standardisation

Before attempting any calculations on the data, the data first needed to be inspected. This included testing the normality of the data, identifying outliers and determining the correlation amongst the variables. Finally, the data were standardised to solve data differentiations (see section 3.3.1). These tests are subsequently explained.

### 3.3.1 Data inspection

As mentioned in section 3.1, an equal weights method and a PCA approach were used and compared in this study to measure the market accessibility of different markets for South African exports. Both methods were used, because no clear indication was found in literature on how to weigh all the different variables included in this study relative to one another.

One of the prerequisites for a reliable PCA approach is that the variables included should be normally distributed (Field, 2013). Normality tests were, therefore, performed on the variables explained in section 3.2 (see Appendix A). Although not perfectly, all of the variables except for the tariff index were normally distributed (see Figure A-1 and Figures A-3 to A-7). After further inspection, it was evident that the average tariffs charged on

[58] Shipping costs and time take routing (for instance, lower transport costs and times associated with main routes (Hoffmann, 2002)), transhipments and dwelling costs (for example, the time costs involved with loading, unloading and port waiting time (Coughlin, 2004)) into account.

imports from South Africa were closer to a normal distribution (see Figure A-2) and that the complexity of tariffs and zero percentage tariff (see section 3.2.1) variables skewed the tariff index. These variables were, therefore, excluded from the tariff index and only the average tariffs charged on imports from South Africa were used for this barrier to market accessibility.

To ensure that outliers did not skew the index values, outliers were identified. Chad was identified as an outlier in terms of total transportation costs while Chad, Venezuela, Kazakhstan and the Kyrgyz Republic were identified as outliers in terms of total trade time (see Appendix B). These countries were excluded from the analysis. The data on these countries are reported on in Appendix C.

Despite some unavailable data points of countries, the market accessibility of each country was still calculated. An arithmetic mean was calculated for the indicators. Data were available within each of the categories (see Figure 3-1). Missing values were excluded in the average calculation (in both the numerator and denominator of the equation). Tariffs and customs and border administration were the only categories affected by missing values. No data were available for Taiwan with regard to average tariff rates charged by destination countries on products imported from South Africa while no data were available for Bosnia and Herzegovina, Jordan, Oman and the United Arab Emirates with regard to the time predictability of import procedures. Although this method is not ideal, countries with missing values were not extensively penalised or treated favourably. See Table D-1 in Appendix D for the full dataset of the 144 countries included in this study.

A second prerequisite for a factor analysis/PCA approach is that the variables included should correlate fairly well, but not perfectly (Field, 2005).

Variables with low correlations in relation to all of the other variables should be eliminated from a PCA approach. Also, variables that have a correlation close to or higher than 0.9 should not be included in a factor analysis because these variables cause singularity in data. The following table illustrates the correlation matrix of all the market accessibility variables collected.

Table 3-1: Correlation matrix of all the market accessibility variables collected

| | Tariffs | Transportation costs | Trade time | The efficiency of logistics | Customs and border administration | Infrastructure |
|---|---|---|---|---|---|---|
| **Tariffs** | 1 | 0.026 | 0.094 | 0.054 | 0.061 | 0.084 |
| **Transportation costs** | 0.026 | 1 | 0.361 | 0.202 | 0.250 | 0.245 |
| **Trade time** | 0.094 | 0.361 | 1 | 0.595 | 0.517 | 0.564 |
| **Efficiency of logistics** | 0.054 | 0.202 | 0.595 | 1 | 0.886 | 0.888 |
| **Customs and border administration** | 0.061 | 0.250 | 0.517 | 0.886 | 1 | 0.919 |
| **Infrastructure** | 0.084 | 0.245 | 0.564 | 0.888 | 0.919 | 1 |

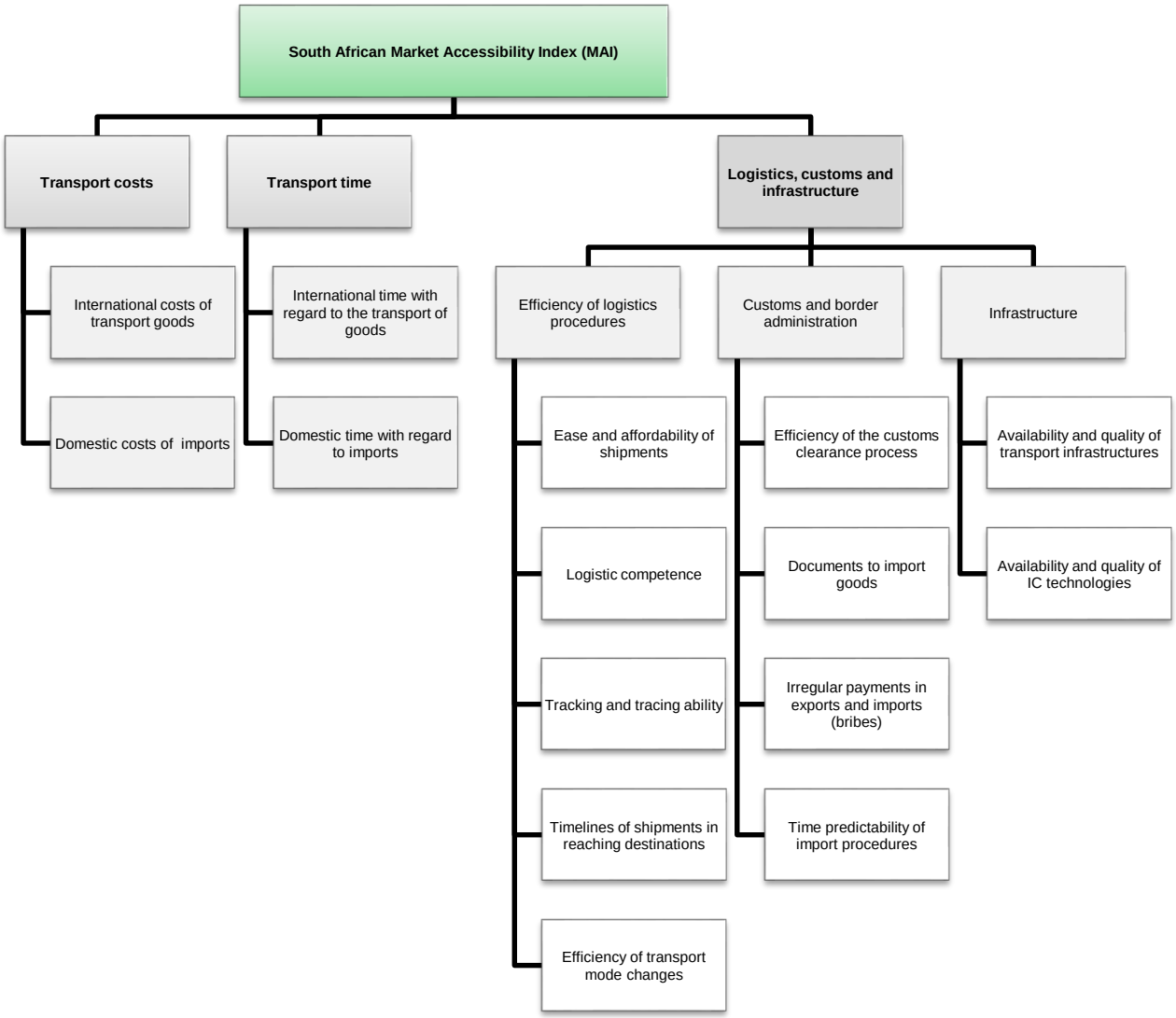
Source: The researcher constructed his own table

Tariffs showed a very low correlation (between 0.026 and 0.094) with all of the other variables. This can perhaps be attributed to the fact that these variables are determined by policymakers and are not affected by transportation costs and time, the efficiency of logistics, customs and border administration or infrastructure. Tariffs were, therefore, excluded from both the equal weights method and the principle component analysis due to a very low correlation.

The efficiency of logistics, customs and border administration and infrastructure correlated very high with one another (between 0.886 and 0.919). These variables were, therefore, grouped together (averaged) under a new logistics, customs and infrastructure variable (see Figure 3-1).

Based on the literature review (see section 2.2) and the correlation matrix (see Table 3-1), the variables gathered to measure the market accessibility of South African exports to different destination countries around the world can be grouped into three categories, namely transport costs, transport time, and logistics, customs and infrastructure. These categories are illustrated in Figure 3-1:

Figure 3-1: The South African Market Accessibility Index framework[59]




[59] Variables and indicators were gathered from different sources and partner organisations, namely the ITC, the Global Express Association (GEA), the World Trade Organization, the World Bank and also information obtained from the UNCTAD. A number of variables and indicators were also drawn from the World Economic Forum's Executive Opinion Survey.

### 3.3.2 Standardisation of data

Because the data were captured in different units of measurement, the data were standardised. This was done by using z-scores. Value standardisation fixes the problem of values being measured in different units. For example, tariffs are measured in *ad valorem* percentages, costs in US dollar values, time in days and logistics, customs and infrastructure in index values (between 1-5 or 1-7, based on surveys). More specifically, the z-score for each value or data point was calculated as follows (Field, 2005):

$$z - score = \left(\frac{actual\ value - sample\ average}{standard\ deviation\ of\ the\ sample}\right)$$

Since a value equal to the average of the sample obtains a z-score of zero, a z-score smaller than zero for a particular destination country indicates a below average performance in that variable while a z-score above zero indicates an above average performance.

For the variables with a higher value that have a negative effect on trade (for example higher costs to import cause a decrease in trade), the study relied on a transformation formula. In addition to the standardising of the values to z-scores, this formula reversed these values in such a way that high values indicate good performances and lower values poor performances:

$$z - score = -\left(\frac{actual\ value - sample\ average}{standard\ deviation\ of\ the\ sample}\right)$$

After the relevant data were collected, analysed and standardised, the next step was to calculate a composite index to measure South Africa's market accessibility per importing country. A more detailed explanation follows in section 3.4.

## 3.4 Calculating a market accessibility index for South African exports

Two different methods were used and compared in this study to calculate an index measuring South Africa's market accessibility in each destination country with available data since there are no clear guidelines available in literature on weighing the different market accessibility indicators relative to one another (see section 3.1). These methods

included an equal weights method and a PCA approach.[60] In the next sub-sections each of these methods are described in more detail.

### 3.4.1 Equal weights method

Following the World Economic Forum's Enabling Trade Index methodology, the first method used in this study to compile a market accessibility index for South African exports was the equal weights method.

Firstly, the data described in sections 3.2 and 3.3 were organised into three main categories. These categories include transportation costs, transportation time and logistics, customs and infrastructure (see Table 3-1). To summarise, transportation costs include the total of international and domestic costs associated with transporting a 20-foot cargo container from South Africa to designated warehouses to destination countries. Transport time calculates the total number of days necessary for transportation and compliance to procedures necessary to export goods from South Africa to warehouses of destination countries. Logistics, customs and infrastructure focus on the relative ease and efficiency with which goods can be moved into and from countries including customs and border efficiency and quality of infrastructures (see also section 3.2 and 3.3).

Finally, the variables within each of the categories were weighted equally within each category and amongst categories (see Figure 3-1).

The following section explains the PCA approach that was used to measure the market accessibility of South African exports.

### 3.4.2 Principle Component Analysis (PCA)

A PCA is a statistical procedure that makes use of a linear transformation to convert different variables into a smaller set of values of linearly uncorrelated variables, known as principle components (Jollife, 2002). The transformation is done in such a way that the first principle component has the largest possible variance while each subsequent

[60] A PCA serves as a helpful tool in an explanatory data analysis and for creating predictive models. A PCA also makes it possible to quickly visualise and analyse correlations amongst different variables (Field, 2013).

component has the highest possible variance under the constraint that it is linear to the previous components (Abdi & Williams, 2010).

This analysis was used in addition to an equal weights method due to the fact that the relative weights of all the different variables included in this study were relative to one another and could not be determined from literature. A PCA approach extracts components and combines a set of variables into smaller number of factors (in this case one). This type of analysis takes into consideration variances within data when the different variables within each factor are weighted. These factor scores can then be used as index values that can indicate, in this case, the market accessibility of countries relative to one another.

In the application of a PCA approach in this study, it had to be statistically determined whether the three categories identified were indeed measuring the same construct, namely market accessibility. A correlation matrix (R-matrix) was, therefore, considered. A PCA approach requires that the variables included correlate well, but not perfectly (R<0.9) (Field, 2013). Table 3-2 illustrates the correlation matrix amongst the three category variables.

Table 3-2: Correlation matrix amongst the three category variables

| | | TRANSPORTATION COSTS INDEX | TRANSPORTATION TIME INDEX | LOGISTICS, CUSTOMS AND INFRASTRUCTURE INDEX |
|---|---|---|---|---|
| Correlation | TRANSPORTATION COSTS INDEX | **1.000** | 0.357 | 0.227 |
| | TRANSPORTATION TIME INDEX | 0.357 | **1.000** | 0.577 |
| | LOGISTICS, CUSTOMS AND INFRASTRUCTURE INDEX | 0.227 | 0.577 | **1.000** |
| Sig. (1-tailed) | TRANSPORTATION COSTS INDEX | | 0.000 | 0.004 |
| | TRANSPORTATION TIME INDEX | 0.000 | | 0.000 |
| | LOGISTICS, CUSTOMS AND INFRASTRUCTURE INDEX | 0.004 | 0.000 | |

Source: The researcher constructed his own table by using SPSS statistics

From Table 3-2 it is clear that all variables sufficiently correlated without causing singularity (see also section 3.3 and Table 3-1).

The next step was to determine whether the data were suitable for a PCA. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test were, therefore, used.

The KMO measures sample adequacy and represents the ratio of the squared correlations amongst variables to the squared partial correlations[61] amongst variables (Field, 2013). Statistics range between zero and one. Values closer to zero indicate that unreliable factors were extracted from data. Values closer to one indicate that the patterns of correlation are relatively compact and a PCA approach should yield distinct and reliable factors (Field, 2013).

Bartlett's measure tests the null hypothesis that the original correlation matrix (R-matrix) is not an identity matrix (Field, 2013). Table 3-3 illustrates the statistics for the KMO measure and Bartlett's test for this analysis:

Table 3-3: Kaiser-Meyer-Olkin measure and Bartlett's test

| Measure | Value |
|---|---|
| Kaiser-Meyer-Olkin measure of sampling adequacy | 0.582 |
| Bartlett's test of sphericity | |
| Approximate Chi-Square | 71.453 |
| Degrees of freedom | 3 |
| Significance | 0.000 |

Source: The researcher constructed his own table by using SPSS statistics

From Table 3-3, the KMO value for this analysis is 0.582. Even though values above 0.7 are more desirable, a value between 0.5 and 0.7 is acceptable (Field, 2013). Bartlett's test was highly significant in this analysis (significance <0.05), which means that the *R*-matrix was not an identity matrix and there were suitable relationships amongst the categories included in this analysis.

Based on the results of the KMO measure and Bartlett's test, it was concluded that a PCA approach[62] was appropriate to analyse the market accessibility data. The following table illustrates the total variance of the original variables that were explained in the extracted factor.

[61] Partial correlations measure the relationships between two variables while controlling the effect one or more additional variables have on both (Field, 2013).

[62] The results of a PCA are defined by component scores or factor scores (the transformed variable values corresponding to a particular data point) (Bro & Smilde, 2014). By discovering which factors exist, and estimating the equation that describes them, it is possible to estimate each country's score on a factor based on the country's scores for the constituent variables.

Table 3-4: Total variance explained

| Component | Initial Eigenvalues | | | Extraction sums of squared loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 1.805 | 60.172 | 60.172 | 1.805 | 60.172 | 60.172 |
| 2 | 0.790 | 26.322 | 86.494 | | | |
| 3 | 0.405 | 13.506 | 100.000 | | | |

Source: The researcher constructed his own table by using SPSS statistics

Table 3-4 shows how much of the total variance in the original variables is explained in the factors extracted. One factor (with an Eigenvalue of >1) was extracted in a PCA, which was used in the study as a market accessibility index (see Table 3-5 and 3-6). This factor explains 60.17% of the total original variance in the data, consisting of transportation costs, transportation time, and logistics, customs and infrastructure.

Table 3-5 illustrates the component matrix while Table 3-6 illustrates the component scores by means of a coefficient matrix.

Table 3-5: Component matrix

| | Component |
|---|---|
| | Factor 1 |
| TRANSPORTATION COSTS | 0.631 |
| TRANSPORTATION TIME | 0.866 |
| LOGISTICS, CUSTOMS AND INFRASTRUCTURE | 0.811 |

Source: Own table constructed using SPSS statistics

From Table 3-5 it is clear that transportation time indicated the highest loading/factor weight[63] (0.866) while the loading of logistics, customs and infrastructure was 0.811 and transportation costs indicated a loading of 0.631. Additionally, all three of the variables included in Table 3-5 indicated high loadings,[64] which mean that transportation costs, transportation time, and logistics, customs and infrastructure theoretically fit together and they measure the same construct, namely market accessibility.

The following table illustrates the component scores by means of a coefficient matrix:

[63] Factor loadings refer to the correlation between a specific observed variable and a specific factor. Higher values mean a closer relationship (Field, 2013).
[64] Loadings less than 0.3 are considered low and should be omitted to improve clarity (Field, 2013).

Table 3-6: Component score (coefficient matrix)

| | Component |
|---|---|
| | Factor 1 |
| TRANSPORTATION COSTS | 0.350 |
| TRANSPORTATION TIME | 0.480 |
| LOGISTICS, CUSTOMS AND INFRASTRUCTURE | 0.449 |

Source: The researcher constructed his own table by using SPSS statistics

Table 3-6 illustrates the relative weight of each variable in the component/factor. The larger the absolute value of the coefficient, the more important the corresponding variable is in calculating the component (Field, 2013). Transportation times (0.480), therefore, contributes relatively more or indicated a higher loading towards measuring market access compared to logistics, customs and infrastructure (0.449) and transportation costs (0.35).

The results for both the equal weights method and PCA approach are provided and compared in chapter 4.

The following section provides a summary of this chapter.

## 3.5 Summary

The aim of this chapter was to explain the data analysis and method used to construct a South African market accessibility index.

Firstly, a description was provided of the data found in literature on trade impediments that can be used in a South African market accessibility index. This description explained the content of each variable, how it was measured and where data were obtained from.

Before including all these variables into a composite market accessibility index, the distribution of the data was determined, outliers were identified, the correlations amongst the variables were investigated and the data were standardised.

Subsequently, a South African market accessibility index was constructed by making use of two methods. An equal weights method and a PCA approach were used. These methods and their appropriateness in constructing the index were explained.

Consequently, this chapter helped to reach the main objective of this study, namely to determine the market accessibility of South African exports. In the next chapter, an analysis of the results are provided to identify the countries to which South Africa has a relative higher or lower market access. A closer look is taken at South Africa's access with regard to SADC member countries.

To conclude, Table 3-7 attempts a combined summary of the literature review (chapter 2) and empirical study (chapter 3) by providing a summary of literature support for every variable included in the empirical study to construct a South African market accessibility index.

Table 3-7: A literature overview of the categories and variables used to develop a market accessibility index for South Africa

| Category | Variables per category | An explanation of the variable | Examples of support from literature | The impact of each category on international trade[65] |
|---|---|---|---|---|
| **Transportation costs (see section 2.2.3)** | International and domestic costs of transport goods (www.worldfreightrates.com; World Bank Doing Business Report, 2014b) | This variable measures the international and domestic cost to transport a 20-foot cargo container from Durban harbour, South Africa, to the various countries around the world. Transport cost is calculated in US$. | Hummels (2001) | The cost of one day in transit (ocean transit) is equivalent to a tariff rate of 0.8%, which in turn amounts to a 16% tariff rate for a 20 days transit route. |
| | | | Limão and Venables (2001) | Trade volumes increase annually about 20% worldwide, if transportation costs are reduced by 10%. Moreover, if transportation costs are doubled, a 45% decrease takes place in trade volumes. Land transportation is about seven times more expensive than sea transportation. An additional 1000 kilometres increases sea transportation costs by $190, while land transportation costs are increased by $1380. |
| | | | Elbadawi *et al.* (2001) | The lower the transportation costs, the higher the supplier access of domestic companies. The lower the international transportation costs, the higher the foreign market access for domestic producers. |
| | | | Limão and Venables (2001) | Compared to coastal countries, landlocked countries experience 50% higher transportation costs and 60% lower trade volumes. However, if landlocked countries improve their infrastructure, their transport costs are lowered. |

[65] These findings are based on data of different samples of countries. One should, therefore, take caution when interpreting these results. The detailed findings are not provided in Table 3-1, as the purpose of this table is only to illustrate the importance of category selection in developing a suitable market accessibility index for South Africa.

Table 3-7: Literature overview of the categories and variables used to develop a market accessibility index for South Africa (continues)

| Category | Variables per category | An explanation of the variables | Examples of support from literature | The impact of each category on international trade |
|---|---|---|---|---|
| **Transportation costs (see section 2.2.3)** | International and domestic costs in transporting goods (www.worldfreightrates.com; World Bank Doing Business Report, 2014b) | This variable measures the international and domestic costs in transporting a 20-foot cargo container from the Durban harbour, South Africa, to the various countries around the world. Transportation costs are calculated in US$. | Hoffman (2002) | Transportation costs have similar effects on trade as on tariffs. Compared to tariffs which decline on average over time, the relative importance of transportation costs in export competitiveness has increased. Furthermore, the costs of transportation also increase as the value of goods increases. More specifically, a 1% increase in the value of goods is associated with a 0.358% increase in transportation costs. |
| | | | Hoffman (2002) | Economies of scale exist as the availability of liner shipping services between two countries increases. Increasing the amount of liner shipping services available from 5 to 20 is linked with a 12% decrease in freight costs and insurance. |
| | | | Clark *et al.* (2004) | Reducing the inefficiency of countries associated with transportation costs from the 25$^{th}$ to the 75$^{th}$ percentile, increases trade by almost 25%. An increase in the transportation costs of countries from the 25$^{th}$ to the 75$^{th}$ percentile reduces trade by 22%. Estimates are based on exporting to the United States of America (see section 2.2.3). |
| | | | Egger (2005) | For each 1% reduction in transportation costs, trade openness increases by 0.6%. The effect of transportation costs on trade openness has in fact grown over time. |
| | | | Martìnez-Zarzoso *et al.* (2007) | A 10% decrease in transportation costs increases trade volumes (both exports and imports) by more than 20%. |
| | | | Moreira *et al.* (2008) | When transportation costs are reduced by 10%, a 10% increase follows in the number of goods exported and a 9% increase in the amount of goods imported. Estimates are based on nine Latin American countries (see section 2.2.3). |
| | | | United Nations Conference on Trade and Development (2009) | High transportation costs have the ability to price countries out of export markets, especially when transportation costs represent a large part of the final price of products. |
| | | | World Trade Organization (2015) | High transportation costs have an impact on the competitiveness and trade performance of countries. High transportation costs increase the prices of imported goods, capital goods, food and intermediate inputs, which in turn inflate the costs of domestic productions. |

Table 3-7: Literature overview of the categories and variables used to develop a market accessibility index for South Africa (continues)

| Category | Variables per category | An explanation of the variable | Examples of support from the literature | The impact of each category on international trade |
|---|---|---|---|---|
| **Transportation time (see section 2.2.4)** | International and domestic times in transporting goods (www.searates.com; World Bank Doing Business Report, 2014b) | This variable measures the international and domestic times in transporting a 20-foot cargo container from the Durban harbour, South Africa, to the various countries around the world. Transport times are calculated in calendar days. | World Trade Organization (2004) | For each day in transit, the costs of product rise by 0.5%, which is about 30 times more compared to costs associated with pure-inventory holdings. |
| | | | Coughlin (2004) | Time costs have been reduced over time through more effective multi-modal transportation, faster ships and reduced air transportation costs. |
| | | | Hausman *et al.* (2005) | A 10% increase in time is associated with a 5-8% decrease in trade volumes. |
| | | | Djankov *et al.* (2006) | A 10% delay in time-sensitive goods is linked with a 30% increase in exports. Furthermore, export consignments delayed for one day are equivalent to a country being 85 kilometres away from the export country, which in turn is the same as reducing trade by 1%. |
| | | | Nordås *et al*. (2006) | Taking zero trade flows into account, a 10% increase in trade time leads to a 5-25% decrease in trade volume. |
| | | | Hummels and Schaur (2012) | For every day in transit, the probability of a country exporting to the United States of America declines by 1% for all goods and 1.5% for manufactured goods. |
| | | | World Trade Organization (2013) | When consignments are delayed for one week, the volume of exports is decreased by 7% or delivered prices of goods increase by 16%. In terms of time-sensitive goods, volumes can be decreased by 26%. |
| | | | World Trade Organization (2004). | Efficient logistics play an important role in determining the competitiveness of countries. Efficient logistics do not only reduce transportation costs and time, but also production costs. |
| **Logistics (see section 2.2.5)** | Efficiency of logistics procedures (World Bank, LPI 2014; World Economic Forum Executive Opinion Survey, 2012 & 2013) | This variable measures the ease and efficiency with which goods are moved into and from countries. It is calculated as an index value, 1-5 and 1-7, based on surveys. | Hoekman and Nicita (2008) | A higher LPI has a direct positive impact on trade. For instance, if low-income countries could increase their LPIs to the average of middle-income countries, their imports increase with about 15%. Coefficient estimates for LPIs also indicate that a 1% increase in a LPI score raises trade volumes (exports and imports) by almost 50%. |
| | | | Arvis *et al.* (2012) | Countries with the same level of per capita income, but with a better logistics performance, can experience an additional 1% growth in GDP and a 2% growth in trade. In addition, countries with inefficient logistics usually have higher average export and import times, which explain why improved logistics leads to faster trade. A competitive network of international logistics is, therefore, considered as the backbone of international trade. |
| | | | World Trade Organization (2015) | Logistics networks help to solve problems linked with cross-country coordination. These problems include customs delays, non-integrated time schedules, inadequate flows of information regarding delays or incompatible standards. |
| | | | Customs and border administration as well as infrastructure form part of logistics (see section 2.2.5 for more details). | |

Table 3-7: Literature overview of the categories and variables used to develop a market accessibility index for South Africa (continues)

| Category | Variables per category | An explanation of the variable | Examples of support from the literature | The impact of each category on international trade |
|---|---|---|---|---|
| **Logistics (see section 2.2.5)** | Customs and border administration (World Bank, LPI 2014; World Economic Forum Executive Opinion Survey, 2012 & 2013) | This variable measures the extent to which administration at borders facilitates the entry or exit of goods. It is calculated as an index value, 1-5 and 1-7, based on surveys. | Hummels (2001) | Delays caused by factors, such as administrative procedures (border and customs administration), have similar effects on exporting as delays in shipping times. |
| | | | Deardorff (2001) | Border delays can make time-sensitive industries even more expensive than formally levied tariffs or explicit transportation costs. |
| | | | Nordås and Piermartini (2004) | By increasing the average number of days required for customs clearance from five to seven days, trade is decreased by more than 40%. |
| | | | World Trade Organization (2004) | When administrative procedures regarding border crossings are cumbersome, these inefficient procedures have a large negative impact on trade. |
| | | | World Bank (2009) | Setting up new electronic data interchange systems for the processing and submitting of documents can improve the time to clear goods at customs. |
| | | | Hoekman and Nicita (2008) | A higher LPI has a direct positive impact on trade. For instance, if low-income countries increase their LPIs to the average of middle-income countries, their imports increase with about 15%. Coefficient estimates for LPIs also indicate that a 1% increase in a LPI score raises trade volumes (exports and imports) by almost 50%. |
| | | | Arvis *et al.* (2012) | Countries with the same level of per capita income, but with a better logistics performance, experience an additional 1% growth in GDP and a 2% growth in trade. In addition, countries with inefficient logistics usually have higher average export and import times, which explain why improved logistics lead to faster trade. A competitive network of international logistics is, therefore, considered as the backbone of international trade. |
| | | | World Trade Organization (2014) | Reducing red tape and paper work lessens the probability of irregular payments and discretionary measures throughout the entire importing and exporting process. |
| | | | World Economic Forum (2014) | Improvements in border administration lead to government advantages by reducing costs associated with duty collection and profit margins are increased. |
| | | | World Trade Organization (2015) | Logistics networks help to solve problems linked with cross-country coordination, for example, customs delays, non-integrated time schedules, inadequate flows of information regarding delays or incompatible standards. |

Table 3-7: Literature overview of the categories and variables used to develop a market accessibility index for South Africa (continues)

| Category | Variables per category | An explanation of variables | Examples of support from literature | The impact of each category on international trade |
|---|---|---|---|---|
| **Logistics (see section 2.2.5)** | Infrastructure (United Nations Conference on Trade and Development Transport Section, Trade Logistics Branch 2014; World Economic Forum Executive Opinion Survey, 2012 and 2013) | This variable measures whether countries have the necessary transportation and communication infrastructures in place to facilitate the movements of goods within the country and across borders. It is calculated as an index value, 1-7, based on surveys. | Limão and Venables (2001) | If countries increase their infrastructure level by 25 percentiles, it will reduce costs by an equivalent amount of 419 km of overland travel and 3,466 km of sea travel. It would also increase trade volumes by 68%, which is equivalent to being 2,005 km closer to other countries. |
| | | | Limão and Venables (2001) | For landlocked countries, poor infrastructure accounts for 60% of their predicted transportation costs compared to coastal countries. Furthermore, by improving their infrastructure by 50%, landlocked countries can overcome more than half of their disadvantages for being geographically isolated. |
| | | | Wilson *et al*. (as cited by Bagai & Wilson, 2006) | There is a positive relationship between the quality of infrastructure and trade volumes. |
| | | | World Trade Organization (2003) | High-income countries have on average 13 times more kilometres of paved roads per 100 square kilometres than low-income countries. |
| | | | World Trade Organization (2004) | A proper telecommunications infrastructure is imperative and affects the pattern of international specialisation and merchandise trade. |
| | | | Clark *et al.* (2004) | Improving the port efficiency of countries from the 25$^{th}$ to the 75$^{th}$ percentile reduces shipping costs by 12%, which in turn increase bilateral trade by 25%. |
| | | | Chakraborty and Nandi (2011) | Investment returns are expected to be greater in telecommunications infrastructure compared to other types of public infrastructure. |
| | | | Pradhan *et al.* (2014) | A telecommunications infrastructure has the ability to increase economic development by creating new innovation opportunities, reducing transaction and capital costs, closing regional discrepancies in productivity and incomes, providing access to human capital and to new markets and finally, it has the ability to generate positive externalities. |

Source: The researcher constructed his own table

The results of the study are explained in the following section.

# CHAPTER 4: RESULTS

## 4.1 Introduction

This chapter details the results on the market accessibility of selected countries from a South African point of view. As mentioned in chapter 3, two approaches were used to determine market accessibility, namely the equal weights method (see section 3.4.1) and the PCA approach (see section 3.4.2). The results of both these approaches are provided and compared in this chapter. For an easier interpretation of the results, the market accessibility index values/factor scores were converted to range between 0 and 100 in the tables presented in this chapter.

The following formula was used (Stacoverflow, 2016).[66]

$$U = \left(\frac{V-W}{X-W}\right) * ((Z-Y)+Y)$$

Where:

U = new value (calculated value ranging between 0 to 100)
V = old value (z-score/factor score per country)
W = old minimum value (minimum z-score/factor score)
X = old maximum value (maximum MAI z-score/factor score)
Y = new range minimum value (0)
Z = new range maximum value (100)

This formula was applied for z-scores of all sub-indices and factor scores in the dataset for easier interpretation and comparisons in this chapter. Section 4.2 analyses South Africa's market accessibility on a regional level (using both the equal weights method and a PCA approach).

In section 4.3, South Africa's market accessibility is measured. This includes Table 4-2 and Table 4-3, which illustrates the 20 most and least accessible countries with regard to South Africa. South Africa's market accessibility specifically with regard to SADC member countries is investigated in section 4.4. This section provides more clarity concerning

[66] See http://stackoverflow.com/questions/929103/convert-a-number-range-to-another-range-maintaining-ratio for the formula.

South Africa's access to its neighbouring countries and countries with a high proximity to South Africa in the SADC member region.

Finally, the chapter concludes with a summary provided in section 4.5.

## 4.2 Regional results for measuring the market accessibility of South African exports

In this section, South Africa's export market accessibility with regard to worldwide regions is measured. This includes Table 4-1, which illustrates South Africa's market accessibility with regard of each region[67] according to the equal weights method and PCA approach. The average score concerning the transportation costs, transportation time as well as logistics, customs and infrastructure of countries in relation to South Africa is illustrated.[68]

Table 4-1: South Africa's market accessibility with regard to worldwide regions

| Ranking | World region | Average proximity to South Africa (km) | Average transportation costs (US$) from South Africa | Average transportation time (days) from South Africa | Average logistics, customs and infrastructure (0-100) | Average MAI value (0–100) |
|---|---|---|---|---|---|---|
| **Equal weights / PCA** | | **(Region proximity ranking)** | **(Region cost ranking)** | **(Region time ranking)** | **(Region logistics, customs and infrastructure ranking)** | **Equal weights / PCA** |
| **1 / 1** | Western Europe | 9 017.40 (9) | 4 341.20 (8) | 30 (1) | 87.91 (1) | 67.90 / 70.50 |
| **2 / 3** | South-Eastern Asia | 10 009.08 (11) | 2 064.16 (1) | 35 (5) | 42.06 (9) | 65.69 / 62.70 |
| **3 / 2** | Northern Europe | 10 052.41 (12) | 4 579.80 (10) | 31 (3) | 76.54 (3) | 62.22 / 64.54 |
| **4 / 4** | Western Asia | 7 536.29 (6) | 4 106.92 (5) | 30 (1) | 47.58 (7) | 57.19 / 57.56 |
| **5 / 5** | Oceania | 10 224.12 (13) | 3 884.39 (4) | 37 (8) | 58.74 (4) | 56.51 / 56.57 |
| **6 / 7** | Southern Africa | 802.67 (1) | 3 281.31 (3) | 31 (3) | 26.93 (13) | 55.99 / 54.22 |
| **7 / 9** | Eastern Asia | 10 225.18 (14) | 2 950.38 (2) | 41 (14) | 44.25 (8) | 55.14 / 52.93 |
| **8 / 8** | Southern Europe | 8 164.75 (7) | 4 172.87 (6) | 35 (5) | 50.54 (5) | 53.92 / 54.15 |
| **9 / 6** | Northern America | 12 546.35 (16) | 5 374.91 (16) | 36 (7) | 81.90 (2) | 53.40 / 56.54 |
| **10 / 10** | Eastern Europe | 9 256.56 (10) | 4 887.75 (13) | 39 (11) | 49.71 (6) | 45.12 / 45.90 |
| **11 / 11** | Central America | 12 818.55 (17) | 4 760.47 (11) | 38 (9) | 37.26 (10) | 43.17 / 43.28 |
| **Top 10 country average** | | **1 785.99** | **1 780.64** | **22** | **91.71** | **82.79 / 82.99** |
| **Bottom 10 country average** | | **13 294.95** | **6 848.41** | **58** | **5.20** | **11.79 / 10.92** |
| **Sample average** | | **8 168.96** | **4 268.96** | **37** | **42.84** | **49.27 / 49.10** |

[67] Countries included in each region are illustrated in Appendix E.

[68] The efficiency of logistics, customs and border administration as well as infrastructure correlated very high (see Table 3-1). Consequently, these three variables were grouped together (averaged) under one heading, namely logistics, customs and infrastructure (see section 3.3.1). Each country's average logistics, customs and infrastructure score was then converted to range between 0 and 100 (see section 4.1).

Table 4-1: South Africa's market accessibility with regard to worldwide regions (continues)

| Ranking | World region | Average proximity to South Africa (km) | Average transportation costs (US$) from South Africa[69] | Average transportation time (days) from South Africa[70] | Average logistics, customs and infrastructure (0-100) | Average MAI value (0–100) |
|---|---|---|---|---|---|---|
| **Equal weights / PCA** | | **(Region proximity ranking)** | **(Region cost ranking)** | **(Region time ranking)** | **(Region logistics, customs and infrastructure ranking)** | **Equal weights / PCA** |
| **12 / 12** | Northern Africa | 6 929.80 (5) | 4 400.61 (9) | 40 (13) | 28.37 (12) | 41.39 / 40.46 |
| **13 / 13** | South America | 8 966.20 (8) | 5 311.35 (15) | 38 (9) | 32.11 (11) | 37.86 / 38.47 |
| **14 / 14** | Middle Africa | 3 370.04 (3) | 4 269.61 (7) | 39 (11) | 8.83 (17) | 37.35 / 35.42 |
| **15 / 15** | Eastern Africa | 2 958.55 (2) | 4 906.47 (14) | 41 (14) | 18.37 (15) | 34.67 / 33.91 |
| **16 / 16** | Western Africa | 5 638.12 (4) | 4 799.06 (12) | 45 (17) | 16.17 (16) | 30.87 / 29.49 |
| **17 / 17** | Caribbean | 11 632.46 (15) | 6 236.76 (17) | 41 (14) | 25.11 (14) | 27.07 / 28.36 |
| **Top 10 country average** | | **1 785.99** | **1 780.64** | **22** | **91.71** | **82.79 / 82.99** |
| **Bottom 10 country average** | | **13 294.95** | **6 848.41** | **58** | **5.20** | **11.79 / 10.92** |
| **Sample average** | | **8 168.96** | **4 268.96** | **37** | **42.84** | **49.27 / 49.10** |

Source: International Trade Centre (2011); World Economic Forum (2014); World Bank (2015), own calculations

From Table 4-1 it is clear that:

Western Europe (67.90) is the most accessible region for South African exports. Three out of the top twenty most accessible countries with regard to South Africa are situated in this region (see Table 4-2). South-Eastern Asia (65.69) is ranked second and Northern Europe (62.22) third in the overall regional market accessibility rankings.

The Caribbean (27.07), Western Africa (30.87) and Eastern Africa (34.67) regions are the least accessible regions for South African exporters. In addition, ten out of the twenty least accessible countries with regard to South Africa are situated in these regions (see Table 4-3).

In terms of proximity, the following regions are below the sample average (8 168.96 km): Southern Africa (802.67 km on average); Eastern Africa (2 958.55 km); Middle Africa (3

[69] The transportation costs from South Africa comprise of two variables, namely the international costs to transport goods from South Africa, and the domestic costs to import goods (see section 3.2.3).
[70] The transport time from South Africa includes two variables, namely the international time to transport goods from South Africa, and the domestic time to import goods (see section 3.2.4).

370.04 km); Western Africa (5 638.12 km); Northern Africa (6 929.80 km); Western Asia (7 536.29 km); and Southern Europe (8 164.75 km). Western Asia (fourth) is the only region that is ranked amongst the top five most accessible regions with regard to South Africa. This indicates that proximity does not necessary translate into higher market access. Moreover, South-Eastern Asia ($2 064.16); Eastern Asia ($2 950.38); Southern Africa ($3 281.31); Oceania ($3 884.39); Western Asia ($4 106.92); and Southern Europe ($4 172.87) are the only regions whose average transportation costs are below the sample average ($4 268.96).

In terms of transport times, the following regions are all below the sample average (37 days): Western Asia (30 days); Western Europe (30 days); Southern Africa (31 days); Northern Europe (31 days); South-Eastern Asia (35 days); Southern Europe (35 days); and Northern America (36 days). Four of these regions are ranked amongst the top five most accessible regions with regard to South Africa. The conclusion is, therefore, that transport times contribute relatively high towards the market accessibility of regions/countries (see Table 3-6 for the loading of each variable towards measuring market accessibility).[71]

Furthermore, Western Europe (87.91); Northern America (81.90); Northern Europe (76.54); Oceania (58.74); Southern Europe (50.54); Eastern Europe (49.71); Western Asia (47.58); and Eastern Asia (44.25) are the only regions whose logistics, customs and infrastructure score is above the sample average (42.84). Four of these regions are ranked in the top five most accessible regions with regard to South Africa. Overall, African regions lack in logistics, customs and infrastructure performance as these regions are all ranked amongst the bottom five in the regional ranking according to their logistics, customs and infrastructure performance − Southern Africa ranks 6th, Northern Africa 12th, Middle Africa 14th, Eastern Africa 15th and Western Africa 16th out of the 17 regions.[72] The following section explains how accessible specific countries are for South African exports.

[71] Please take note that variable loadings are only applicable to a PCA.
[72] Despite their low logistics, customs and infrastructure performance, South Africa's neighbouring countries still performed well in terms of transportation costs and time.

## 4.3 South Africa's market accessibility with regard to worldwide countries

In this section, South Africa's market accessibility is measured on a country level. Table 4-2 shows the 20 most accessible countries with regard to South Africa and their respective sub-index values/scores that were used to calculate an equal weights and a PCA market accessibility index (MAI) value for each country:

Table 4-2: The 20 most accessible countries with regard to South Africa[73]

| Ranking (EW and PCA) | Country | Transportation costs (US$) from South Africa (cost ranking) | Transportation times (days) from South Africa (time ranking) | Logistics, customs and infrastructure (0–100) (logistics, customs and infrastructure ranking) | MAI value (z-score and factor score)[74] | MAI value (0-100) EW and PCA |
|---|---|---|---|---|---|---|
| 1 / 1 | Singapore | 1 367.66 (1) | 19 (2) | 100.00 (1) | 1.98 / 2.60 | 100.00 / 100.00 |
| 2 / 2 | Hong Kong SAR | 1 797.34 (5) | 24 (7) | 95.55 (2) | 1.65 / 2.17 | 91.59 / 91.54 |
| 3 / 3 | Malaysia | 1 433.52 (2) | 22 (6) | 73.84 (25) | 1.57 / 2.00 | 89.51 / 88.16 |
| 4 / 4 | United Arab Emirates | 3 014.47 (20) | 19 (2) | 83.91 (15) | 1.37 / 1.88 | 84.30 / 85.78 |
| 5 / 5 | Korea, Rep. | 2 119.13 (11) | 28 (18) | 81.28 (18) | 1.27 / 1.65 | 81.93 / 81.34 |
| 6 / 6 | Taiwan, China | 2 073.42 (10) | 30 (35) | 80.29 (20) | 1.21 / 1.55 | 80.26 / 79.39 |
| 7 / 8 | Japan | 2 587.47 (16) | 34 (64) | 90.58 (6) | 1.06 / 1.39 | 76.35 / 76.31 |
| 8 / 9 | Australia | 3 018.58 (21) | 26 (10) | 74.37 (24) | 1.03 / 1.38 | 75.60 / 76.06 |
| 9 / 11 | Oman | 3 154.64 (23) | 19 (2) | 53.23 (47) | 0.99 / 1.32 | 74.56 / 74.82 |
| 10 / 15 | Thailand | 1 887.03 (6) | 30 (35) | 53.29 (46) | 0.96 / 1.14 | 73.78 / 71.43 |
| 11 / 7 | Netherlands | 4 064.89 (50) | 27 (14) | 95.31 (3) | 0.95 / 1.40 | 73.70 / 76.44 |
| 12 / 10 | United Kingdom | 4 161.52 (57) | 27 (14) | 92.07 (4) | 0.89 / 1.32 | 72.12 / 74.85 |
| 13 / 14 | Mauritius | 3 401.17 (26) | 16 (1) | 41.29 (58) | 0.89 / 1.19 | 72.03 / 72.33 |
| 14 / 12 | Denmark | 3 844.98 (37) | 27 (14) | 84.19 (14) | 0.89 / 1.27 | 72.00 / 73.94 |
| 15 / 13 | Germany | 4 035.66 (49) | 29 (26) | 91.55 (5) | 0.85 / 1.25 | 71.12 / 73.49 |
| 16 / 16 | Israel | 3 340.67 (25) | 25 (8) | 61.87 (32) | 0.84 / 1.12 | 70.69 / 71.10 |
| 17 / 18 | Cyprus | 3 795.76 (36) | 20 (5) | 51.98 (48) | 0.77 / 1.07 | 69.04 / 70.02 |
| 18 / 19 | New Zealand | 3 576.14 (30) | 30 (35) | 76.25 (23) | 0.77 / 1.07 | 68.99 / 69.95 |
| 19 / 22 | Qatar | 3 451.20 (27) | 30 (35) | 72.88 (26) | 0.76 / 1.04 | 68.86 / 69.50 |
| 21 / 20 | Switzerland | 4 529.89 (87) | 29 (26) | 88.88 (7) | 0.69 / 1.07 | 67.03 / 69.94 |
| **Top 10 country average** | | **1 780.64** | **22** | **91.71** | **1.31 / 1.73** | **82.79 / 82.99** |
| **Bottom 10 country average** | | **6 848.41** | **58** | **5.20** | **-1.46 / -1.95** | **11.79 / 10.92** |
| **Sample average** | | **4 268.96** | **37** | **42.84** | **0.00 / 0.00** | **49.27 / 49.10** |

[73] Please take note that the results of Table 4-2 are based on the most accessible countries with regard to South Africa. If countries are ranked firstly under a sub-index, it does not necessarily mean that these countries rank first in the overall market accessibility index and *vice versa*. One should, therefore, take caution when the results are interpreted. Caution should also be applied to Table 4-3 and 4-4.

[74] A market accessibility index of 0 represents the sample average. Values above 0 indicate above-average market accessibility. Values lower than 0 indicate below-average market accessibility.

From Table 4-2 the following can be derived:

Based on the study analysis, Singapore, Hong Kong, Malaysia, the United Arab Emirates and South Korea are amongst the most accessible countries for South African exporters. In fact, Singapore ranks 1st in the overall MAI rankings for both the equal weights method and a PCA approach. Singapore also ranks 1st in two of the sub-indexes, namely transportation costs and logistics, customs and infrastructure, while rank 2nd in terms of transportation time.

Out of the 133 countries included in the sample, Hong Kong ranks 5th in transportation costs, 7th in transportation time and 2nd in logistics, customs and infrastructure. This indicates that Hong Kong has a world-class transportation infrastructure combined with excellent transport services. Overall, Hong Kong ranks 2nd in the MAI rankings for both the equal weights method and a PCA approach.

Furthermore, Malaysia ranks 3rd in the overall MAI rankings (equal weights method and a PCA approach), despite being ranked 30th in logistics, customs and infrastructure. However, Malaysia ranks 2nd in transportation costs and 6th in transportation times.

The United Arab Emirates ranks 4th on the MAI (in both an equal weights method and a PCA approach) even though the country ranks 20th in transportation costs. Also, the United Arab Emirates ranks 2nd in transportation time and 10th in logistics, customs and infrastructure.

South Korea ranks 11th in transportation costs and 18th in both transportation times and logistics, customs and infrastructure. Overall, the country ranks 5th in both an equal weights method and a PCA approach. Mauritius is the best performing African country and is ranked 13th (equal weights method) and 14th (a PCA approach) in the overall MAI rankings.

The total transportation costs from South Africa is the lowest in Singapore ($1 367.66, 1st); Malaysia ($1 433.52, 2nd); and Hong Kong ($1 797.34, 3rd) which rank all below the top ten country averages for transportation costs. Although Switzerland falls within the 20 most accessible countries with regard to South Africa, its transportation costs ($4 529.89, 87th) are above the sample average ($4 268.96).

Considering total transportation times, Mauritius (16 days, 1st); Singapore (19 days; 2nd); United Arab Emirates (19 days; 2nd); Oman (19 days, 2nd); and Cyprus (20 days, 5th) are below the top ten country average. In other words, it takes South Africa the least number of days to export goods to these countries. The transportation times to and in the top 20 countries are all below the sample average of 37 days.

The logistics, customs and infrastructure index scores are above the top ten country average in Singapore (100.00, 1st); Hong Kong (95.55, 2nd); the Netherlands (95.31, 3rd) and the United Kingdom (92.07, 4th). It is, therefore, the easiest and most efficient to move goods into and from these countries. Mauritius (41.29, 20th) is the only country listed in the 20 most accessible countries with regard to South Africa whose logistics, customs and infrastructure score is below the sample average (42.84).

It is interesting to note that some countries outperform other countries in one or more of the market accessibility indicators, but perform worse in others. For example, Oman's transportation times (19 days, 2nd) contribute to its overall good (top ten) MAI performance, despite being ranked 23rd in transportation costs and 47th in logistics, customs and infrastructure.

Other examples include the Netherlands who ranks third in logistics, customs and infrastructure and 14th in transportation time, but is ranked 50th in transportation costs. The United Kingdom ranks fourth in logistics, customs and infrastructure and 14th in transportation time, but is ranked 57th in transportation costs.

Mauritius ranks first in transportation times (16 days), 26th in transportation costs and 58th in logistics, customs and infrastructure. Germany ranks 5th in logistics, customs and infrastructure and 26th in transportation time, but 49th in transportation costs. Cyprus ranks 5th in transportation time, but ranks 36th in transportation costs and 48th in logistics, customs and infrastructure.

Moreover, the position of the first six countries on the overall MAI remains unchanged regardless of what method was used. These countries include Singapore, Hong Kong, Malaysia, United Arab Emirates, South Korea and Taiwan. However, some of the rankings of the countries differ between the two methods. The biggest difference was for Thailand who ranks 10th based on an equal weights method and 15th based on a PCA approach. Also, the Netherlands ranks 11th based on an equal weights method and 7th

in a PCA approach. Overall, the equal weights method and the PCA approach provided very similar results when comparing the relative rankings of countries between the two methods.

The following table shows the 20 least accessible countries with regard to South Africa and their respective sub-index values/scores that were used to calculate a MAI value for each country.

Table 4-3: The 20 least accessible countries with regard to South Africa

| Ranking (EW and PCA) | Country | Transportation costs (US$) from South Africa (cost ranking) | Transportation times (days) from South Africa (time ranking) | Logistics, customs and infrastructure (0-100) (logistics, customs and infrastructure ranking) | MAI value (z-score/factor score) | MAI value (0–100) EW and PCA |
|---|---|---|---|---|---|---|
| 133 / 132 | Burkina Faso | 7 471.34 (133) | 60 (131) | 15.93 (109) | -1.92 / 2.46 | 0.00 / 0.94 |
| 132 / 133 | Zimbabwe | 5 660.00 (115) | 71 (132) | 14.58 (115) | -1.83 / 2.51 | 2.47 / 0.00 |
| 131 / 130 | Haiti | 6 303.96 (125) | 53 (123) | 0.00 (133) | -1.56 / 2.08 | 9.24 / 8.47 |
| 130 / 131 | Mongolia | 4 404.66 (74) | 71 (132) | 11.15 (120) | -1.53 / 2.22 | 9.94 / 5.63 |
| 129 / 129 | Burundi | 6 716.12 (128) | 51 (118) | 7.54 (125) | -1.52 / 1.97 | 10.32 / 10.62 |
| 128 / 128 | Mali | 7 277.97 (132) | 46 (110) | 16.99 (108) | -1.40 / 1.72 | 13.49 / 15.39 |
| 127 / 125 | Zambia | 5 856.12 (121) | 54 (127) | 20.71 (103) | -1.25 / 1.65 | 17.34 / 16.83 |
| 126 / 127 | Libya | 5 533.81 (112) | 54 (127) | 14.31 (116) | -1.23 / 1.67 | 17.68 / 16.44 |
| 125 / 126 | Côte d'Ivoire | 5 572.05 (114) | 56 (130) | 21.41 (100) | -1.23 / 1.65 | 17.76 / 16.73 |
| 124 / 124 | Ethiopia | 5 305.45 (108) | 54 (127) | 15.83 (111) | -1.16 / 1.58 | 19.65 / 18.17 |
| 123 / 122 | Azerbaijan | 6 923.18 (129) | 43 (98) | 26.52 (93) | -1.10 / 1.32 | 21.16 / 23.26 |
| 122 / 118 | Russian Federation | 6 668.41 (126) | 45 (107) | 33.91 (73) | -1.01 / 1.22 | 23.29 / 25.23 |
| 121 / 120 | Ecuador | 6 221.38 (124) | 49 (114) | 35.37 (67) | -1.01 / 1.26 | 23.33 / 24.39 |
| 120 / 121 | Moldova | 5 058.44 (104) | 53 (123) | 25.61 (94) | -0.95 / 1.30 | 24.96 / 23.69 |
| 119 / 123 | Angola | 4 497.10 (86) | 51 (118) | 6.96 (126) | -0.94 / 1.37 | 25.10 / 22.38 |
| 118 / 107 | Colombia | 7 238.23 (131) | 34 (64) | 30.64 (83) | -0.84 / 0.91 | 27.86 / 31.32 |
| 117 / 119 | Nepal | 3 970.81 (45) | 53 (123) | 12.03 (119) | -0.81 / 1.23 | 28.40 / 25.04 |
| 116 / 113 | Honduras | 6 184.35 (123) | 39 (87) | 23.00 (96) | -0.81 / 0.99 | 28.52 / 29.81 |
| 115 / 108 | Jamaica | 6 713.83 (127) | 39 (87) | 35.85 (66) | -0.80 / 0.91 | 28.64 / 31.22 |
| 114 / 117 | Ghana | 4 298.89 (68) | 53 (123) | 22.11 (99) | -0.79 / 1.15 | 29.08 / 26.62 |
| **Top 10 country average** | | **1 780.64** | **22** | **91.71** | **1.31 / 1.73** | **82.79 / 82.99** |
| **Bottom 10 country average** | | **6 848.41** | **58** | **5.20** | **-1.46 / 1.95** | **11.79 / 10.92** |
| **Sample average** | | **4 268.96** | **37** | **42.84** | **0.00 / 0.00** | **49.27 / 49.10** |

Source: International Trade Centre (2011); World Economic Forum (2014), own calculations were used

From Table 4-3 it is clear that:

Taking all three dimensions of market accessibility measured in this study into consideration, Burkina Faso and Zimbabwe (a neighbouring country) are the least accessible for potential exports from South Africa.

The transportation costs in Burkina Faso ($7 471.34, 133rd); Mali ($7 277.97, 132nd); Colombia ($7 238.23, 131st) and Azerbaijan ($6 923.18, 129th) is above the bottom 10 average. Additionally, Nepal is the only country listed in the 20 least accessible countries with regard to South Africa whose transportation costs are below the sample average.

In terms of transportation times, Zimbabwe (71 days; 132nd), Mongolia (71 days, 132nd) and Burkina Faso (60 days, 131st) are the only countries whose transportation times are above the bottom 10 average. Although Colombia ranks in the 20 least accessible countries with regard to South Africa, it is the only country in this list whose transportation times are below the sample average.

The logistics, customs and infrastructure in Haiti (0.00, 133rd); Angola (6.96, 126th); Burundi (7.54, 125th); Libya (14.31, 116th); Zimbabwe (14.58, 115th); Burkina Faso (15.93, 109th); Ghana (22.11, 99th) and Honduras (23.00; 96th) are below the bottom 10 country average. Additionally, the Russia Federation (33.91, 73rd) and Azerbaijan (26.52, 93rd) are the only countries listed in the 20 least accessible countries with regard to South Africa whose logistics, customs and infrastructure scores are above the sample average. However, the transportation costs and times of these two countries are very high, because there is no direct shipping route to Russia and Azerbaijan is a landlocked country.

Despite the transportation costs being close to the sample average for Mongolia, the country ranks 120th in logistics, customs and infrastructure and 132nd in transportation time (71 days). The transportation costs to Mali, Azerbaijan and Colombia are far above the sample average and bottom 10 country average while the transportation times are below the bottom 10 country average and logistics, customs and infrastructure above the bottom 10 country average in these countries.

As previously explained, some of the rankings of countries differ between the two methods. The biggest difference was observed for Colombia and Jamaica. Colombia

ranks 118th based on an equal weights method and 107th in a PCA approach. Jamaica ranks 115th in an equal weights method and 108th in a PCA approach.

Landlocked countries are expected to be less accessible due to being entirely enclosed by land and their distance from ports. As a result, ten out of the twenty least accessible markets with regard to South Africa are landlocked countries. These countries include Azerbaijan, Burkina Faso, Burundi, Ethiopia, Mali, Moldova, Mongolia, Nepal, Zambia and Zimbabwe (see Table 4-3).

Furthermore, ten out of the twenty least accessible countries with regard to South Africa are African markets. These countries include Burkina Faso, Zimbabwe, Burundi, Mali, Zambia, Côte d'Ivoire, Ethiopia, Angola, Libya and Ghana.

As mentioned in section 1.2, member countries of the SADC region are expected to be amongst the countries in which South Africa has the highest market access due to proximity and regional trade agreements. However, only one SADC member country, namely Mauritius, is in the 20 most accessible country list (see Table 4-2). In the 20 least accessible country list, there are three SADC member countries, namely Angola, Zambia and Zimbabwe (see Table 4-3). To shed more light on this issue, the next section focuses on South Africa's market accessibility with regard to specific member countries in the SADC region.

## 4.4 Comparing South Africa's market accessibility with regard to SADC member countries

In section 4.4, South Africa's market accessibility with regard to SADC member countries[75] are measured. Table 4-4 indicates South Africa's market accessibility with regard to SADC member countries according to both the equal weights method and the PCA approach.

[75] The Southern African Development Community is an inter-governmental organisation headquartered in Botswana. Its main purpose is to develop socioeconomic integration, cooperation as well as security and political cooperation amongst the 15 Southern African countries. Only 11 out of the 15 SADC member countries are included in Table 4-4 due to data limitations, including South Africa. The other three countries include the Democratic Republic of the Congo, the Seychelles and Swaziland. See Appendix F for data on all of the African countries.

The scores of each of the SADC member countries are provided with regard to their proximity to South Africa, transportation costs, transportation times, and logistics, customs and infrastructure (see section 3.4 for calculations).

Table 4-4: South Africa's market accessibility with regard to SADC member countries

| SADC ranking (MAI ranking) | Country | Proximity (km) to South Africa (SADC member country proximity ranking) | Transportation costs (US$) from South Africa (cost ranking) | Transportation times (days) from South Africa (time ranking) | Logistics, customs and infrastructure (logistics, customs and infrastructure ranking) | MAI value (0–100) EW and PCA MAI value (0-100) |
|---|---|---|---|---|---|---|
| **(Equal weights / PCA)** | | | | | | **Equal weights / PCA** |
| 1 (13/14) | Mauritius | 3 643.22 (11) | 3 401.20 (26) | 16 (1) | 41.29 (58) | 72.03 / 72.33 |
| 2 (43/49) | Lesotho | 520.92 (1) | 1 945.00 (7) | 33 (60) | 17.47 (106) | 60.58 / 56.41 |
| 3 (51/50) | Namibia | 954.45 (3) | 4 288.90 (67) | 25 (8) | 32.73 (78) | 55.96 / 56.31 |
| 4 (63/70) | Botswana | 932.63 (2) | 3 610.00 (33) | 35 (69) | 30.59 (84) | 51.43 / 49.93 |
| 5 (72/73) | Madagascar | 2 745.12 (9) | 4 108.80 (52) | 26 (10) | 9.65 (123) | 49.71 / 48.68 |
| 6 (80/81) | Mozambique | 1 834.77 (5) | 4 454.80 (80) | 26 (10) | 6.13 (129) | 46.37 / 45.64 |
| 7 (81/85) | Malawi | 2 252.18 (8) | 2 870.00 (19) | 43 (98) | 17.39 (107) | 45.83 / 42.08 |
| 8 (89/89) | Tanzania | 2 968.44 (10) | 3 911.10 (42) | 36 (76) | 6.74 (127) | 41.71 / 39.45 |
| 9 (119/123) | Angola | 2 217.35 (7) | 4 497.10 (86) | 51 (118) | 6.96 (126) | 25.10 / 22.38 |
| 10 (127/125) | Zambia | 2 004.36 (6) | 5 856.10 (121) | 54 (127) | 20.71 (103) | 17.34 / 16.83 |
| 11 (132/133) | Zimbabwe | 1 429.68 (4) | 5 660.00 (115) | 71 (132) | 14.58 (115) | 2.47 / 0.00 |
| **SADC country average** | | **1 954.83** | **4 054.82** | **38** | **18.57** | **42.59 / 40.91** |
| **Top 10 country average** | | **1 785.99** | **1 780.64** | **22** | **91.71** | **82.79 / 82.99** |
| **Bottom 10 country average** | | **1 3294.95** | **6 848.41** | **58** | **5.20** | **11.79 / 10.92** |
| **Sample average** | | **8 168.96** | **4 268.96** | **37** | **42.84** | **49.27 / 49.10** |

Source: International Trade Centre (2011); World Economic Forum (2014), own calculations were used

From Table 4-4 it is clear that:

Mauritius (72.03, 1st); Lesotho (60.58, 2nd); Namibia (55.96, 3rd); Botswana (51.43, 4th); and Madagascar (49.71, 5th) are amongst the most accessible SADC member countries for South Africa. Although no SADC member country's market accessibility is above the top 10 country average, these countries still performed above the sample average. Nonetheless, Zimbabwe (2.47, 11th) is the only SADC member country whose market accessibility is below the bottom 10 country average.

Lesotho is the only country whose transportation costs ($1 945.00, 7th) are below the top 10 country average. This makes Lesotho the least expensive SADC member country for South Africa to export to. Additionally, the transportation costs of Lesotho ($1 945.00, 7th); Malawi ($2 870.00, 19th); Mauritius ($3 401.20, 26th); Botswana ($3 610.00, 33rd); Tanzania ($3 911.10, 42nd) and Madagascar ($4 108.80, 52nd) are below the sample average.

Countries whose transportation costs are above the sample average include Namibia ($4 288.90, 67th); Mozambique ($4 454.80, 80th); Angola ($4 497.10, 86th); Zimbabwe ($5 660.00, 115th) and Zambia ($5 856.10, 121th). In fact, not one of the SADC member countries' transportation costs are above the bottom 10 country average.

Considering the transportation times of countries from South Africa, Mauritius (16 days, 1st) is the only country below the top 10 country average. Furthermore, the transportation times of Mauritius (16 days, 1st); Namibia (25 days, 8th); Madagascar (26 days, 10th); Mozambique (26 days, 10th); Lesotho (33 days, 60th); Botswana (35 days, 69th) and Tanzania's (36 days, 76th) are all below the sample average.

The transportation times of Malawi (43 days, 98th); Angola (51 days, 118th); Zambia (54 days, 127th) and Zimbabwe (71 days, 132nd) are above the sample average. Zimbabwe is the only SADC member country whose transportation times are above the bottom 10 country average.

Overall, SADC member countries lag in logistics, customs and infrastructure performance as not one of the countries' logistics, customs and infrastructure score is above the sample average. In fact, the SADC average is 18.57 while the sample average is 42.84. Compared to the non-African regions in Table 4-1, this is amongst the lowest regional averages in the world.

It is worth noting that Western Europe, South-Eastern Asia, Northern Europe, Western Asia, Oceania, Eastern Asia, Southern Europe, Northern America and Eastern Europe and Central America are all further away from South Africa in proximity, but offer higher accessibility than the average SADC member country. In fact, North and Central American countries are on average more than six times further away from South Africa, yet these countries offer a higher overall accessibility with regard to South Africa.

Despite the proximity of the SADC member countries, the logistics and customs inefficiency and poor infrastructure seem to hamper the accessibility of these markets.[76]

The following section provides a summary and conclusion of chapter 4.

## 4.5 Summary

As expected, advanced economies are more accessible with regard to South African exports than developing countries. Advanced economies dominate the South African market accessibility index rankings with 17 countries being high-income countries amongst the top 20 most accessible markets for South Africa. These countries typically enjoy lower trade costs, because economic development is intimately associated with enhanced capabilities in infrastructure, administration and regulation. These factors all lead to lower transportation costs and time as explained in literature (see chapter 2). The remaining three countries in the top 20 are upper middle-income countries, namely Malaysia, Thailand and Mauritius.

Twelve countries out of the twenty most accessible countries with regard to South Africa are Asian markets. Of these countries five are Western Asian countries, namely the United Arab Emirates (4th); Oman (9th); Israel (16th); Cyprus (17th) and Qatar (19th). Four countries are in Eastern Asia, namely Hong Kong (2nd); South Korea (5th); Taiwan (6th) and Japan (7th). The other three countries are from South-Eastern Asia, namely, Singapore (1st); Malaysia (3rd) and Thailand (10th).

Five European countries were identified. Of these countries, three are Western European countries, namely the Netherlands (11th); Germany (15th) and Switzerland (20th). Two identified countries are in Northern Europe, namely the United Kingdom (12th) and Denmark (14th). Of the remaining economies in the top 20, two are Oceania countries, namely Australia (8th) and New Zealand (18th) while Mauritius (13th) is the only African country listed in the 20 most accessible markets with regard to South Africa.

One would expect that South Africa has the privilege of higher market access to countries within the SADC region. However, in Tables 4-2 to 4-4 it is clear that South Africa finds it

[76] Please take note that the proximity to South Africa as a variable was not included in the MAI, but used to indicate that proximity does not necessarily translate into higher market access in the case of SADC member countries.

more difficult to access these markets particularly due to the fact that they lack in logistics, customs and infrastructure efficiency.

Furthermore, the SADC region which is on average 1 954.83 km away from South Africa with an overall average MAI of 42.59 is less accessible than Western Europe (9017.40 km, 67.90); South-Eastern Asia (10 009.08 km, 65.69); Northern Europe (10 052.41 km, 62.22); Western Asia (7 536.29 km, 57.19); Oceania (10 224.12 km, 56.51); Eastern Asia (10 225.18 km, 55.14); Southern Europe (8 164.75 km, 53.92); Northern America (12 546.35 km, 53.40); Eastern Europe (9 256.56 km, 45.12) and Central America (12 818.55 km, 43.17), which indicate that proximity does not generally translate to higher market access (see sections 4.3 and 4.4).

Ten out of the twenty least accessible countries with regard to South Africa are African countries. Of these countries, five are low-income countries, namely Burkina Faso (133rd); Zimbabwe (132nd); Burundi (129th); Mali (128th) and Ethiopia (124th). Three countries are lower middle-income countries, namely Zambia (127th); Côte d'Ivoire (126th) and Ghana (114th). Two countries are upper middle-income countries, namely Libya (125th) and Angola (119th). Lower-income countries typically experience higher trade costs due to their underdeveloped economy and poor infrastructure (see section 2.2.7). As a result, South African faces higher transportation costs to export to these countries (see Appendix D for the transportation costs analysis).

Of the remaining countries listed in the 20 least accessible markets with regard to South Africa, two countries fall under Eastern Asia, namely Mongolia (130th, upper middle-income) and Nepal (117th, low-income) while one country falls under Western Asia, namely Azerbaijan (123rd, upper middle-income). Two countries are South American countries, namely Ecuador (121st, upper middle-income) and Colombia (118th, upper middle-income) while one country falls under Central America, namely Honduras (116th, lower middle-income).

Additionally, two Caribbean countries are included, namely Haiti (131th, low-income) and Jamaica (115th, upper middle-income). One Oceania country is included, namely Moldova (120th, lower middle-income).

Overall, the most accessible regions with regard to South Africa are Western Europe, South-Eastern Asia and Northern Europe while the Caribbean, Western Africa and Eastern Africa are the least accessible regions.

The efficiency of logistics, customs and border administration as well as infrastructure quality seem to be the biggest problems for Southern African countries. South Africa, therefore, does not take advantage in trading with its neighbouring countries or with SADC member countries closer in proximity.

Also, upper middle-income countries bear an uneven share of global trade costs despite the fact that they have become more integrated into the world economy in recent years. Some middle-income countries have been successful in reducing high trade costs, but low-income countries still struggle with obstinate high trade costs.

The summary, conclusions and recommendations of this study follow in chapter 5.

# CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

As mentioned in chapter 1, the South African government regards growth in exports and export diversification as key points in achieving their macroeconomic goals. However, South Africa continuously faces trade impediments that inhibit and impede their access to other markets. Based on the above-mentioned description, the primary objective of this study was to determine the global market accessibility for South African exports (see section 1.3.1).

In order to reach the primary objective, a number of secondary objectives have been formulated, namely (i) to identify from relevant literature, the different impediments to trade or trade costs which influence the market accessibility of markets; (ii) to analyse from literature the impact that trade impediments have on international trade; (iii) to collect data on trade impediments that are quantifiable and to compare the size of the trade impediments faced by South Africa's exports in countries around the world; (iv) to develop a market accessibility index for South Africa's exports in countries around the world; (v) to determine whether SADC member countries are indeed amongst the countries in which South Africa has the highest market access due to proximity; and lastly, (vi) to propose recommendations to South African exporters and export promotion organisations on the typical trade impediments they face in different world regions and specific countries in order for them to plan their export endeavours accordingly (see section 1.3.2).

The research method included a literature and empirical study. In the literature study, the different trade impediments to trade were identified in international trade literature and discussed. Additionally, an overview of the empirical evidence of each impediment's impact on international trade was given from literature. The empirical study investigated, measured and compared the trade impediments to export from South Africa to different markets around the world. Two different approaches were used, namely an equal weights method and a PCA approach.

In the first chapter, an introduction to this study was provided by stating the background, problem statement, motivation, objectives, method and outline of the chapters. The literature study in chapter 2 provided an overview of current literature on the impediments

to trade and the impact of these impediments on international trade. Chapter 3 provided a description of the research methodology and data analysis techniques used to construct a South African MAI. Chapter 4 provided the results of South Africa's market access to other world countries.

The objectives of this study are provided in Table 5-1 together with the different chapters in which each objective was addressed.

Table 5-1: Meeting of objectives (stated in section 1.3)

| | **Objective:** | **Where reached:** |
|---|---|---|
| 1. | To provide a literature overview of the different impediments to trade or trade costs, which influence the market accessibility of markets. | Chapter 2 |
| 2. | To analyse from literature the impact that trade impediments have on international trade. | |
| 3. | To collect data on trade impediments that are quantifiable and to compare the size of the trade impediments faced by South Africa in different world regions and countries. | Chapter 3 |
| 4. | To develop a market accessibility index for South Africa's exports in countries around the world. | |
| 5. | To determine whether SADC member countries are indeed amongst the countries in which South Africa has the highest market access due to proximity. | Chapter 4 |
| 6. | To propose recommendations to South African exporters and export promotion organisations on the typical trade impediments they face in different world regions and specific countries. | Chapter 5 |

Source: The researcher's own table

## 5.2 Summary of the results and conclusions of the study

Chapter 2 focused on defining and identifying the different impediments to trade and the impact these impediments have on international trade. Table 3-7 summarises literature on the impact of each trade impediment included in the market accessibility index developed in this study.

Transportation costs associate negatively with trade. It was also found that transportation costs depend on many complex details concerning infrastructure, geography and administrative impediments. Transportation costs increase export prices that result in priced export products that are uncompetitive. Transportation costs increase the prices of imported goods, which in turn increase the costs of domestic production (see section 2.2.3).

Trade time was found to be an important competitive factor and is viewed as a trade impediment in its own right. Time does not only affect the volume of trade, but also the

ability of companies to enter export markets. Furthermore, it was found that the longer it takes to ship goods, the more expensive merchandise become which again leads to uncompetitive export prices. The costs of time can, however, be reduced over time due to more effective multi-modal transportation, reduced air transport costs and faster ships (see section 2.2.4).

Efficient logistics are found to not only reduce the costs and times of transportation, but also the costs of production. Countries have more recently begun to increase their focus on improving their logistics performance, given the major impact logistics have on economic activities. Logistics include customs and border procedures, the quality of infrastructures and the efficiency of ports (see section 2.2.5).

Excessive customs and border procedures inhibit trade. By improving customs and border procedures, trade can be increased, but contributions of both trading partners are needed even if one contributor contributes more than the other. Efficient border administration and coordination of the different agencies involved in border clearance were also found to be increasingly important in trading processes. Delays caused by factors, such as administrative procedures, are found to have similar effects on exporting as delays in shipping times. Border delays also tend to increase the prices of goods in transit. There is, however, scope for reducing time spent at customs and at all stages of border processes (see section 2.2.6).

The quality of infrastructure was found to have a significant and relatively large effect on bilateral trade flows. Infrastructure includes both physical transportation infrastructure, such as port facilities, roads and rail networks and telecommunications infrastructure. Improved infrastructures were found to reduce trade costs and time while poor infrastructures result in increased trade costs (see section 2.2.7).

High trade costs impede the ability of countries to take full advantage of market access opportunities created by a bilateral trading system. Obsolete or ill-adapted infrastructures, cumbersome and time-consuming border procedures and high transportation costs all serve to price too many companies out of international trade (see section 2.2).

Trade costs alone do not explain the development pathways of individual economies − they are key factors in clarifying why some economies are unable to diversify or grow their exports. Upper middle-income countries bear an uneven share of global trade costs

despite the fact that they have become more integrated into the world economy in recent years. Some middle-income countries are successful in reducing high trade costs, but low-income countries still struggle with high trade costs (see section 4.3; 4.4 and Table D-1).

Overall, the competitive advantages of countries remain unexploited while they struggle to convert their market access into a market presence (see section 2.2).

In chapter 3, the methodology and data analysis techniques used to compile a South African market accessibility index were explained. Firstly, a description of the data on the trade impediments found in literature were provided that could be used in a South African market accessibility index. This description in particular, explained how each variable was measured, what was included in each variable and where the data were obtained (see section 3.2).

However, before all these variables were included in a composite market accessibility index, the distribution of the data was examined, outliers were identified, the correlation amongst the variables was investigated and the data were standardised (see section 3.3).

A South African market accessibility index was constructed by making use of two methods. An equal weights method (variables are weighted equally within each category and amongst categories) and a PCA approach (a statistical procedure that makes use of a linear transformation to convert different variables into a smaller set of values of linearly uncorrelated variables) were used in the study. Accordingly, these two approaches and their appropriateness in constructing an index were explained (see section 3.4).

Chapter 4 detailed the market accessibility of selected countries with regard to South Africa. Firstly, South Africa's market accessibility was analysed on a regional level using both an equal weights method and a PCA approach. To perform this analysis, the average transportation costs, transportation times, and logistics, customs and infrastructure score with regard to South Africa were illustrated (see section 4.2).

Western Europe is the most accessible region for South African exports. This region is followed by South-Eastern Asia and Northern Europe. The Caribbean, Western Africa and Eastern Africa regions are the least accessible for South African exports. Overall, African regions lack logistics, customs and infrastructure performance as these regions

are all ranked amongst the bottom five in the regional logistics, customs and infrastructure rankings (see section 4.2). As a result, Southern Africa ranks 6th out of 17 regions; Northern Africa 12th, Middle Africa 14th, Eastern Africa 15th and Western Africa 16th in terms of their market accessibility (see Table 4-1).

Secondly, South Africa's market accessibility to worldwide countries was analysed. Table 4-2 illustrates the 20 most accessible markets with regard to South Africa and their respective sub-index values/scores that were used to calculate an equal weights method and a PCA MAI value for each country. Singapore; Hong Kong; Malaysia; the United Arab Emirates and South Korea are the most accessible countries for South African exports (see section 4.3).

The 20 least accessible countries for South African exports were also identified. Burkina Faso and Zimbabwe (a neighbouring country) are the least accessible for exports from South Africa. This is followed by Haiti; Mongolia and Burundi. Interestingly, ten out of the twenty least accessible markets with regard to South Africa are African markets (see Table 4-3).

Specifically, South Africa's market accessibility with regard to SADC member countries was investigated. It was found that the average costs and times for South Africa to export to SADC member countries are very close to the sample average although it was expected to be much lower due to proximity. However, SADC member countries lag far behind in logistics, customs and infrastructure performance. In fact, the average of SADC member countries is 18.57 while the sample average is 42.84. Compared to the non-African regions in Table 4-1, this is the lowest regional average. Furthermore, Western Europe; South-Eastern Asia; Northern Europe; Western Asia; Oceania; Eastern Asia; Southern Europe; Northern America; Eastern Europe and Central America are all further away from South Africa in proximity, but offer higher accessibility than the average SADC member country.

Regardless of the proximity, logistics and customs inefficiency as well as poor infrastructure of SADC member countries seem to restrict South Africa's access to these markets.

The following section explains the contribution of the study.

## 5.3 Contribution of the study

By examining issues linked to market access in international trade and specifically the market access of South African exports to different countries, this study provides important information on specific measures which can enable South Africa to benefit from trade in the future.

The specific contributions of this study are as follows:

- To assist South African export promotion organisations to better understand the impediments that may be faced in trading with different countries around the world.
- To introduce a method to calculate market access from a South African exporter's point of view (the research method described in section 3.4 and results reported in section 4.2 to 4.4 (see Table 4-1 to 4-4)).
- To determine South Africa's market access into other African countries, specifically SADC member countries. Also to compare South Africa's access into other African countries to other world regions (motivation described in section 1.1 and results given in section 4.4).

The following section concludes the study by providing recommendations made from the findings of this study.

## 5.4 Recommendations

The following recommendations are offered for South African export promotion organisations and for further research in the field of market accessibility.

### 5.4.1 Recommendation to South African policymakers and export promotion organisations

This study provides information on the trade impediments South African exporters face in different world regions and in specific countries (see Appendix D). The study identifies markets that are more (and less) accessible to South African exporters.

In more accessible markets, South African export promotion organisations should investigate and identify specific export opportunities to pursue. This means that they

should do additional research on import demands, competitors, technical requirements and standards in these markets.

For less accessible countries, policymakers and export promotion organisations should investigate ways to reduce the specific trade impediments that limit accessibility. This can include more general trade policies, preferential access agreements and cooperation during trade facilitation initiatives, such as the World Trade Facilitation Agreement).

Specifically, access to SADC member countries that is viewed as priority markets by the government for regional integration and trade should be addressed. Policymakers and export promotion organisations should specifically focus on impediments which relate to logistics, customs and infrastructure. This can include engagements with the policymakers of these member countries to simplify and streamline customs and border procedures and to invest in both physical and communication infrastructure projects.

As a result, South African exporters can hopefully compete better in the face of ever-increasing international competition.

### 5.4.2 Limitations of the study and recommendations for future research

This study used and compared two different approaches to compile a market accessibility index for South African exports due to the fact that no clear indication in literature was found on how to weigh all the different trade impediments relative to one another.

The study followed the World Economic Forum's ETI approach by making use of an equal weights method and employed a PCA approach to compare with the results obtained from the equal weights method.

The results of the two approaches were similar in terms of the relative ranking of the different countries.

However, a PCA approach has certain prerequisites to which data should adhere. Amongst others, the variables included in the analysis should be normally distributed and not correlate lower than 0.3 or higher than 0.9 with each other. This meant that tariffs were not included in the analysis (see section 3.3.1 and Figure A-1). However, tariffs (and non-tariff barriers if more updated data become available) are determined by policymakers and do not correlate with the other variables used in this study.

For the purpose of this study, the same variables were used in both the analyses in order to be able to compare the results of the two approaches.

For future research on this topic where multidimensional, uncorrelated (but relevant) variables are included, the equal weights method (as suggested by the World Economic Forum) should be used. Care needs to be taken in identifying the different categories of variables and not to overemphasise certain variables. Tariffs theoretically forms an important part of market access for which the equal weights method would be more desirable.

Furthermore, only ocean freight was used in the measurement of international shipping times and costs due to the difficulty of obtaining transportation quotes and times in transit for all modes of transport. In this study, quotes to ship a 20-foot general cargo container from the Durban harbour, South Africa, to various countries around the world were obtained from an online source, namely www.worldfreightrates.com (see section 3.2.3).

For future research, it is recommended that shipping quotes be obtained directly from shipping lines or freight forwarders operating in South Africa to compare to the (easier to access) web information and to confirm the accuracy of this information.

## APPENDIX A:

Figure A-1: Normal distribution of the tariff index

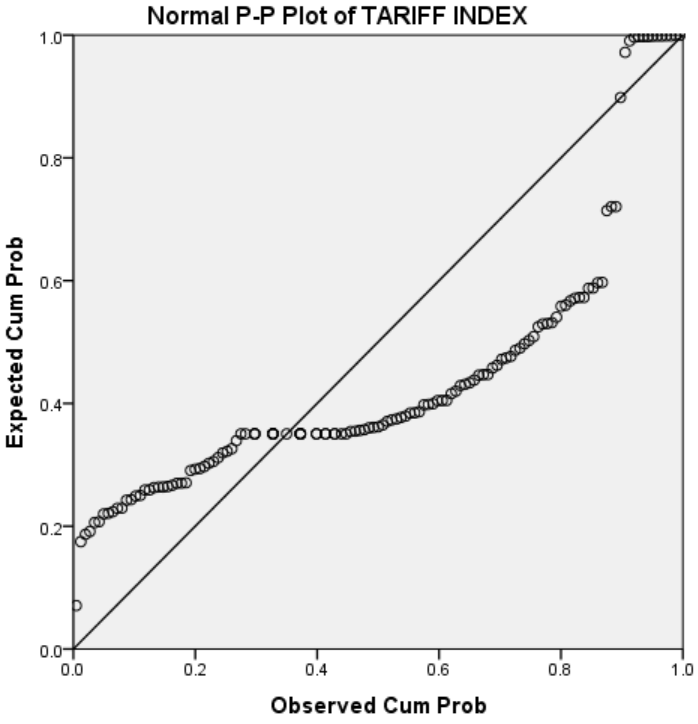



Figure A-2: Normal distribution plot of the South African average tariff rate

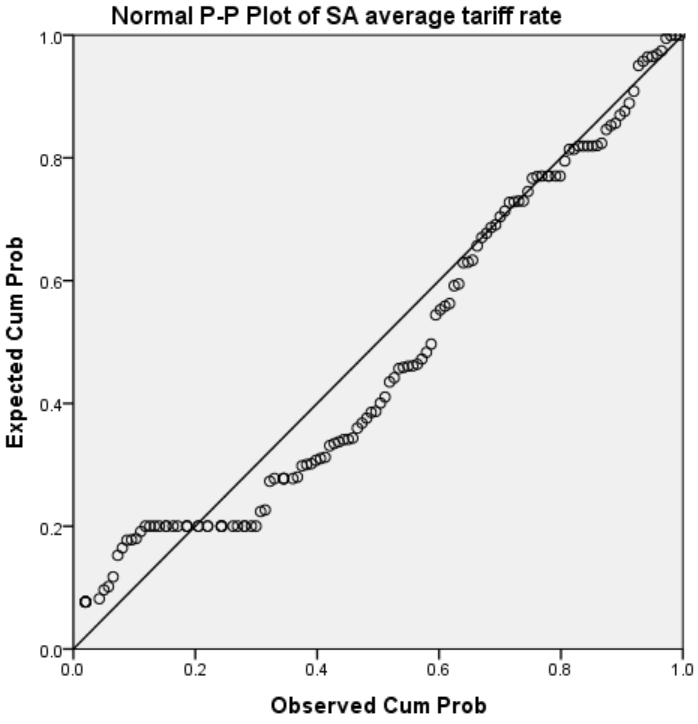


Figure A-3: Normal distribution plot of the cost index

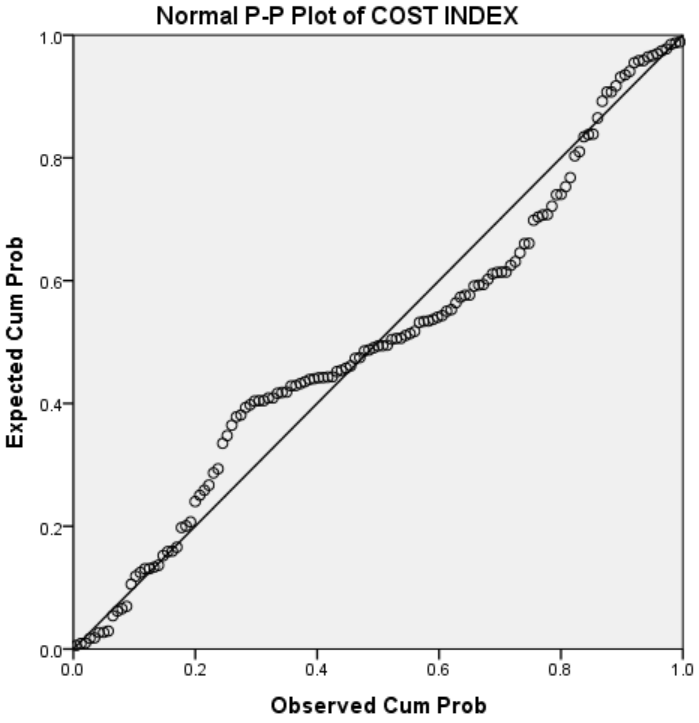



Figure A-4: Normal distribution plot of the time index

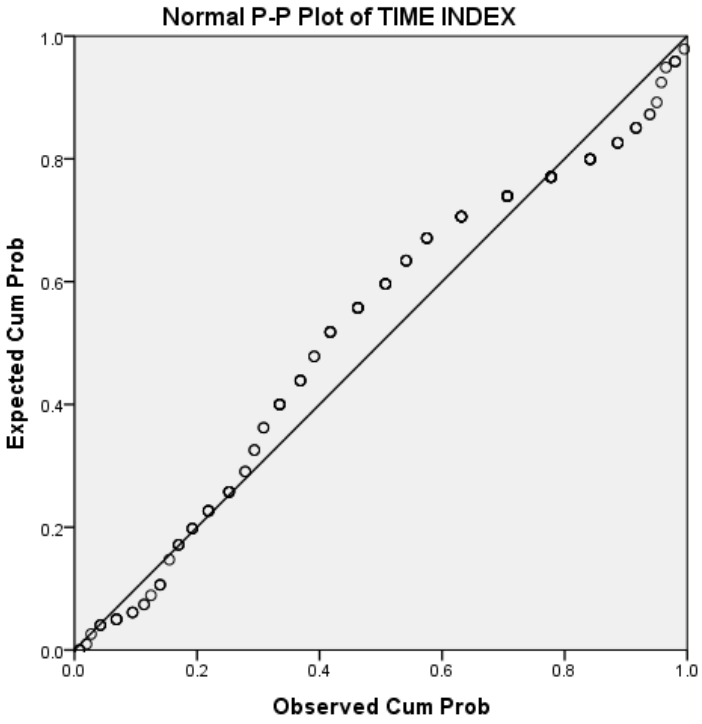


Figure A-5: Normal distribution plot of the logistics index

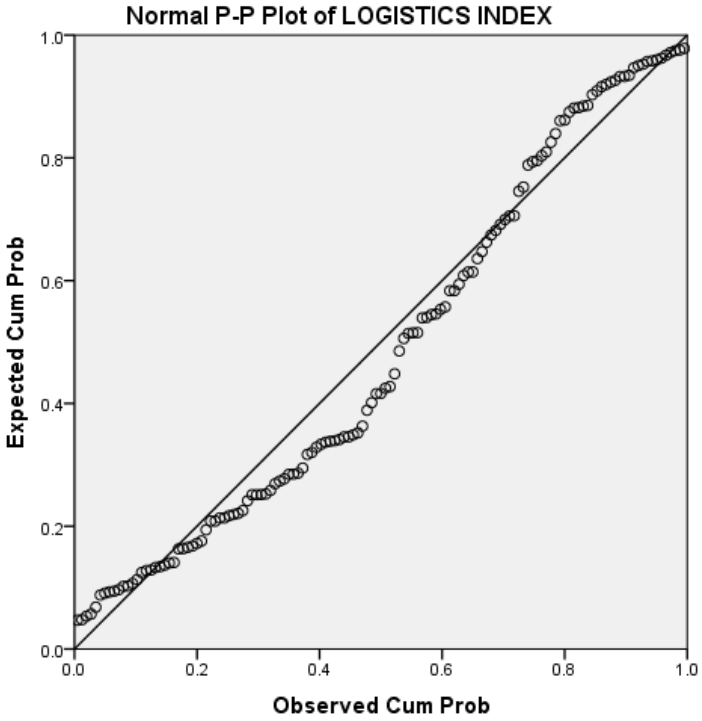



Figure A-6: Normal distribution plot of the customs and border administration

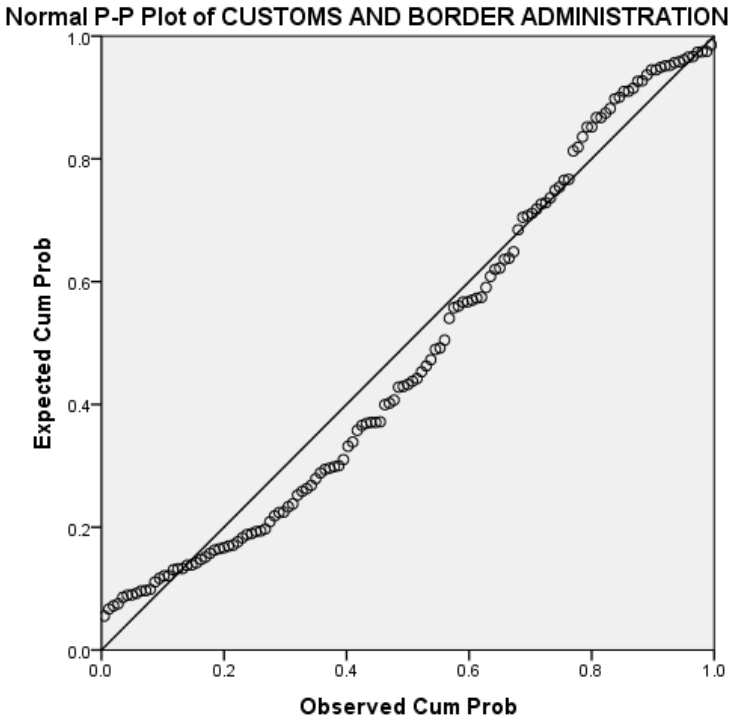
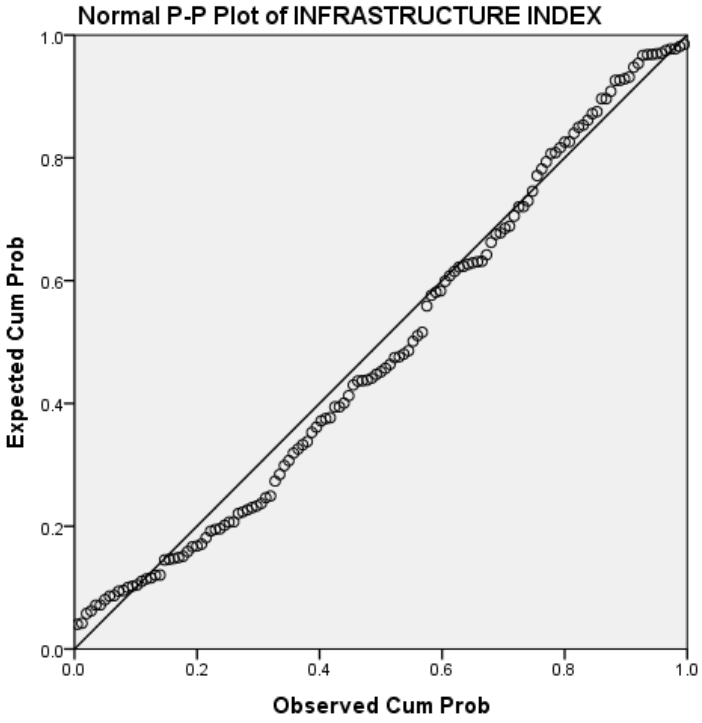


Figure A-7: Normal distribution plot of the infrastructure index



## APPENDIX B:

Figure B-1: A box plot to identify outliers under the South African average tariff rate

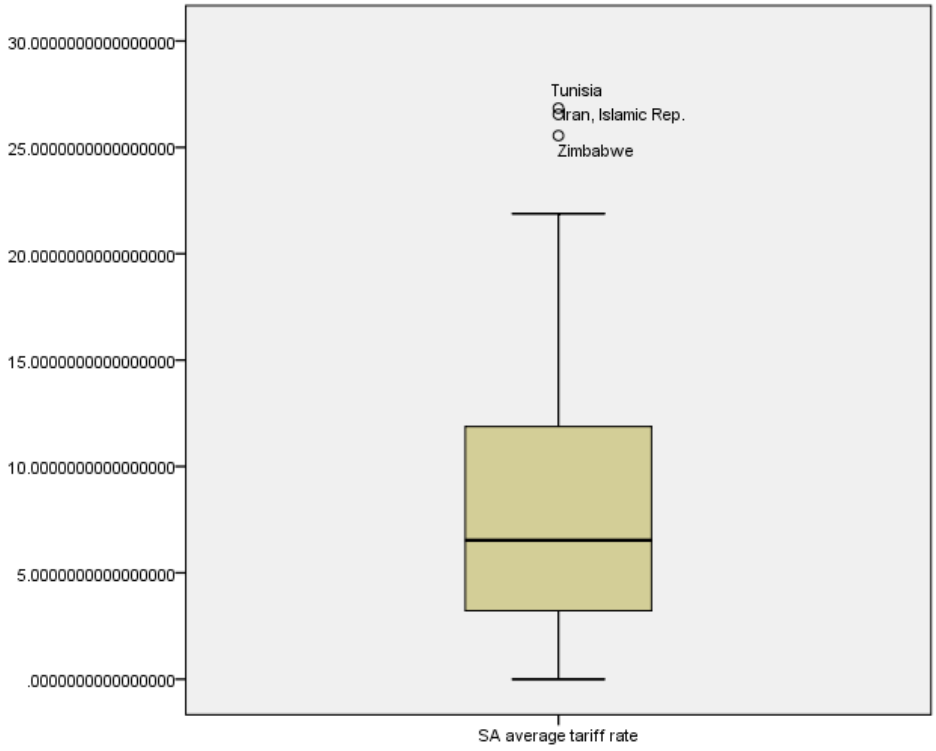



Figure B-2: A box plot to identify outliers under the complexity of tariffs

Figure B-3: A box plot to identify outliers under the share of duty free imports

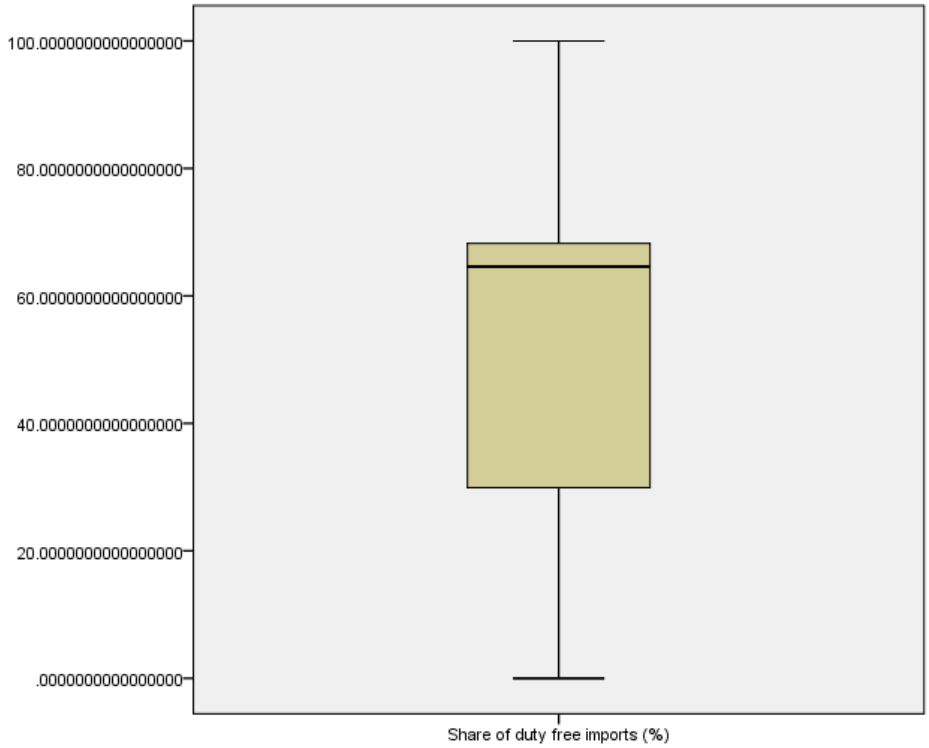



Figure B-4: A box plot to identify outliers under transport cost

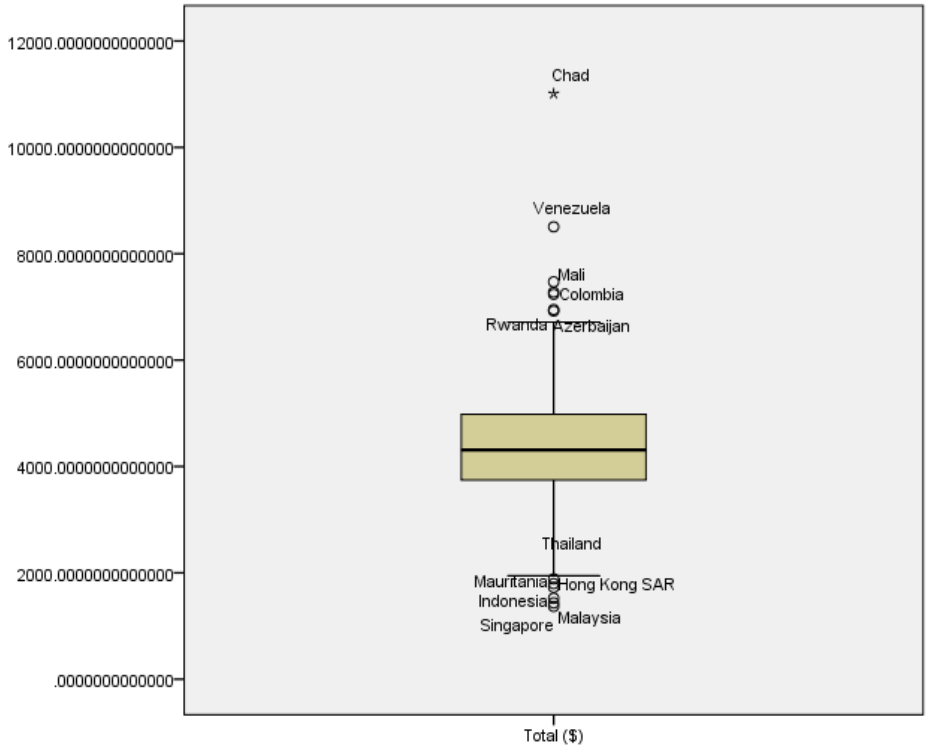
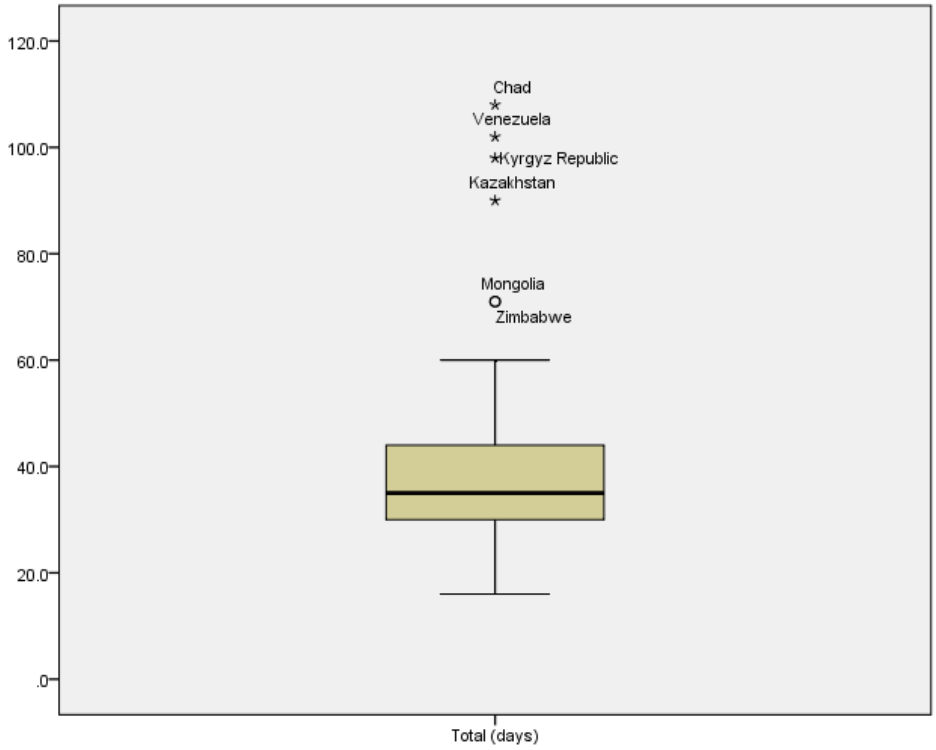


Figure B-5: A box plot to identify outliers under transport time



# APPENDIX C:

Table C-1: Outlier country data for all variables

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chad | 17.82 | 11009.87 | 108 | 2.33 | 2.34 | 2.71 | 3.02 | 2.07 | 2.46 | 11 | 1.75 | 2.29 | 1.92 | 1.46 |
| Venezuela | 13.34 | 8506.31 | 102 | 2.94 | 2.76 | 2.92 | 3.18 | 2.10 | 2.39 | 9 | 1.90 | 1.92 | 2.23 | 3.66 |
| Kyrgyz Republic | 4.54 | 6622.10 | 98 | 2.43 | 2.13 | 2.20 | 2.36 | 3.18 | 2.03 | 11 | 2.50 | 3.56 | 2.59 | 3.43 |
| Kazakhstan | 10.38 | 6319.66 | 90 | 2.68 | 2.72 | 2.83 | 3.24 | 4.36 | 2.33 | 12 | 3.80 | 3.97 | 3.59 | 4.90 |

# APPENDIX D:

Table D-1: Country data for all variables

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 4.99 | 3744.78 | 35 | 2.84 | 2.65 | 2.65 | 3.58 | 3.45 | 2.43 | 8.00 | 3.22 | 3.53 | 2.44 | 3.812 |
| Algeria | 18.56 | 4353.49 | 46 | 2.54 | 2.54 | 2.54 | 3.04 | 2.78 | 2.71 | 9 | 1.98 | 3.02 | 2.74 | 2.58 |
| Angola | 7.30 | 4497.10 | 51 | 2.79 | 2.31 | 2.59 | 3.02 | 1.81 | 2.37 | 9 | 2.16 | 2.50 | 2.07 | 2.02 |
| Argentina | 12.75 | 5346.78 | 44 | 2.96 | 2.93 | 3.15 | 3.49 | 2.87 | 2.55 | 8 | 2.26 | 1.91 | 2.71 | 4.39 |
| Armenia | 3.05 | 5538.18 | 36 | 2.75 | 2.75 | 2.50 | 3.00 | 3.98 | 2.63 | 8 | 3.02 | 3.66 | 3.40 | 3.83 |
| Australia | 2.75 | 3018.58 | 26 | 3.52 | 3.75 | 3.81 | 4.00 | 5.05 | 3.85 | 7 | 5.42 | 4.52 | 4.52 | 5.86 |
| Austria | 3.22 | 4250.66 | 30 | 3.26 | 3.56 | 3.93 | 4.04 | 5.09 | 3.53 | 4 | 5.13 | 5.22 | 5.03 | 5.76 |
| Azerbaijan | 9.12 | 6923.18 | 43 | 2.57 | 2.14 | 2.14 | 2.57 | 4.52 | 2.57 | 11 | 3.02 | 3.49 | 3.89 | 4.22 |
| Bahrain | 5.13 | 3453.00 | 28 | 3.04 | 3.04 | 3.29 | 2.80 | 5.35 | 3.29 | 8 | 5.20 | 4.69 | 4.36 | 5.78 |
| Bangladesh | 14.56 | 3186.18 | 50 | 2.82 | 2.64 | 2.45 | 3.18 | 3.28 | 2.09 | 8 | 2.04 | 3.11 | 2.34 | 2.40 |
| Belgium | 3.22 | 4475.47 | 29 | 3.80 | 4.11 | 4.11 | 4.39 | 5.39 | 3.80 | 4 | 5.47 | 5.18 | 5.22 | 5.37 |
| Benin | 11.91 | 4561.34 | 38 | 2.69 | 2.35 | 2.45 | 2.85 | 2.52 | 2.64 | 7 | 2.07 | 3.29 | 2.08 | 2.42 |
| Bhutan | 21.88 | 3900.81 | 52 | 2.38 | 2.48 | 2.28 | 2.28 | 3.50 | 2.09 | 12 | 4.06 | 3.68 | 2.77 | 2.64 |
| Bolivia | 11.17 | 5164.24 | 42 | 2.35 | 2.68 | 2.68 | 2.60 | 3.66 | 2.40 | 6 | 2.11 | 3.70 | 2.50 | 3.15 |
| Bosnia & Herzegovina | 6.60 | 4249.68 | 31 | 2.78 | 2.73 | 2.55 | 3.44 | 3.66 | 2.41 | 8 | 4.16 | n/a | 2.78 | 3.76 |
| Botswana | 0.00 | 3610.00 | 35 | 2.42 | 2.58 | 2.40 | 2.94 | 3.39 | 2.38 | 6 | 4.40 | 3.93 | 3.14 | 3.71 |
| Brazil | 13.70 | 4561.63 | 30 | 2.80 | 3.05 | 3.03 | 3.39 | 3.10 | 2.48 | 8 | 3.86 | 2.88 | 2.65 | 4.72 |
| Bulgaria | 3.22 | 4577.95 | 34 | 3.31 | 3.00 | 2.88 | 4.04 | 4.05 | 2.75 | 5 | 3.93 | 4.26 | 3.31 | 4.72 |
| Burkina Faso | 11.91 | 7471.34 | 60 | 2.63 | 2.63 | 2.49 | 3.21 | 3.10 | 2.50 | 9 | 2.38 | 3.53 | 2.32 | 2.21 |
| Burundi | 12.86 | 6716.12 | 51 | 2.60 | 2.51 | 2.51 | 2.76 | 2.69 | 2.60 | 10 | 2.19 | 2.82 | 2.33 | 1.54 |
| Cambodia | 14.19 | 2510.40 | 41 | 2.83 | 2.67 | 2.92 | 2.75 | 3.62 | 2.67 | 9 | 2.39 | 3.66 | 2.46 | 3.13 |
| Cameroon | 17.81 | 4151.87 | 35 | 2.20 | 2.52 | 2.52 | 2.80 | 2.98 | 1.86 | 11 | 2.56 | 3.63 | 2.45 | 2.33 |
| Canada | 3.72 | 5766.90 | 44 | 3.46 | 3.94 | 3.97 | 4.18 | 5.53 | 3.61 | 3 | 5.55 | 4.32 | 4.85 | 5.35 |
| Chile | 5.99 | 4349.24 | 30 | 3.12 | 3.19 | 3.30 | 3.59 | 4.53 | 3.17 | 5 | 5.72 | 5.02 | 3.53 | 5.02 |
| China | 9.67 | 2069.66 | 45 | 3.50 | 3.46 | 3.50 | 3.87 | 4.57 | 3.21 | 5 | 3.93 | 4.46 | 5.14 | 3.73 |

Table D-1: Country data for all variables (continues)

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colombia | 6.46 | 7238.23 | 34 | 2.72 | 2.64 | 2.55 | 2.87 | 3.32 | 2.59 | 6 | 3.43 | 3.86 | 2.48 | 4.34 |
| Costa Rica | 5.45 | 5678.87 | 36 | 2.63 | 2.86 | 2.83 | 3.04 | 3.49 | 2.39 | 5 | 3.89 | 3.89 | 2.44 | 4.20 |
| Côte d'Ivoire | 11.91 | 5572.05 | 56 | 2.87 | 2.62 | 2.97 | 3.31 | 3.28 | 2.33 | 10 | 3.02 | 3.38 | 2.59 | 2.70 |
| Croatia | 4.94 | 4234.68 | 33 | 2.98 | 3.00 | 3.11 | 3.37 | 4.39 | 2.95 | 7 | 3.70 | 4.50 | 3.78 | 4.99 |
| Cyprus | 0.85 | 3795.76 | 20 | 3.01 | 2.92 | 3.00 | 3.31 | 4.85 | 2.88 | 7 | 4.98 | 4.88 | 3.95 | 4.46 |
| Czech Republic | 3.22 | 4285.66 | 39 | 3.59 | 3.51 | 3.56 | 3.73 | 5.13 | 3.24 | 6 | 3.93 | 4.53 | 4.48 | 5.21 |
| Denmark | 3.22 | 3844.98 | 27 | 3.65 | 3.74 | 3.36 | 4.39 | 5.43 | 3.79 | 3 | 5.49 | 5.17 | 4.76 | 6.39 |
| Dominican Republic | 8.57 | 5692.48 | 31 | 2.93 | 2.91 | 2.91 | 3.18 | 3.84 | 2.58 | 6 | 2.90 | 4.41 | 3.72 | 3.71 |
| Ecuador | 10.06 | 6221.38 | 49 | 2.79 | 2.61 | 2.67 | 3.18 | 4.36 | 2.49 | 6 | 3.55 | 4.05 | 3.13 | 3.76 |
| Egypt | 16.90 | 3524.59 | 30 | 2.87 | 2.99 | 3.23 | 2.99 | 3.71 | 2.85 | 10 | 2.63 | 3.25 | 3.83 | 4.24 |
| El Salvador | 5.87 | 3590.88 | 35 | 3.20 | 3.16 | 3 | 2.75 | 4.21 | 2.93 | 7 | 2.93 | 3.52 | 3.28 | 3.98 |
| Estonia | 3.22 | 4422.26 | 29 | 3.34 | 3.27 | 3.20 | 3.55 | 4.50 | 3.40 | 4 | 5.52 | 5.27 | 3.18 | 5.99 |
| Ethiopia | 17.31 | 5305.45 | 54 | 2.50 | 2.62 | 2.67 | 3.17 | 3.68 | 2.42 | 10 | 3.09 | 2.81 | 2.73 | 2.01 |
| Finland | 3.22 | 4449.53 | 31 | 3.52 | 3.72 | 3.31 | 3.80 | 6.24 | 3.89 | 5 | 6.52 | 6.00 | 4.81 | 6.41 |
| France | 9.16 | 4536.33 | 32 | 3.68 | 3.75 | 3.89 | 4.17 | 5.04 | 3.65 | 2 | 5.04 | 4.77 | 6.30 | 5.65 |
| Gabon | 17.76 | 4159.87 | 31 | 2.58 | 2.25 | 1.92 | 2.31 | 2.84 | 2.00 | 8 | 3.61 | 3.07 | 2.20 | 2.95 |
| Gambia | 14.03 | 3903.75 | 34 | 2.67 | 2.22 | 2.00 | 2.46 | 4.50 | 2.06 | 7 | 3.60 | 4.34 | 2.99 | 2.77 |
| Georgia | 1.32 | 4958.18 | 28 | 2.32 | 2.44 | 2.59 | 3.09 | 4.12 | 2.21 | 4 | 5.72 | 5.38 | 3.67 | 3.99 |
| Germany | 3.22 | 4035.66 | 29 | 3.74 | 4.12 | 4.17 | 4.36 | 5.76 | 4.10 | 4 | 5.16 | 4.72 | 6.29 | 5.65 |
| Ghana | 12.96 | 4298.89 | 53 | 2.73 | 2.37 | 2.90 | 2.86 | 3.23 | 2.22 | 7 | 2.72 | 3.38 | 2.73 | 3.15 |
| Greece | 3.22 | 3968.35 | 31 | 2.97 | 3.23 | 3.03 | 3.50 | 4.03 | 3.36 | 6 | 3.76 | 4.06 | 3.55 | 4.77 |
| Guatemala | 5.54 | 4167.46 | 42 | 2.87 | 2.68 | 2.68 | 3.24 | 3.72 | 2.75 | 7 | 3.55 | 3.83 | 3.30 | 3.67 |
| Guinea | 11.90 | 4453.92 | 43 | 2.47 | 2.35 | 2.41 | 3.10 | 2.03 | 2.34 | 9 | 1.96 | 3.15 | 1.86 | 1.55 |
| Guyana | 10.94 | 5730.64 | 40 | 2.43 | 2.27 | 2.47 | 2.74 | 4.25 | 2.46 | 7 | 2.63 | 3.47 | 2.39 | 2.77 |
| Haiti | 2.77 | 6303.96 | 53 | 2.27 | 2.14 | 2.32 | 2.63 | 2.00 | 2.25 | 10 | 2.65 | 2.36 | 1.94 | 1.91 |
| Honduras | 5.63 | 6184.35 | 39 | 2.79 | 2.47 | 2.61 | 2.79 | 3.44 | 2.70 | 7 | 3.35 | 2.95 | 2.63 | 3.04 |
| Hong Kong SAR | 0.00 | 1797.34 | 24 | 3.58 | 3.81 | 3.87 | 4.06 | 6.45 | 3.72 | 3 | 5.88 | 5.99 | 6.49 | 6.00 |
| Hungary | 3.22 | 3940.66 | 41 | 3.40 | 3.33 | 3.82 | 4.06 | 3.81 | 2.97 | 6 | 4.27 | 4.89 | 3.43 | 5.05 |

Table D-1: Country data for all variables (continues)

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Iceland | 4.64 | 6146.58 | 31 | 3.15 | 3.46 | 3.38 | 3.51 | 5.72 | 3.54 | 4 | 6.19 | 5.51 | 3.80 | 5.68 |
| India | 13.61 | 2589.47 | 32 | 3.20 | 3.03 | 3.11 | 3.51 | 4.02 | 2.72 | 11 | 2.74 | 3.44 | 4.30 | 2.87 |
| Indonesia | 7.31 | 1728.88 | 37 | 2.87 | 3.21 | 3.11 | 3.53 | 3.96 | 2.87 | 8 | 3.14 | 3.82 | 3.60 | 3.73 |
| Iran, Islamic Rep. | 26.55 | 4575.92 | 49 | 2.49 | 2.66 | 2.49 | 2.66 | 4.20 | 2.19 | 10 | 3.32 | 2.97 | 3.47 | 2.87 |
| Ireland | 3.22 | 4485.48 | 31 | 3.44 | 3.94 | 4.13 | 4.13 | 4.52 | 3.80 | 2 | 6.06 | 5.35 | 4.33 | 5.16 |
| Israel | 6.24 | 3340.67 | 25 | 2.71 | 3.35 | 3.20 | 4.18 | 4.71 | 3.10 | 4 | 5.27 | 3.88 | 4.02 | 5.62 |
| Italy | 3.22 | 4100.54 | 36 | 3.54 | 3.62 | 3.84 | 4.05 | 3.50 | 3.36 | 3 | 3.67 | 3.87 | 4.79 | 4.87 |
| Jamaica | 7.46 | 6713.83 | 39 | 2.79 | 2.72 | 2.72 | 3.14 | 4.09 | 2.88 | 7 | 2.99 | 3.80 | 3.86 | 3.40 |
| Japan | 2.48 | 2587.47 | 34 | 3.52 | 3.93 | 3.95 | 4.24 | 5.98 | 3.78 | 5 | 6.03 | 5.41 | 6.03 | 6.00 |
| Jordan | 11.21 | 4140.46 | 29 | 2.96 | 2.94 | 2.67 | 3.46 | 4.73 | 2.60 | 7 | 4.75 | n/a | 3.70 | 4.00 |
| Kenya | 12.86 | 4309.69 | 32 | 3.15 | 2.65 | 3.03 | 3.58 | 4.02 | 1.96 | 9 | 2.74 | 3.57 | 2.86 | 3.04 |
| Korea, Rep. | 12.76 | 2119.13 | 28 | 3.44 | 3.66 | 3.69 | 4.00 | 5.85 | 3.47 | 3 | 4.45 | 4.11 | 5.75 | 6.37 |
| Kuwait | 4.60 | 3578.60 | 33 | 2.76 | 2.96 | 3.16 | 3.39 | 4.48 | 2.69 | 10 | 3.91 | 3.76 | 3.64 | 4.61 |
| Lao PDR | 9.66 | 3037.03 | 43 | 2.50 | 2.31 | 2.20 | 2.65 | 3.97 | 2.45 | 10 | 2.84 | 3.86 | 2.76 | 2.29 |
| Latvia | 3.22 | 4597.64 | 35 | 3.38 | 3.21 | 3.50 | 4.06 | 4.58 | 3.22 | 5 | 4.54 | 4.44 | 3.29 | 5.17 |
| Lebanon | 7.80 | 4463.83 | 45 | 2.53 | 2.89 | 3.22 | 2.89 | 2.73 | 2.29 | 7 | 2.20 | 3.28 | 3.85 | 3.63 |
| Lesotho | 0.00 | 1945.00 | 33 | 2.48 | 2.23 | 2.35 | 2.60 | 3.29 | 2.22 | 7 | 3.60 | 3.78 | 2.69 | 2.36 |
| Liberia | 10.27 | 4662.99 | 40 | 2.57 | 2.86 | 2.57 | 2.57 | 3.13 | 2.57 | 12 | 2.88 | 3.52 | 2.11 | 1.98 |
| Libya | 0.00 | 5533.81 | 54 | 2.29 | 2.29 | 2.85 | 2.85 | 2.02 | 2.41 | 9 | 2.95 | 3.01 | 2.55 | 3.03 |
| Lithuania | 3.22 | 4766.03 | 32 | 3.10 | 2.99 | 3.17 | 3.60 | 5.02 | 3.04 | 5 | 4.52 | 4.36 | 3.61 | 5.23 |
| Luxembourg | 3.22 | 4495.47 | 28 | 3.82 | 3.78 | 3.68 | 4.71 | 5.04 | 3.82 | 4 | 6.15 | 5.60 | 5.04 | 6.10 |
| Macedonia, FYR | 6.95 | 4213.35 | 27 | 2.38 | 2.51 | 2.46 | 2.81 | 3.72 | 2.35 | 8 | 4.45 | 4.15 | 3.02 | 4.28 |
| Madagascar | 6.11 | 4108.76 | 26 | 2.38 | 2.33 | 2.29 | 3.07 | 3.07 | 2.06 | 9 | 2.57 | 3.33 | 2.31 | 2.02 |
| Malawi | 11.21 | 2870.00 | 43 | 2.63 | 2.86 | 2.63 | 2.99 | 3.36 | 2.79 | 11 | 2.86 | 3.59 | 2.67 | 1.86 |
| Malaysia | 8.46 | 1433.52 | 22 | 3.64 | 3.47 | 3.58 | 3.92 | 5.21 | 3.37 | 4 | 4.44 | 5.02 | 5.30 | 5.00 |
| Mali | 11.91 | 7277.97 | 46 | 2.80 | 2.20 | 2.70 | 2.90 | 3.71 | 2.08 | 10 | 1.65 | 3.56 | 2.98 | 2.84 |
| Malta | 3.22 | 4315.21 | 26 | 3.23 | 3.00 | 3.15 | 3.15 | 4.95 | 3.00 | 7 | 4.23 | 4.64 | 4.43 | 5.36 |
| Mauritania | 11.85 | 1523.00 | 52 | 2.07 | 2.06 | 2.23 | 2.75 | 2.86 | 1.93 | 8 | 2.38 | 3.06 | 2.13 | 2.62 |

Table D-1: Country data for all variables (continues)

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mauritius | 0.69 | 3401.17 | 16 | 2.63 | 2.48 | 2.34 | 2.88 | 5.04 | 2.25 | 5 | 4.05 | 4.53 | 4.20 | 4.07 |
| Mexico | 11.47 | 4225.42 | 38 | 3.19 | 3.12 | 3.14 | 3.57 | 4.07 | 2.69 | 4 | 3.59 | 3.94 | 3.64 | 3.81 |
| Moldova | 8.71 | 5058.44 | 53 | 3.14 | 2.44 | 2.35 | 2.89 | 3.47 | 2.46 | 8 | 2.61 | 3.39 | 2.85 | 3.81 |
| Mongolia | 4.97 | 4404.66 | 71 | 2.62 | 2.33 | 2.13 | 2.51 | 2.90 | 2.20 | 13 | 3.30 | 2.98 | 2.31 | 3.77 |
| Montenegro | 5.08 | 3901.71 | 49 | 3.15 | 2.45 | 2.76 | 3.19 | 4.44 | 2.83 | 5 | 4.02 | 3.76 | 3.09 | 4.48 |
| Morocco | 18.07 | 4459.43 | 34 | 3.01 | 2.89 | 3.01 | 3.51 | 4.37 | 2.64 | 7 | 4.02 | 3.75 | 4.25 | 4.09 |
| Mozambique | 5.50 | 4454.79 | 26 | 2.08 | 2.10 | 2.08 | 2.74 | 2.79 | 2.26 | 9 | 2.91 | 3.24 | 2.29 | 2.03 |
| Myanmar | 5.60 | 2345.44 | 47 | 2.14 | 2.07 | 2.36 | 2.83 | 2.84 | 1.97 | 9 | 2.16 | 2.96 | 1.85 | 1.62 |
| Namibia | 0.00 | 4288.94 | 25 | 2.70 | 2.69 | 2.56 | 3.15 | 4.54 | 2.27 | 7 | 3.86 | 4.09 | 3.41 | 3.13 |
| Nepal | 12.37 | 3970.81 | 53 | 2.64 | 2.50 | 2.72 | 3.06 | 2.78 | 2.31 | 11 | 2.30 | 3.31 | 2.33 | 2.34 |
| Netherlands | 3.22 | 4064.89 | 27 | 3.64 | 4.13 | 4.07 | 4.34 | 5.98 | 3.96 | 4 | 5.90 | 5.38 | 5.97 | 6.40 |
| New Zealand | 2.21 | 3576.14 | 30 | 3.67 | 3.56 | 3.33 | 3.72 | 5.26 | 3.92 | 6 | 6.62 | 5.36 | 4.12 | 5.81 |
| Nicaragua | 5.59 | 3975.97 | 44 | 2.69 | 2.58 | 2.58 | 3.17 | 3.47 | 2.66 | 5 | 3.64 | 3.53 | 2.56 | 2.66 |
| Nigeria | 11.19 | 4451.39 | 44 | 2.63 | 2.70 | 3.16 | 3.46 | 2.98 | 2.35 | 13 | 2.09 | 3.16 | 2.37 | 2.77 |
| Norway | 7.62 | 4392.37 | 29 | 3.42 | 4.19 | 3.50 | 4.36 | 5.12 | 4.21 | 5 | 6.13 | 5.12 | 3.89 | 6.36 |
| Oman | 4.60 | 3154.64 | 19 | 3.41 | 2.84 | 2.84 | 3.29 | 5.09 | 2.63 | 8 | 5.50 | n/a | 4.45 | 4.72 |
| Pakistan | 13.45 | 2381.18 | 30 | 3.08 | 2.79 | 2.73 | 2.79 | 3.85 | 2.84 | 8 | 2.59 | 3.52 | 3.42 | 2.46 |
| Panama | 7.25 | 5500.32 | 31 | 3.18 | 2.87 | 3.34 | 3.63 | 5.09 | 3.15 | 3 | 3.52 | 4.63 | 4.37 | 4.29 |
| Paraguay | 10.37 | 5122.79 | 43 | 2.83 | 2.76 | 2.89 | 3.22 | 2.66 | 2.49 | 9 | 2.66 | 3.86 | 2.49 | 3.37 |
| Peru | 3.67 | 5090.79 | 39 | 2.94 | 2.78 | 2.81 | 3.30 | 3.37 | 2.47 | 7 | 3.79 | 4.11 | 2.67 | 3.62 |
| Philippines | 6.27 | 2286.59 | 32 | 3.33 | 2.93 | 3.00 | 3.07 | 3.30 | 3.00 | 7 | 2.74 | 3.53 | 2.69 | 3.71 |
| Poland | 3.22 | 4652.26 | 37 | 3.46 | 3.47 | 3.54 | 4.13 | 3.54 | 3.26 | 4 | 4.55 | 3.97 | 3.25 | 4.94 |
| Portugal | 3.22 | 4255.79 | 31 | 3.43 | 3.71 | 3.71 | 3.87 | 4.89 | 3.26 | 4 | 5.22 | 5.09 | 4.81 | 5.02 |
| Qatar | 4.60 | 3451.20 | 30 | 3.55 | 3.55 | 3.47 | 3.87 | 5.51 | 3.21 | 7 | 6.30 | 5.29 | 4.43 | 5.60 |
| Romania | 3.22 | 4707.95 | 30 | 3.32 | 3.20 | 3.39 | 4.00 | 3.57 | 2.83 | 6 | 3.53 | 3.20 | 2.68 | 4.26 |
| Russian Federation | 10.59 | 6668.41 | 45 | 2.64 | 2.74 | 2.85 | 3.14 | 3.92 | 2.20 | 10 | 3.12 | 3.24 | 3.94 | 4.88 |
| Rwanda | 12.86 | 6949.69 | 36 | 2.78 | 2.64 | 2.94 | 3.34 | 4.02 | 2.50 | 9 | 5.47 | 5.12 | 3.22 | 2.23 |
| Saudi Arabia | 4.60 | 3742.80 | 29 | 2.93 | 3.11 | 3.15 | 3.55 | 4.97 | 2.86 | 7 | 5.14 | 4.33 | 4.12 | 4.97 |

Table D-1: Country data for all variables (continues)

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Senegal | 11.91 | 4612.97 | 28 | 3.03 | 2.53 | 2.65 | 2.53 | 3.47 | 2.61 | 5 | 2.99 | 4.28 | 2.78 | 2.87 |
| Serbia | 7.35 | 4809.68 | 33 | 3.12 | 3.02 | 2.94 | 3.55 | 3.95 | 2.37 | 7 | 3.47 | 3.71 | 2.64 | 4.43 |
| Singapore | 0.19 | 1367.66 | 19 | 3.70 | 3.97 | 3.90 | 4.25 | 6.29 | 4.01 | 3 | 6.45 | 5.90 | 6.53 | 6.18 |
| Slovak Republic | 3.22 | 4575.66 | 38 | 3.30 | 3.16 | 3.02 | 3.94 | 4.15 | 2.89 | 6 | 3.89 | 4.53 | 3.77 | 4.88 |
| Slovenia | 3.22 | 3865.26 | 52 | 3.05 | 3.51 | 3.51 | 3.82 | 4.40 | 3.11 | 7 | 5.15 | 4.72 | 3.91 | 5.03 |
| Spain | 3.22 | 4415.43 | 28 | 3.51 | 3.83 | 3.54 | 4.07 | 5.60 | 3.63 | 4 | 4.70 | 5.16 | 6.11 | 5.27 |
| Sri Lanka | 10.80 | 2698.87 | 28 | 2.56 | 2.91 | 2.76 | 3.12 | 3.88 | 2.56 | 7 | 2.44 | 3.77 | 3.58 | 3.12 |
| Sweden | 3.22 | 4531.64 | 29 | 3.76 | 3.98 | 3.98 | 4.26 | 5.67 | 3.75 | 3 | 5.96 | 5.52 | 4.27 | 6.46 |
| Switzerland | 5.16 | 4529.89 | 29 | 3.58 | 3.75 | 3.79 | 4.06 | 6.33 | 3.92 | 4 | 5.77 | 5.38 | 5.69 | 5.90 |
| Taiwan, China | n/a | 2073.42 | 30 | 3.71 | 3.60 | 3.79 | 4.02 | 5.66 | 3.55 | 6 | 5.14 | 5.32 | 5.37 | 5.68 |
| Tanzania | 12.68 | 3911.12 | 36 | 2.32 | 2.18 | 2.11 | 2.89 | 3.31 | 2.19 | 11 | 2.47 | 3.34 | 2.22 | 2.24 |
| Thailand | 15.17 | 1887.03 | 30 | 3.30 | 3.29 | 3.45 | 3.96 | 3.99 | 3.21 | 5 | 3.05 | 3.78 | 4.43 | 3.91 |
| Tunisia | 26.84 | 4131.72 | 35 | 2.91 | 2.42 | 2.42 | 3.16 | 3.89 | 2.02 | 6 | 3.41 | 3.53 | 3.39 | 3.81 |
| Turkey | 8.65 | 4023.88 | 31 | 3.18 | 3.64 | 3.77 | 3.68 | 4.18 | 3.23 | 8 | 3.90 | 4.33 | 4.46 | 3.81 |
| Uganda | 12.86 | 5334.69 | 39 | 3.02 | 2.59 | 2.45 | 3.52 | 3.19 | 2.84 | 10 | 2.60 | 3.16 | 2.45 | 2.10 |
| Ukraine | 4.53 | 5693.44 | 46 | 2.95 | 2.84 | 3.20 | 3.51 | 3.97 | 2.69 | 8 | 2.50 | 2.67 | 3.70 | 3.91 |
| United Arab Emirates | 4.60 | 3014.47 | 19 | 3.20 | 3.50 | 3.57 | 3.92 | 6.12 | 3.42 | 5 | 6.17 | n/a | 6.53 | 5.64 |
| United Kingdom | 3.22 | 4161.52 | 27 | 3.63 | 4.03 | 4.08 | 4.33 | 5.28 | 3.94 | 4 | 5.80 | 4.98 | 5.93 | 6.44 |
| United States | 2.82 | 4982.91 | 28 | 3.45 | 3.97 | 4.14 | 4.14 | 5.55 | 3.73 | 5 | 4.91 | 4.54 | 6.01 | 5.93 |
| Uruguay | 10.52 | 4287.79 | 29 | 2.64 | 2.58 | 2.89 | 3.06 | 3.61 | 2.39 | 7 | 4.77 | 4.79 | 2.57 | 4.63 |
| Vietnam | 9.72 | 1980.85 | 38 | 3.22 | 3.09 | 3.19 | 3.49 | 3.88 | 2.81 | 8 | 2.30 | 3.49 | 3.28 | 4.15 |
| Yemen | 7.28 | 4024.90 | 35 | 2.35 | 2.21 | 2.21 | 2.78 | 3.27 | 1.63 | 9 | 1.93 | 3.21 | 2.12 | 2.13 |
| Zambia | 7.04 | 5856.12 | 54 | 2.13 | 2.47 | 2.47 | 2.91 | 3.74 | 2.54 | 8 | 3.27 | 4.10 | 2.69 | 2.60 |
| Zimbabwe | 25.55 | 5660.00 | 71 | 2.25 | 2.50 | 2.22 | 2.93 | 3.03 | 1.89 | 8 | 3.32 | 2.80 | 2.81 | 2.96 |
| Uganda | 12.86 | 5334.69 | 39 | 3.02 | 2.59 | 2.45 | 3.52 | 3.19 | 2.84 | 10 | 2.60 | 3.16 | 2.45 | 2.10 |
| Ukraine | 4.53 | 5693.44 | 46 | 2.95 | 2.84 | 3.20 | 3.51 | 3.97 | 2.69 | 8 | 2.50 | 2.67 | 3.70 | 3.91 |

# APPENDIX E:

Table E-1: Worldwide regions and their respective countries

| **Region / Countries** | **Caribbean (Income group)** | Central America (Income group) | Eastern Africa (Income group) | Eastern Asia (Income group) | Eastern Europe (Income group) | Middle Africa (Income group) |
|---|---|---|---|---|---|---|
| **1** | Dominican Republic (Upper middle income) | El Salvador (Lower middle income) | Mauritius (Upper middle income) | Hong Kong SAR (High income) | Czech Republic (High income) | Gabon (Upper middle income) |
| **2** | Haiti (Low income) | Panama (Upper middle income) | Madagascar (Low income) | Korea Rep. (High income) | Hungary (High income) | Cameroon (Lower middle income) |
| **3** | Jamaica (Upper middle income) | Mexico (Upper middle income) | Kenya (Lower middle income) | Taiwan, China (High income) | Romania (Upper middle income) | Angola (Upper middle income) |
| **4** | | Guatemala (Lower middle income) | Mozambique (Low income) | Japan (High income) | Bulgaria (Upper middle income) | |
| **5** | | Nicaragua (Lower middle income) | Malawi (Low income) | Sri Lanka (Lower middle income) | Poland (High income) | |
| **6** | | Costa Rica (Upper middle income) | Tanzania (Low income) | Pakistan (Lower middle income) | Slovak Republic (High income) | |
| **7** | | Honduras (Lower middle income) | Uganda (Low income) | China (Upper middle income) | Ukraine (Lower middle income) | |
| **8** | | | Ruanda (Low income) | India (Lower middle income) | Russian Federation (Upper middle income) | |
| **9** | | | Ethiopia (Low income) | Bangladesh (Lower middle income) | | |
| **10** | | | Zambia (Lower middle income) | Iran, Islamic Rep. (Upper middle income) | | |
| **11** | | | Burundi (Low income) | Bhutan (Lower middle income) | | |
| **12** | | | Zimbabwe (Low income) | Nepal (Low income) | | |
| **13** | | | | Mongolia (Lower middle income) | | |

Table E-1: Worldwide regions and their respective countries (continues)

| **Region / Countries** | **Northern Africa (income group)** | Northern America (income group) | Northern Europe (income group) | Oceania (income group) | South America (income group) | South-Eastern Asia (income group) |
|---|---|---|---|---|---|---|
| **1** | Egypt (Lower middle income) | United States (High income) | United Kingdom (High income) | Australia (High income) | Chile (High income) | Singapore (High income) |
| **2** | Morocco (Lower middle income) | Canada (High income) | Denmark (High income) | New Zealand (High income) | Uruguay (High income) | Malaysia (Upper middle income) |
| **3** | Tunisia (Lower middle income) | | Sudan (High income) | Moldova (Lower middle income) | Brazil (Upper middle income) | Thailand (Upper middle income) |
| **4** | Algeria (Upper middle income) | | Norway (High income) | | Peru (Upper middle income) | Indonesia (Lower middle income) |
| **5** | Libya (Upper middle income) | | Finland (High income) | | Paraguay (Upper middle income) | Philippines (Lower middle income) |
| **6** | | | Ireland (High income) | | Bolivia (Lower middle income) | Vietnam (Lower middle income) |
| **7** | | | Estonia (High income) | | Argentina (Upper middle income) | Cambodia (Lower middle income) |
| **8** | | | Lithuania (High income) | | Guyana (Upper middle income) | Lao PDR (Lower middle income) |
| **9** | | | Latvia (High income) | | Colombia (Upper middle income) | Myanmar (Lower middle income) |
| **10** | | | Iceland (High income) | | Ecuador (Upper middle income) | |

Table E-1: Worldwide regions and their respective countries (continues)

| **Region / Countries** | **Southern Africa (Income group)** | Southern Europe (Income group) | Western Africa (Income group) | Western Asia (Income group) | Western Europe (Income group) |
|---|---|---|---|---|---|
| **1** | Lesotho (Lower middle income) | Spain (High income) | Senegal (Low income) | United Arab Emirates (High income) | Netherlands (High income) |
| **2** | Namibia (Upper middle income) | Portugal (High income) | Gambia (Low income) | Oman (High income) | Germany (High income) |
| **3** | Botswana (Upper middle income) | Malta (High income) | Mauritania (Lower middle income) | Israel (High income) | Luxembourg (High income) |
| **4** | | Greece (High income) | Benin (Low income) | Cyprus (High income) | Switzerland (High income) |
| **5** | | Italy (High income) | Liberia (Low income) | Qatar (High income) | Belgium (High income) |
| **6** | | Croatia (High income) | Nigeria (Lower middle income) | Bahrain (High income) | Austria (High income) |
| **7** | | Macedonia, FYR (Upper middle income) | Guinea (Low income) | Saudi Arabia (High income) | France (High income) |
| **8** | | Bosnia and Herzegovina (Upper middle income) | Ghana (Lower middle income) | Turkey (Upper middle income) | |
| **9** | | Albania (Upper middle income) | Côte d'Ivoire (Lower middle income) | Jordan (Upper middle income) | |
| **10** | | Serbia (Upper middle income) | Mali (Low income) | Kuwait (High income) | |
| **11** | | Slovenia (High income) | Burkina Faso (Low income) | Georgia (Upper middle income) | |
| **12** | | Montenegro (Upper middle income) | | Yemen (Lower middle income) | |
| **13** | | | | Armenia (Lower middle income) | |
| **14** | | | | Lebanon Upper middle income) | |
| **15** | | | | Azerbaijan (Upper middle income) | |

# APPENDIX F:

Table F-1: African country data for all variables

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | 18.56 | 4353.49 | 46 | 2.54 | 2.54 | 2.54 | 3.04 | 2.78 | 2.71 | 9 | 1.98 | 3.02 | 2.74 | 2.58 |
| Angola | 7.30 | 4497.10 | 51 | 2.79 | 2.31 | 2.59 | 3.02 | 1.81 | 2.37 | 9 | 2.16 | 2.50 | 2.07 | 2.02 |
| Benin | 11.91 | 4561.34 | 38 | 2.69 | 2.35 | 2.45 | 2.85 | 2.52 | 2.64 | 7 | 2.07 | 3.29 | 2.08 | 2.42 |
| Botswana | 0.00 | 3610.00 | 35 | 2.42 | 2.58 | 2.40 | 2.94 | 3.39 | 2.38 | 6 | 4.40 | 3.93 | 3.14 | 3.71 |
| Burkina Faso | 11.91 | 7471.34 | 60 | 2.63 | 2.63 | 2.49 | 3.21 | 3.10 | 2.50 | 9 | 2.38 | 3.53 | 2.32 | 2.21 |
| Burundi | 12.86 | 6716.12 | 51 | 2.60 | 2.51 | 2.51 | 2.76 | 2.69 | 2.60 | 10 | 2.19 | 2.82 | 2.33 | 1.54 |
| Cameroon | 17.81 | 4151.87 | 35 | 2.20 | 2.52 | 2.52 | 2.80 | 2.98 | 1.86 | 11 | 2.56 | 3.63 | 2.45 | 2.33 |
| Côte d'Ivoire | 11.91 | 5572.05 | 56 | 2.87 | 2.62 | 2.97 | 3.31 | 3.28 | 2.33 | 10 | 3.02 | 3.38 | 2.59 | 2.70 |
| Egypt | 16.90 | 3524.59 | 30 | 2.87 | 2.99 | 3.23 | 2.99 | 3.71 | 2.85 | 10 | 2.63 | 3.25 | 3.83 | 4.24 |
| Ethiopia | 17.31 | 5305.45 | 54 | 2.50 | 2.62 | 2.67 | 3.17 | 3.68 | 2.42 | 10 | 3.09 | 2.81 | 2.73 | 2.01 |
| Gabon | 17.76 | 4159.87 | 31 | 2.58 | 2.25 | 1.92 | 2.31 | 2.84 | 2.00 | 8 | 3.61 | 3.07 | 2.20 | 2.95 |
| Gambia | 14.03 | 3903.75 | 34 | 2.67 | 2.22 | 2.00 | 2.46 | 4.50 | 2.06 | 7 | 3.60 | 4.34 | 2.99 | 2.77 |
| Ghana | 12.96 | 4298.89 | 53 | 2.73 | 2.37 | 2.90 | 2.86 | 3.23 | 2.22 | 7 | 2.72 | 3.38 | 2.73 | 3.15 |
| Guinea | 11.90 | 4453.92 | 43 | 2.47 | 2.35 | 2.41 | 3.10 | 2.03 | 2.34 | 9 | 1.96 | 3.15 | 1.86 | 1.55 |
| Hungary | 3.22 | 3940.66 | 41 | 3.40 | 3.33 | 3.82 | 4.06 | 3.81 | 2.97 | 6 | 4.27 | 4.89 | 3.43 | 5.05 |
| Kenya | 12.86 | 4309.69 | 32 | 3.15 | 2.65 | 3.03 | 3.58 | 4.02 | 1.96 | 9 | 2.74 | 3.57 | 2.86 | 3.04 |
| Lesotho | 0.00 | 1945.00 | 33 | 2.48 | 2.23 | 2.35 | 2.60 | 3.29 | 2.22 | 7 | 3.60 | 3.78 | 2.69 | 2.36 |
| Liberia | 10.27 | 4662.99 | 40 | 2.57 | 2.86 | 2.57 | 2.57 | 3.13 | 2.57 | 12 | 2.88 | 3.52 | 2.11 | 1.98 |
| Libya | 0.00 | 5533.81 | 54 | 2.29 | 2.29 | 2.85 | 2.85 | 2.02 | 2.41 | 9 | 2.95 | 3.01 | 2.55 | 3.03 |
| Madagascar | 6.11 | 4108.76 | 26 | 2.38 | 2.33 | 2.29 | 3.07 | 3.07 | 2.06 | 9 | 2.57 | 3.33 | 2.31 | 2.02 |
| Malawi | 11.21 | 2870.00 | 43 | 2.63 | 2.86 | 2.63 | 2.99 | 3.36 | 2.79 | 11 | 2.86 | 3.59 | 2.67 | 1.86 |
| Mali | 11.91 | 7277.97 | 46 | 2.80 | 2.20 | 2.70 | 2.90 | 3.71 | 2.08 | 10 | 1.65 | 3.56 | 2.98 | 2.84 |
| Mauritania | 11.85 | 1523.00 | 52 | 2.07 | 2.06 | 2.23 | 2.75 | 2.86 | 1.93 | 8 | 2.38 | 3.06 | 2.13 | 2.62 |
| Mauritius | 0.69 | 3401.17 | 16 | 2.63 | 2.48 | 2.34 | 2.88 | 5.04 | 2.25 | 5 | 4.05 | 4.53 | 4.20 | 4.07 |
| Morocco | 18.07 | 4459.43 | 34 | 3.01 | 2.89 | 3.01 | 3.51 | 4.37 | 2.64 | 7 | 4.02 | 3.75 | 4.25 | 4.09 |
| Mozambique | 5.50 | 4454.79 | 26 | 2.08 | 2.10 | 2.08 | 2.74 | 2.79 | 2.26 | 9 | 2.91 | 3.24 | 2.29 | 2.03 |

Table F-1: African country data for all variables (continues)

| Country | SA average tariff rate (%) | Transport cost (US$) | Transport time (days) | Ease and affordability of shipments | Logistics competence | Tracking and tracing ability | Timelines of shipments in reaching destination | Efficiency of the transport mode change | Efficiency of the customs clearance process | Documents to import goods | Irregular payments of import and export procedures | Time predictability of import procedures | Availability and quality of transport infrastructure | Availability and quality of IC technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Namibia | 0.00 | 4288.94 | 25 | 2.70 | 2.69 | 2.56 | 3.15 | 4.54 | 2.27 | 7 | 3.86 | 4.09 | 3.41 | 3.13 |
| Nigeria | 11.19 | 4451.39 | 44 | 2.63 | 2.70 | 3.16 | 3.46 | 2.98 | 2.35 | 13 | 2.09 | 3.16 | 2.37 | 2.77 |
| Rwanda | 12.86 | 6949.69 | 36 | 2.78 | 2.64 | 2.94 | 3.34 | 4.02 | 2.50 | 9 | 5.47 | 5.12 | 3.22 | 2.23 |
| Senegal | 11.91 | 4612.97 | 28 | 3.03 | 2.53 | 2.65 | 2.53 | 3.47 | 2.61 | 5 | 2.99 | 4.28 | 2.78 | 2.87 |
| Tanzania | 12.68 | 3911.12 | 36 | 2.32 | 2.18 | 2.11 | 2.89 | 3.31 | 2.19 | 11 | 2.47 | 3.34 | 2.22 | 2.24 |
| Tunisia | 26.84 | 4131.72 | 35 | 2.91 | 2.42 | 2.42 | 3.16 | 3.89 | 2.02 | 6 | 3.41 | 3.53 | 3.39 | 3.81 |
| Zambia | 7.04 | 5856.12 | 54 | 2.13 | 2.47 | 2.47 | 2.91 | 3.74 | 2.54 | 8 | 3.27 | 4.10 | 2.69 | 2.60 |
| Zimbabwe | 25.55 | 5660.00 | 71 | 2.25 | 2.50 | 2.22 | 2.93 | 3.03 | 1.89 | 8 | 3.32 | 2.80 | 2.81 | 2.96 |

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