

The Role of Transport Costs and Logistics in South Africa's International Competitiveness

Aletta Maria Jansen van Rensburg

Honns. B.Com

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Supervisor: Prof. Dr. W.A Naudé

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Abstract

The Role of Transport costs and Logistics in the Competitiveness of South Africa's Exports

International competitiveness is a requirement for a country to attain high economic growth rates. It is also a precondition to benefit from the globalisation of the world economy. Improving competitiveness can raise a country's exports, which are frequently seen as a "growth engine" for an economy. South Africa is currently facing increasing global competition because of the trade liberalisations. The success of domestic firms depends on whether they can increase their international competitiveness. In this study, the role of transport costs and logistics in South Africa's competitiveness is investigated.

It was established that transport infrastructure and the cost of transport plays a significant role in the cost of trade, as a result of different geographical locations of places and countries. In the case of South Africa, where high transport costs are assumed to lead to higher input prices and decreased competitiveness, national as well as international transport costs are investigated. The findings resulted in the conclusion that although insufficient transport infrastructure and insufficient maintenance of existing transport infrastructure are the cause of higher national transport costs and thus higher production costs, they are not the most significant contributors to the uncompetitiveness of South African export products. High harbour taxes (unique to South Africa), in addition to terminal handling costs as well as insufficient handling of goods at harbours, was identified to be the main obstacles from a transport and logistical perspective to South African exports.

Irrespective of the transport cost problem, it was also found that insufficient logistical management plays a significant negative part in the competitiveness of South African products. The South African logistical management system, of which the management and handling of transport forms a part, compares very unfavourable to other countries. This indicated the infant stage in which the South African logistical system is at the moment. An accelerated improvement of the logistical systems of companies is essential for the improvement of their products' competitiveness in international markets.

Opsomming

Die Rol van Vervoerkoste en Logistiek in die Mededingendheid van Suid Afrika se Uitvoer.

Internasionale mededingendheid is noodsaaklik in 'n land se strewe na 'n hoë en volgehoue ekonomiese groeikoers. Dit is ook 'n voorvereiste om voordeel te trek uit die toenemende globalisering van wêreld ekonomieë. Sterker mededingendheid kan lei tot groter uitvoer, wat dikwels gesien word as 'n "growth engine". 'n Liberalisasie van handel in Suid Afrika sedert 1994 stel plaaslike ondernemings bloot aan groter internasionale mededinging. In dié studie is die rol wat vervoerkoste en logistiek in 'n land se mededingendheid kan speel ondersoek.

Dit is bevind dat verskille in die geografiese ligging en eienskappe van lande impliseer dat vervoerinfrastruktuur en vervoerkoste van uiterste belang is in die totale koste en omvang van internasionale handel. In Suid Afrika se geval waar hoë vervoerkoste een van die probleme van hoë pryse en onmededingendheid is, is binnelandse sowel as internasionale vervoerkoste ondersoek. Die bevinding is dat alhoewel onvoldoende infrastruktuur en onvoldoende instandhouding van bestaande infrastruktuur binnelandse vervoerkoste en dus die kostes vir die vervaardiging van handelsprodukte verhoog, dit egter nie die grootste oorsaak van die onmededingendheid van Suid-Afrika se uitvoer produkte in internasionale markte nie. Hoë hawebelastings wat addisioneel van terminaalhanteringsheffings gehef word, is gevind as 'n beduidende oorsaak van die onmededingendheid van Suid-Afrikaanse produkte. Die oneffektiewe hantering van goedere by hawens (wat die op- en aflaai van skepe vertraag) is ook uitgewys as 'n beduidende probleem.

Die studie bevind verder dat onvoldoende logistieke bestuur ook 'n beduidende negatiewe invloed op die mededingendheid van Suid-Afrika se produkte het. In vergelyking met ander lande is Suid-Afrika se logistieke bestuur stelsel, waar van die bestuur en hantering van vervoer deel is, relatief onderontwikkeld. 'n Verbetering van ondernemings se logistiekebestuur is derhalwe noodsaaklik vir die verbetering van hul produkte se mededingendheid in internasionale market.

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Abbreviations

ADF	Augmented Dickey Fuller test
BOT	Build-Operate-Transfer
CIF	Cost Insurance and Freight
CSIR	Council for Scientific and Industrial Research
CTS	Council for Trade in Services
DBSA	Development Bank Southern Africa
DFS	Dornbush-Fuller-Samuelson
DoT	Department of Transport
ECR	Efficient Consumer Response
ECTM	European Conference of Transport Ministers
EDI	Electronic Data Interchange
EEC	European Economic Community
EU	European Union
FDI	Foreign Direct Investment
FOB	Free on Board
GATS	General Agreement on Trade in Services
GATT	General Agreement on Trade and Tariffs
GDFI	Gross Domestic Foreign Investment
GDP	Gross Domestic Product
GEAR	Growth, Employment and Redistribution programme
GNP	Gross National Product
GVM	Gross Vehicle Mass
IFS	International Financial Statistics
IMD	Institute for Management Development
IMF	International Monetary Fund
IRU	International Road Transport Union
IT	Information Technology
ITS	International Transport Costs
JIT	Just-in-Time
JSE	Johannesburg Stock Exchange
LOP	Law of one price
MFN	Most Favoured Nation

MSA	Moving South Africa
NAFTA	North American Free Trade Agreement
NGMTS	Negotiating Group on Maritime Transport Services
NRA	National Roads Agency
OECD	Organisation for Economic Co-operation and Development
OPRAF	Office of Passenger Rail Franchising
POS	Point of sale
PPP	Public-private partnerships / Purchasing power parity
QR	Quick response
RSA	Republic of South Africa
R&D	Research and Development
RTQS	Road Transport Quality System
SAAFF	South African Association of Freight Forwarders
SACU	Southern Africa Customs Union
SADC	Southern Africa Development Community
SAECS	Southern African Europe Container Service
SAFECON	South Africa Far East Freight Conference
SATCC	Southern Africa Transport and Communication Commission
SATS	South African Transport Services
SDI	Spatial Development Initiative
TEU	Twenty-foot Equivalent Units
THC	Terminal Handling Charges
UN	United Nations
VAR	Vector autoregressive model
VFTPC	Victoria Falls and Transvaal Power Company
WTO	World Trade Organisation

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Chapter 1

INTRODUCTION

1.1 Hypothesis

South Africa's international competitiveness¹ is currently seen as a weakness in the country's efforts to attain high and sustainable growth rates. Transportation costs and logistic management may have a significant influence on firms' international competitiveness. Improving the efficiency and effectiveness of transportation costs and logistic management may therefore contribute to higher export growth from South Africa.

1.2 Problem Statement

Most countries recognise the benefits of globalisation and thus of being competitive in a global economy. Competitiveness benefits a country's exports - and exports are often seen as an engine of growth. The role of exports in growth is also supported in South Africa's development strategy (GEAR, 1996).

¹ The international competitiveness of a country refers to how countries are doing in providing firms with an environment that sustains the domestic and global competitiveness of the firms operating in their borders. The competitiveness inputs factors consist of **domestic economy** (macro-evaluation of the domestic economy), **internationalisation** (extent to which the country participates in international trade and investment), **government** (extent to which government policies and practices are conducive to competitiveness), **finance** (performance of capital markets and quality of financial services), **infrastructure** (extent to which natural, technical and communication resources are adequate to serve the basic needs of businesses), **management** (extent to which companies are managed in an innovative, profitable and responsible manner), **science and technology** (scientific and technological capacity) and **people** (availability and qualifications of human resources) (World Competitiveness Report of IMD, 1999).

The South African economy has been opening up to international trade and globalisation since the early 1990s by reducing import tariffs in accordance with the country's GATT-obligations. However the effect of trade liberalisation and globalisation have begun to be questioned by an increasing number of researchers (see e.g Coetzee et al, 1997; Coetzee & Naudè, 1999, Bell & Cattaneo, 1997; Nattrass, 1998). To benefit from globalisation a country needs to improve its competitiveness in order to survive global competition.

The World Competitiveness report ranked South Africa in the 42nd place of 48 countries in terms of overall ranking in 1998. Compared to 1994, the economy improved its position on the factors including domestic economy, internationalisation, government, finance, science and technology and people. Infrastructure and management however did not improve (Anon, 1998b). In July 1999, South Africa was ranked 47th in terms of global competitiveness dropping five places from 1998 position. Executives surveyed globally considered South Africa as one of the five least secure countries of the 59 surveyed (Dludlu, 1999).

An inadequate transport system could place South Africa's development strategy at risk because exports could lose competitiveness as a result of expensive and unreliable transport (Chalmers, 1999). If transport costs are an obstacle to exports, current export and investment incentive schemes offered by the government may need to be re-evaluated². Under-investment in infrastructure required for international trade, inappropriate technologies, high transport costs and uncompetitive conditions might imply that some "natural" barriers to trade should not be viewed as 'unavoidable' constraints. The investigation of "natural" barriers to trade therefore needs to be rectified not only for the sake of better trade policy but also for increased competitiveness (Milner, 1997:8).

² Currently there is no incentive scheme taking transport costs into account, although the Reynders Commission of Inquiry (RSA, 1972) recommended such measures. Commission of Inquiry (RSA, 1972) recommended such measures.

It may thus be argued that the role of transport and logistics has so far been neglected in their research and support measures. Traditionally, economic theory assumed away factors such as distance, transportation technology and logistics management systems as determinants of a country's competitiveness. It was only recently, primarily through contributions on the geography of trade, and on geography and economic development (see Gallup et al, 1998, Krugman, 1991a) on the management challenges posed by globalisation (Furion, 1999) that the importance of transportation and logistics in international trade theory has begun to receive recognition. Although trade in South Africa is in the process of being liberalised, transportation (particularly rail transport and harbour management) has been slow to be deregulated. This may have a negative impact on trade since the state ownership of railways, harbours and airlines as well as the determination of freight rates and terminal-handling charges by monopolies may keep total transportation costs unnecessarily high.

International trade takes place between countries with different geographical locations. It is generally accepted that the cost of transfer acts as a barrier to trade and therefore for international trade to take place, the price difference for the goods between the importing and exporting countries must at least exceed the cost of transfer (Christopher, 1994). Transfer costs do not only comprise the domestic transport costs as reflected by the production costs and the international transport costs as reflected in supplying costs, but also includes logistics costs. These may include warehousing costs and other incidental costs such as damage, pilferage and delay costs. An example of incidental costs was the delays at Durban port during June and July 1999 caused by port congestion (Vermeulen, 1999). This was the result of the implementation of Portnet's new computer system "Cosmos". Congestions were exacerbated by alleged cartel behaviour by shipping companies.

The consequences of cartel behaviour and port congestions are negative for South Africa's importers and exporters and also South Africa's international competitiveness (Vermeulen, 1999). The relative reliability and quality of transport and logistical services are important to determine the competitiveness of the export product and any reduction in transfer costs could serve as a stimulus for international trade.

According to Sterns (1996), an important variable in the decision making process of firms to become exporters, is their perceptions about transaction costs. These transactions costs include transport costs, and high transports costs may have a negative influence on their decision. To raise the competitiveness of the manufacturing sector of a country, an effective manufacturing strategy should focus on the entire spectrum of value added supporting activities from raw material supply, through product and process design, the production process to distribution and after sales service to customers (Whelan, 1998). In South Africa, there are indications that distribution costs may be outstripping labour costs in manufacturing and that inadequate distribution infrastructure may be hampering South Africa's trade as well as the attraction of Foreign Direct Investment (FDI) (Naudè, 1999a). Transportation costs and systems and inherited infrastructure and past transport policies, may also explain the unequal spatial distribution of manufacturing in South Africa (Kleynhans, Naudè & Suleman, 1998).

In light of the above this study will analyse the contribution of transport and logistics in South Africa's international competitiveness. Particularly, an analysis of transportation modes, logistical management systems and distribution costs and bottlenecks will be done.

1.3 Motivation

There is a growing consensus in the economics literature and amongst economic policy makers that an outward orientation in trade policy is beneficial for exports and economic growth (Sachs & Warner, 1995, 1997). South Africa is an example of a country where trade liberalisation, with the aim of raising economic growth and job creation through improving the country's international competitiveness, has been adopted as official policy (Coetzee, et al, 1997).

The vision of the South African government to integrate the South African economy into global markets and promote exports, is set out in its official macro-economic strategy, the "Growth, Employment and Redistribution (GEAR)" strategy (GEAR, 1996).

Whilst the view that outward-orientation (or "openness") and export-led growth may offer the best prospects for development in many developing countries are founding ever more supporters (see Ng & Yeats, 1996; Edwards, 1997; Sala-i-Martin, 1997, Sachs & Warner, 1997; Collier & Gunning, 1997), there have recently been a resurgence of interest in the so-called "new economic geography" (Krugman, 1991a, 1993, 1995b, 1996; Porter, 1994; 1996; Martin & Sunley, 1998: Martin, 1999). From this work have resulted in a small, but growing, body of literature that seems to temper the optimism about export-led growth somewhat. The weakness in the export-led growth theory exposed by the economic geography literature is that the former ignores, in following with the main models in the international trade literature, the role and impact of geography (through example transport costs) on exports and growth.

For a developing country such as South Africa, which is located geographically distant from its major exports markets (the Far East, Europe and the USA) geographical considerations may raise questions about the suitability and nature of export-led growth and its accompanying or supportive policies. Radelet and Sachs (1998:2) recently concluded a

survey on the relationship between shipping costs and manufacturing exports. The evidence suggests that high-shipping costs countries will find it more difficult to promote export-led development, even if they reduce tariff rates, remove quantitative restrictions and follow prudent macroeconomic policies. Thus, transport costs could be a significant factor adversely affecting the competitiveness of South African exports on global markets. It if can be established that this is the case, incentive measures based on geographical considerations, as well as regional economic integration initiatives³ that promotes "seamless" transportation across borders may acquire urgency (Naudè, 1999a:2).

In this light, the present study have the following benefits: to determine the effect that high transport costs have on the competitiveness of South Africa's exports and to evaluate logistics in South Africa.

1.4 Methodology

In this study both a literature and empirical analysis will be done. In chapter two, a brief overview of the new economic geography within a discussion on the role of transport costs in international trade theory is given. Chapter three outlines the transport infrastructure, system and service providers in South Africa, the logistics and supply chain management, and the current state of transportation and logistic management in South Africa. Chapter four discusses the transportation of South Africa's exports as well as domestic and international transport costs in and from South Africa.

³ Particularly for the landlocked countries in Southern Africa that are part of the Southern African Development Community (SADC) the incidence of transport costs could be an important motivation for fast-tracking regional integration agreements. Sachs and Warner (1997:339) states that "Landlocked countries, in particular, face very high costs of shipping, since they must pay road transport costs across at least one international boundary in addition to sea freight costs"

Chapter five present a model to estimate the impact of international transport costs on South African merchandise exports. This will include an analysis of transportation statistics, using time series data from Statistics SA, Department of Transport, (CSIR) and the IMF's International Financial Statistics. Chapter six will conclude the findings of the study.

1.5 Layout

Chapter two presents an overview of the development of transport international trade, the classical contributions to international trade theory such as Smith and Ricardo as well as an explanation of the factor-proportions model of Hecksher-Ohlin and modern additions and elaborations to this model. New trade theories and the new economic geography are also set out. Transport costs in international business cycles are explained.

Chapter three consists of a discussion on the state of transport infrastructure and economic development in South Africa and an overview on the South African transport system and transport service providers. The importance and state of supply chain management and logistics in South Africa are also discussed.

In chapter four, the extent to which domestic transport costs and international transport costs may be important in determining how "open" the South African economy is, will be discussed. The South African economy is chosen here since (a) its new government has explicitly adopted and outward-oriented growth strategy which hopes to emulate the East Asian experience and in which it has already made substantial progress as far as reducing tariffs are concerned: (b) it is geographically far from its main export markets in the Far East, Europe and the Americas; (c) its transport sector is being deregulated after being dominated - as in other African countries - by the state since 1910; and (d) its transport sector is perhaps the most advanced on the African continent (at least in Southern Africa) so that if transport costs can be

shown to be significant obstacle in South Africa, it might be more acute in other African countries.

In chapter five the effect of transport costs on the export supply of South Africa is empirically examined. By estimating a standard export supply equation for South Africa and using quarterly data over the period 1975 to 1998 to determine the effect. Chapter six concludes the findings in the paper and forward possible recommendations.

Chapter 2

TRANSPORT COSTS IN INTERNATIONAL TRADE THEORY

2.1 Introduction

In chapter one it was hypothesised that high transport costs may adversely affect the competitiveness of South Africa's exports. Two probable causes were put forward. Firstly South Africa's relative distance from world markets which may results in relatively high international transport costs (e.g. high shipping costs) and secondly, the rigid transportation infrastructure, regulatory environment for transportation, and inappropriate institutional framework in South Africa coupled with inadequate logistical management (or supply chain management) by manufacturing firms. The latter may also result in relatively high domestic transport costs.

It was further stated in chapter one that transport costs are important for economic development in South Africa since transport costs may (a) influence trade volumes⁴; (b) a country's trade patterns; (c) the location decisions of manufacturing plants and thus a country's spatial distribution of firms and related to the former points, (d) the success of regional integration schemes, such as SADC.

Despite the importance of transport costs in international trade, development and manufacturing, it has only been recently that the theory of international trade and development has began to incorporate transport costs and logistics⁵ into theoretical and empirical analyses. In this light the

⁴ If transport costs can be shown to be a significant obstacle to the expansion of exports from South Africa, current export incentive schemes offered by the South African government, as well as regional location incentive schemes for new manufacturers, may be inadequate. None of these schemes at currently offer compensation for South Africa's geographical disadvantages in international trade as stated in chapter one.

⁵ The physical distribution of goods, known as logistics, is concerned with getting products and services where they are needed when they are needed (Christopher, 1994).

purpose of the present chapter is to survey the incorporation of transport costs in the theory of international trade.

The chapter's outline is as follows. Section two is a historical overview of the development of transport and international trade. The views of the medieval, feudal and mercantilist traders on transport, economic development and international trade are discussed. In section three the classical contributions to international trade theory such as those by Adam Smith and David Ricardo, will be set out. In section four the factor-proportions model of Hecksher and Ohlin, the "working-horse" of international trade economists, will be discussed with a specific focus on the treatment of transport in the model. Thereafter, in section five, modern additions and elaborations of the Hecksher-Ohlin model are discussed, such as Wood's (1994) land-skill model. In section six the new trade theories are elaborated while in section seven the so-called new economic geography associated mainly with Krugman (1997, 1998) is set out.

Finally, section eight presents the incorporation of transport costs into theories of the international business cycle following recent work by Backus, Kehoe & Kydland (1994) and Frankel, Stein and Wei (1995). The chapter concludes with a summary.

2.2 Transport in Trade and Economic Development

The histories of the most developed countries in the world, namely those in Europe and North America suggest that economic development and the development of transportation are closely related. Preceding and during the era of the Industrial Revolution (+/- 1760 – 1900) economic development in Europe and the North America's was stimulated by the development of maritime transport, channels, railways (the steam engine) and access via maritime infrastructure to geographically dispersed markets.

The rise and development of transportation and transportation structures in order to establish better trade in medieval Europe was a difficult and extended task. Improvements in transportation were closely associated with changes in production. Expanded production depended on and demanded a transportation system that was able to spread products to wider markets effectively and fast. This ability came in two stages. Firstly, improved rivers, (the canal), better roads, and larger sailing ships enabled producers to move larger quantities of cheap, bulky, heavy, or fragile commodities more quickly over long distances at lower cost. Secondly, the development of the steam and (later) the internal-combustion engines increased further the size of the load, gave certainty of movement, defied climatic obstacles, added greatly to speed and flexibility, reduced costs further, and provide the power to penetrate areas inaccessible by river or canal (Heaton, 1968).

2.2.1 *Maritime*

The importance of especially maritime transport in the economic development of Europe is emphasised by Gallup, Sachs and Mellinger (1998:4) who recognises that “coastal economies are generally higher income than the landlocked countries ...nearly all landlocked countries in the world are poor”. During the thirteenth century much of the long-range trade of northern Europe were dominated by merchants who were situated in towns with ready access to the North Sea and northwestern Europe such as Amsterdam, Hamburg and Bremen. These towns are still amongst the most prosperous in Europe. Within a short period of time these merchants handled much of the surrounding countries trade. They became known as the Hansard merchants and also established Hanseatic states for themselves all over Europe, in city-states such as Hamburg and Rostock. They served the financial, commercial and transportation need of primary producing regions. The Hansards found markets for their produce and brought them in return the primary products or manufactured articles they needed. Efficient transport infrastructure and services was provided; lighthouses, buoys, and trained pilots made

navigation safer and they had established a comprehensive body of maritime law to govern relations (Heaton, 1968).

Natural barriers on every side hemmed in medieval Europe. From the mid-fifteenth century, expeditions were therefore systematically being undertaken along the African coast to find an alternative route from Europe to the East. In 1488 on his search for Prester John, Bartholomew Diaz rounded the Cape of Good Hope. But only 10 years later in 1498, Vasco da Gama reached India by the use of the sea route around the Cape. This was another improvement of trade between the West and the East, and contributed to the economic development of Portugal and Spain, and later in the 17th century to the development of the Netherlands and Great Britain.

In the late fifteenth century Antwerp was regarded as the commercial metropolis of Europe. The significant levels of economic development reached by Antwerp in the 15th century directly illustrate the important relationship between transport and economic development. Antwerp achieved its development status because of its geographical position (Heaton, 1968). Situated at the transport crossroads, there was easy access by water to the sea, industrial areas and the lower Rhine. There was an overland road to Cologne, from which point a combination of river, cart and packhorse transportation led to the Alpine passes and through to Italy and the mediterranean. This resulted in quick, safe and low cost movement of goods. All this led to Antwerp becoming a highly sensitive and complex market in Europe⁶ (Heaton, 1968).

⁶ Religious disorder from around 1566 was mainly the cause for this city's decreasing trade, which caused Antwerp to lose status among the other trading hubs.

In 1602, the Dutch East India Company was founded, uniting the groups that had nursed the infant trade in Europe. Its charter, granted for twenty-one years but periodically renewed, gave it monopoly of Dutch Oriental trade, with sovereign power to make war and peace, found colonies, build forts, maintain an army and navy and do what ever seemed necessary for the extension of its power and profit. Those extensions were affected by a combination of trading, fighting and establishing control over native peoples. This was the beginning of the Dutch "golden era" (Heaton, 1968).

By 1680, the Dutch had made the spice regions of the Malay Peninsula and Archipelago their own preserve and even the native traders had been eliminated. They held Ceylon and points on the shores of India, of the Persian Gulf, and of the Red Sea. They were stationed in Canton and had a trading colony on the island of Deshima in Nagasaki Bay and when in 1638 Europeans were ordered to leave Japan, the Dutch alone were given permission to stay. The Company also had a monopoly over Malaya. In North America, Dutch ventures were less important than in South America and the West Indies. The development of the Dutch East Indian Company illustrated the importance of foreign trade on sources of inputs and outlets for production in economic development.

This commerce with three distant continents, interwoven with the large traffic nearer home, made the Dutch the owners of nearly half of Europe's shipping tonnage. As stated by Defoe (in Heaton 1968), they were "The Carriers of the World, the Middle persons in Trade, the Factors and Brokers of Europe.....they buy to sell again, take in to send out; and the Greatest Part of their vast Commerce consists in being supplied from all parts of the World, that they may supply all the World again". To complete their equipment for this work they became industrialists and bankers.

Due to the increase in competition in Europe by the mid 19th century, significant pressure had build up to reduce transport costs to the East. A result was improvements in transport infrastructure serving Europe in the form of the Suez Canal. The Suez Canal, dug by De Lesseps and a French Company was opened in 1869. At first it was narrow, shallow and unprofitable. A ship spent 3 days passing through it. By 1880, after various improvements, the traffic and profits were rising. The opening up of this Canal reduced distances between western and eastern countries. The Mediterranean Sea soon became the second most important ocean route (Heaton, 1968).

When Suez began to pay dividends, De Lesseps and a group of French investors tried to repeat it at Panama, but failed. The USA government however succeeded and opened the Canal in 1914. The main objective for this Canal was to shorten journeys between the two coasts of the Americas and to bring the west coast nearer to Europe. Not only was the main objective achieved, but it also brought the west coast along with New Zealand, Japan and the eastern half of Australia nearer to New York than to London. Thus the American exporter was given an advantage over his British and German competitors, and the era between 1900 and around 1960 saw the rise of the USA as the world's economic superpower (Heaton, 1968).

Ocean routes were changed as the America's level of economic development increased. Ships that travelled from Europe via Suez to New Zealand and the Orient now returned via Panama instead of through Suez or round the Cape Horn. By 1939, two thirds of the tonnage using the Canals was foreign which indicate the affect that these two Canals had on trade routes.

Maritime transportation, one of the oldest modes of transportation, was significant also in the economic development of Germany. Inland water transportation in Germany was heavily invested in during the 19th century – particularly on rivers and canals – so that by 1903 the country had

almost 9 000 miles of navigable waterway. In 1924 waterways transported 110 000 000 tons of freight, of one-fifth the amount moved by rail. Coal and coke were the main commodities and others included sand, ore, brick, grain, fertiliser etc. Half of these commodities went to or came from abroad. Berlin was one of the first inland ports, as a third of the goods it bought were transported by water (Heaton, 1968).

2.2.2 Rail and Road

The value of steam was realised by scientist before 1700 and even Leonardo da Vinci thought about its possible uses during the early seventeenth century (Heaton, 1968). Newcomen improved pumping equipment by the use of steam and made an engine model of his own in 1705. Newcomen's engine became popular as it was improved through the century and they were in use on the coalfields until 1830 (Heaton, 1968).

The first complete improvement in pre-railroad transportation was carried out in Great Britain, and would contribute to the origins of the Industrial Revolution in Britain. By 1750 many rivers in Great Britain were made navigable which led to a decrease a freight rates by about three-quarters. This encouraged them to focus on the development of the canals, but at the same time they also focused on the building of roads. Two problems were faced. Firstly how to finance this infrastructure and secondly to find the constructing a durable surface. By overcoming these problems, the road network led to easier and faster delivery of goods and materials throughout Great Britain. After 1830 the railroad challenged both the waterways and road. By providing greater speed and safety, lowering freight rates and transporting goods in greater loads than could be taken over the highways, it provided an alternative to long-distance road traffic. It was superior to the waterways by carrying bulk commodities at lower rates than those charged by canals. Some railways assured their profitability by buying or leasing canals and letting them stagnate or pass

out of use. Thus the railroad exceeded the use of the older transportation systems by providing a better service (Heaton, 1968).

Advantages of the railroads, apart from the reduction of time and cost of movement where that it ended long-distance driving of livestock along the highways, created new fields for employment of labour and became a major destination for capital investment. At first revenue was obtained from passengers using the railroads, but after 1850 freight steadily grew more important than passengers. A service was build up for the handling of small consignments of produce and merchandise and regular freight-train schedules were in operation. The rise of the railway in Britain thus played a significant role in its industrialisation and would do so again in the case of the United States of America (Johnson & van Metre, 1922).

2.2.3 *Air*

Unlike the automobile, to which its development was intimately related, the aeroplane is a product of the 20th century. Although investigations into aerodynamic effects were carried out by inventors throughout the 19th century. World War I gave impetus to this technological development, transforming small-scattered aircraft manufacture into a major industry and transforming the airplane itself from a fragile construction in wood and glue into a robust machine capable of startling aerobatic feats (Encyclopaedia Britannica, 1984b).

To pinpoint the exact time when aviation turned a corner and won recognition as an important contributing factor to the world's economy, would be difficult, but a breakthrough occurred in the early 1930s. In the 1929-32 period, the external configurations and the inboard arrangements of virtually all categories of airplane underwent radical changes. In 1932 the impact of research was clearly in evidence and streamlining had become the order of the day. By 1955 the major economies had adopted jet propulsion for combat aircraft. All major airlines were deeply involved in the design and procurement of jet-powered passenger and cargo

planes. The development of aircrafts have ever since increased and improved (Encyclopaedia Britannica, 1984a).

2.3 Theories of Trade and Transport

2.3.1 *The Mercantilists*

The term mercantile system was coined to describe the efforts “to enrich a great nation rather by trade and manufacturers than by the improvement and cultivation of land, rather by industry of the towns than by that of the country” (Heaton, 1968).

Mercantilism usually refers to the collection of economic thinking that came into existence during the period from 1500 to 1750. Central to the Mercantilist thinking was the view that national wealth was reflected in a country’s holdings of precious metals. The mercantilists stressed the need to maintain a positive balance of payments by obtaining an excess of exports over imports.

Another mercantilistic point of view was the static view of world resources. Economic activity in this setting can best be viewed as a zero-sum game⁷ in which one country’s economic gain was at the expense of another country. Acquisition thus became the means for increasing wealth and well being and the focus of the emerging European nation-states. The enhancement of government power was seen critical to the growth process and a strong especially navy and shipping fleet, were seen as critical to maintaining and increasing the power of a nation-state (Appleyard & Field, 1992; Salvatore, 1998).

⁷ A zero-sum game is a game such as poker where one person’s winnings are matched by the losses of the other player.

Government intervention was therefore an important doctrine of the mercantilists. Governments controlled the use and exchange of precious metals and also gave exclusive trading rights for certain routes or areas to specific companies. These trading houses fostered the generation of higher profits through the exercise of both monopoly and monopsony market power⁸. These profits contributed both directly and indirectly to a positive trade balance as well as to the wealth of the rules that shared the profits of this activity (Appleyard & Field, 1992). Viewing trade as a zero-sum game, transport systems (apart from monopoly and monopsony market power) was essential for the mercantilistic strive to conquer the territories and markets needed to strengthen their power over trade and trade patterns. During the mercantilistic era significant investments in transport infrastructure was made by all economically developed nations, particularly in the field of maritime transport (see section 2.2.1).

2.3.2 *Classical Theory*

During the Classical era (+/- 1750 to 1880), the main concern was to explain why countries trade with each other and to identify the factors determining countries' patterns of trade. Two main contributions were Adam Smith's theory of absolute advantage and Ricardo's theory of comparative advantage.

2.3.2.1 *Absolute advantage*

Adam Smith departed views with the mercantilists and posited that all nations would gain from free trade. Smith also advocated the policy of laissez-faire (i.e. as little government interference with the economic system as possible) (Salvatore, 1998).

⁸ The Dutch East India Trading Company and Hudson Bay Company are familiar examples of trade monopolies, which continued until the latter part of the 18th century. monopolies, which continued until the latter part of the 18th century.

Smith's arguments were based on the principle of absolute advantage. In a two-country two-product world, international trade and specialisation will be beneficial when one country has an absolute cost advantage in the production of one product, whereas the other country has the absolute cost advantage in the other product. According to Smith it was better for a nation to import products that could be produced overseas more efficiently than to manufacture it. Therefore nations would import products in the production of which they had an absolute disadvantage against the exporting nation. They would export products in the production of which they had an absolute advantage over the importing nation (Salvatore, 1998).

Smith also argued that when a nation has an absolute advantage in one product, they would produce that product at a lower cost, becoming more competitive than its trading partner does. Cost differences could thus determine the movement of products among nation. Smith claimed that the productivity of factor inputs represent the major determinant of production cost and thus trade patterns and volumes.

Smith stressed the relationship between geographic location and international trade (Radelet & Sachs.1998:1). Productivity depends on specialisation, specialisation then depends on the extent of the market. The extent of the market in turn depends on both the freedom of markets as well as the cost of transport. Smith realised that geography is crucial in transport costs (Radelet & Sachs.1998:1). He observed that a more extensive division of labour was likely to develop first along seacoasts and navigable rivers, where transport costs were especially low:

"As by means of water-carriage a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon the sea-coast, and along the banks of navigable rivers, that industry of every kind naturally begins to sub-divide and improve itself, and it is frequently not till a long time after that those improvements extend themselves to the inland part of the country" (Smith, 1937:18).

2.3.2.2 Comparative advantage

According to Smith, mutually beneficial trade required that each country must at least have an absolute advantage in one of the products. But what if a nation is more efficient than its trading partner in both products? In 1817, David Ricardo established the theory of comparative advantage to explain that potential gain from international trade was not restricted to the case of absolute advantage (Carbaugh, 1992, Appleyard & Field, 1992).

To focus on key relationships and concepts, Ricardo based his model on the following assumptions: two country, two commodity world, fixed endowment of resources, factors of production is mobile nationally but immobile internationally, fixed technology for both countries, constant production costs, full employment, perfect competition, no obstacles to economic activity, labour theory of employment is present and *transportation costs are zero*, both internally and internationally. In the model, if one country has an absolute advantage in both products, the less efficient country should specialise in and export the product in which it is comparatively less inefficient (where its absolute disadvantage is least). The more efficient country should specialise in and export that product in which it is comparatively more efficient (where its absolute advantage is the greatest). The key to determining which country has a comparative advantage in the production of which product is to calculate the opportunity cost of producing each product in each country.⁹

Ricardo did not regard absolute productive efficiency as a crucial factor governing beneficial trade. Ricardo ascribed the source of differences in comparative advantage between countries to the different productivity of labour in different countries. Countries with a high productivity of labour would tend to have a comparative advantage in the production of high technology products (associated with high labour productivity), while

⁹ This opportunity cost is expressed in terms of how many units of the other good must be foregone in order to produce one unit of the good in question.

countries with low labour productivity would tend to have a comparative advantage in the production of goods and services that required low technology (associated with low labour productivity) (Munday, 1996).

With the development of the neo-classical price theory these other factors of production was also identified as having an influence on the value of a product. Thus Heckscher and Ohlin (1933) suggested that different opportunity costs between different countries were the result of different factor endowments in general (not just labour).

2.3.3 *Heckscher-Ohlin model*

The Heckscher-Ohlin model and its extensions remain the “workhorse” for explaining international trade.

2.3.3.1 *The Basic Model*

The Ricardian model does not include trade issues such as the influence of resource supplies on international specialisation and the influence of trade on the distribution of income. Heckscher-Ohlin formulated a model to address these issues. Their model delegates primary importance to the factor endowments nations enjoy (Carbaugh, 1992).

The factor endowment model asserts that the pattern of trade is explained primarily by differences in relative national supply conditions. Heckscher-Ohlin attribute relative price differentials to differences in natural resource endowments. Geography may thus be included amongst natural resource endowments as a factor, which – through transport costs for instance – effects relative price differentials between countries.

The basic Heckscher-Ohlin model is based on a number of assumptions, amongst which should be noted is the standard assumption of zero transportation costs (frictionless trade) (Salvatore, 1998):

- There are two nations, two products and two factors of production;
- Both nations use the same technology in production;
- Product X is labour intensive and product Y is capital intensive in both nations;
- Both products are produced under constant returns to scale in both nations;
- There is incomplete specialisation in production in both nations;
- Tastes are equal in both nations thus identical demand conditions;
- There is perfect competition in both product and factor markets in both nations;
- There is perfect factor mobility within each nation but no international factor mobility;
- All resources are fully employed in both nations;
- International trade between the two nations is balanced;
- There are no transport costs, tariffs, or other obstructions to the free flow of international trade;

Given these assumptions, the Heckscher-Ohlin model implies that given identical demand conditions and input productivities, the differences in the relative abundance of factors of production determine relative price levels and the pattern of trade. Capital is relatively cheaper in the capital-abundant country and labour relatively cheaper in the labour-abundant country. The capital-abundant country will export the capital-intensive product and the labour-abundant country will export the labour-intensive product (Carbaugh, 1992; Salvatore, 1998; Appleyard & Field, 1992)

The basic Hecksher-Ohlin model therefore concludes that each country exports the product that is relatively intensive in the production factor with which it is relatively well endowed. This will dictate specialisation in the world economy and the direction of trade of different products.

Using input-output data for the USA, Wassily Leontief tested the Hecksher-Ohlin theory. According to Hecksher-Ohlin theory the USA (a relative capital-abundant country) will export capital-intensive products and import labour-intensive products. But Leontief found that although the USA is a relative capital-abundant country, it imported and exported capital-intensive products and about 30% of the imports were capital-intensive products. This contradiction became known as the Leontief Paradox. (Carbaugh, 1992). Intra-industry trade models (see section 2.3.4.1) have been advanced to explain the Leontief paradox.

2.3.3.2 Skills and Natural Resources in the Hecksher-Ohlin model

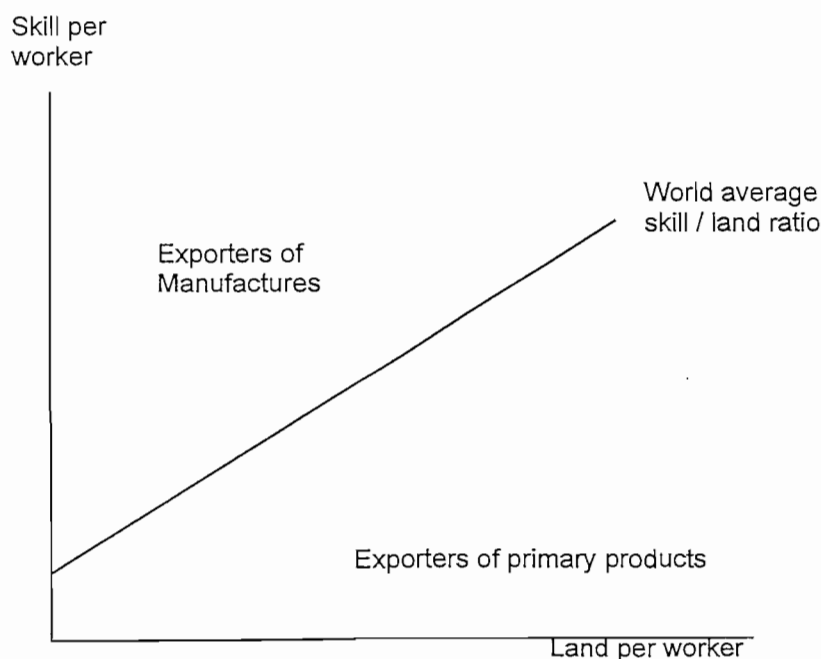
According to Wood et al (1994), inappropriate trade policies are not always the main obstacle to manufactured exports. It is often the “wrong” resource endowments that are the problem. To support this, they present a modified version of the Hecksher-Ohlin theory to determine if the difference between a country mainly exporting manufactures and a country exporting mainly primary products could be based on the skill level of its labour force relative to the extent of its natural resources.

The basis of the original Hecksher-Ohlin theory, namely that countries tend to export those goods, which is produced from the factors of production in which they are relatively abundantly endowed, is still applicable. Wood et al (1994:3) claims that to provide a credible answer, the difference in factor proportions between exports of manufacturing products and primary products, must be known. The nature of this difference must also be established. To establish the nature of the difference in factor proportions between manufacturing products and

primary products, Wood et al (1994:3) defines a factor as an input to production that is internationally immobile. The comparative advantage of particular countries cannot be governed by the availability of traded intermediate inputs because they are internationally mobile. Capital therefore becomes the next factor to be disqualified because it is too internationally mobile to be a basic influence on the commodity composition of trade.

Wood et al's (1994) immobility criteria (as explained above) reduce the list of factors of production to natural resources and human resources (acknowledging, of course, that some part of the world's labour force, too, is internationally mobile). Wood et al assumed that all sorts of natural resources can be aggregated into *land* (N), and that all sorts of skills can be aggregated into a single stock of *skill* (H). The production function for either manufacturers or primary products can be written as $Q_i = f(N_i, H_i, L_i)$, where L is the number of workers involved, and capital and intermediate inputs are omitted for the sake of simplicity. This is illustrated in figure 2.1.

Figure 2.1: Determinants of comparative advantage



In figure 2.1 the x-axis measure the average level of skill per worker and the y-axis measure the average level of land per worker in each country. Each country must lie on a ray from the origin, whose slope measures the ratio of its endowments of skill and land. There must also be one particular ray from the origin which measures the world average ratio of skill to land: and whether a country is a net exporter of manufactures or of primary products must depend on whether it lies above or below that ray. A country's trade pattern is not only determined by capital. Therefore the per capital income, insofar as it depends on resource availability, is measured by the distance from the origin. Thus countries with different income levels and similar skill:land ratios, may lie on the same ray. There are some rich exporters of primary products and also some poor exporters of manufactures.

The advantage of this narrow definition is that it allows the model to cover trade in services. For services that resemble narrow manufactures (and differs from primary products) in having relatively high skill:land input ratios.

To the extent that Wood et al's (1994) model, like the basic Heckscher-Ohlin model, abstracts from transportation costs and transportation infrastructure, it may be argued to be lacking. Especially in Wood's case, where the ratio of skill:land determines success in export of manufactures, it may be argued that the lower the rates of skill:land, the higher domestic transport costs in that country would be. Thus, the skill:land ratio may in fact be a crude proxy for transport costs. In such a case, the Wood model may illustrate the relationship between export of manufactures and transport costs. To establish the connection or correlation between the skill:land ratio and transport costs, the discussion in Gallup, Sachs & Mellinger (1998:9-10) refer. They point out firstly that the density of human settlement in a country's coastal region is highly correlated with its development level. In the poorest region in the World, Sub-Sahara Africa, only 19% of the population reside within 100 km of the coast. This suggests a large inland, and rural population, where skill levels are

traditionally low, resulting in lower skill:land ratios. Secondly, large countries overall tend to have smaller coastlines and larger possibility for rurally distributed populations. Thirdly, in larger countries transport systems may be argued to be more important/vital in integrating markets, but also more expensive due to the relative absence of scale economies.

2.3.3.3 *Transport Costs in the Hecksher-Ohlin model*

The incorporation of transport costs into the Hecksher-Ohlin model of international trade is discussed in this section and the major conceptualization of the inclusion of a transport sector onto the basic two-country, two-good model is presented and analyzed.

The empirical evidence about the relevance of transport costs in international trade is noteworthy. First of all, transport costs represent a relevant share of FOB values of imports and exports. In 1993 the freight and insurance costs as a percentage of the FOB price of the E.E.C exports ranged from 8% for the U.K to 5% for Italy (Bottazzi et al, 1996). For South Africa this percentage was 7% in 1991. Second, the transport and logistic costs plays an important part in the GDP of a country (Bottazzi et al, 1996). In South Africa transport, warehousing and communications costs increased from 7.43% in 1990 to 8.25% of GDP in 1998, which indicate the importance of transport costs in a country's economy (Bottazzi et al, 1996).

Although the quantitative importance of the transport sector has been recognized, the theoretical role of transportation has received little attention in the trade literature (Casas, 1983¹⁰; Bottazzi et al, 1996). One distinguishing feature of international trade, which indicate the importance

¹⁰ For example, Hadley and Kemp (1966:125) states that "costs of transporting, commodities between countries have never been satisfactorily integrated with the competitive general equilibrium theory of international trade." Kindleberger (1973:103) admits that "the pure theory of trade has abstracted from a vital fact of life – the existence of transport costs", and Falvey (1976:536) recognises that "the inclusion of a transport sector in the standard trade model has received little attention in the trade literature".

of its recognition in trade models, is the presence of transport costs exceeding those of internal trade, particularly for intercontinental trade (Falvey, 1976).

Among the earliest attempts to introduce transport into a framework of the simple general equilibrium model of international trade was Mundell's (1957)-study based on earlier work by Samuelson (1954). Samuelson was primarily interested in the effects of transport costs on the terms of trade in the context of the transfer problem (Samuelson, 1954). Mundell, on the other hand, has a broader interest in the implications of transport costs and stressed the geometry¹¹ of the problem (Mundell, 1957). Samuelson and Mundell stressed the role of supply and demand conditions in the markets for traded goods in determining the division of the burden of supplying transportation and the consequent welfare loss for the two trading countries (Casas, 1983). A crucial assumption of Samuelson and Mundell's model can be illustrated by quoting Samuelson (1954): "To carry each good across the ocean you must pay some of the good itself. Rather than set up elaborate models of a merchant marine, invisible items, etc., we can achieve our purpose by assuming that just as only a fraction of ice exported reaches its destination as unmelted ice so will...fraction of a country's exports...reach the other country as imports" (Samuelson, 1954). This model became known as the Samuelson (1954) 'iceberg' transportation model¹², in which transport costs "melt" away in transit. This 'iceberg' model has two advantages. First, it eliminates the need to introduce transportation as an additional sector. Second, it implies that the elasticity of demand with respect to a firm's F.O.B. price is the same as that with respect to its C.I.F. price, eliminating many potential complications (Krugman, 1995a:1261).

¹¹ Mundell used a simple geometric method for depicting transport costs in offer-curve diagrams, and applied the method to analyse transport cost in the context of the terms of trade, the transfer problem, the optimum tariff and real factor returns. For a description see Mundell, 1968.

¹² Extended explanation in Casas, (1983) and Samuelson, (1954).

Unlike Samuelson and Mundell, Herberg (1970) assumed that transport services are distinct from the two traded goods and can be supplied by either country. The technology in the transport sector was assumed to be linearly homogenous¹³ in labour and capital, but rather than leaving market forces determine the supplier of transport services, Herberg stipulated that each country transports its own imports. But since all the transport services supplied by each country involve the moving of the products in one direction only, the assumption gives rise to a conceptual difficulty recognised by Herberg himself (1970:579)¹⁴. This assumption seems to be acceptable if the transport media carrying for technical reasons goods in one direction only as, e.g. pipelines are considered. The difficulty on the other hand is that the assumption is far less satisfactory with regard to backhauling e.g., ships, lorries, freight trains; it would imply that they are not used efficiently since they would be empty on every outward journey. Herberg's contribution underscores the idea that transport directly absorbs resources and illuminates the role of the transport technology in determining equilibrium commodity prices (Casas, 1983).

The model constructed by Falvey (1976)¹⁵ is similar to the Herberg model in assuming that the transportation technology is distinct from that for traded goods, but differs from it in allowing market conditions, i.e., costs of production, to determine the supplier of transport services rather than arbitrarily assigning the production burden between the two countries (Casas, 1983). In Falvey's analysis, the restricted assumption of Herberg that each country transports its own imports is substituted by assuming that transport technology is identical for the two traded goods¹⁶ as well as in the two trading countries. The Heckscher-Ohlin model theorem linking factor endowments and the trade pattern on the basis of the commodities'

¹³ Linearly homogenous suggests that technology was linearly the same for capital as well as labour, in other words if changing capital by a factor of x results in changing technology by the same factor and the same for labour and technology.

¹⁴ For an extended explanation of Herberg's model see Casas, (1983).

¹⁵ For an extended explanation of Falvey's model see Falvey, (1976).

¹⁶ This should be interpreted to mean that for any given factor price ratio, the capital-labour ratio used in transporting the two goods will be the same, but not necessarily that the quantity of transportation services necessary to carry one unit of each traded good will be the same for the two products.

relative intensities was extended by Falvey to predict which country would produce transport services. The result was that transport costs have two effects on a country. The first one is an implicit tariff effect that concentrates on the differential in the countries' relative prices on the two traded goods. The second included a resource cost effect that concentrates on the reallocation of resources in the traded goods industries forced by the withdrawal of factors into the transport sector (Falvey, 1976). Falvey therefore has contributed to the role of technology in the transport sector in determining the origin of the resources used up in carrying traded commodities (Casas, 1983).

A "joint production model" outlined by Casas (1983) suggests that the resources used in transportation may – and in general will – originate in both trading countries, with technology and market conditions determining each country's contribution. According to Casas (1983) the views of Herberg and Falvey fails to recognise that transportation calls for the joint productive participation of the exporting and importing countries. Whether trucking, shipping, air freight or railways are considered, it becomes apparent that resources from the country of origin as well as from the country of destination of the goods carried will be used up in the process of effecting their transport from one country to the other. These resources will normally include both capital (e.g. airports, docks, roads, stations, as well as equipment) and labour (e.g. loading and unloading, driving administration, etc.). The relevant question is not which country supplies transportation but how much of each country's resources will be absorbed in supplying it.

Casas (1983) postulated a general production function for the transport sector of the form:

$$T = (F_T^h, L_T^h, K_T^h, L_T^f, K_T^f) \quad (1)$$

Where L_T^h and K_T^h denote the quantities of the home country's inputs used in the transport sector, while L_T^f and K_T^f are the quantities of the foreign country's inputs.

In the positive theory of international trade, transport costs were introduced to explain the distinction between traded and non-traded commodities (Samuelson, 1954; Mundell, 1957). To some extent, these costs might be expected to depend on geographical factors and can, therefore be treated as an exogenous variable. According to Bougheas et al (1999), these costs could depend inversely on the development of transport and telecommunications infrastructure. Variations in transport costs across countries may be able to account for differences in their ability to compete in international markets. Thus, differences in the volume and quality of infrastructure across countries may be responsible for differences in transport costs, which in turn, may be able to account for differences in competitiveness (Bougheas et al, 1999). Bougheas et al (1999) introduced infrastructure and transports costs in the Dornbusch-Fischer-Sameulson (1977) model to indicate that infrastructure, by reducing transport costs, may be able to enhance trading opportunities¹⁷. Although this model did not indicate how the cost of infrastructure should be shared between two trading partners, it established that good infrastructure reduces transport costs with all trading partners, and therefore benefit all trading partners.

¹⁷ For an extended explanation, Bougheas et al (1999).

2.3.4 *New Trade Theories*

Apart from the Leontief Paradox and the omission of transport costs there were various other criticisms against the traditional trade theories (Appleyard & Field, 1992, Munday, 1996). As some of these criticisms have implications for transport costs and logistics, they will be reviewed in this section.

Under the assumption of perfect competition, any one group involved in trade would not dominate the international market, and thus an unbalanced distribution of the gains from trade would be unlikely (Munday, 1996).

The assumption of perfect factor mobility would imply that a country could immediately swap its production if the terms of trade were found to be unfavourable. Thus there would be no problem due to a country being committed to the production of a certain commodity.

The traditional trade theories rely on the joint assumptions of constant costs in all industries and full employment. Without these assumptions, it is possible that unemployed resources may offset the gains from specialisation that are suggested. This could be the result of a limit to the possible resource transfer towards activities that have diminishing returns as wages cannot fall below some minimum levels.

The starting point of more recent contributions to international trade theory is the observation that perfect competition and constant returns to scale are not reasonable assumptions with regard to international trade. Instead the recent contributions are emphasising imperfect competition, increasing returns to scale and externalities (e.g. Romer, 1986, Krugman, 1987a, Holden, 1992). Stegemann (1989:73) states in this regard that:

"The theory of international trade has changed drastically over the last decade by admitting into its mainstream a body of literature that focuses on the implication of monopolistic elements in international markets."

It was suggested in chapter one that a major benefit of trade liberalisation is likely to be the wider market that is available to producers. It may allow them to benefit from economies of scale. The problem implied by this statement is that the existence of significant economies of scale suggests the impossibility of perfect competition. Because this is in the drive to reduce costs (a presumed benefit to competition) that will lead to concentration and to the domination of any industry with significant economies by a few firms (Munday, 1996).

Economies of scale can create barriers to entry into the industry and any new firms can only compete successfully if it enters as a large enterprise. The so-called 'infant industry' argument for protection against free trade therefore argued that new, smaller firms need protection for a period of time until they were 'grown up' and sufficiently large to be able to compete on an even footing in the international market (Salvatore, 1998).

The assumptions of perfect competition, as utilised in traditional trade theories, fail to recognise many issues raised by firms and policymakers (Porter, 1990). Instead of countries basing trade on comparative advantages, trade often occurs due to advantages of large-scale production, experience and transitory advantaged resulting from innovation. In terms of the first theorem of welfare economics¹⁸, and its assumptions, failure of any of the conditions can be viewed as failure of the market. Therefore, the imperfect competition revealed in current international trade theory could be characterised as a market failure.

¹⁸ The theorem of welfare economics or optimal theorem can be explained as follows. The first optimal theorem states that. Resource allocation is Pareto-optimal, if there is perfect competition, no technological externalities, and no market failure connected with uncertainty. The second optimality theorem states that. Any specified Pareto-optimal resource allocation that is technically feasible can be achieved by establishing free markets and an appropriate pattern of factor ownership, if there are no increasing returns, no technical externalities, and no market failures connected with uncertainty.

Where there is market failure, it is in principle possible for a government to intervene to improve upon market equilibrium. The new theories does not suggest that international trade is undesirable, but conclude that there may be a case for government intervention in international trade providing a superior outcome than permitting totally free international trade (Munday, 1996).

Krugman (1987b:134) claims in this regard that "Increasing returns to scale and imperfect competition as necessary parts of the explanation of international trade,...we are living in a second-best world where government intervention can, in principal, improve on market outcomes". Furthermore, governments might feel that certain goods and industries generate desirable spin-off benefits (positive externalities) for other domestic producers, which would justify intervention. An example might be transport infrastructure. Transport may generate positive externalities that will contribute to different levels of the economy. The existence of a transport system not only increases job creation and thereby the population welfare, but also simplify the difficulties that people might encounter to attend their jobs. Another positive externality that transportation and transport infrastructure have is the development, increase and acceleration of trade, nationally as well as internationally. The existence of a reliable transport system contributes to the competitiveness of industries and the country itself.

As such an understanding of more recent trade theories may be necessary for an understanding of the role of transport costs and transport infrastructure in international trade.

2.3.4.1 Intra-Industry Trade models

Intra-industry trade models are used to explain the Leontief paradox which stated that capital abundant countries do not only export capital intensive products, but they also import capital intensive products and the same with labour abundant countries.

Stegemann (1989:77) claims that “intra-industry trade models explain why similar industrial countries trade so much with each other and why so much of their trade consists of an exchange of similar products. These models assume a large number of producers or free entry, differentiated products, and increasing returns to scale for each product (Wilson, 1986).

The policy recommendations of these models tend to be similar to those of traditional trade models but are not part of the traditional theory (Munday, 1996). In the case of intra-industry trade, benefits from trade are higher due to greater utilisation of scale economies, more product variety and increased competition among the suppliers of similar goods (Brander, 1988). Effective supply chain management can enhance the competitiveness of a supplier. Supply chain management can be defined as:

“The delivery of enhanced customer and economic value through synchronised management of the flow of physical goods and associated information from sourcing through consumption”. (La Londe, 1998).

Supply chains¹⁹ mainly span from raw materials, to manufacturing, distribution, transportation, warehousing and product sales. With transportation as part of the supply chain, the evaluation of transport costs is an important direct cost that could effect a supplier's competitiveness. As indicated in the Moving South Africa (MSA) report, one strategic action required to address the gaps across the entire freight transport system is

¹⁹ Supply Chains can be defined as the process from the initial raw material to the ultimate consumption of the finished product linking across supplier-user companies. The functions within and outside a company that enable the value chain to make products and provide services to the customer (Anon, 1999b).

to improve firm-level competitiveness through increased productivity (MSA, 1999).

Most models designed to explain intra-industry trade imply that the production of trade commodities is not associated with profits or external effects that could be reaped by any of the countries involved. These models are not part of the theory of comparative advantage and although they still lead to a presumption in favour of free trade, they suggest gains different from those presented in the traditional theory (Suleman, 1998).

2.3.4.2 *Strategic Trade Policy*

In so-called “strategic trade policy models” (Krugman, 1987b; Stegemann, 1989), it is assumed that an increase in the production of a tradable good implies a greater share of the potential monopoly rents or externalities related to this activity. This is referred too as “profit shifting”. The different models of strategic trade policy illustrate that government intervention can generate favourable results for the home country at the expense of foreign countries. Models of strategic trade policy merely demonstrate the possibility that a government, under certain assumptions, can improve national welfare by shifting profits from foreign to domestic producers (Stegemann, 1989:79).

The essence of strategic trade policy is that with increasing returns to scale and imperfect competition, firms in certain industries may be able to earn long-run abnormal profits, or returns greater than the opportunity cost than the resources employed. This could be illustrated by the extreme situation where the economies of scale in an industry are so large that there is only room for one firm to function successfully in the industry. More than one firm would imply that both firms would incur losses. The industry is therefore a natural monopoly. In such a situation it is possible to illustrate how strategic government intervention (e.g.

lowering of transport costs / other export promotions) can benefit a particular country (Stegemann, 1989:79).

The two strategic policy models that will be reviewed are those of Brander-Spencer (1985) who concentrate on the concept of “profit shifting”, i.e. shifting profits from one country to another. Krugman (1987b) contends through strategic trade policy that export promotion can be attained via import restriction.

The model of Brander & Spencer (1985) focus on strategies that can shift monopoly profits from a foreign to a domestic producer. To illustrate this, they assume an industry with two firms producing a homogenous product. Herein, the provision of a transport subsidy to domestic producers may be such a strategy²⁰. The two firms are situated in different countries, and produce for a common export market in a third country (assuming that all sales and profits are initially made in the third country). Brander & Spencer’s concern is with profit sharing, and how government can intervene to realise a larger profit for its domestic producer from the duopolist’s common market.

In the Brander-Spencer model, both firms are assumed to utilise output as their choice viable, and behave like Cournot duopolists (see Gravelle & Rees, 1992:301). Without government intervention the Brander-Spencer model would result in a Cournot equilibrium²¹. Brander-Spencer (1985) subsequently derives a model similar to von Stackelberg’s (Creedy, 1992) “asymmetrical duopoly solution”.

²⁰ It was pointed out in chapter 1 that the Reynders Commission suggested the consideration of such a subsidy for South African manufacturers.

²¹ Cournot content that equilibrium is reached when each firm is doing the best that it can, in the sense that it is maximising profits through the choice of its own level of output, given the output level of its rival.

In Stackelberg's theory, one firm is sophisticated enough to anticipate / judge the other firms Cournot adjustment before hand, and set its output accordingly, and thus moves to a superior position, making it a "Stackelberg leader"²². This is achieved by each firm occupying an "independent supply position" (Dowrick, 1996). The Brander-Spencer model differs in that one country's government takes over as the rule maker to enable its firms to act as a Stackelberg leader. Hence, whilst both firms operate as Cournot duopolists, one government provides an export subsidy or a subsidy to compensate for high transport costs due to unfavourable geographical location to assist their domestic producer (as the leader would), whilst the other government remains inactive. It is assumed that the follower must view the leaders' government as making a credible decision when it intervenes (Brander, 1987). The net result is gross sales are increased and per unit costs decreases in the leader country due to the transport subsidy. However, because the follower "makes room for the leader", the volume of sales of the follower country is curtailed and thus receives lower profit per unit. Therefore government intervention succeeds in shifting profits from the foreign rival firm to the domestic one (Brander & Spencer, 1985).

An assumption of this model is that a government has information on the structure of its countries' industry, and is able to set a credible subsidy on exports (e.g. for transport) before the quantity decision being taken by the firm. This assumption is necessary because firms operating under a Cournot equilibrium could not make a credible decision on their own to assume a Stackelberg leadership role. In the absence of government intervention, the Cournot equilibrium places the two firms on equal ground. Therefore, a move by one firm to increase output would not be deemed credible and profitable because the other firm could not be expected to reduce output.

²² A "Stackelberg Leader" is a firm who knows and uses the other firms Cournot connections, to move itself to a superior position. In other words, suppose that instead of firms making simultaneous output choices, firm 1 announces its output first and, once that announcement is made, the output cannot be changed. This makes firm 1 the *market leader* and defines the von Stackelberg model (Gravelle & Rees, 1992:304)

To assume government intervention, such as a subsidy, can change the complexion of the situation. Once the rival firm acknowledges the government subsidy, it can view the increased output from the other firm as a credible choice. It is credible because the expansion will be privately profitable even if the rival firm does not reduce output levels, implying that the subsidising government is credibly committed. This subsidy has the effect of lowering the domestic firm's marginal cost curve, and shifting its reaction curve²³ outwards. Whilst both duopolists move along their reaction curves, a new Cournot equilibrium is attained with the subsidising firm having increased output with the other firm having a lower level of output. Only when a firm's action is deemed credible can this situation occur (Brander, 1987).

Brander-Spencer (1985) examines joint-profit co-operative situations. They point out that it is inefficient when one country takes a unilateral initiative to capture a greater share of the profits of the export market. The obvious retaliation from the non-subsidising country's government is intervention via export transport subsidisation. Hence, another Cournot equilibrium evolves albeit with government subsidisation.

Brander and Spencer (1985) conclude that this new equilibrium may be sub-optimal under its non co-operative state. If firms were to form a joint co-operative cartel and impose a tax on the exports to the third country, which would result in the most optimal solution. However, they assume that firms could not reach such an agreeable solution.

An implication of the Brander-Spencer model is that domestic firms can be placed at an advantage by government intervention, if such interventions can induce foreign firms to contract or expand output levels at a rate lower than they otherwise would (Brander and Spencer, 1985).

²³ The reaction curve indicates the speed with which a firm reacts on changes in the firm's marginal costs.

Krugman (1987b) demonstrates how a country can promote a domestic industry by protecting its home market, and allowing a firm to move up the “learning curve” at a rate faster than its foreign rivals can.

Krugman (1987b) adds a strategic dimension to the traditional infant industry argument in constructing his model for government intervention. The traditional infant industry argument centre around rivalry between established industrial countries and emerging / developing nations (Wilson, 1986). The fundamentals of the argument are based on the existence of three key distortions in the policy-making country. These are:

- imperfections in the capital market which form a barrier to entry through heavy initial capital outlays;
- external benefits of learning that arise when firms lose trained employees after the initial phases; and
- external benefits of learning that arise from knowledge diffusion, which tends to adversely affect a firm during the initial phases.

Consequently, the optimal intervention for all of the distortions mentioned is intervention in the domestic market. A protectionist policy to protect the domestic market is deemed unnecessarily costly because policy makers are not dealing with a trade distortion. Traditional theory does not allow for profit shifting, government retaliation and other oligopolistic circumstances that are common in modern global trade. Therefore, the traditional infant-industry argument with the assumption of perfect competition, and numerous established firms and a domestic one that needs to “catch up” may be inappropriate (Krugman, 1987a).

Krugman (1987b) incorporates the unorthodox assumptions of strategic import restrictions to achieve welfare gains for the domestic economy. His analysis rests on two basic ingredients: international oligopoly and economies of scale.

Concerning oligopoly, Krugman (1987b) assumes two firms, one foreign and one domestic, in which each firm produces a single product that it sells in various segmented markets. Furthermore, the products are assumed to be close substitutes, but are not required to be perfect substitutes and that both firms act as Cournot duopolists. The result is a multi-market Cournot model. With respect to Krugman's (1987b) other basic ingredient, he clarifies three different forms of scale economies leading to as many versions as his general model. In his third version, Krugman comes close to the infant-industry argument, where he introduces economies of learning by doing. The conclusion that arises is the same, in that a government gives its domestic producer an advantage in scale economies over its foreign rival. These scale advantages lower the domestic firm's marginal costs and increase their market share, even in unprotected markets.

When a government restricts a foreign producer from a market previously open to it, the intervention induces opposite effects on the marginal costs of the domestic and foreign rivals. The domestic firm's marginal costs will fall as it sells more in its market where the foreign firm has been excluded. Consequently, the foreign firm's marginal cost will rise due to the reduction in output forced by the market exclusion. There are additional effects because, as both firms' marginal costs are inversely affected, so are their sales in unprotected markets. Hence, the domestic firm will expand output further whilst the rival will retreat. Krugman (1987b) contends that the process of adjustments continues till a new multi-market Cournot equilibrium is attained.

An often asked question is why countries do not agree to use subsidies and thus gain the greatest benefits possible? International treaties try to accomplish just that, and the formation of the General Agreement of Tariffs and Trade (GATT), is an example of an attempt to get countries to agree multilaterally to have low tariffs. Problems have arisen though because some individual countries have incentives to cheat or defect. Furthermore, an international governing body to force countries to abide

by the treaties they sign is not yet available (although some regulation exists via the WTO) (Suleman, 1998).

New trade theory, with its conclusions that modern international trade reflects increasing economies of scale and imperfectly competitive markets, is gaining acceptance in the economic profession (Holden, 1994). The conclusion that this justifies more government intervention, however, has been substantiated by theory. The critiques of the new interventionism are partially based on the politics of trade policy, but there are also three key criticisms. First, critics claim that the empirical difficulties involved in modelling imperfect markets make it difficult to formulate viable interventionist policies. Second, critics argue that any gains resulting from intervention will be eroded by entry of profit-seeking firms. Thirdly, critics state that general equilibrium considerations drastically increase the empirical difficulty of devising interventionist policies, which could end up doing more harm than good (Rodrik, 1995).

2.3.5 Externalities

Meade (1973) defined an externality as follows:

“An external economy (diseconomy) is an event which confers an appreciable benefit (inflicts and appreciable damage) on some person or persons who were not fully consenting parties in reaching the decision or decisions which led directly or indirectly to the event in question”.

In other words, an externality exists when a third party is affected by the decision(s) of others. Externalities can be either positive or negative. In other words the decisions of certain people may have beneficial or non-beneficial effects on others. As explained by Munday (1996), the existence of positive externalities plays an important part in economic growth as well as international trade.

Endogenous growth theories such as Arrow's 'learning-by-doing' (1962 in Munday, 1996) and Kaldor's emphasis on Verdoorn's law and the importance of economies of scale (1966 among others elsewhere in Munday, 1996) emphasise the relation between positive externalities and economic growth. The positive externalities, which are associated with the growth process, include for example, capital accumulation (which causes positive learning externalities to take place thus learning-by-doing) (Arrow, 1962 in Munday, 1996) and the alternative version of learning-by-watching (King and Robinson, 1989 in Munday, 1996) as well as research and development. These externalities will increase the competitiveness of companies, industries and the country in international markets.

The possible existence of externalities or external economies in international trade favours the new trade theories' justification of government intervention in international trade (Munday, 1996). If certain industries produce positive externalities for an economy, then government intervention will try to benefit (subsidise) that industry in order to increase the level of production beyond market equilibrium. The benefits for the economy as a whole will be greater than those accruing to private firms involved. This could provide a rational for government intervening in the process of free trade between countries.

An example of these externalities is the "overspills" of research and development or knowledge from one firm to others. If one firm invest in R&D and as a result invent new products, production techniques or any other benefits, other firms will also benefit from these discoveries. This is the basis of the economic argument of government intervention in the area of R&D. Without such government intervention firms will try to 'free ride' on the efforts of other, and thus cause under-provision to take place (Munday, 1996).

Government intervention in international trade may increase the welfare of a country by protecting an industry that produces such an externality from international competition.

The transport sector is one of the most complicated economic sectors. Therefore, the benefits of transport or infrastructure supply cannot be seen in isolation of its interaction with the entire economic system (Verhoef et al, 1997). As argued by Verhoef et al (1997) the benefits of the transport system arise through the supply and existence of infrastructure and its usage. The benefits of infrastructure supply and usage are related: without usage, there are no benefits of infrastructure, and the total benefits of infrastructure can thus be seen as the total net benefits of the usage over the life of the infrastructure.

Transport demand is often a 'derived demand', serving to satisfy spatial mismatches between demand and supply on various markets. Often, the possibility to demand or supply certain goods (for freight transport) or services (for passenger transport) at different locations yields benefits rather than the consumption itself. In such cases, the benefits of transport are to be found in the increase of consumers' and/or producers' surpluses in these markets. For a given infrastructure, the benefits of its usage thus often arise in other markets, and cannot be seen in isolation of the factors that determine the demand for transport. The benefits of transport can often be thought of as the benefits of the increased local specialisation it enables (Verhoef et al, 1997).

The effects of infrastructure supply are:

- the construction phase effects
- trade
- changes in distribution systems
- productivity
- housing and labour markets
- monopolistic price settings

The construction phase effect is a temporary effect that refers to the stimulation of employment and income during the infrastructure construction phase via the demand side. The spatial effect of the construction process may result in a positive spill-over effect into other regions, for example non-local workers may be needed to help with construction or the supply of construction materials may take place in other regions. Improvement of infrastructure leads to lower transport costs and tendencies towards local specialisation and larger trade flows. When scale economies exist, regions with an initial advantage may benefit more from a reduction in transport costs (Krugman, 1991b).

Infrastructure improvement may affect the way production, transportation and distribution are organised. In principle, it may affect route choice (including port choice), mode choice, location of distribution centres, number of levels in distribution structure, choice of logistical strategies. Transport infrastructure supply have three types of 'reorganizational benefits' that are of importance (McKinnon, 1996). The first is market expansion where the improvement of infrastructure makes the exploitation of natural resources feasible. This may reduce transport costs that will result in improved opportunities for reaching markets further away. The second is spatial concentration of the optimal plant size as a result of a trade off between size dependent production costs and transport costs of input and outputs. The third is tighter scheduling, such as that required by the just-in-time production method in manufacturing (Verhoef et al, 1997).

The productivity impacts in empirical studies vary among economic sectors (Fukuchi, 1978, Blum, 1982) and between various transport modes (Blum, 1982; Anderson, Anderstig and Harsman, 1989).

A general formulation of a production function for sector i in region r with various types of infrastructure is used by Verhoef et al (1997) to indicate infrastructures contribution to production.

$$Q_{ir} = f_{ir}(L_{ir}, K_{ir}, IA_r, \dots, IN_r) \quad (2)$$

Where:

Q_{ir} = value added in sector i , region r

L_{ir} = employment in sector i , region r

K_{ir} = private capital in sector i , region r

IA_r, \dots, IN_r = infrastructure of various types in region r

According to this function, value added in a sector is a function of employment, private capital and various types of infrastructure. Thus, production takes place by means of combining labour, private capital and infrastructure. In this production function an increase in the infrastructure stock leads to a shift in productivity but it do not lead to a permanently higher growth rate. According to endogenous growth theory, a permanent increase in the growth rate might be present when transport infrastructure investments lead to a higher level of knowledge production (Verhoef et al, 1997).

Improvement in infrastructure may lead to improved functioning of labour markets. Employment opportunities are within reach leading to a reduction of unemployment and vacancies due to a better match between the demand and supply side of the labour market. There may also be an increasing welfare effect on households. Improved infrastructure leads to an increase in the number of suppliers or demanders in the market, which has an favourable effect on consumer welfare because of increased diversity of products on the market (Verhoef et al, 1997).

From the effects discussed above, it may be surmised that changes in transport may bring about a large number of changes in the economy, many of them having welfare improving results. Transport infrastructure provision creates spillover effects apart from the effects that only takes place in the transport sector itself.

2.3.6 *Geography and Trade*

The "new economic geography" (Krugman, 1998:7) may be described to embrace four main research programmes, namely an investigation into the spatial agglomeration of economic activity and an investigation into the dynamics of regional growth convergence (Martin, 1999:67). A third research programme investigates the effects of differentiated physical geography on development (e.g. Gallup, Sachs & Mellinger, 1998), whilst a fourth programme investigates the effects of geography on regional integration (e.g. Amjadi & Winters, 1997).

In these programmes, the linkage between trade barriers (especially transport costs) and export performance has been identified as important. For instance, African economies attract the smallest percentage (around 2%) of outward-bound foreign direct investment (FDI), and have had a diminishing share of global exports (around 1.2%). Also, Africa as a region (with the exception of Botswana and Mauritius) has had the most dismal economic growth rates of all regions since the Second World War (Sachs & Warner, 1997:335). In Africa's case the global spatial agglomeration of economic activity (as witnessed in low FDI and domestic fixed investment) and lack of convergence with trading partners (as witnessed in low growth) may have an explanation rooted in its geography.

This explanation has not always been recognised in the economic literature. Advances in the understanding of how African economies function and why Africa is marginal increasingly emphasise that Africa's poor economic performance is due to its lack of openness. Sachs and

Warner (1997:339) constructed an index of openness based on five tests²⁴ and established that openness is significantly associated with economic growth, and that Africa as a region is the least "open" of all regions. Most often the economics literature ascribes inappropriate domestic economic policies as the cause of Africa's lack of openness (Ng & Yeats, 1996:1). Recently, Gallup, Sachs and Mellinger (1998:9) identified a number of geographic features that may further contribute to the lack of openness of African economies. They show that Africa is characterised by (a) a very high concentration of land in the tropics, (b) a population heavily concentrated in the interior²⁵, (c) more than a quarter of the population in landlocked countries, (d) far from the closest core markets in Europe, and (e) with low population densities in the coastal regions.

A significant effect of the above geographical features that may result in a lack of openness to international trade is that it all raises transport costs-both domestic transport costs (i.e. within a country - particularly landlocked countries) as well as international transport costs (such as higher shipping charges).

However, this does not necessarily imply that there is little that African countries can do in the way of policy and management to increase the openness of their economies and thereby change the global spatial agglomeration of economic activity in their own favour, or increase the rate of growth convergence with other economies (Naudè, 1999a). The gist of the "new economic geography" is that whilst physical geography might matter in the way described above, factors such as increasing returns to scale, agglomeration economies, product differentiation as well as transport costs can lead to a "highly differentiated spatial organisation

²⁴ An economy is judged to be "open" if (a) average tariff rates are below 40%, (b) average quota and licensing coverage of imports less than 40%, (c) the black market exchange rate premium is less than 20%, (d) there are no extreme controls on exports; and (e) it is not a socialist country. According to these tests of Sachs and Warner (1995; 1997) South Africa is "open" to international trade - although geographical factors (natural trade barriers) may limit the real openness.

²⁵ They find that only 19% of Sub-Saharan Africa's population lives within 100 km of the coast.

of economic activity...even when the underlying physical geography is undifferentiated" (Gallup, Sachs & Mellinger, 1998:12). In this, the "new economic geography" follows the "new trade theory"²⁶. It suggests that institutions and regulations in the African transport sector, as well as management techniques such as logistics management and logistics technology - which depend on the level of human capital in these countries - may be important explanations for high transport costs faced by African countries (Naudè, 1999a).

2.3.6.1 *Development of the "new economic geography"*

Although economic geography has developed over a period of almost a century it seems to be fairly recently that economists are (re) "discovering" geography (Martin, 1999). Martin (1999) described the earlier efforts of August Lösch who argued that economists should take space and location seriously in their economic theories. As a result a German tradition of equilibrium 'location theory' was established, mainly through contributions from Johann von Thünen's (1826). This have been revived in the 1920s and 1930s by Alfred Weber's (1929) *Theory of the Location of industries*, and Walter Christaller's (1933) *Central Places in Southern Germany*. During the 1950s and 1960s, the basic *esprit géométrique* bequeathed by Lösch's classic, *The Economics of Location*, provided the foundations for two other disciplines, namely regional science and economic geography.

By the late 1970s, regional science, (championed by Walter Isard in his *Location and Space economy* (1956) and *Methods of Regional Analysis* (1960)), had become a highly mathematical theory of abstract, equilibrium economic landscapes. By this time, economic geography had evolved into a more eclectic and empirically orientated subject (Martin, 1999:66).

²⁶ Traditional trade theories assume away geography and thus transport costs. It has only been recently that international trade theory has begun to modify its models to include transport costs - see Botazzi and Ottaviano (1996) for a useful review.

Since the late 1980s, incorporating ideas from French regulation theory, Schumpeterian models of technological evolution, and institutional economics have led to a further expansion of economic geography. More recently however, it has turned to economic sociology and cultural theory for inspiration and as mentioned before, economics may be seen to be at last (re) discovering 'geography'. This new movement to geographical economics includes contributions from Krugman, Porter, Arthur, Barro, Sala-i-Martin, Eichengreen, Blanchard, Katz, Venables and Quah (see Martin, 1999).

The neglect of spatial issues in the traditional economic theories arise as a result of the difficulty of how to conceptualise market structure in the face of increasing returns (Krugman, 1995a). To resolve this problem, the approach of constant returns and perfect competition that dominates economic analysis must be replaced by increasing returns and imperfect competition. Krugman (1995a) aimed to construct a theory of economic localisation based on increasing returns. In his view, increased returns are essentially a regional and local phenomenon, so that the study of spatial economic agglomeration and specialisation is sufficiently important to warrant 'the acceptance of economic geography as a major field within economics' (Krugman, 1991a, 1997). There are three reasons in particular why economic geography is important. "First, the location of economic activity within countries is an important subject in its own right...Second, the lines between international economics and regional economics are becoming blurred...However, the most important reason to look again at economic geography is the intellectual and empirical laboratory it provides" (Krugman, 1991a). Likewise, Porter (1990, 1994, 1996) has stressed that the degree of geographical clustering of industries within a nation is a key determinant of that nation's international competitiveness. Porter (1990:157) also argues that there are strong grounds for making economic geography a 'core discipline in economics'.

2.3.6.2 The 'New economic geography' and spatial agglomeration of economic activity

Economic activities are unevenly distributed across space. The determinants of spatial differences in the patterns of production have traditionally been presented in terms of differences in endowments, technologies, or policy regimes. Such explanations, while relevant, fail to explain why even a priori similar regions can develop different production structures. They also contrast with the changing pattern of comparative advantage of regions and countries undergoing rapid development. Contributions to the 'new economic geography' have developed a novel approach to location; one in which firms tend to cluster together, and regions with similar underlying characteristics can turn out to be very different (Ottaviano et al, 1997). Comparative advantage, while relevant, provides a weak explanation for the spatial concentration of activity, often very similar regions have different production structures (Ottaviano et al, 1997).

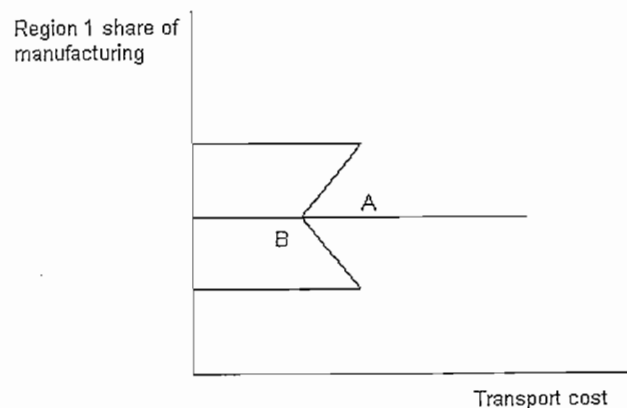
'New economic geography' is based on the argument that increasing returns, economies of scale and imperfect competition are more important than constant returns, perfect competition and comparative advantage in causing trade and specialisation. The market, technology and other externalities underpinning these increasing returns are not international or even national in scope, but arise through a process of regional or local economic agglomeration (Arthur, 1986, 1994, 1996; Krugman, 1991a, 1991b, 1991c, 1993; Venables, 1996a, 1996b, Ottaviano and Puga, 1997). Thus to understand trade it is necessary to understand increasing returns, and to understand increasing returns it is necessary to study regional economic concentration and specialisation.

Different authors stress different roles of increasing returns in the process of spatial agglomeration. In the models by Krugman and Venables (1996), for example, the agglomerating (centripetal) forces are basically Marshall's (1890) triad of 'location externalities' (labour market pooling,

technological spillovers, and intermediate goods supply and demand linkages). These tend to lead to the local clustering of economic activity. Centripetal and centrifugal forces can explain the clustering/concentration of economic activities as well as changes in this concentration. Therefore models of economic geography will exhibit a pattern in which the qualitative behaviour of the model changes abruptly when the quantitative balance of forces (centripetal and centrifugal) passes some critical level. The models are characterised by bifurcations (divisions). The typical form of these bifurcations may be illustrated by figure 2.2 (Krugman, 1998:11).

The model envisaged an economy consisting of two symmetric regions with two industries: immobile, perfectly competitive agriculture and mobile, imperfectly competitive (Dixit-Stiglitz) manufacturing. The backward and forward linkages in manufacturing generate centripetal forces and the pull of the immobile farmers the centrifugal force.

Figure 2.2: New Economic Geography features



(Source: Krugman, 1998)

Figure 2.2 illustrates one of the appealing features of the new economic geography: it easily allows one to work through an 'imaginary' situation.

Suppose for example that represented in figure 2.2 is an economy that starts with high transport costs and therefore with an even division of manufacturing between regions, a situation illustrated by point A. Then suppose that transport costs were gradually to fall. When the economy reach B, it would begin a cumulative process in which a growing concentration of manufacturing in one region would lead to a still larger concentration of manufacturing in that region. That is, the economy would spontaneously organise itself into a core-periphery geography (Krugman, 1998:11).

This example gives a sense of the typical dynamics of new geography models: multiple equilibria, spontaneous self-organisation of the economy into some kind of spatial structure, often one with very uneven distribution of activity among locations with more or less identical natural endowments, and qualitative changes in underlying parameters (Krugman, 1998:12).

On a broader regional level, pecuniary externalities, that are market-size effects, are also important, leading to a large-scale centre-periphery pattern of economic development within nations. The countervailing centre-fugal forces making for locational dispersion are those arising from product-market and factor-market competition (such as bidding up of local land and wage costs). Transport costs and labour immobility and mobility are the key determinants making for spatial agglomeration or dispersion: the lower transport costs are, the more the forces of spatial agglomeration will prevail over those of dispersion; the more immobile labour is, the more dispersion will prevail over agglomeration (Krugman 1991a, 1991b, Krugman and Venables, 1996, Puga and Venables, 1997a, 1997b, Venables, 1996a, 1996b, Ottaviano and Puga, 1997).

Economic integration, by affecting the balance between dispersion and agglomeration forces can decisively affect the spatial location of economic activities. For high transport costs, the need to supply markets locally encourages firms to locate in different regions. For intermediate values of transport costs, the incentives for self-sufficiency weaken. Pecuniary externalities then take over, and firms and workers cluster together (Ottaviano et al, 1997). Therefore, in new trade theory and new economic geography models, there is a trade-off between the advantage of being close to the larger market and being where factor costs are lower and the trade-off depends on the importance of scale economies and transport costs in the industry (Haaland et al, 1999). The lower the transport costs are, the less important will it be for the industry in question to locate closer to the centre; hence the lower the transport costs, the less concentrated would the industries be (see Amiti, 1998). According to the new trade theory, a positive relationship between transport costs and absolute concentration (agglomeration) should be expected (Haaland et al, 1999).

To date, the 'new economic geography' has focused on mathematical modelling. According to Ottaviano and Puga (1997), the direct testing of these spatial agglomeration models is still in infant stage because they are too abstract, over simplified and too idealised (Martin, 1999).

2.3.6.3 The new economics of regional growth and convergence

Another major strand of 'geographical economics' that have emerged focuses on long-run regional growth and convergence, rather than on industrial location, although there are links between the two themes (Martin, 1999). In the same way that the interest in spatial agglomeration was promoted by the 'new trade theory', interest in regional convergence has been stimulated by the so-called 'new growth theory' (see Barro and Sala-I-Martin, 1995).

The standard neo-classical (Swan-Solow) growth model assumes diminishing returns to capital and labour. In this framework, a relatively poor country with a lower stock of capital per worker has a higher marginal productivity of capital and a higher rate of return to capital. Hence the model predicts that poorer countries will grow faster than, and eventually catch up with, richer ones. According to Barro and Sala-i-Martin (1995), because there is much greater uniformity of structural, technological, institutional and social characteristics within nations than between them, the neo-classical convergence model is more applicable at the cross-regional than cross-national level. Using a neo-classical 'growth regression' (in which regional income growth rates are regressed on initial regional income levels) several authors (see for example, Barro and Sala-i-Martin, 1991, 1995; Coulombe and Lee, 1993; Cashin, 1995) found that the observed rate of regional convergence is slow, about 1 to 2% per annum, and lower than predicted by the simple neo-classical growth model²⁷. These results may imply either that returns to labour and capital are non-diminishing or diminishing very slowly or that interregional spillovers of capital, labour and technology are much less than expected, and hence that there are endogenous effects in regional growth. In this context, some studies have found evidence of regional convergence 'clusters' or more especially spatial clustering of regions with similar growth rates (Armstrong, 1995, Canova and Marcet, 1995), while others suggest that regional growth patterns show conditional convergence to different regional steady-state relative per capita income levels (Evans and Karras, 1996).

According to the 'new economic geography', the impact of integration on the regional distribution of economic activity and wealth will depend on the relative scale of market-size effects (pecuniary externalities), the lowering of transport costs, and increase in labour mobility, the models predict greater spatial agglomeration, and divergence between a rich 'core' and a

²⁷ A rate of 2% per annum (as found for the USA) implies that it takes about 35 years for an initial disparity in regional relative per capita incomes to be halved, while a convergence rate of 1% implies a 'half life' of around 70 years.

less prosperous 'periphery' (see Krugman, 1991a, 1991b, Krugman and Venables, 1996). On the other hand, if labour remains relatively immobile between regions, so that labour and congestion costs eventually rise in the 'core', this will cause the spatial dispersal of economic activity and regional convergence (Martin, 1999).

Although a considerable number of empirical studies have been conducted, almost all of these examine only one aspect of regional economic convergence, namely income or output per head. By contrast there has been few attempts to unravel the relative role of capital flows, labour migration or technical spillovers in the evolution of the cross-region income distribution (Martin, 1999).

2.3.6.4 Regional Integration and Transport Costs

Regionalism are processes which tend to promote the organisation of alliances and/or agreements that are instrumental in the formation of regional or continental trading zones or blocs to enhance the transnationalisation process²⁸ and promote trade on a restricted geographical basis (Wheeler et al, 1998). The role of transport costs in the theory of regionalism can be discussed in the context of models of differentiated products or in more traditional models with homogeneous goods (Amjadi & Winters, 1997).

One approach to the role of transport costs in the theory of regionalism stems from an extension of Krugman models (1991a, 1991b). Frankel, Stein and Wei's (1995) model is built around differentiated goods and imperfect competition stresses the differences between intra- and inter-bloc transportation costs as determinants of the benefits of regional integration. They also argue that the larger the difference between intra- and inter-bloc transportation costs is, the more beneficial integration will be (see Amjadi & Winters, 1997).

²⁸ The increase of the propensity for capital to flow across international borders.

An alternative model deals only with homogeneous goods. Wonnacott & Wonnacott (1981) first isolated the role of transportation costs in integration theory. They argued that integration between neighbouring countries could offer benefits that were not available to either party individually through unilateral trade liberalisation. They also argued that preferences between neighbours could divert trade with the rest of the world, which was expensive in terms of transportation costs, to take place instead between neighbours, which were cheaper partners in transportation terms. The resulting savings of real resources would allow one partner to experience a terms of trade of gain – either the exporting partner saving the costs of shipping the good to the rest of the world or the importing partner saving the cost of shipping in from there. A necessary condition for integration to be beneficial in a homogeneous products world is that after integration, the partners trade only with themselves and not with the rest of the world (Amjadi & Winters, 1997).

The benefits of regional integration of trade depend on the extent to which trade is created/offset by the extent to which trade is diverted. Regional trade pacts are normally to be regarded as inferior to progress towards global free trade, because of the scope for diversion of trade within a regional free trade area. Nevertheless, a regional free trade group may be justified as at least an improvement on the constrictions imposed by protected national economies. The growing tendency for the formation of regional trading blocks, such as the North American Free Trade Area (NAFTA) and the plans for an Asia-Pacific Economic Co-operation free trade area, modelled in part on the development of the EU, is stimulating those outside these blocks to form alliances for trade and trade bargaining (Amjadi & Winters, 1997).

The Southern African regional trading groups are of various types. The Southern African Customs Union (SACU) is a close customs union, dominated by South Africa, with virtually free internal trade, a common external tariff and a duty and excise revenue sharing arrangement. Southern African Development Community (SADC) worked mainly on

sectoral and project level cooperation, with extensive use of donor support (DBSA, 1998).

After democratisation in 1994, South Africa became a member of the SADC. SADC countries experience severe economic problem caused by, inter alia, weak economic policies, deterioration in global terms of trade, and the effects of apartheid government's destabilization policies. Inter-regional trade is now widely recognized as a crucial factor in the region's prosperity. However in 1995, the ratio of South Africa's exports to imports into and from the SADC region stood at 7.4:1 (R9.2 billion), resulting in South Africa holding a significant trade surplus with the region. This may be due to the lack of complementarity in the production structures of the individual SADC economies, the infrastructure imbalances in Southern Africa as well as the fact that only South Africa and Zimbabwe have industrial capabilities of any significance (DBSA, 1998:176).

The current situation may be unsustainable and in neither South Africa's nor the region's long-term interest. The imbalance in SADC trade is one of the factors giving rise to higher transport costs, due to backhaul on freighters being relatively empty. The government has therefore adopted a strategy that targets development of the southern Africa region through developing trade and investment relations within a multilateral regional framework. This aims to provide opportunities for South African exporters and to enhance prospects of foreign investment. The structural imbalances in the regional trade and labour flows cannot be addressed in isolation from economic integration. Thus, effort is being devoted to strengthening the SADC through trade integration and related agreements and to negotiating a trade and development agreement with the European Union that accords with SADC arrangements (DBSA, 1998:178).

South Africa's accession to the SADC has had an impact on intra-regional trade patterns. In 1993, South Africa's exports to the SACU accounted for approximately 13 % of total exports (R15 billion, which is more than exports to either Asia or North America), while non-SACU SADC

countries accounted for 6 % of South Africa's total exports. South Africa's exports to the region increased by 59 % between 1994 and 1995, and from 7.5 to 10.6 % of total trade. These still increasing export percentages of South Africa to SADC and SACU indicate that the lowering of transport costs will be beneficial for South Africa and will lead to further increases in exports.

On account of the infrastructure imbalances and the weak sea-bound transportation linkages, landlocked countries such as Botswana, Lesotho and Swaziland depend on South Africa for channelling exports and imports. In turn, the sea-linked countries like Mozambique, Angola and Tanzania have poor rail-port interfaces, lack sufficient cargo-handling equipment and do not have reliable shipping information. Even with low volumes of sea traffic, port congestion is a common problem caused by gross port insufficiencies and inefficiencies. Therefore it is stressed by Saasa (1998) that transport and communications require a synchronisation of equipment, legislation, standards and procedures, as well as ratification of international convention. More use by South Africa of regional infrastructure facilities such as transport would not only serve as an economic stimulus for the weaker regional states, but could also contribute to correcting the economic and trade imbalances that currently favour South Africa (DBSA, 1998).

For the southern Africa region to become more efficient and integrated, countries' economies must become more diversified and, in turn, be stimulated by demand from beyond national borders. This requires a range of factors, of which infrastructure is one. To be competitive Sassa (1998) stresses the urgent need to reorient the southern Africa region's transport sector to encompass both continental and intercontinental perspective. Industries such as shipping and aviation must be viewed in a global context. The integration of the southern Africa region into the global trading system depends on such regional organisations as the SADC, SACU and the Common Market for Eastern and Southern Africa (Comesa) focusing beyond regional transport development strategies

(DBSA, 1998). According to the above review of regionalism in southern Africa, it is clear that transport costs (which are determined by the state of the available infrastructure) plays a significant role in the improvement of integration and thus trade between countries.

2.3.7 *International Business Cycle Models*

In modern development economies, goods and assets are traded across national borders, so that events in one country generally have economic repercussions in others. International business cycle research focuses on the economic connections among countries and on how much of an impact these connections have on the transmission of aggregate fluctuations across various countries (Backus et al, 1995).

In the international real business cycle literature, the attention is focused on the role of transport costs in accounting for the “prize puzzle” and in explaining the high volatility and persistence of real exchange rates. The “prize puzzle”²⁹ as highlighted by Backus, Kehoe and Kydland (1994,1995) refers to the fact that international business cycle models can account only for a fraction of the observed variability in the terms of trade (Mazzenga et al, 1998). Mazzenga & Ravn, (1998) quantified the importance of transport costs in accounting for relative price behaviour and addressed the issue of whether transport costs can help to explain what Backus, Kehoe and Kydland (1995) have phrased the “prize puzzle”. The two reasons, as stated earlier, why transport costs might be important include the following. First, such costs make trade more costly and lead to a tendency for greater relative price adjustments. Secondly, transport costs introduce a wedge between marginal rates of substitution and relative prices (Mazzenga et al, 1998).

²⁹ The “price puzzle” i.e. the high empirical terms of trade volatility relative to the theory.

Exploring the high volatility and persistence of two relative prices are important in international business cycle theory and international finance. A standard reference for explaining such deviations from the law of one price (LOP) and purchasing power parity (PPP) is transport costs, for example Krugman and Obstfeld (1991) list transport costs as one of three potential explanations for the negative empirical evidence on absolute PPP³⁰. Further more, there is some empirical evidence that transport costs explain some of the variations in prices across geographical areas, see e.g. Engel and Rogers (1996).

Mazzenga & Ravn (1998) investigated transport costs' potential in contributing towards the large and persistent fluctuations that can be observed in relative prices. A two-country, two-good international business cycle model is studied. Mazzenga & Ravn (1998) deviate from the standard assumption of "iceberg costs"³¹ and model instead the transport sector as any other sector of the economy that produces output with and input of factors of production and intermediate goods³². The result was that transport costs affect terms of trade movements through two channels. First, transport costs make imports more costly. Secondly, since a part of the cost of imports are produced by the transport sector, the direct link between the terms of trade and the marginal rate of substitution between foreign and domestic goods is broken. Transport costs also increase the standard deviation of the real exchange rate by around 20% but the implied standard deviation is still at least 8 times lower than in the OECD post-war data (Mazzenga & Ravn, 1998). When the transport sector production technology is specified by a function that is almost equivalent to a Leontief production function Mazzenga & Ravn found that the standard deviation of the terms of trade increases to 1.6% and the standard deviation of the real exchange rate increases to 1.4%.

³⁰ Absolute PPP refers to the equality between the level of the exchange rate and the ratio of the levels of domestic and foreign price indices. Relative PPP refers to the equality of the rate of depreciation of the currency and the inflation differential. Absolute PPP implies relative PPP but the opposite is not true.

³¹ According to which a fraction of exports melts during transports (see section 2.3.3.3).

³² This was motivated by the observations that transport sectors account for non-trivial shares of factor inputs in the OECD.

The increased volatility of the relative prices is therefore due to much larger implied volatility of transport costs.

2.4 Summary

Despite the importance of transport costs in international trade, development and manufacturing, it has only been recently that the theory of international trade and development has begun to incorporate transport costs and logistics into theoretical and empirical analyses. In this light the purpose of the chapter was to survey the incorporation of transport costs in the theory of international trade. The historical development of transport in trade and economic development suggested that transport systems, and their ability to reduce transport costs, is important to increase the international competitiveness of a country or region.

The views on trade and transport discussed in section 2.3 sets out the development of theories on transport and its importance in trade. Traditional trade theories assumed perfect competition and much criticism were attracted by the assumption of constant returns to scale. These assumptions were regarded as unreasonable to international trade. Therefore more recent contributions to international trade theory through the “new trade theories” emphasises imperfect competition, increasing returns to scale and externalities.

The most well-known new trade theories is intra-industry trade models which explain why similar industrial countries trade predominantly with each other and why a significant portion of their trade consists of an exchange of similar products. Various models of strategic trade policy (Brander-Spencer Model and Krugman’s Strategic trade Policy Model) illustrate that government intervention can generate favourable results for the home country at the expense of foreign countries. The possible existence of externalities or external economies in international trade favours the new trade theories’ justification of government intervention in international trade. Transport infrastructure is one of the items in an

economy that creates spillover effects or positive externalities that has welfare improving results.

Geography is a previously neglected subject that has a significant affect on international trade and transport costs. Recently economists like Krugman and Martin have started to emphasise this subject's importance to international trade with the "new economic geography". The "new economic geography" embraces four main research programmes namely, spatial agglomeration of economic activity, the dynamics of regional growth convergence, the effects of differentiated physical geography on development and the effects of geography on regional integration. In these programmes the linkage between trade barriers, especially transport costs, and export performance (international competitiveness) has been identified as important. Possible reasons that were identified for causing high transport cost and a lack of competitiveness of countries in Africa were firstly, lack of economic openness. Secondly, institutions and regulations in the African transport sector as well as management techniques such as logistics management and logistics technology might be an important explanation.

Spatial agglomeration of economic activities or the clustering/ concentration of economic activities can be partly explained by centripetal (agglomeration) force and centrifugal (dispersion) forces. Transport costs and labour mobility are key determinants for spatial agglomeration or dispersion. Low transport costs will encourage agglomeration of activities and immobile labour will result in dispersion. Economic integration can also effect the spatial location of economic activities through affecting the balance between dispersion and agglomeration forces. There is thus a trade-off between the advantage of being close to a larger market and being where factor costs are lower and this trade-off depends on the importance of scale economies and transport costs in the industry. This suggests that a positive relation might exist between transport costs and spatial agglomeration.

Apart from the focus on industrial location, geographical economics also focuses on long-run regional growth and convergence. The new economic geography suggest that the impact of integration on the regional distribution of economic activity and wealth will depend on the relative scale of market-size effects, the lowering of transport costs and increase in labour mobility.

Transport cost in the theory of regionalism can be discussed in the context of models of differentiated products of in more traditional models with homogeneous products. The benefits of regional integration of trade depend on the extend to which trade is created/offset by the extend to which trade is diverted. In Southern Africa the most important regional trading groups are SACU and SADC. The current trade imbalance between South Africa and the other countries in those regional trading groups may be unsustainable and in neither South Africa's nor the region's long-term interest. Transport infrastructure is an important element needed to facilitate region trade as will be discussed in chapter three. It is important to reorientate the southern Africa region's transport sector to encompass both a continental and an intercontinental perspective. Industries such as shipping and aviation must be viewed and adapted in a global context. Transport costs, which are determined by the state of the available infrastructure, play a significant role in the improvement of integration and thus trade between countries.

International business cycles focus on the economic connections among countries and on how much of an impact these connections have on the transmission of aggregate fluctuation across countries. In international business cycle literature the attention is focused on the role of transport costs in accounting for the high volatility in terms of trade and real exchange rates. It was found in this chapter that transport costs affect terms of trade movements through two channels. Firstly, transport costs make imports more costly. Secondly, since imports are produced by the transport sector, the direct link between the terms of trade and the marginal rate of substitution between foreign and domestic goods are

broken. Transport costs also increase the standard deviation of the real exchange rate by around 20%.

In chapter three the relation between transport infrastructure and economic development is stressed together with an overview of South Africa's transport infrastructure.

Chapter 3

TRANSPORT INFRASTRUCTURE AND DEVELOPMENT

3.1 Introduction

As concluded in chapter two, efficient costs and transportation systems are important for a country's international competitiveness. Infrastructure facilities produce services that countries need to modernise and diversify their production, to attract foreign investment and to compete in world markets, as well as to improve the health and productivity of the poor (Ingram & Fay, 1998:158).

In recent years, developing countries have invested an average of 4% of their GDP in infrastructure – about \$250 billion in 1996. The precise link between infrastructure and development are still being explored, but infrastructure such as transport is an input for every commodity. However, studies of the return to infrastructure at the national level are not yet showing consistent and reliable results, and the direction of causation between infrastructure and growth is not fully established in macro level studies (Holts-Eakin, 1992). Evidence does suggest that the economic benefits of infrastructure investments are not realised instantaneously, but rather over periods as long as a decade (Canning & Fay, 1993). These analyses suggest that infrastructure has a significant potential pay-off in economic growth (Ingram & Fay, 1998:159). Economic policies also affect the impact of infrastructure on growth and poor economic policies can reduce the returns on infrastructure projects by 50% or more (Kaufmann, 1991).

In this chapter the relation between transport infrastructure and economic development is explored in section 3.2. In section 3.3 an overview of the South African transport infrastructure is provided. Finally, in section 3.4 the importance of logistic management in competitiveness and the role of

transport in logistics are discussed. The chapter conclude in section 3.5 with a summary.

3.2 Transport Infrastructure and Economic Development

Infrastructure supports sustainable development, provided that it is purposefully managed and financed (DBSA, 1998).

3.2.1 Definitions and Classifications

Infrastructure consists of durable resources collectively used by producers and households (Holmberg & Johanssons, 1992:1). It contains similar qualities to capital stock, which are used by different production processes. Infrastructure therefore forms part of the capital stock of a country (le Roux, 1996). Different types of infrastructure will not have the same impact in all locations and under all conditions, therefore a distinction can be made between economic and social infrastructure.

Economic infrastructure is that part of an economy's capital stock that produces services to facilitate economic production or serve as inputs to production (e.g. electricity, roads and ports) or is consumed by households (e.g. water, sanitation and electricity). Economic infrastructure assist productive activities and the movement of goods and services directly, because economic infrastructures like roads, water and electricity are used as inputs in production processes (le Roux, 1996).

Social infrastructure on the other hand provides services such as health, education and recreation and has both a direct and indirect impact on the quality of life. Directly, it supports production and trade, indirectly it streamlines activities and outcomes such as recreation, education, health and safety (DBSA, 1998 and Hansen, 1965a:151). The indirect benefits are a result of increased technical knowledge, increased levels of research and development and increased levels of human capital (obtained through education) (Van der Ploeg & Tang, 1992:18).

Development and more specifically economic development, was formerly seen as being synonymous with economic growth, where the latter could be measured in terms of an increase in gross national product (GNP) or GDP, with per capita GNP (income per capita) being the preferred index (Naudè & Kleynhans, 1999). However, when it became apparent that economic growth did not necessarily lead to a reduction in poverty and a better quality of life for the population at large, analysts re-examined the concept of development and the concept was broadened. The World Development Report of 1991 describes the challenge of development as an improvement in the quality of life. It is therefore maintained that development is about people and the key dimensions of development are economic growth, income growth, sustainable livelihoods, environmental sustainability and institutional capacity (DBSA, 1998).

3.2.2 *The Affinity between Infrastructure and Economic Development*

The positive association between infrastructure and a society's level of development is usually obvious. Despite of the positive association between infrastructure and economic growth, there is still no consensus on the magnitude of infrastructure on growth. Many studies have concluded that the role of infrastructure in growth is substantial, significant, and frequently greater than that of investment in other forms of capital (World Development Report, 1994). The economies of developed societies have a sophisticated infrastructure that supplies sustainable services. The first link is the economic dimension, but the social and institutional dimensions of development are equally important. Infrastructure supports development, first because it creates favourable conditions for production and consumption and second, because it facilitates diversification. It often improves people's welfare by enabling access to services and opportunities (DBSA, 1998).

To investigate the relationship between infrastructure and economic growth a micro and a macro approach could be used. The micro-economic approach is concerned with producers and consumers. Infrastructure increases the profits of producers through a cost and income effect. Through the cost effect, infrastructure can increase production costs directly as well as indirectly. The direct effect of infrastructure development as a result of the supply of infrastructure inputs like transport, water and electricity. Infrastructure supply decreases the costs of private capital investment (in transport, water and electricity) and as a result decreases the production costs of the producer.

The indirect effect is a result of infrastructure's influence on the productivity of other production factors. Infrastructure increases the productivity of labour and capital that will decrease production costs. For example, improvements in the mobility and transfer of information could provide access to technological improvements. The income effect refer to infrastructure (like roads and transport facilities) that creates consumption opportunities for consumers through establishing improved contact with product markets (le Roux, 1996:17-23).

Apart from the producers' profits, infrastructure also influences the income of consumers. Infrastructure increases the income of consumers through increasing working hours. The availability of infrastructure decreases hours spend on unproductive activities, it assure access to more labour markets and the demand and supply increases as a result of higher profits and higher production outputs of producers (le Roux, 1996:17-23).

The relation between infrastructure and economic growth on a macro economic level can be discussed through the influence of infrastructure on private investment, public investment and international competitiveness. There is a lack of consensus about the role of infrastructure as source for economic development. Aschuaer (1989, Black & Themeli, 1992 and Hansen, 1956) postulate a positive relation ("crowding in") between infrastructure investment and economic growth.

This positive relationship exists when public infrastructure investment increases the limit productivity of private investment, which result in a decrease of the costs of private sector activities, and/or promotes positive externalities. On the other hand Weiss, 1995, Carlin & Siskice, (1990) Blejer & Khan, (1984) and Kessides, (1993), postulate a negative relation ("crowding out") between infrastructure investment and economic growth. This negative relationship between infrastructure and private investment states that public infrastructure investment and private investment are perfect substitutes and/or indicates that public investment increases real interest rates in order to crowd out private investment (le Roux, 1996:17-23).

With regard to international competitiveness, the lack of key infrastructure (ports and packing facilities, multi-modal transport facilities and communication networks) together with insufficient service management is the primary cause of developing countries' lack of international competitiveness (le Roux, 1996:17-23). Insufficient infrastructure results in increased shipping costs, e.g. because of infrastructure problems, shipping costs from Africa to Europe are 30% higher than those from Asia to Europe (World Development Report, 1994). These higher shipping costs have to be borne by the exporters and therefore it can be argued that the competition for new export markets is especially dependent on high-quality infrastructure. Increased globalisation of world trade during the past 20 years was not only a result of trade liberalisation but major advances in communication, transport and storage technologies also contributed. These advances improve the management of logistics (as explained in section 3.4.4) to achieve cost savings in inventory and working capital and to respond more rapidly to customer demand.

Macro-economic policy is another significant determinant of infrastructure's contribution to economic development. For example a study of the economic returns to individual World Bank projects shows that, when macro-economic policy conditions are poor, the returns to infrastructure investment decline. Returns are lower by 50% or more in

countries with restrictive trade policies than in countries where conditions are more favourable. Infrastructure spending therefore cannot overcome an unfavourable climate for economic activity (World Development Report, 1994).

Infrastructure provision affects and is affected by, both the levels of economic development and its change over time. Economic diversification is a precondition for sustainable growth and development (DBSA, 1998). Diversification in an economy results in changes in the relative importance of categories of economic activity. Infrastructure services normally play a role in this pattern by supporting growth in economic output, opening opportunities for poor people and contributing to environmental sustainability.

3.2.3 *Transport Infrastructure's contribution to sustainable growth*

Infrastructure is a necessary, although not sufficient, precondition for growth but adequate complements of other resources must be present as well (World Development Report, 1994). Properly planned and discreet managed infrastructure opens many economic opportunities, supports growth and contributes to development. The World Development Report of 1994 found that infrastructure capacity increases with economic output. A 1% increase in infrastructure stock is associated with a 1,25% increase in GDP (World Development Report, 1994).

South Africa confirms the truism that infrastructure is necessary for economic growth and development. The importance of infrastructure can be seen in its contribution to the country's GDP, as indicated in table 3.1

Table 3.1: Infrastructure percentage shares of GDP

Economy	Electricity gas water	Transport Storage communications	Total
South Africa annual average, 1994-97	3.5	6.8	10.4
South Africa annual average, 1960-97	3.1	8.4	11.5
Low-income economies	1.3	5.3	6.6
Middle-income economies	2.2	6.8	9.0
High-income economies	1.9	9.5	11.4

(Source: SARB, World Bank, 1994)

Table 3.1 shows that the value added in transport, storage and communications averaged 6.8% of GDP between 1994 and 1997. Which is below the historical average of high-income economies but at the same level as middle-income economies.

Infrastructure creates economic linkages since it affects both fixed³³ and variable³⁴ costs of production. Infrastructure services are purchased as an intermediate input, their cost is part of variable costs and will vary with the scale of output. For example, higher production levels mean greater use of roads to transport inputs and outputs, and therefore higher costs related to road use, such as toll payments or maintenance costs for vehicles travelling on bad roads. Lower toll fees or improved road quality will lower variable costs for road users.

Infrastructure also has indirect effects on the productivity of factors of production (capital and labour), through which it impacts on average and/or marginal unit production costs. This is not an effect on the cost levels of these factors. For example, wages do not change depending on whether workers arrive at work fresh or tired, but are influenced by the level of output produced. Over time, however, infrastructure service improvements can affect the costs of productive factors (e.g. better urban

³³ Fixed costs do not vary with the scale of output.

³⁴ Variable costs do vary with the scale of output, thus the higher the output, the higher the variable costs will be.

transport can affect wage increases), and thus impact directly upon the long-term cost function (DBSA, 1998).

From the above examples it may be concluded that reliable and affordable infrastructure services support production, trade and information management. On the other hand, inadequate infrastructure provision or poor supply of services increases fixed and variable costs.

South Africa's infrastructure is generally regarded as more sufficient and reliable than the rest of Africa. Based on a survey of the perceptions of business leaders in the South African economy, the World Competitiveness Report of 1998 rates South Africa's infrastructure 35th out of 46 countries for its overall ability to satisfy business needs. Transport infrastructure (rail, road, port and air) seemed largely to satisfy business needs, with a rating in the top 25% of surveyed countries. Maintenance seems to be a problem. South Africa is ranked 30th out of 46 countries in adequacy of infrastructure maintenance (DBSA, 1998:39). South Africa's infrastructure ranking however has improved from 35th place in 1998 to 34th place in 1999 (World Competitiveness Report of IMD, 1999).

Infrastructure can reduce the costs of buying and selling in the market place. These transaction costs are fundamental to the allocation of goods and services. Different types of infrastructure contribute in their own right, but especially jointly, to making markets work. For instance, while telecommunications may reduce the cost of acquiring information and negotiating transactions, it depends on other infrastructure to do so. It needs, among other things, transport to ensure the physical flow of goods and services across the markets. The discussion thus far has indicated that the provision of new or expanded infrastructure services lowers the different types of cost faced by individual producers and thus has a positive impact on the growth of output. Apart from the encouragement of economic growth and structural changes, infrastructure further contributes to the creation of employment opportunities and thus poverty reduction

(DBSA, 1998:39). For example, access to transport and water supply can contribute to higher and more stable incomes (World Development Report, 1994).

For growth to be sustainable, two points need to be considered. The first is the contribution of infrastructure to structural economic change. The second is the integration of the preservation of natural resources with development and growth. Flexible infrastructure is a critical contribution to sustainable growth. Infrastructure lowers transaction costs by facilitating flows of information and goods, as well as interaction in markets. In this it contributes significantly to flexibility and thus to a sustainable growth path. Infrastructure and the environment can interact in the process of growth and development either in mutual benefit or in potential conflict. For example, transport services enable society to overcome distance as a constraint to economic activity. Infrastructure therefore interacts with the environment to create opportunities for growth and conditions for quality of life. The potential conflict arises from the negative impact of output growth on the natural environment. The challenge is to ensure that environmental costs, such as production of waste and consumption of non-renewable resources, are not so high as to dominate the benefits of growth (DBSA, 1998:39).

It can be concluded that the availability of the 'right' infrastructure, or its absence, can determine the decisions of producers and consumers in the economy. It influences where they choose to live, work, what they produce and also whether they produce. This in turn affects the ability of the economy as a whole.

3.3 The South African Transport Infrastructure

The South African transport system consists of private and public service providers and transport infrastructure. Transport is recognised as a basic need in South Africa – especially passenger transport – and is essential for economic growth and development as stated in chapter one and section 3.2. South Africa's transport infrastructure consists of roads, railroads, airports, harbours and related infrastructure such as warehouses, depots, garages and hangers.

3.3.1 *Development of South Africa's Transport Infrastructure*

While several economic and political imperatives influenced the types and location of South Africa's infrastructure stock, the main initial force for infrastructure development in South Africa has been the needs of the mining industry. This started with diamonds in the late 1860s, moved on to gold from the late 1880s, and then expanded into coal, iron ore and a range of other minerals during the 20th century. Investors initially provided their own infrastructure or purchased services from small private providers. The government later took over infrastructure provision when the latter's economic viability was more firmly based and network expansion became necessary.

Houghton (1976) expresses this clearly in relation to transport: "It was only after the mining industries had justified themselves and had generated sufficient income that a modern transport system was embarked upon". Railway construction started before the discovery of diamonds and by 1891, 6 680km of railways had been built. Given the scale involved, railway construction involved the public sector from the outset, but railways only became more firmly established in tandem with the gold mines.

As gold mining moved from opencast to deep-level technologies, the need for energy increased. Initially, mining companies provided their own energy. As mining demands grew, a energy-generating industry emerged, involving private and municipal suppliers regulated by government. In 1900, steam power generation in Kimberley used coal mined in Wales, transported by sea to Cape Town, by rail to Beaufort West, and by ox wagon for the remainder of the journey. This was expensive energy costing 21.5 pence per unit. After De Beers installed a turbo generator in 1903, and local coal began to be used, the price of electricity dropped to sixpence per unit in 1904 and two pence by 1913. The drop in price of over 95 % in a dozen years provides a clear indication of the positive externalities of efficient infrastructure provision.

Given the capital requirements for energy generation, potential commercial suppliers were prepared to enter the industry only once it was certain that gold mining industry was securely established, which occurred only after the Boer War of 1899-1902. Capital and technology for the energy industry came from abroad, as it did for the mining industry itself. The most important company was the Victoria Falls and Transvaal Power Company (VFTPC), established in 1906 by Rhodes's British South Africa Company, the German equipment supplier, AEG, and German banks. The initial idea was to use the Victoria Falls to generate hydroelectric power, but this was quickly discarded as coal-fired energy was subsequently produced on the Highveld. The company grew rapidly as the gold mines' demand for energy rose with mechanisation.

In 1923, the VFTPC sold more electricity to the mines than was consumed in the cities of London, Sheffield and Birmingham combined. In 1992, the Electricity Supply Commission (Escom, later renamed Eskom) was established as a public sector entity, with the objective of supplying electricity at cost. Over the next four decades Escom became a monopoly as the VFTPC was nationalised in 1948 and municipal generation of power stopped in the 1960s. The establishment of the Free State goldfields in the 1950s led to a new surge in the demand for energy

and frequent shortages resulted in a substantial expansion of Escom's capacity by 1960.

While mining made it possible for the fixed cost hurdle to setting up transport and electricity systems, it was not only mining which benefited. Infrastructure provision preceded considerable growth of secondary manufacturing industry and services. Mining nevertheless tended to go into heavy industry, which was similarly energy-intensive and often produced inputs for the mining sector (such as explosives) or, alternatively they were involved in downstream processing of mineral products such as chemicals. The Eskom policy of pricing to cost provided substantial support to these sectors, while freight transport pricing was also influential.

The South African economy grew relatively rapidly during the 1960s, but the manufacturing sector was both import-intensive and oriented almost exclusively to domestic markets. This created growth difficulties, especially as the collapse of the international fixed exchange rate system at the beginning of the 1970s introduced volatility into global gold and other commodity prices.

The decline in long-term growth was exacerbated as the government's development strategy became dominated by political considerations, with apartheid under growing threat from domestic and international opposition. In 1994, the new government shifted to a new outwardly orientated development strategy. Targeted infrastructure programmes came to form a key part of the post-1994 strategy.

Today Spoornet and Portnet own transport infrastructure such as rolling stock and rail infrastructure and the ports, whilst most airports in South Africa are state-owned through the Airports Company of South Africa (although 30% of the latter has been sold to the Italian Airport Company).

The direct control for national roads now rests with the National Roads Agency (NRA), a registered company of which the Minister of Transport is the only shareholder. The NRA is responsible for national road development, and also concessions and leases contracts for toll roads. The major toll road operators are Tolcon and Intertoll.

3.3.2 *Infrastructure in South and Southern Africa*

There seems to be recognition that South Africa has good transport infrastructure relative to other developing countries particularly in Africa. If South Africa is compared to the rest of Africa and the SADC region³⁵, then the following with respect to transportation is clear:

3.3.2.1 *Roads*

Road transport accounts for nearly 80% of overall transport infrastructure and yet coverage of both truck roads and rural access roads in many African countries is inadequate (DBSA, 1998). Only about 17% of the roads in Africa are paved, compared to the 42% in South Asia and the 25% in Latin America. This low share implies higher transport costs for African (as well as South African) producers which also includes higher packing and packaging costs as a result of the bad roads, reducing their ability to be competitive in world markets. Inadequate maintenance creates extra costs for Africa up to about \$1.2 billion annually.

Southern Africa has a relatively extensive regional road network although the quality and capacity of the roads vary widely. Only South Africa and Swaziland have freeways outside of urban areas. Recent major developments include the opening of the Trans-Kalahari Highway, the Maputo Corridor and the new Mbabane-Manzini Highway in Swaziland.

³⁵ In the light of the importance of transport infrastructure in regional integration (see chapter 2), the discussion on transport infrastructure in SADC is pertinent.

South Africa has more than one-half of the paved and total road network in the SADC region³⁶, and four-fifths of the vehicle fleet (as indicated on table 3.2 on page 96). Over one-half of all cross-border freight originates in South Africa, which illustrate the country's role as the major supplier to the SADC region.

3.3.2.2 *Rail*

In Africa, railways have lost its predominant role to roads and rail traffic is on a decline in most countries. There is also general dissatisfaction with the quality and cost of rail services. In Africa, low capacity utilisation and low labour productivity are the main problems.

SADC railways share the standard Cape gauge so that there are no impediments to cross-border movements of trains. The railways of the SACU countries are better maintained and more efficient than those in the northern SADC region. On several railways, particularly Zambia, Malawi and CFM(N), the track is in poor condition. Consequent speed restrictions limit the capacity of these liners and have adverse effects on operating efficiency. Poor service predictability is the main factor in the failure of rail to attract traffic such as long-distance containers for which it should have a transport cost advantage. For example, an average time of 12 to 14 days is normal for the movement of goods between Dar-es-Salaam and Zambia compared to 4 to 5 days by road, and there has been diversion of traffic to road transport. Railways in Southern Africa are parastatal bodies, but they are now being restructured and most of the railways have been commercialised, for example Swaziland and South Africa.

³⁶ The Southern African Development Community (SADC), includes fourteen Southern African countries. These countries are Angola, Botswana, the Democratic Republic of Congo or DRC (formerly Zaire), Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Seychelles, Swaziland, Tanzania, Zambia and Zimbabwe.

The South African railways compared to the SADC region, dominate all indicators in table 3.2 on page 96, with the exception of cross-border freight volumes, about two-fifths of which originates in the country.

3.3.2.3 *Ports*

Annual traffic in African ports have been growing by an average of 4% with utilisation ranging from as low as 10% at Lobito in Angola to almost full capacity at Richards Bay in South Africa.

Figures in table 3.2 on page 96 relates to the 14 SADC ports and in terms both of facilities and traffic, about 90% of total port tonnage handled at SADC ports were accounted for by the South African harbours. Durban and Richards Bay together handled 72% of the region's total, and Durban alone handles some 57% of aggregate SADC container traffic. Container traffic has grown more rapidly than general cargo, with aggregate container moves through all ports rising by some 90%. A steady expansion of container volumes should continue, as container penetration ratios in Southern Africa remain low by international standards.

In South Africa, sea freight grew by 67.3% (in tonnage terms) in the 12-year period from 1987-1998. According to long-term charting of Portnet figures, the seven South African ports (eight with Walvis Bay included until 1994) moved 91.5 million tons of cargo in 1987 - and reached a 153 million tons total in 1998. Possibly a better measure of trade growth (in unit value terms) is contained in the Portnet statistics for containerised traffic. The number of TEUs (twenty-foot equivalent units) handled by the South African ports gives a different picture. Moving from 640 687 TEUs in 1987 to over 1.65 million in 1998 this mode increase by 158.3%.

3.3.2.4 *Air Ports*

The industry in Southern Africa as a whole has performed comparatively well in the 1990s, with efficiency improving relative to the global average. The position of Johannesburg airport as a regional hub has been consolidated. Comparative SADC data are not up to date, but in 1996 Johannesburg handled 6.6 million passenger movements as against 2.9 million for Cape Town, 1.95 million for Durban, 1.14 million for Port Louis, Mauritius and 1.11 million for Harare, Zimbabwe. By 1997 the Johannesburg figure had risen to 8.1 million.

There have been some improvements to airport organisation, operation and infrastructure. In South Africa, for example, the management of airports has been taken over by the Airports Company which is responsible for the terminal buildings, leasing of commercial shopping space, parking and services to aircraft.

Airfreight is playing an increasingly important role in the logistics of international companies. Safcor airfreight is transporting about 7000 packages a month in and out of South Africa, weighing about 110 ton. This amounts to enough cargo to fill 12 Boeing 747 freighters. This represents a large increase over the volumes that were being transported five years ago.

The main area where air freight is important is in the transfer of electronic goods, as these represents a high value for the weight of the goods and are also very sensitive to the elements, therefore transport by ship would be impossible.

Table 3.2: South Africa in Southern African Transport³⁷

Indicator	Year	Unit	SA	SADC	SA %
ROADS					
Total Network	1996	km	440 427	860 760	51.2
Paved Network	1996	km	57 034	100 477	56.8
No. Vehicles	1993	'000	6 342	7 788	81.4
Cross-border freight (origin)	1996	'000 tons	4 230	7 806	54.2
RAILWAYS					
Locos in use	1996	No	2 309	2 875	80.3
Wagons in use	1996	No	123 708	147 005	84.2
Freight	1995	'000 tons	175 956	203 225	86.6
Cross-border freight (origin)	1995	'000 tons	3 390	7 909	42.9
Total revenue	1995	US\$ mill	2 549	2 390	87.0
PORTS					
Total throughput	1996	'000 tons	143 815	160 758	89.5

(Source: SATCC 1996, Maputo)

Apart from South Africa's relatively good transport infrastructure compared to the rest of Africa and SADC, there are still significant backlogs or gaps in the sufficiency of existing infrastructure and the transport systems still has serious problems such as 10000 road fatalities each year, the lack of investment in road system maintenance, declining use of rail and bus transport, disproportionately high charges for transport, a lack of finance and capacity and overloading by road hauliers (MSA, 1999). Roads and rail infrastructure are generally deteriorating. This also applies to ports (which are all operating at almost full capacity and where turnaround times are slow), airports and warehouses.

3.3.3 State of South Africa's Transport Infrastructure

The *World Competitiveness Report* of 1999 rates South Africa's infrastructure 35th out of 46 countries for its overall ability to satisfy business needs. The ratings of different sectors varied sharply. Whereas transport infrastructure (rail, road, port and air) seemed largely to satisfy business needs, with a rating in the top 25% of surveyed countries,

³⁷ The table provides comparative indicators of the South African and some SADC transport sectors; it does not include the Democratic Republic of Congo and Seychelles, which have recently joined the SADC.

telecommunication infrastructure was much less satisfactory in the eyes of investors.

As far as roads are concerned, estimates are that R15.2 billion a year for ten years is needed to overcome the backlog in rural roads, prevent deterioration of South Africa's road network and meet new demands. Of this, R2.4 billion and R5.5 billion are needed each year for the backlogs on primary and secondary rural roads respectively. About R4.1 billion is needed to prevent the deterioration of roads and R3.2 billion for new road expenditure. It is further estimated that roads carry 90% of all passengers and freight, but treasury funds are adequate for only 60% on maintenance needs. In 1993, 25% of the road network was considered to be in good condition. It is estimated that this figure decreased to 5% in 1997. The number of cars on the roads currently stands as 5.5 million and should reach 8.7 million in the year 2020.

Table 3.3: South Africa's Roads (estimates), 1997

Network type	Km	% Distribution
Total	488 000	100
National	20 000	4
Provincial	162 000	33
Urban roads	85 000	18
Rural roads (unproclaimed)	221 000	45

(Source: Infrastructure Development report, DBSA, 1998)

Road networks have been improved and SDIs have seen public and private resources being combined to improve transportation, while ensuring multisectoral development around major national and cross-border routes.

Spoornet, a division of Transnet, has 20 324 km of railways (33 000 km single track), 3 600 locomotives and 143 000 wagons. The total volume of freight transport during 1997 amounted to approximately 175 million tonnes. Mainline passenger services play an important role in the transport industry. During 1997/8 approximately 7 012 trains transported some 5 million passengers (DBSA, 1998)

Although the road and rail transport system has the infrastructural capacity to carry the freight volumes on offer, the traffic is not optimally distributed between road and rail. Goods traffic on the roads has been stimulated by the fact that user charges are far below the social costs of using the roads, and also by increases in the permissible size of heavy vehicle combinations. In overseas countries with sustainable rail systems, the average maximum gross vehicle mass (GVM) is between 34-45 tons. In South Africa, GVM has been raised from 38 tons in 1977 to 56 tons in 1992. The result is that the average condition of road surfaces is deteriorating. According to the CSIR's 1997 South African Heavy Vehicle Weighing Statistics Annual Report, overloaded heavy vehicles cause about 60% of the damage to roads in South Africa, representing damages of R600 to R700 million a year (CSIR, 1997).

Damage to roads increases exponentially as axle loads increase. For example, an axle carrying double the legal load may cause from 4 to 60 times more damage than one carrying a legal load. But there are some stumbling blocks that may prevent the effective control of vehicle overloading. These include the lack of weighing facilities throughout the country, shortage of manpower, unrealistic low fines which range between R200 and R1 000 and seldom exceed R5 000 as well as alternative roads to those where weighing takes place (CSIR, 1997).

In order to reduce their own costs, the overloading problem with road hauliers, occurs. They raise the cost of maintaining roads for the entire system and in order to compete, the rail system is forced to price at levels that do not allow for reinvestment (Chalmers, 1999:8). For equitable competition between road and rail, user charges for heavy vehicles should be increased substantially, GVM should be reduced, the rail system should be reorganised, and efficient multi-modal transport facilities should be developed at strategic points such as the main ports and inland dry ports.

In terms of the new South African constitution, the maintenance and construction of many roads is a provincial (regional) governmental responsibility. However since 1994 all provincial governments (without exception) have been reducing maintenance and capital expenditure on roads. Pretorius (1997:6-4) found that the economic roads servicing South Africa's ports are deteriorating at an alarming rate, to the detriment of exporters. Johnson (1994) claims that South Africa's backlog in maintaining its almost 220 000 km of formal roads were R 20 billion (used 3 billion) in 1994.

In 1997 South Africa had 150 licensed public airports, including nine operated by the Airports Company and 14 provincial airports. There were 60 licensed private airports. Of the nine airports of the Airports Company, three, namely Johannesburg, Cape Town and Durban, have international status. During 1996/7 more than 8.1 million passengers departed from Johannesburg airport only. Air traffic movements during the same period numbered 172 000.

Portnet, a division of Transnet, manages the seven commercial ports along the South African coastline. During 1996/7 a new record was set with the movement of 178.8 millions tonnes of cargo. Vessel calls numbered 14 098. Container tonnage handled amounted to 20.9 million tonnes. The number of TEUs (twenty-foot equivalent units) handled was 1.5 million.

3.3.4 *Prospects for South Africa's Transport Infrastructure*

3.3.4.1 *Roads*

South Africa is pursuing a policy of commercialisation of its national road network. A South African National Roads Agency (NRA) became operational in April 1998. Its current assets consist of the existing 7 000 km of proclaimed national roads, together with the financial balance sheet associated with those roads. Financing will initially be achieved through a 5 cents per litre portion of the fuel levy, increasing in 1999 to 6 cents and in 2000 to 7 cents. This will generate about R750 million per annum, increasing to R900 million in 1999. Thereafter the intention is to proceed towards incorporating an overall total of the 20 000 km of national rural roads which, together with the rail network, carry 80 % of the country's economic traffic. It is envisaged that this rural road network will be financed and managed jointly by the private sector, the NRA and the provinces. The concessioning program, in particular, is proceeding apace with bids having been invited and granted for the N4 road to Maputo, Bids for the N3 to Durban and the N4 West to Botswana are being evaluated. Build-Operate-Transfer (BOT) of public-private partnership (PPP) arrangements are also being considered for the N2 along the KwaZulu-Natal coast, as well as on the Garden Route, and portions of the remainder of the N1 and other national routes.

The South African government currently spends approximately R3.4 billion per annum on its 183 000 km of proclaimed rural roads. This is an average of R18 580 per km per annum. The NRA will be able to spend R51 560 per km per annum on its network, excluding the concessioned roads, which are funded as separate and individual entities. While the economic importance of the primary road system is recognised, this approach may lead to an imbalance in resource allocation towards the national network, to the possible detriment of the rest of the rural network (DBSA, 1998).

The provinces of Gauteng, KwaZulu-Natal and the Western Cape are proposing roads agencies of their own, funded by increased license fees and provincial taxes and centrally apportioned budgetary allocations.

3.3.4.2 Railways and Ports

South Africa is well endowed with an extensive rail network and port system, as its strategic importance for export and food production has long been recognised. The legacy of this core system is, however, an inflexible institutional arrangement that supports a variety of non-core activities ranging from property development to telecommunications. While the White Paper implicitly supports a strategy of restructuring Transnet, movement in this direction remains slow. This could negatively affect rail-against road-based modes, as the efficiencies of rail transport for low-value, high-bulk goods are not reflected in tariff structures. This observation extends to southern Africa's ports, where a monolithic institutional structure militates against cost-efficient transport for both exports and imports.

As the role of the port system becomes even more pronounced in the wake of SADC trade strategies, the restructuring of Transnet into manageable core units that can operate efficiently, particularly in meeting southern Africa's export and bulk food handling needs will become an even greater priority. The MSA study also highlighted that only a few rail routes are currently financially self-sustaining. These routes in effect subsidise all others, which places a financial burden on the entire railway network. Commercialised management, accurate pricing and, in general, market-driven approaches will need to form key elements of a strategy to rectify these problems

3.4 Logistics Management and Transport Costs

As was stated in chapter one, international trade takes place between countries with different geographical locations. It is generally accepted that the cost of transfer acts as a barrier to trade and therefore for international trade to take place, the price difference for the goods between the importing and exporting countries must at least exceed the cost of transfer (Christopher, 1994). Transfer costs does not only comprise the domestic transport costs as reflected by the production costs and the international transport costs as reflected in supplying costs, but also includes logistics costs. These may include warehousing costs and other incidental costs such as damage, pilferage and delay costs. The relative reliability and quality of transport and logistical services are important to determine the competitiveness of exports.

In the light of this, the purpose of this section is to outline the role of transportation in logistics management and transport costs in exports. The components and activities of the logistics chain and supply-chain management as well as the sources of logistics costs will also be discussed with reference to their influence on international competitiveness.

3.4.1 Definitions

Logistics may be defined as follows:

“Logistics is the process of strategically managing the procurement, movement, and storage of materials, parts, and finished inventory (and related information flows) through the organisation and its marketing channels in such a way that current and future profitability are maximised through the cost-effective fulfilment of orders.” (Christopher, 1994)

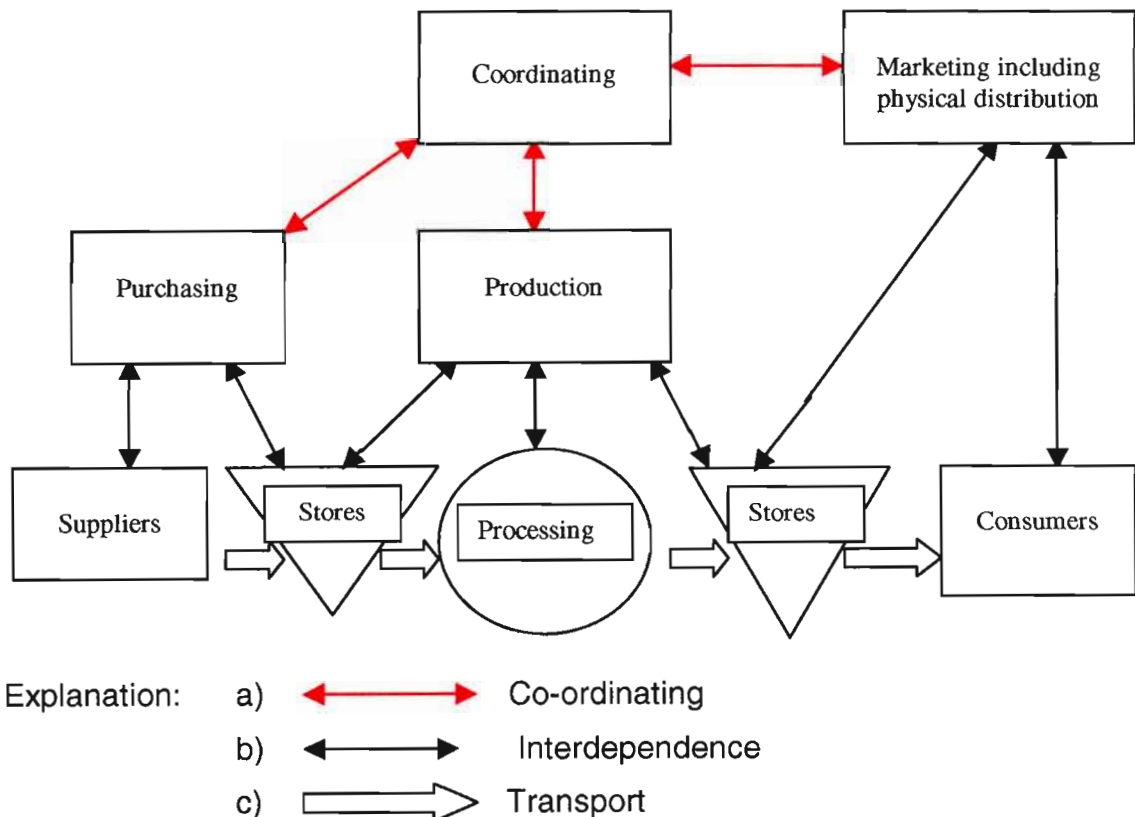
And supply chain management can be defined as:

1. "The delivery of enhanced customer and economic value through synchronised management of the flow of physical goods and associated information from sourcing through consumption". (La Londe, 1998)
2. "The management of the flow of goods and services from the point of origin to the point of consumption, with the intention of fostering mutually beneficial relationships". (Kelly, 1998a)

3.4.2 The Role of Transport in Logistics

The role of transport in the logistics system can be seen in perspective by noting the frequency of transport decisions. Figure 3.1 shows schematically that transport is directly involved in the flow of products (raw material, semi-finished and finished products), but also indirectly involved in the co-ordination of several activities of the logistics system.

Figure 3.1: The Role of Transport in the Logistics System



(Source: Shahia & Smuts, 1993)

In figure 3.1 represents a logistical system wherein the red arrows indicate the elements in the system that requires co-ordination. The black arrows indicate the interdependence between suppliers, purchasing, stores, production, marketing, physical delivery and consumers during the whole process of delivering the product to the final consumer. The white arrow indicates the role of transport in the logistical process concerning the delivering of the products.

Transport therefore not only involves physical movement, but also has a direct effect on decision making throughout the logistics system. This influence is summarised by Johnson and Wood (1986:104). Transport costs are directly influenced by the location of the company's factories, warehouses, suppliers and customers. Inventory requirements are also influenced by the transport mode used because costly but fast transport services make smaller inventory levels possible. The form of transport largely determines the packaging required and the handling equipment for the loading and unloading of cargo and the design of loading docks depends primarily on the type of carrier. A method of order processing that makes maximum consolidation of consignments possible, has the advantage of volume discount, since carriers can transport larger consignments. The type of carrier selected influence customer service objectives. Transport costs also represent the greatest single cost element of the logistics system as indicated further on (Shahia & Smuts, 1993).

The transportation link permits goods to flow from one point to another and thus bridge over the buyer-seller gap in trading. The way and time in which this bridging is performed determine the efficiency of the operation supply chain facility and determines the company's competitive edge (Coyle et al, 1996:318). The geographical differences between suppliers and consumers result in the value added by transportation to a company by creating time and place utility. The value added is the physical movement of the goods to the place desired at the time desired (Coyle et al, 1996:318). Transportation costs in the USA in 1994 was 6.3% of the

GDP. In South Africa transportation costs increased from 7.82% of the GDP in 1994 to 8.25% of GDP in 1998; which emphasises the importance of transportation in a country's economy (Engler, 1997). Transportation is also significant in a company's distribution costs, as indicated in table 3.4 on page 107 where transportation cost as a percentage of sales is the most significant part of the total cost factor as a percentage of sales. In determining the transportation mode to be used in the conveyance of a consignment, a cost-service trade-off is necessary because for example if a company switches from rail to air transportation, there will be an increase in speed/lower transit time, lower inventories, decreased warehousing space and less-stringent product packing. The company realises these advantages at the expense of higher transportation costs (Coyle et al, 1996:319).

Although transport is the most important activity in logistics, it should be regarded as a sub-function of logistics together with storage, handling and inventory control. Optimisation of the transport activity does not necessarily lead to optimisation of the logistics function as a whole. The influence of a transport decision on other elements in the logistics system should therefore be taken into account, which implies a continuous application of the total cost approach (Coyle et al, 1996:319, Shahia & Smuts, 1993).

Transport also influences the following company decisions: production decisions, marketing decisions, purchase decisions and more importantly price decisions since transport costs constitute a significant part of the total cost of the end product, they should be taken into account in decisions regarding the price of the product (Shahia & Smuts, 1993). The lower the value of the end product, the greater the contribution of the transport cost element to the total cost will be, and the greater the influence of transport prices changes on the price of the product (Lambert & Stock, 1982:103).

It should be emphasised that although efficient transport can raise the value of the product, this increased value is not through physical change or processing of the product but transport creates value by providing time and place utility to raw materials and purchased products available at the right time and place. Through this increase in value, transport contributes directly to increasing the company's revenue and also to the contribution that the logistics system makes to profit maximisation (Shahia & Smuts, 1993).

3.4.3 *Logistics as Cost Element in Transport*

Logistics costs are an important cost element. "Logistics, together with inventory holding and warehousing costs, is the third largest cost of doing business for the average company. About 48 cents out of every R1 sale goes towards manufacturing costs, 27 cents to marketing costs, and 21 cents to logistic costs" (Moss, 1991)

According to Dehlen (1993:24), logistic cost, as a proportion of total costs of production, and transport costs as a proportion of logistic costs, will vary from product to product. This is illustrated by data from the USA³⁸. This Physical Distribution Cost Database that was used, surveys large companies in the USA (Barks, 1990). As indicated in table 3.4, the average distribution costs of the companies surveyed were 7.5% of the sales, with transportation costs accounting for the largest share of 2.9%.

³⁸ Data for South Africa was not available at time of calculations.

Table 3.4: Distribution costs in the average US company, 1989.

ELEMENT OF PHYSICAL DISTRIBUTION	DISTRIBUTION COST AS % OF SALES
Transportation: Cost of primary (point of manufacture to distribution centre) and secondary (distribution centre to customer) movement of finished goods	2.9%
Warehousing: Cost of plant and field warehouses	1.8%
Customer service: Cost of taking customer orders and handling customer inquiries	0.5%
Administration: Personnel management costs in the distribution function	0.4%
Inventory carrying: Carrying costs tied to the current value of materials located at any stage in the distribution pipeline	1.9%
Total costs	7.5%

(Davis database, Barks 1990)

The annual expenditure to perform logistics in the US was almost 10% of the 1994 gross national product (GNP). Put in another perspective, for every trillion dollars spend on GNP, the associated logistical cost was over 100 billion dollars (La Londe, 1998). In Australia, the cost of logistics activities for most companies is estimated to be between 20% and 50% of the revenue from sale (Gilmour 1974:2). In South Africa, Prinsloo (1978:152) has established that the cost of logistics activities amounts to be 21% of the wholesale price of food sales. In Europe the comparable figure is between 16% and 18%. Expenditure for transportation in 1994 in the US was \$425 billion, which represent 6.3% of GNP. In South Africa, the contribution of the transport industry to the GNP is between 9% and 10% (Bowersox et al 1986:4) and according to Harvey logistics the contribution of the transport industry is 26%.

According to the U.S Department of Commerce, nearly 60% of all Fortune 500 companies' logistics costs are spent on transporting products from manufacturers to distribution centres or retailers (Engler, 1997). Furthermore, transportation costs can amount to 2% to 8% of a company's sales (Caldwell, 1997).

3.4.4 *Logistics Management*

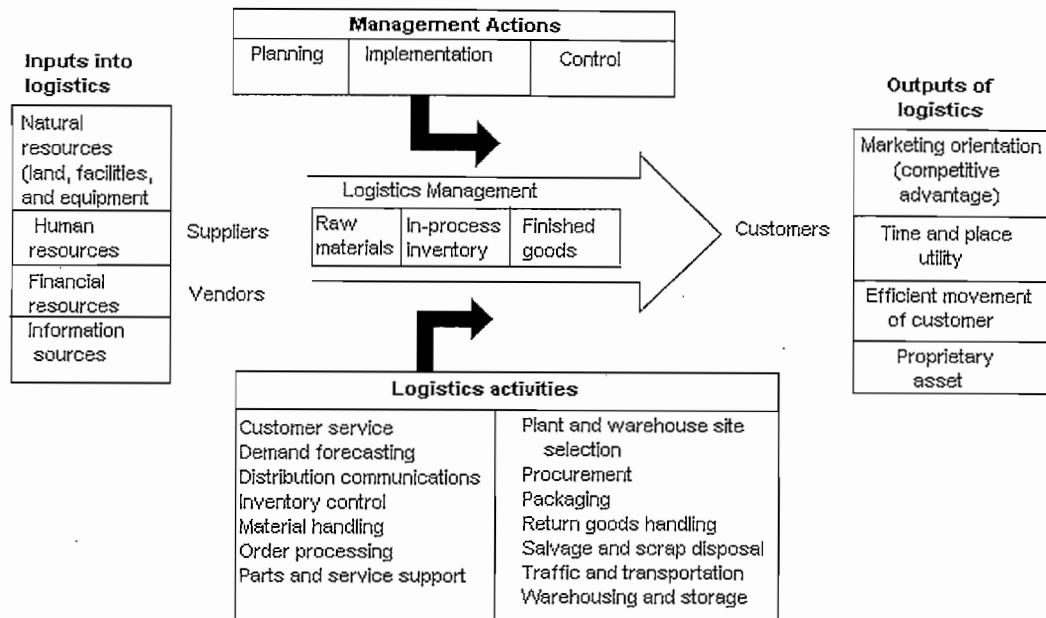
Globalisation has raised the demands on the effectiveness and efficiency of logistical activities. These changes do not only increase the demand for logistics and transport capacity, but also to different patterns of distribution and delivery services. The interdependence between logistics, production and consumption is also reinforced. An important goal of integrated logistics management is to minimise the total cost of logistics rather than to try and reduce the cost of individual components. Efforts to minimise the cost on individual components can lead to sub optimisation and an increase in total cost (Shahia & Smuts, 1993). Ballou (1973:22) summarises the total cost concept as follows:

"The total cost concept is the recognition that the logistics system should be defined broadly enough so that all the relevant costs to a decision problem are considered in the decision process and are balanced at optimum."

Apart from the total cost concept, the systems approach to logistics makes it possible to engineer trade-offs between different logistics activities. Trade-offs occur when costs are deliberately incurred in one area of activity of logistics management to accomplish greater benefits in another area of activity (Gattorna 1983:7). The ability to achieve successful trade-offs between activities is probably the greatest single factor that helps the logistics approach to achieve cost savings for the company (Shahia & Smuts, 1993).

The components of logistics management are shown in figure 3.2. From a macro-perspective, however, transportation and storage and the related information flow are the most important logistics activities. (Pretorius et al, 1994:3-2)

Figure 3.2: Components of Logistics management



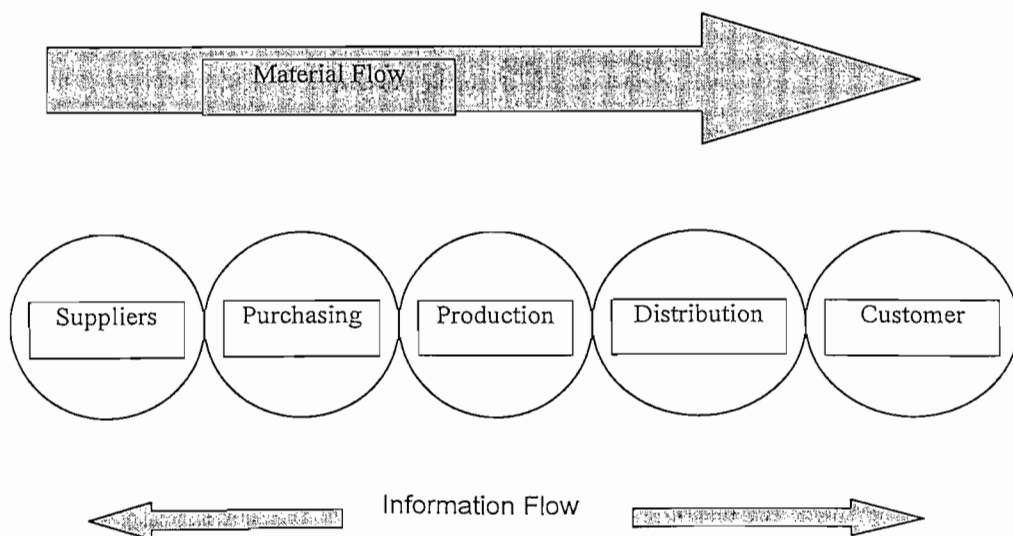
(Source: Pretorius et al, 1994:3-2)

For logistic management to take place inputs into logistics are needed, and they could consist of natural resources, human resources, financial resources and information resources. Suppliers and vendors provide these inputs. The logistics management process includes the management of raw material, in-process inventory and finished goods, but apart from the inputs that are needed to implement the management process, the process itself needs management actions, which consist of planning, implementation and control in order to provide successful management process. These management actions are used to regulate the logistical activities that are performed in the logistical management

process. After the management actions and logistics activities are combined in the logistics management process, the outputs of logistics are provided which includes marketing orientation, time and place utility, efficient movement to customer and proprietary asset. These outputs provide for the successful delivery of the products to satisfy the customer.

The discipline of logistics was not always considered to be of significant strategic importance (Christopher, 1994). More recently, the logistics function is at the core of a new strategic focus called supply chain management. Now customers tell suppliers how and when they want their inventory delivered. The driver behind this new strategic focus is to remove inefficiencies, excess costs and excess inventories from the supply pipeline. The success of supply chain management rests with logistics and requires a logistics model based on quick order to delivery response (Craig, 1998). These changes that raise the importance of logistics are dictated by several market forces including shifting channel power from the manufacturer to the large retailer who now dictate the terms of business, faster cycle-time-to-market, enhanced information technology applications and globalisation of the company (Christopher, 1994).

Figure 3.3: The concepts of supply chain management



(Source: Anon, 1999b)

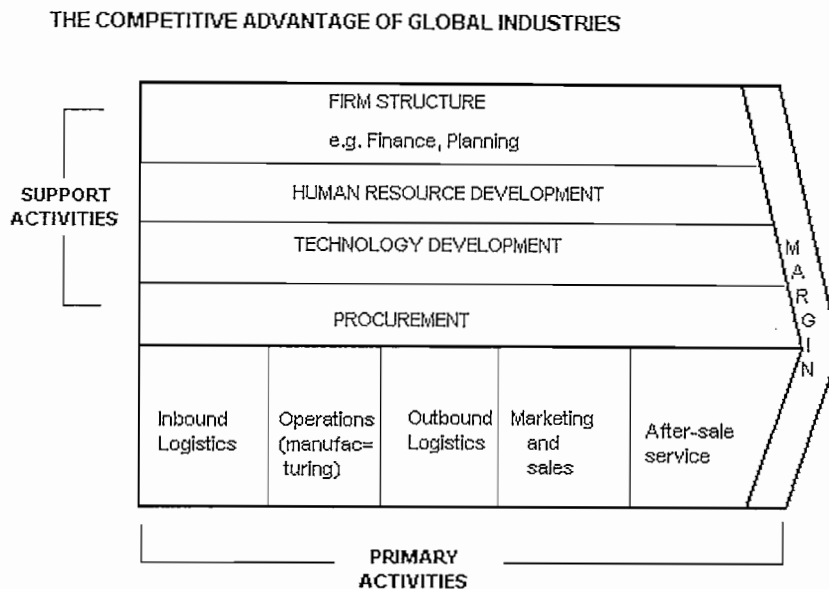
As indicated in figure 3.3, the material flow occurs through out the supply chain. From the suppliers of the material to purchasing and production and then the distribution of the products to the customer. Information flow however is evident in multiple directions through the supply chain, the suppliers provide information through purchasing, production and distribution to the customer and the customer can also provide information with regard to their requirements backwards to the suppliers. The supply chain is built upon strategic relations, information sharing, the application of time-based competitive strategies, and information technology. Consistent and accurate information flow through out the supply chain is therefore crucial for effective supplying. Information based tool includes: Point of sale data acquisition (POS), Electronic Data Interchange document transition (EDI), Just-in-Time materials management (JIT) and Efficient consumer response and Quick response replenishment (ECR/QR) (La Londe, 1998). Supply chain management offer companies a way to improve competitiveness.

Over the last 10 years emphasis has been placed on the search for strategies that will provide superior value to the customer. To a significant extent, Porter (1994) and his "value chain" concept emphasised the importance of competitive relativities in achieving success in the market place. The achievement of competitive advantage through the value chain as depicted in figure 3.4, can be explained as follows:

"Competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Each of these activities can contribute to a firm's relative cost position and create a basis for differentiation...The value chain disaggregates a firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation. A firm gains competitive advantage by performing these strategically important activities more cheaply or better than its competitors" (Porter, 1985).

The activities performed in competing in a particular industry can be grouped into categories as shown in figure 3.4, Porter's value chain.

Figure 3.4: Porter's value chain



(Source: Porter, 1994:41)

Activities in the value chain contribute to buyer value. In Figure 3.4 activities can be divided broadly into primary activities which includes, inbound logistics, operations, outbound logistics, marketing and sales, and service as well as support activities, which include, infrastructure, human resource management, technology development and procurement. The support activities are integrated in each of the primary activities because every activity employs purchase inputs, human resources, some combination of technologies, and draws on firm infrastructure such as general management and finance. Strategy guides the way a firm performs individual activities and organises its entire value chain. Activities vary in importance to competitive advantage in different industries (Porter, 1990:41).

For a company to obtain competitive advantage over its rivals, it must promote value to its customers by performing activities more efficiently than its competitors or by performing activities in a unique way that creates greater buyer value (Porter, 1994). Firms therefore gain competitive advantage from conceiving of new ways to conduct activities, employing new procedures, new technologies or different inputs. A firm's value chain is an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. Linkages often create trade-offs in performing different activities that must be optimised. For example a more costly product design, more expensive components, and more thorough inspection can reduce after-sale service costs. A company must resolve such trade-offs, in accordance with its strategy, to achieve competitive advantage (Porter, 1990:41).

Increased global competition and development in international trade affects the freight requirements to maintain competitiveness and therefore impact the transportation system of a country (Caldwell, 1997). The transportation function is an important competitive tool in a company (de Roulet, 1993). An important element that contributes to the impact on the transportation system, is the development of advanced logistics systems for production and distribution. Speed and reliability is the main characteristics demanded by the freight industry. A goal of freight logistics is to reduce total delivery cost. The reduction of delivered costs allows a company to remain competitive from a logistical perspective and business to become more efficient to survive (Caldwell, 1997). The reduction of warehouse inventories through just-in-time delivery, regional distribution hubs and the rolling warehouse concept³⁹ demands a transportation system with high degrees of reliability. These factors will decrease the interest carrying costs and transportation costs as a share of total delivery cost (Caldwell, 1997).

³⁹ The reliance on the transport system to serve as a "warehouse" and deliver the inventory on time rather than inventory stored in a warehouse until delivery is due.

South Africa is still in the supply chain “confusion” area, possibly because of the immaturity of integration of logistics activities (de Villiers, 1999). But there is clear evidence that South African logistics industry may be changing, and that logistics management and an understanding of the supply chain is at last reaching importance (Sikkema, 1997). The challenge is to move South Africa towards logistics excellence while utilising logistics for improving the cost effectiveness of the national economy (de Villiers, 1999).

Since the early eighties transport services offered have expanded and the transportation function has developed into a professional value-added logistics service. Outsourcing in transportation, distribution and the warehouse function, also went through significant changes. This has been characterised by the deregulation of the transport industry, the establishment of new third party logistics companies and the expansion of several international third party logistics companies into South Africa. The warehousing industry in South Africa includes basic logistics installations with no electronic support at all, to highly sophisticated automated storage and retrieval equipment, in which technology such as bar coding is of primary importance.

Increasing global competition, new manufacturing philosophies, increased use of information technology and the integration of value-added activities throughout the supply chain are amongst the most prominent changes facing countries and firms (Fawcett & Clinton, 1997:18). As a result, the ability of manufacturing firms to gain access to global markets and to obtain their global market share is critical to long-term survival. The managing of logistics plays a vital role in the success of global manufacturing and marketing strategies (Fawcett & Clinton, 1997).

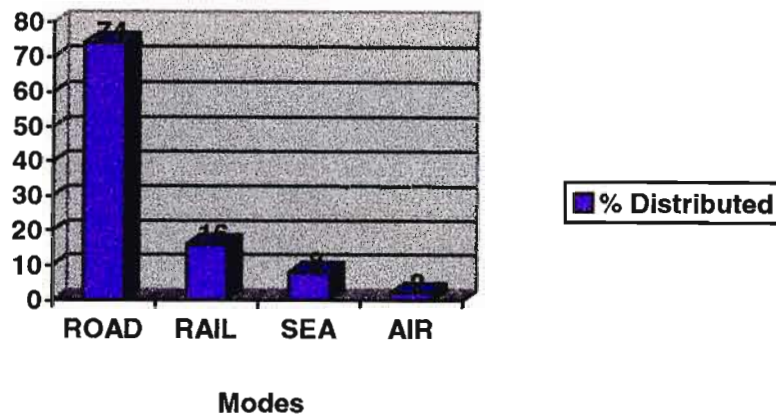
The reasons for this importance of logistic processed in the success of global manufacturing and marketing strategies as provided by Fawcett & Clinton (1997:18) includes:

- Economies of scale are important in achieving global success and it can only be achieved by co-ordinating global operations and logistics and information technologies are the key co-ordinating mechanisms.
- Logistics costs needs to be decreased to increase the benefits of economies of scale
- A high level of performance needs to be supplied and this requires effective logistics management.
- A company's local image for consumers is dependent on logistics decisions that affect product availability through local channels.
- Global strategies require that both information and material flow quickly and smoothly across borders and among channel members.

As indicated by the above, logistics management provides the co-ordinating and adaptive mechanism that allows a firm to take full advantage of global operations.

Transportation and distribution are major elements of the total logistics effort and have a significant effect on customer service and logistics costs. These logistics have seen significant change in South Africa in recent times. The usage of the different transport modes by participating organisations in the country is illustrated in figure 3.5.

Figure 3.5: Usage of transport modes



(Source: Franz et al, 1997)

The average usage of the various transport modes in South Africa is as follows, road 74%, rail 46%, sea 8% and air 2%. This is largely in line with the national South African averages, except that the usage of rail is lower than the national South African average.

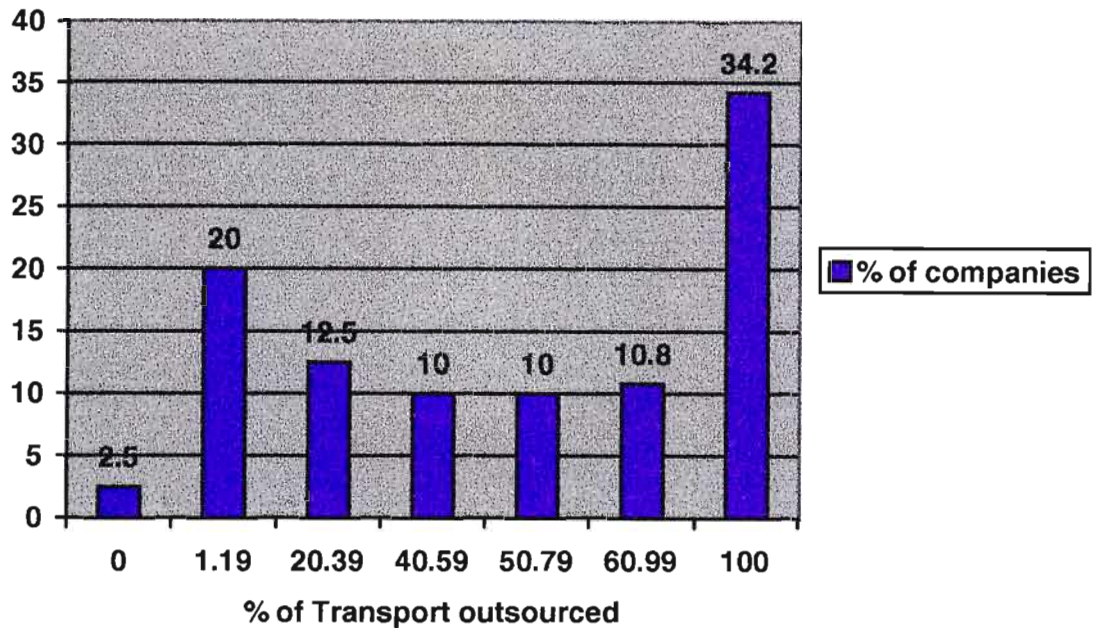
3.4.5 Logistical Outsourcing and Transport costs

Third party logistics where certain elements of logistics are outsourced to third party service providers has been a growing international trend in logistics. This is an area of logistics in South Africa that has seen significant changes in recent times, particularly in transport and distribution. This has been characterised by the deregulation of the transport industry, the establishment of new third party logistics companies and the expansion of several international third party logistics companies into South Africa.

The prime reasons for outsourcing are, improved service, increased flexibility, reduced cost and improved management control. Other reasons for outsourcing include the need to cater for troughs and peaks in demand, geographic limitations, sub-contract the provision of the service to current employees and focus the concentration of resources and effort

on core competencies. The current level of transport outsourced in South Africa is depicted in figure 3.6.

Figure 3.6: Level of Transport outsourcing



(Source: Franz et al, 1997)

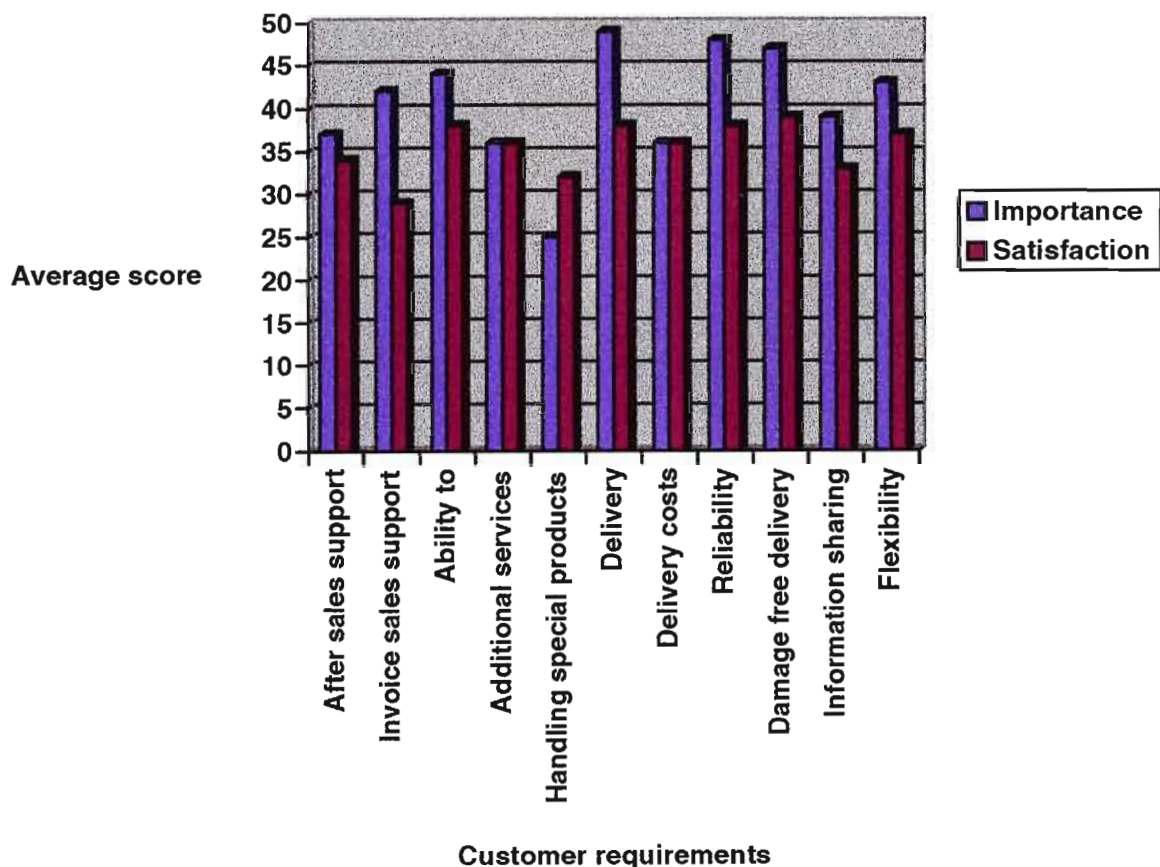
Most organisation outsource at least a proportion of their transport requirements. The entire transport function is outsourced in 34% of the cases, while a further 25% outsource more than 50% of their transportation. If a distinction is made between normal and emergency shipment, 46% of the companies outsource the entire transport requirement for emergency shipments.

Customer satisfaction is a high priority for logistics, and to this end it is important that third party suppliers deliver satisfactory results in order to contribute towards the satisfaction of the customers of their clients. The reasons for outsourcing transport are given above, but the following figure compares the exception level compared to the achievements in the specific areas.

For the most part, third party suppliers were not living up to expectation, with a 30% gap between the expectation level and the performance level. It must be kept in mind that outsourcing transport as such might not be new to South Africa, but outsourcing distribution and transportation as part of an integrated logistics system, requires a certain level of integration and partnership between service provider and third party supplier. The fact that current levels of customer's satisfaction with third party suppliers seem to be below expectation might also be the result of partnerships that have not yet been developed up to the level required for maximum logistics efficiency.

Customer service from transport carriers is analysed in more detail in figure 3.7.

Figure 3.7: Importance and satisfaction with customer service attributes



(Source: Franz et al, 1997)

From figure 3.7 the customer service priorities are in order of importance: on-time delivery, reliability of delivery, damage-free delivery, ability to expedite and flexibility. Although there is a negative gap between expectation and performance in the majority of aspects, having a zero gap is probably the ideal. It is important, however, to interpret the size of the gap against the background of the level of importance attached to the service attribute and the competitive benchmark. In this regard, the differences between expectation and performance are the biggest in the priority areas mentioned above.

Price rates as the ninth most important attribute which may be an indication that, from a transport perspective, customers are more concerned with the performance than the cost involved. It must be kept in mind that cost-efficiency will always play a role, but that customers might be willing to substitute a small cost difference for improved customer service.

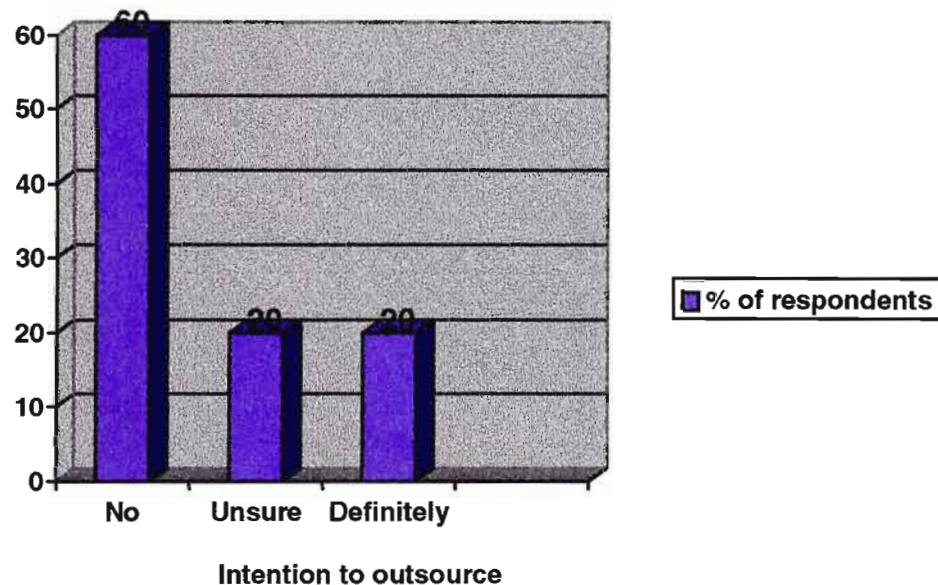
Another conclusion from figure 3.7 above is that the additional or value-added services only rated as ninth in importance together with price. A possible reason for this is the current negative gap between expectation and performance in the top service priorities.

Adding value, in terms of additional services, may be compromised if performance in the core attributes is not up to standard. Once service providers perform the requirements in the core areas, the situation for additional services will probably change.

Currently 34% of respondents in South Africa outsource their entire transport requirement. When this is compared to international trends it is interesting to note that in Europe the third party suppliers of transport have a dominant market share.

As far as future trend for transport outsourcing in South Africa is concerned, figure 3.8 depicts the intentions of companies not currently outsourcing transport.

Figure 3.8: Intention of companies not outsourcing transport



(Source: Franz et al, 1997)

Transport outsourcing in South Africa seems to be static according to the figures from the above figure. The majority of companies 80%, have no intention to outsource transport. This figure should be seen against the background of the attitude of companies in South Africa towards outsourcing in general. Although there are number of outsourcing successes, companies are still carefully considering outsourcing as a strategy.

Traditionally supply chains were created by organisations for individual product lines and even for specific customers. Supply chains were seen as one of the elements that provided organisations with a competitive advantage.

Supply chains can be merged to cater for multiple product lines with the creation of multi-purpose vehicles and cross-docking warehouse facilities. A very low percentage of respondents currently share supply chains, although this is likely to increase.

Of interest is that the trend to share was most prevalent in the group of respondents with a turnover of R50-100 million. Organisations were also more likely to share logistics resources earlier in the supply chain and less likely to share logistics resources closer to the final customer.

In many cases, competition is now coming from international sources and there is more advantage to be gained through the pooling of resources among traditional local competitors in the interest of improving the competitiveness of South African organisations.

The respondents own an average of about 63% of warehouse space with the balance being leased (26%) or owned by third parties (11%). Indications were that this is gradually moving to increased outsourcing, although most respondents were hesitant to relinquish control over their warehouse facilities. Reasons for outsourcing in order of priority were improved service, cost reduction, flexibility and management control.

Of the firms interviewed by Franz et al, 1997, 46% had a centralised warehousing policy and a further 33% had a combination of a centralised and decentralised warehouse strategy. Through improved communication and transportation, warehousing is increasingly inclining towards becoming a centralised, "hub and spoke" infrastructure.

3.5 Summary

This chapter highlighted the importance of transport infrastructure to development and economic growth because infrastructure facilities produce services that countries need to modernise and diversify their production, to attract foreign investment and to be competitive internationally as well as to improve the health and productivity of the poor. The relationship between infrastructure and economic development can be examined on a micro- as well as a macro-economic level. On a micro level, as explained in section 3.2.2, appropriate infrastructure increases the profit of producers and also influences the income of consumers positively. On a macro-economic level, the relation between infrastructure and economic development was discussed with reference to the effects of infrastructure on private investment, public investment and international competitiveness. It was determined that the lack of appropriate infrastructure and insufficient service management leads to increase shipping costs for exporters.

Infrastructure percentage shares of GDP in South Africa suggests that infrastructure is necessary for economic growth and development. Between 1994 and 1997, the total infrastructure in South Africa averaged 10.4% of the GDP and 6.8% was contributed by transport, storage and communication, which indicates the importance of transport and logistical infrastructure.

The main initial force for infrastructure development in South Africa was the mining industry. Later the manufacturing industry also benefited from infrastructure provision. South Africa has a relatively good transport infrastructure compared to other developing countries in Africa and particularly the SADC region. South Africa has more than one-half of the paved and total road network in the SADC region, which contributes to decreasing transport cost since unpaved roads increase vehicle maintenance, packaging costs and shipping time. Given that over one-

half of all cross-border freight originates in South Africa, the country's role as the major supplier to the SADC region, is evident.

South African railways' total revenue for 1995 was US \$2 549 million compared to SADC's total revenue of US \$2 390 million in 1995. With regard to ports, Durban and Richards Bay together handled 72% of the SADC region's total container traffic. The South Africa ports are therefore vital infrastructure in the SADC region. The airport industry in southern Africa as a whole has performed comparatively well in the 1990s, with efficiency improving relative to the global average. Although comparative SADC data are not up to date, Johannesburg International's position as a regional hub has been consolidated.

Although South Africa's transport infrastructure compares favourably in southern Africa, there are still some backlogs and gaps in the sufficiency of existing infrastructure and transport system. These backlogs are a major contribution to additional costs that increase shipping costs and affect international competitiveness of exports negatively. Overloading by road hauliers, lack of investment in road system management, declining use of rail transport, lack of finance and capacity and deterioration of rail and road infrastructure are only some of the problems by the South African infrastructure. However by commercialising South Africa's transport infrastructure provision and maintenance, these problems and backlogs might be reduced or even eliminated.

Logistic costs, as discussed in section 3.4, is vital in the competitiveness of a country's exports because it can consist up to 21% of the total sales cost. Logistics costs comprise of a number of different costs and can include, transportation costs, warehousing costs, customer service costs, administration costs as well as inventory carrying costs. International competitiveness can only be achieved by providing a high quality product at a competitive price to the consumer. Transportation costs comprises a significant element of logistic costs. Transportation of goods represents a significant part of the logistical process because it provides the physical

delivery of the products to the consumers and also directly affects the decision-making throughout the logistical system. Transport also creates value by providing time and place utility to raw materials and purchased products available at the right time and place. Through this increase in value, transport contributes directly to increasing a company's revenue and also to the contribution that the logistics system makes to profit maximisation.

Globalisation has raised the demand on the effectiveness and efficiency of logistical activities and therefore, the important goal of integrated logistics management is to minimise the total cost of logistics rather than to try and reduce the cost of individual components. More recently however, the logistics function is implemented at the core of a new strategic focus called supply chain management. This strategic focus makes it possible for customers to tell suppliers how and when they want their inventory delivered. This also contributed to the further development of just-in time delivery. This new approach to distribution of products raised the importance of reliable transportation systems and warehousing facilities.

The South African logistical system has undergone significant changes in recent times particularly in transport and distribution. The deregulation of the transport industry, establishment of new third party logistics companies and the expansion of several international third party logistics companies into South Africa contributed to these changes. But despite of changes and improvements in the logistical field, South African companies still needs a lot of improvements concerning logistic and supply chain management. South Africa is still in the supply chain "confusion" area, possible because of the immaturity of integration of logistics activities. In chapter four, the role of transport in South Africa's economy is discussed in a global perspective as well as the domestic and international transport costs.

Chapter 4

TRANSPORT AND TRANSPORT COSTS IN SOUTH AFRICA: A GLOBAL PERSPECTIVE

4.1 Introduction

In chapter two, the various ways through which transport costs may affect a country's international competitiveness was set out. In chapter three the relation between transport infrastructure and economic development was discussed. It is therefore important to determine how South Africa's exports are effected by national as well as international transport costs, to determine which of the two costs has the most significant impact on the exports and then what can be done to decrease this cost.

The chapter is structured as follows. The South African transport service providers are identified in section 4.2. An overview of transport services in South Africa and their macro-economic contribution to GDP, GDFI, employment and trade are discussed in section 4.3 as well as the competitiveness of South African transport services and their sectoral impact. Section 4.4 provides an overview of South Africa's exports. In section 4.5 and explanation of the domestic as well as the international transport costs in and from South Africa compared to other countries are given. Section 4.6 contains a summary.

4.2 The Role of Transport in South Africa's Economy

4.2.1 *Macro-economic Contribution of Transport Services*

4.2.1.1 *Contribution to GDP, GDFI*

The services sector in South Africa makes the largest contribution to national output, namely 65%. In 1997 the transport sector contributed 5.3% to South Africa's GDP. Table 4.1 below places this in context with the other services sectors in the economy.

Table 4.1: Services Sector Contributions to South Africa's GDP

SERVICES SUB-SECTOR (SIC 71, 73)	% OF GDP (1997)	% OF GDFI (1997)
Utilities	3,8%	7,5%
Construction	2,8%	0,5%
Internal Trade Services (Distribution)	14,5%	4,8%
Catering & Accommodation	0,9%	N/A
Transport	5,3%	13,5%
Communication	2,1%	N/A
Financial Services	6,1%	20,4%
Business Services	11,1%	N/A
Community Services	18,6%	27,5%
TOTAL SERVICES SECTOR	65,1%	74,2%

(Source: SARB Quarterly Bulletins; CSS OHS, 1995)

Table 4.1 shows that transport services, whilst contributing 5.3% to GDP, is more important in terms of its contribution to fixed investment, contributing 13.5% to South Africa's total fixed investment in 1997. This suggests that the transport services sector is relative capital intensive, compared for instance to distribution services or community services (Naudè, 1999b).

Table 4.2 below shows that the share of transport, storage and communication in GDP has been increasing over time to over 8%.

Table 4.2: R million contribution of transport, storage and communication as % of GDP (At constant 1990 prices)

Year	Transport, storage and communication	GDP at factor cost	As % of GDP
1971	9751	163424	5.97%
1972	10137	166585	6.09%
1973	10917	172938	6.31%
1974	12260	182233	6.73%
1975	12648	185889	6.80%
1976	12965	191221	6.78%
1977	13220	191184	6.91%
1978	13799	196633	7.02%
1979	15018	204338	7.35%
1980	16075	216901	7.41%
1981	17093	227767	7.50%
1982	16564	226213	7.32%
1983	15592	221282	7.05%
1984	16817	232868	7.22%
1985	17027	232020	7.34%
1986	16735	232042	7.21%
1987	16850	235676	7.15%
1988	17655	244627	7.22%
1989	18343	249905	7.34%
1990	18377	247315	7.43%
1991	17975	244549	7.35%
1992	18316	238711	7.67%
1993	18748	242485	7.73%
1994	19444	248575	7.82%
1995	20351	255497	7.97%
1996	21109	263694	8.01%
1997	21637	268142	8.07%
1998	22123	268182	8.25%

(Source: SARB Quarterly Bulletin, 1972-1999)

4.2.1.2 Contribution to Trade

In terms of the transport sector's contribution to imports and exports. Table 4.3 indicates that transport service exports accounted for 5.6% of South Africa's total trade in 1996 and 7.9% of imports. The 7.9% share in imports is the largest of any service sector in South Africa. Most of these imports are currently cross-border trade with some scope to increase consumption abroad, given the capital-intensive nature of transport services and the structure of transport services (Naudé, 1999b).

Table 4.3: Services Sector Shares in South Africa's Imports and Exports

SERVICES SUB-SECTOR (SIC)	IMPORTS SHARE %	IMPORT GROWTH % (1988-96)	EXPORT SHARE %	EXPORT GROWTH % (1988-96)
Utilities	0	N/A	0,1	6,7
Construction	0,1	4,3	0,0	2,2
Distribution, Catering & Accommodation	4,7	7,9	6,2	28,8
Transport Services	7,9	6,5	5,6	1,8
Communication Services	0,8	7,0	0,6	14,9
Financial Services	1,0	1,5	1,9	10,1
Business Services	1,2	7,2	0,9	34,5
Community Services	0,1	-6,3	0,3	9,4
TOTAL SERVICES	17,8	2,7	16,8	5,7

(Source: Naudé, 1999b)

Table 4.3 also shows that the export share of transport services (5.6%) in 1996 was the second largest (after distribution and tourism). However, the average annual growth rate in transport services exports has been the lowest (1.8%) of all the sectors. This suggests that the sector is perceiving / experiencing significant export growth constraints (e.g. high transport prices and inefficiencies).

4.2.2 Competitiveness of the South African Transport Services Sector

The share of transport in the economy has been increasing, and is more representative of a middle to high-income economy than of a low-income economy, as table 4.4 suggests. This reflects the "stylised fact" finding of Francois and Reinert (1996:1) that "the share of value added originating in services, including both private services and trade, transport and communications services, is positively linked to the level of development".

Table 4.4: Percentage share of Transport, Storage and communications GDP: A Comparative View

Economy	Transport, storage and communications
South Africa annual average, 1994-7	6.8%
South Africa annual average, 1960-97	8.4%
Low -income economies	5.3%
Middle-income economies	6.8%
High-income economies	9.5%

(Source: Naudè, 1999a)

The Department of Transport (see MSA) found that the South African transport system is competitive only in bulk exports where it may provide both cost and service advantages to customers. By contrast, the general cargo transport system is deficient on both grounds. Maasdorp (1999:40) also finds that domestic freight costs are high - exceeding international transport costs (Naudè, 1999b).

Customer demand for freight transport services is currently highly concentrated on two bulk export flows, one large general cargo export flow between Gauteng and Durban and a limited number of other mid-sized flows, including those into the SADC region. The majority of customers are geographically concentrated requiring transport from dense industrial locations to destinations fed by relatively dense transport corridors. There is significant evidence that the freight system is further consolidating around these high volume corridors. Customers revealed a significant level of dissatisfaction with key aspects of the system, particularly with rail general freight prices and service and with service and prices in the ports. Other than in export bulk freight, performance against international benchmarks was poor. Customers articulated overall goals for higher reliability on almost all modes, and better pricing for rail and ports.

The strategic challenges identified were consolidated into two specific areas of concern:

- Lack of support for export competitiveness; and
- Low levels of system sustainability

The former issue is due to a lack of alignment for value-added ocean-bound exports and barriers to cross-border SADC traffic. The system sustainability challenge was focused on the high non-user cost of domestic freight – principally in the form of externality costs like safety and environmental costs and road building and maintenance – and the deterioration of overall system quality.

4.2.3 Sectoral Importance of Transport Services

According to Francois and Reinert (1996:1) “some of the most striking aspects of service sector growth relate to the relationship of services to the production structure of economies, and particularly the relationship of the services sector to manufacturing”.

Transport services are an important intermediate input in the South African economy. For agriculture, mining and manufacturing it is the most important service input after distribution services – accounting for between 2 to 3% of total intermediate inputs for these sectors (Naudè, 1999b).

The importance of transport as an intermediate input can also be seen in the part of total inputs per unit that consist of transport costs as indicated in table 4.5. According to the 1993 South African input-output tables, the industries with the highest transport input were meat, fertilisers, cement and other non-metallic minerals.

Table 4.5: The total transport per unit of total inputs in South African industries

Sector	Transport per unit of total inputs '71	Transport per unit of total inputs '81	Transport per unit of total inputs '84	Transport per unit of total inputs '88	Transport per unit of total inputs '89	Transport per unit of total inputs '93
Food Processing						
Meat	0.042	0.036	0.049	0.011	0.027	0.042
Dairy	0.030	0.025	0.031	0.006	0.017	0.022
Fruit & Vegetable	0.025	0.021	0.025	0.005	0.015	0.019
Fish	0.029	0.025	0.023	0.005	0.020	0.026
Oils & Fats	0.028	0.038	0.036	0.008	0.016	0.023
Grain Mill	0.042	0.036	0.045	0.011	0.027	0.037
Bakery	0.015	0.032	0.028	0.006	0.019	0.028
Sugar Mills	0.041	0.038	0.047	0.013	0.027	0.034
Confectionary	0.208	0.027	0.028	0.006	0.016	0.020
Other Food Products	0.025	0.025	0.032	0.007	0.017	0.022
Prepared Animal Feeds	0.023	0.026	0.030	0.007	0.017	0.022
Beverages						
Distilleries & Wineries	0.018	0.022	0.018	0.003	0.011	0.014
Malt beverages	0.023	0.019	0.023	0.003	0.011	0.014
Soft drinks	0.019	0.008	0.017	0.004	0.012	0.015
Tobacco products	0.024	0.036	0.036	0.007	0.019	0.025
Textiles						
Spinning & Weaving		0.012	0.016	0.003	0.012	0.014
Made-up textiles	0.010	0.014	0.013	0.002	0.007	0.007
Garment knitting	0.007	0.015	0.014	0.002	0.006	0.007
Other knitting Mills	0.009	0.013	0.012	0.002	0.006	0.006
Carpets & Rugs	0.021	0.024	0.017	0.002	0.007	0.008
Cordage & Rope	0.016	0.015	0.011	0.001	0.014	0.017
Other Textiles	0.015	0.021	0.024	0.004	0.007	0.009
Clothing	0.007	0.009	0.010	0.001	0.006	0.007
Leather Products						
Tanneries & Leather	0.016	0.013	0.017	0.002	0.005	0.009
Leather Products	0.012	0.011	0.015	0.002	0.004	0.018
Footwear	0.012	0.011	0.011	0.001	0.018	0.004
Wood & Wood Products	0.020	0.020	0.028	0.006	0.018	0.020
Furniture	0.013	0.012	0.018	0.003	0.013	0.014
Paper & Paper Products						
Pulp & Paper	0.028	0.034	0.039	0.006	0.017	0.019
Containers	0.029	0.046	0.047	0.006	0.020	0.026
Other Paper Products	0.023	0.032	0.041	0.006	0.015	0.019
Printing & Publishing	0.014	0.019	0.024	0.004	0.009	0.012
Chemical Products						
Basic chemicals					0.014	0.015
Fertilizers	0.070	0.030	0.082	0.022	0.050	0.055
Resins & Plastics	0.019	0.028	0.031	0.004	0.025	0.029
Paints & Varnishes	0.038	0.021	0.028	0.004	0.160	0.018

Pharmaceutical Products	0.016	0.017	0.020	0.003	0.012	0.014
Soap & Cosmetics	0.022	0.018	0.025	0.004	0.011	0.013
Other Chemical Products	0.023	0.022	0.029	0.005	0.002	0.016
Petroleum Products	0.072	0.031	0.100	0.044	0.067	0.113
Rubber Products						
Tyres & Tubes	0.020	0.019	0.023	0.004	0.015	0.018
Other Rubber Products	0.022	0.014	0.022	0.003	0.011	0.013
Plastic Products	0.027	0.017	0.016	0.002	0.011	0.013
Non-Metallic Mineral Products						
Pottery	0.021	0.013	0.043	0.007	0.018	0.017
Glass	0.024	0.019	0.135	0.004	0.015	0.016
Clay Products	0.050	0.023	0.054	0.009	0.029	0.028
Cement	0.050	0.027	0.053	0.016	0.037	0.044
Other Non-Metallic Minerals	0.057	0.049	0.081	0.016	0.057	0.059
Iron & Steel Basic Industries	0.044	0.038	0.059	0.012	0.037	0.035
Non-Ferrous Metal Basic Industries	0.031	0.023	0.064	0.013	0.028	0.032
Metal Products						
Cutlery & Hardware	0.012	0.013	0.018	0.003	0.017	0.019
Furniture & Fixtures	0.017	0.023	0.037	0.007	0.024	0.029
Structural Metal Products	0.022	0.022	0.031	0.004	0.025	0.030
Other Metal Products	0.023	0.022	0.032	0.005	0.019	0.033
Machinery						
Engines & Turbines	0.013	0.004	0.007	0.001	0.006	0.006
Agriculture Machinery	0.018	0.026	0.027	0.003	0.022	0.030
Woodworking Machinery	0.021	0.008	0.017	0.003	0.010	0.010
Special Machinery	0.019	0.017	0.029	0.004	0.019	0.021
Office Machinery	0.005	0.006	0.014	0.001	0.014	0.014
Other Machinery	0.012	0.014	0.018	0.002	0.013	0.015
Electrical Machinery						
Electrical Industrial Machinery	0.011	0.010	0.018	0.002	0.011	0.010
Radio, TV & Communication Equipment	0.008	0.005	0.007	0.001	0.007	0.007
Electrical appliances	0.014	0.025	0.022	0.003	0.025	0.032
Other Electrical Apparatus	0.015	0.018	0.020	0.003	0.018	0.022
Motor Vehicles & Motor Vehicle Parts						
Motor Vehicles	0.017	0.013	0.017	0.002	0.008	0.009
Motor Vehicle Parts	0.016	0.017	0.023	0.003	0.012	0.014
Other transport equipment						
Railroad equipment	0.021	0.020	0.022	0.002	0.013	0.015
Transport	0.018	0.018	0.024	0.002	0.007	0.010

equipment						
Other Manufacturing						
Jewellery	0.003	0.004	0.006	0.001	0.008	0.010
Other Manufacturing	0.011	0.009	0.019	0.002	0.010	0.012

(SSA input-output tables, 71 - 93)

High transport costs will negatively affect the inputs in manufacturing sectors that will hamper their international competitiveness and therefore also the possible increase in the exports of manufactured products.

4.3 South African Transport Service Providers

4.3.1 Public Sector Transport Service Providers and Deregulation

In addition to the perception that deteriorating transport infrastructure is contributing to raising transport costs in South Africa, so is the fact that the main transport service providers in South Africa have been government regulated and dominated. Since 1910, the government owned South African Transport Services (SATS) – previously the South African Railways and Harbours – enjoyed a monopoly in the South African transport market due to protective legislation. Road transport could only be provided by the private sector if a valid permit was obtained and other prohibitive stipulations were met. Since April 1990 the SATS was reformed into Transnet, remaining government owned, but having to operate according to business principles (Pretorius, 1997:1-4). Transnet consists of seven main divisions/businesses including:

- **Spoornet** – the company's largest transport business, focuses on the transportation of freight, containers and mainline passengers by rail.
- **Petronet** – operates Transnet's liquid petroleum pipeline network and transports petroleum products from the coastal and inland refineries to South Africa's main business centres.
- **Autonet** – specializes in economy and luxury passenger coach services, general cargo, tanker and refrigerated transport by road.

- **South African Airways** – the largest commercial airline operating in the African continent and currently rates amongst the world's 50 largest airlines.
- **Fast Forward** – a container shipment and consignment distribution business and provides a diverse mix of products to clients throughout South and southern Africa.
- **Portnet** – manages and control all seven commercial ports on the South African coastline.
- **Metrorail** – Transnet's commuter rail transport business operating suburban trains in the metropolitan centres of South Africa.

The impact of the monopolistic position enjoyed by the SATS as well as the growing deregulation of road transport since the 1980s the following perceived and real impact on transport costs in South Africa. First, when the SATS were commercialised in 1990, the South African government did not take over the liability of its pension fund. According to Pretorius (1997:4-5), Transnet need to realise a profit of R 1.7 billion per annum to cover this inherited loss, which may be perceived to result in unnecessarily high transport charges. Second, growing intermodal and intramodal competition⁴⁰ in the freight transport market since the government began with deregulation in the 1980s have contributed to decreasing transport costs overall⁴¹. Whilst heavy road transport operators have captured a large portion of the market for high-valued goods, intramodal competition has forced tariffs down and improved service delivery, while at the same time allowing the railways to focus on providing transport for bulk products.

⁴⁰ The number of commercial vehicles on South Africa's roads has increased from 175000 in 1981 to 400 000 in 1991.

⁴¹ The deregulation of road transport in South Africa and the consequent increase in competition has also resulted in certain negative externalities such as speeding of hauliers, overloading, driving for extended hours, decreased expenditure on driver training and servicing of vehicles, as well as road damage. These externalities all raise the social costs of transport.

Since the Road transportation Act of 1977, the White Paper on National transport Policy in 1986 and the (RTQS), the land transport system has been progressively deregulated, eliminating a large measure of protection afforded to the South African Railways and its successors since 1930. The road freight system is essentially operated by the private sector, following Transnet's subsidiary Autonet's withdrawal from competition in road freight in 1992 (Dehlen, 1992).

Apart from Portnet (a division of Transnet) who control all nine South African ports and provide port infrastructure and charge ad valorem wharfage⁴², shipping charges⁴³ and terminal handling charges⁴⁴, there is also the department of environment sea fisheries who provide state owned vessels operated for fishery research and antarctic research and supply duties.

Transnet is today recognised as a dominant player in the transport arena in Southern Africa, not only in terms of the transport and handling of freight and passengers, but also in the provision and maintenance of a highly sophisticated transport infrastructure.

Transnet handles more than 180 million tons of rail freight per year, 2.7 million tons by road, 3 million passengers by road, 180 million tons in the harbours, 16 000 million litres are pumped through its pipelines and transports over 5 million passengers by air. Transnet is worth R 42 779 million in total operating assets and has a workforce of 100 592 employees.

⁴² Ad valorem Wharfage paid to Portnet and represents a contribution towards the costs of maintaining the harbour infrastructure.

⁴³ Shipping charges are levied by Portnet and payable in respect of bulk and breakbulk cargo for the shore handling costs..

⁴⁴ Terminal handling charges are raised by Transnet (all inland ports) and Portnet (all coastal ports) for the use of the container handling facilities.

4.3.2 Private Sector

There are a number of private transport service providers in South Africa of which only the ones listed on the JSE, members of SAAFF and listed in the Word Shipping Directory are listed and discussed below.

The JSE listed private sector service providers that are concerned with freight transportation, warehousing and distribution are listed below. The company's name and listing date are indicted in the first column and in the second column, information regarding the company listed are indicated as follows, firstly, the nature of business, secondly principal shareholders, thirdly the company's fixed assets for 1998 in thousand of rands and fourthly the 1998 earnings per share in cents.

Cargo Carriers (1987)	<ul style="list-style-type: none">• Bulk road transportation, bulk haulage operations for most major industrial sectors.• Bolton Family• 130 681• 24.5 c
Comair (1998)	<ul style="list-style-type: none">• Scheduled airline services in the Southern Africa region• Not available• 73 123• 15.0 c
Grincor (1986)	<ul style="list-style-type: none">• Investment holding company with interest in businesses that are involved in the movement of goods nationally and internationally by sea, air and on land and financial services.• Grindrod Holdings Ltd.• 1 139 135• 42.7 c
Imperial Holdings LTD (1989)	<ul style="list-style-type: none">• Diversified industrial company involved in aviation, truck hire, dedicated transport contracting, transport of liquids and dry bulk products and refrigerated transport.• Old Mutual, Standard Bank Nominees, 81 Main Street Nominees, Eskom Pension Fund and CMB Nominees.• 666 012• 285.0 c

Laser Group LTD (1986)	<ul style="list-style-type: none"> • Removals and storage, commercial transport and logistic services, archive management, relocation and mobility service. • Not available • 200 233 • 81.0 c
Micor LTD (1990)	<ul style="list-style-type: none"> • Interest in freight and logistics and distribution of industrial products. • Vestacor Ltd, Directors' interest • 36 303 • 40.6 c
Millionaire Charter LTD (1999)	<ul style="list-style-type: none"> • Outsourcing and charter operations company, which provides a service to airlines and corporate institutions and to the travel trade internationally and locally, consisting of the provision of fully crewed and maintained aircraft on a contract or non-schedule basis. • Not available • Not available • Not available
Mobile Industries LTD (1969)	<ul style="list-style-type: none"> • Owning, financing, leasing-out and managing of marine cargo containers worldwide and the manufacture and export of containers for international markets. • Joseph Jowell's Holdings, Old Mutual Nominees, Coronation Holdings Ltd, Nedcor Bank Nominees, ABSA Nominees (Pty) Ltd. Standard Bank Nominees (Tvl) (Pty) Ltd. • 54 • 17.9 c
Roadcorp LTD (1987)	<ul style="list-style-type: none"> • Supplies technologically advanced one-stop logistical support services, consolidating, distribution, warehousing, harbour services, container parks, shipping, transport and clearing. • Coenraad Strauss Trust • 140 644 • 238.76 c
Safmarine and Rennies Holdings LTD (Safren) (1984)	<ul style="list-style-type: none"> • Safren's primary activities are conducted through Safmarine and Rennies Group Ltd and include shipping and air transport operations, freight, terminalling, logistics and travel.

	<ul style="list-style-type: none"> • Old Mutual Nominees (Pty) Ltd, Standard Bank Nominees (Tvl) (Pty) Ltd, CMB Nominees (Pty) Ltd, First National Nominees (Pty) Ltd and 81 Main Street Nominees Ltd. • 4 560 millions of rands • 68.9 c
Super Group LTD (1996)	<ul style="list-style-type: none"> • Holding company operating in the fields of transport, motor, automotive components distribution and related financial services. • Not available • 709 808 • 41.8 c
Trencor LTD (1955)	<ul style="list-style-type: none"> • Owning, financing, leasing-out and managing of marine cargo containers worldwide and the manufacturing and export of containers for international markets. • Mobile Industries Ltd, Old Mutual, Standard Bank Nominees (Tvl) (Pty) Ltd, Nedcor Bank Nominees Ltd. • 2 017 948 • 221.8 c
United Service Tech LTD (Union Transport) (1987)	<ul style="list-style-type: none"> • Investment holding company in which the investee company provides a domestic and international courier service under the name Sun Couriers and operates as international clearing and forwarding agents under the name Union Transport. • Not available • 166 624 • 39.4 c
Unitrans LTD (1987)	<ul style="list-style-type: none"> • Road freight transport operators, passenger transportation services, leasing and sale of vehicles, vehicle finance and insurance, logistics and agents for UPS, express delivery service. • United General Investments (Pty) Ltd. • 651 860 • 144.4 c
Value Group LTD (1998)	<ul style="list-style-type: none"> • Provides a comprehensive range of transport and logistical distribution services. Focuses on outsourcing of customers' distribution requirements and encompasses warehousing management, full maintenance leasing of vehicles and forklifts and truck

rental.

- Vaaltrucar Ltd.
- 13 206
- 5.8 c

(JSE Handbook, September 1999 – February 2000)

The SAAFF (South African Association of Freight Forwarders), which represents the majority of freight forwarders in South Africa, promotes the interest of both freight forwarders and their clients. The current 85 members of the SAAFF includes the following companies:

- ADB McGregor & Co (Pty) Ltd.
- Aeromaritime International Management Services (Pty) Ltd.
- Airborne Express SA (Pty) Ltd.
- AMI South Africa c/o Micor House
- Air Imports & Exports Clearing Agents (Pty) Ltd.
- AEI
- Airfreight Africa
- Birkart International Forwarding (SA) (Pty) Ltd.
- Bridge Shipping (Pty) Ltd
- Care Freight International
- Cargocare Freight Services (Pty) Ltd.
- Cargo Management Services
- Cargo Marketing Int t/a Worldwide Freight
- Clearfreight (Pty) Ltd.
- Clover Cargo International
- Concordia International (Pty) Ltd.
- Consortium Shipping Holdings (Pty) Ltd.
- Customs Services
- Cosmotrans (Pty) Ltd.
- Crossroads Distribution (Pty) Ltd. (Skynet)
- DHL International
- Eagle Freight (Pty) Ltd.
- Emery Air Freight Corp. t/a Emery World wide
- Excel Cargo Services
- Expeditors International (Pty) Ltd.
- Forward Air (Pty) Ltd.

- Kintetsu
- Freitan SA (Pty) Ltd.
- Grindrod int Freight
- Hartrodt SA (Pty) Ltd.
- Hellmann International Forwarders (Pty) Ltd.
- Heneways Freight Services (Pty) Ltd.
- Impson Freight TVL (Pty) Ltd.
- Ikamiji Freight
- Inelda Freight CC.
- Intermodal CC.
- Intersped (Pty) Ltd.
- International Breakbulk Services (Pty) Ltd.
- J.H Bachmann & Co (Pty) Ltd.
- Jonen Freight (Pty) Ltd.
- Khuene and Nagel (Pty) Ltd.
- Kingfisher Freight Services
- L.M Knight
- Lehnkering Logistics (Pty) Ltd.
- Leschaco (Pty) Ltd.
- Lochhead White & Womersley CC.
- Macro Freight (Pty) Ltd.
- Mark V Systems SA (Pty) Ltd.
- The SA Mercantile Corporation (Pty) Ltd.
- Megafreight Services (Pty) Ltd.
- Micor Shipping (Pty) Ltd.
- MSAS Cargo International (Pty) Ltd.
- Novotrans International Forwarders
- P.A Cargo CC.
- Pennant Freight (Pty) Ltd.
- Professional Consolidators (Pty) Ltd.
- P.M Freight Forwarding CC.
- Premier Freight (Pty) LTD.
- Pyramid Freight (Pty) Ltd. Union Transport (Airfreight)
- Quay Freight Logistics (Pty) Ltd.
- Renfreight Circle
- Renown Freight (Pty) Ltd.
- Robeck International Freight CC.
- Rhode & Liesenfeld (Pty) Ltd.
- Rohlig & Co

- RTT International
- Sabila Air and Sea (Pty) Ltd.
- Seaways (Pty) Ltd.
- Sebenza Freight Services (Pty) Ltd.
- Sebenza Forwarding & Shipping
- Safcor Freight (Pty) Ltd.
- Schenker & Co (Pty) Ltd.
- Simpson International (Pty) Ltd.
- Strategic Logistical Alliance (Pty) Ltd.
- Sturrock Shipping
- Sun Courier (Pty) Ltd.
- Trans-Atlantic (SA) (Pty) Ltd.
- Baxglobal (Pty) Ltd. (Former Traco)
- Turners Shipping (Pty) Ltd.
- Transcontinental Forwarders (Pty) Ltd. Spedag Air Services
- World Cargo Services (Pty) Ltd. Quay Freight International (Pty) Ltd.
- Worldwide Clearing & Shipping (Pty) Ltd.
- ZA-Trans (Pty) Ltd.
- Zawaco (Pty) Ltd. T/a Waco Logistics SA
- Skyline Freight (Pty) Ltd.

The World Shipping directory of 1998/1999 listed the following shipping operators situated in South Africa.

- **De Beers Marine (Pty) Ltd** whose parent company is the De Beers Group of Companies.
- **FFS Bunkers (Pty) Ltd** who supplies marine fuels, slops removal and is a bunker barge operator in Cape Town, Durban and Richards Bay.
- **Grindrod Unicorn Group Ltd.**
- **Irvin & Johnson Ltd.**
- **Ocean Offshore CC.**
- **Pentow Marine (Pty) Ltd** whose parent companies are Murray & Roberts and Safmarine. They provide ship management, ocean towage/salvage, offshore support and oil pollution control as well as shipping services.
- **Premier Fishing (Pty) Ltd.**
- **Safmarine (South African Matrine Corp Ltd)** whose parent company is Safren. They are an international shipowner and ship operator. Safliner offers sea freight transportation in containerised and general cargo ships on fixed routes to and from South Africa, i.e. USA/South America, Far East, United Kingdom and North West

Continent. Safmarine international, a division of Safmarine, operate a fleet of bulk vessels, which operate worldwide. Safmarine also has another unit that operates as a world wide through transport operator.

- **Sealink Bunker Supplies** whose parent company is Pentow Marine (Pty) Ltd.
- **Unicorn Lines (Pty) Ltd** whose parent company is Grincor Shipping Services (Pty) Ltd: Grindrod Unicorn Group Ltd. They provide ship management, technical superintendency, crewing services and chartering.

Many liner services⁴⁵ operating on the same routes voluntarily get together and form conferences⁴⁶.

The only active conference operating out of southern Africa is the Europe, South and South East African Conference, the members of which are Safmarine, P & O Nedlloyd, DAL, CMBT and Ellerman Harrison Container Line.

Other conferences which are currently dormant, i.e. they share information but do not quote common rates are:

- SAFEFCON, the South Africa Far East Freight Conference involving K-Line, Mitsui OSK Lines (MOL), P & O Nedlloyd, Safmarine, NYK, Maersk and Gold Star.
- The USA, South and East African Conference involving Safbank and mediterranean Shipping Company (MSC).

SAECS, the Southern African Europe Container Service, which operates seven vessels to and from Europe on a weekly basis, is a consortium⁴⁷ with the members the same as the Europe, South and South East African Conference named above.

⁴⁵ Liner vessels offer regular scheduled sailing dates, which are advertised well in advance, call at predetermined ports and tend to carry the majority of consignments conveyed by sea.

⁴⁶ Members of a conference co-operate in terms of both rate and schedules, guaranteeing the shipper regularity of service.

⁴⁷ A consortium is a group of shipping lines which agree to pool their resources, i.e. vessels, human resources, technology and capital, on a particular route.

4.4 Global profile of Transport Services

In this section a brief overview is given of the salient features of transport services globally, focussing on road transport (only freight transport), rail transport and maritime transport.

4.4.1 Road Transport

Road transport tend to represents between 2% and 6% of countries' Gross Domestic Product (GDP), depending on their geography, the structure of their transport network and their level of development. The figures vary considerably even between neighbouring countries with a comparable level of development.

Because of the downstream nature of road transport activity, the steadily increasing complexity of production methods (the increasing numbers of plants involved in the manufacture of a single product) and the generalisation of just-in-time production, road transport has an impact on GDP and employment, which far exceeds these figures. For instance, in the United Kingdom, an econometric study showed that an increase of £1 of road transport costs led to a reduction of £1.66p in GDP⁴⁸ (Naudè, 1999b).

Road transport covers three large sub sectors, namely passenger transport (urban and interurban) and freight transport.

⁴⁸ "Barriers to Road Transport", the Hague Consulting Group, Cambridge, January 1998".

4.4.2 Freight Transport

Freight transport by road is the principal mode of freight transport worldwide. In the European Community for example road transport's share of all the available transport modes was 72.3% in 1995 and increased by 155% between 1970 and 1995, i.e. almost tripled in volume, whereas during the same period rail transport recorded a decline in absolute value (-22%) and a halving of its share.

In South Africa, freight transport by road has become the dominant mode (80%), exceeding that of rail (20%). Freight transportation by road also plays an essential role in the developing countries, particularly in those, which did not develop an extensive rail network during the 19th century and at the beginning of the 20th century (generally speaking, this applies to Latin American countries and African countries lacking cross-rail links).

A method to estimate the relative importance of road freight transport is to compare the numbers of trucks duly registered in the various countries. Africa has 5.62 million trucks, or 3.33% of the total.

Table 4.6: Distribution of Africa's transport trucks

Country	Number of trucks (million)
South Africa	1.73
Egypt	1.28
Algeria	0.87
Zaire	0.55
Libya	0.31
Tunisia	0.28
Morocco	0.27

(Out of Naudé, 1999b)

America has 80.3 million good vehicles or 47.64% of the total.

Table 4.7: Distribution of America's transport trucks

Country	Number of trucks (million)
United States	65.46
Mexico	4.22
Canada	3.72
Brazil	2.76
Argentina	1.23
Chile	0.81

(Out of Naudé, 1999b)

Asia has 45.22million goods vehicles or 26.8% of the total.

Table 4.8 Distribution of Asia's transport trucks

Country	Number of trucks (million)
Japan	21.93
China	6.22
Thailand	4.13
South Korea	2.65
India	2.2
Indonesia	2
Saudi Arabia	1.17

(Out of Naudé, 1999b)

Oceania has 2.63 million goods vehicles or 1.56% of the total.

Table 4.9: Distribution of Oceania's transport trucks

Country	Number of trucks (million)
Australia	2.24
New Zealand	0.35

(Out of Naudé, 1999b)

The whole of Europe has 34.78 million or 20.6% of the total, including 22.99 million for the European Community.

Table 4.10: Distribution of the European Community's transport trucks

Country	Number of trucks (million)
France	5.25
Germany	3.74
Spain	3.48
United Kingdom	3.19
Italy	2.88

(Out of Naudé, 1999b)

For the Russian Federation 5.01 million, 1.79 million for Turkey and 1.47 million for Poland (Naudé, 1999b).

The road freight transport sector is generally characterised by easy entry and poor economies of scale. Generally it is characterised by low concentration: for example, in 1985 in Sweden, 60% of operators were owners driving their own vehicle. In France, 76% of enterprises had less than five employees but accounted for only 18% of the market, whereas companies with less than 50 employees held two thirds of the market and, at the other extreme, the 20 largest enterprises held 19% of the market. It is also possible to observe in United States an apparent movement of de-concentration with the large enterprises converting their employees into independent pseudo-entrepreneurs ("owner-operators"), advancing them some of the money they need to purchase a vehicle and benefiting, in return, from reduced social security contributions and other social charges (Naudé, 1999b).

Road transport is essentially short-haul (for example, in the European Community 66 per cent of loads - measured in tonnes - are delivered within a radius of less than 50 kilometres), and thus most traffic, particularly in large countries, is confined within the national boundaries. In South Africa, a significant part of the sector is involved in longer distances, connecting Gauteng with the harbours such as Richards Bay and Durban.

With regard to cross-border supply, the international regulations have also begun to be liberalised mainly, in view of the "intra-continental" nature of this mode of transport, through regional agreements. Thus, outside the single road transport market of the European Community, the European Conference of Transport Ministers (ECTM), an organisation linked to the OECD but which has for many years included the countries of Central and Eastern Europe, administers a multilateral licence quota, which even includes "green" and "greener and safe" categories, and as a first step towards complete multilateralisation has undertaken to standardise the bilateral agreements on a recommended model. Moreover, road transport is included in NAFTA where it is the subject only of limited reservations concerning mainly cabotage traffic. Finally, several regional agreements in Central America and South America concern road transport and have been the subject of MFN exemptions (Naudè, 1999b).

The IRU has recognised as barrier, inefficient and uncoordinated border-crossing procedures, asks all the States concerned to accede to the international agreements and UN conventions governing international road transport and apply them in an efficient and harmonised manner⁴⁹, and also recommends the development of co-operation between national control services on each side of the border and the introduction of "one-

⁴⁹ The list of United Nations conventions, drawn up by the IRU is as follows: European Agreement on main international traffic arteries (AGR) of 15 November 1975; Convention on road traffic of 8 November 1968; European Agreement supplementing the Convention on road signs and signals (1968); Agreement on minimum requirements for the issue and validity of driving permits (APC) of April 1975; Agreement concerning the adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicle equipment and parts of 20 March 1958; European Agreement concerning the work of crews of vehicles engaged in international road transport (AETR) of 1 July 1970; Convention on the contract for the international carriage of goods by road (CMR) of 19 May 1956; Customs Convention on the international transport of goods under cover of TIR carnets (TIR Convention) of 14 November 1975; International Convention on the harmonisation of frontier controls of goods of 21 October 1982; European Agreement concerning the international carriage of dangerous goods by road (ADR) of 30 September 1957; and Agreement on the international carriage of perishable foodstuffs and on the special equipment to be used for such carriage (ATP) of 1 September 1970. To these should be added, at the regional level, the Final Act of the Conference on Security and Co-operation in Europe (Helsinki, 1975), the Consolidated resolution of the European Conference of Transport Ministers (ECTM) of 1994 recognising the principle of reciprocity in bilateral road transport operations, and the Declaration of Helsinki of 1997 adopted by the European Conference of Transport Ministers (ECTM) providing for the principle of non-discrimination as regards regulatory measures and confirming the duty of carriers to make an appropriate contribution to infrastructure investment and maintenance costs measures and confirming the duty of carriers to make an appropriate contribution to infrastructure investment and maintenance costs

stop" technology, improved training of border personnel and improved quality and capacity of border infrastructure, with international financing institutions and private investors being invited to finance them. These border-crossing problems seem to be universal, as evidenced, for example, by a recent Southern African Development Community document ⁵⁰, which estimates that these delays cost its members \$48 million every year.

A further barrier identified by the IRU concerns the issuing of visas for professional drivers. In this connection, the IRU calls for the introduction of a driver identification document similar to the "seaman's passport" which would exempt drivers from having to obtain a visa. In the event of it not being possible to abolish visas, the industry proposes the creation of a multilateral visa system, the acknowledgement of the role of national road transport associations in acting as intermediaries to obtain visas for their members, the development of multi-entry visas, the simplification of the procedures, and the reduction of the time needed to obtain a visa, the number of documents required and the prices of visas.

4.4.3 Rail Transport

The provision of rail transport is in most countries characterised by "classic" public monopolies. Due to this, there are only few commitments in GATS⁵¹ on rail transport. Globally however the trends are towards deregulation, privatisation and the granting of concessions.

Rail transport is a natural monopoly with high infrastructure costs, indivisibility and substantial externalities. Because of these features, governments in most countries have imposed controls over entry, withdrawal, technology, operating practices, capital formation, pricing, frequency, the financial structure and accounting practices. In South

⁵⁰ SADC "Transport and Communications", Maputo Conference, 29-30 January 1998

⁵¹ The GATS (General agreement on trade in services) was negotiated during the Uruguay Round of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT), and is one of the pillars of the agreement establishing the World Trade Organisation (WTO).

Africa Transnet is an example. Such companies are often vertically integrated; one single entity is responsible for the infrastructure, operation and marketing. The focus is on production and the company is centralised and tightly organised into a hierarchy, which has its counterpart in the high rate of trade union membership. A company may be government-owned (this was the case in Europe, Latin America, Africa and nearly always in Asia), or private (New Zealand, United States, Japan for certain companies). It may have national or regional geographical coverage (Japan, United States) with possible variations on sectorial monopolies (passengers in the United States, freight in Japan) or regional monopolies (passengers in Japan) that may sometimes compete (freight in the United States where several companies only involved in freight may compete on the same routes). It has traditionally been recognised that the advantage of this model of vertical integration is its capacity for planning, but practice has shown that its disadvantages are failure to respond to the market, sometimes questionable investment decisions, absence of any incentive to control costs and poor financial performance (Naudè, 1999b).

Since at least the 1970s, the growth in road carriage of goods and passengers and, to a lesser extent, air transport of passengers has significantly eroded the market share of the railways. To take an example, in the European Union the railway's share in terms of passenger/kilometres fell from 10.3% in 1970 to 8.5% in 1980 and 6.2% in 1994, whereas the figure for automobile traffic rose over the same period from 75.1% to 79.7% and for air transport from 2.1% to 5.8%.

This downward trend is even more noticeable in the freight sector, where the modal split share of railways in tonne/kilometres in the European Community fell from 31.7% in 1970 to 24.9% in 1980, 18.9% in 1990 and 14.9% in 1994, whereas the share of road transport rose from 48.9% to 71.9%. This trend is omnipresent, but the degree varies according to the country, the initial modal split ratio and the structure of the networks.

The trend is even more noticeable in terms of value, because the nature of the goods transported has changed and there is a much larger proportion of light goods with a high unit value that have to be delivered rapidly. The railways' share has therefore gradually been confined to bulk and heavy traffic, although since the early days of containerisation in the United States and later in Europe, they have tried to win back the high value-added traffic by establishing transnational freight corridors for container-only trains (for example, Gioia Tauro-Antwerp) with a guaranteed date of arrival and computerised tracking of the goods (Naudè, 1999b).

The development of combined transport remains marginal, particularly piggy-back transport, and is highly dependent on subsidies or sometimes restrictive transit measures by government authorities, which utilise railways as an ecological and energy-saving alternative to the growing congestion on major highways.

In developing countries, railways are particularly important because they constitute the main form of mass passenger transport at a price accessible to the majority of the population. In 1995 China alone accounted for 18% of passenger/kilometres carried in the world and India 18% (for purposes of comparison, the figure for the 15-member European Community was 14%, for Russia 9%, and for the United States 1%). Railway companies in these countries also face competition from road transport and problems in financing the maintenance and renewal of the infrastructure and rolling stock.

Faced with growing financial losses towards the end of the 1970s, governments in many countries tried to improve the traditional rail model. This led in the first instance to free fixing of prices, often followed by the creation of specialised departments (freight, passengers, long distance, regional passengers, maintenance) as profit-making centres each responsible for its commercial policy but sharing common costs with the

other departments on the basis of analytical accounting (a typical example is the organisation of British Railways from 1980 to 1994).

In parallel with this development, there was growing concern to identify more clearly the public service constraints and a consensus emerged that government authorities, particularly local or regional authorities, should be called on to finance the obligation to provide regular train services in a clearly-defined way adapted to each situation: depending on the country, the financing could be in the form of concessions or contract-plans with a single operator.

In the course of a third phase, a new model separating operating activities from management and maintenance of the infrastructure gradually started to be imposed. The theoretical inspiration for this model is similar to that for the telecommunications, electricity and gas sectors. In the case of railways, the idea was that, even if the costs of the infrastructure could not be recovered, the gains in efficiency obtained by separating operating/traction activities, no longer hampered by the financial burden of the infrastructure, would alone justify the State writing off the debt incurred by investment in infrastructure in its profit and loss account (Naudè, 1999b).

In parallel with this movement to separate the infrastructure from operations and to allow marginal opening up of access rights, more radical privatisation initiatives have been tried out in developed countries, as well as in countries with economies in transition and developing countries under the auspices of the World Bank.

The immediate effect of privatisation was a sharp rise in subsidies given to operators because they had to meet costs not faced by integrated operators: the charges for using the infrastructure and rolling stock (grants to the British Railways Board: 1993/4: £1,121 million; 1994/1995: £1,984 million. Subsidies to concession holders, 1996/1997: £2,090 million; estimated subsidy for 2003: £1,169 million.) Operators have

nevertheless undertaken to reduce the subsidies by half within seven years and some routes could even become profitable. It is as yet too early to draw any lessons from this experience. Some competition can be seen on certain routes, the level of services has improved and operators have started to renew the stock, but the OPRAF is still critical of the level of services provided by certain concession holders and Railtrack has not reached the investment objectives fixed (Naudè, 1999b).

As part of its loan activities for restructuring railways, the World Bank, after having for a long time promoted autonomous operators rather than the government (in Pakistan, Colombia, Korea, Senegal, Mali, Yugoslavia) now encourages the granting of concessions. This was recently the case in Argentina, Côte d'Ivoire and Burkina Faso. Concessions are based on government procurement rather than that of market access within the framework of the GATS. It should nevertheless be noted that no member of the Plurilateral Agreement on Government Procurement has made any commitment on rail transport services.

Land transport was not given much attention during the Uruguay Round negotiations. The liberalisation of passenger and freight transport by road is only of interest to countries that are neighbours, and is therefore more often dealt with bilaterally or at a regional level.

4.4.4 *Maritime Transport*

Maritime transport is a major global service sector. Bulk cargo accounts for 80% by volume of total world trade – for instance the transport of oil, liquid gas, coal, ores, chemicals, and grain. The ships operate between specialised ports often owned by their customers: it is virtually all cross-border trade (mode 1). There is intense competition among the major shipping companies. Over 90% of all South Africa's exports are carried by ship. The majority is bulk cargo.

The other 20% of world trade consist of the carriage of intermediate and finished goods. Shipping companies that sail according to set schedules mostly carries this, and charge published rates: the so-called liner trade. Nowadays little of the liner trade carries people, this activity mostly consisting of charter holiday cruises and short-crossing ferries. An important part of the liner trade is carried in containers, and often relies on state-owned port facilities and services. There is even stronger international competition here than in bulk trade. Only a handful of privately owned ports are open to general trade. Often container trade is carried by multi-modal firms, which own or lease transport between the manufacturer and the export port, and between the import port and the final customer. These links are on road and rail, and form an integral part of the service (Naudè, 1999b).

4.5 Transportation of South Africa's Exports

South Africa is a major exporter of primary products (like many other developing countries), especially of break bulk and bulk raw materials. Precious metals, diamonds, base metals and mineral products comprised on average more than 40% of South Africa's annual exports (in value) between 1994 and 1998. A significant number of South Africa's manufacturing industries (mostly also labour-intensive industries) are dependent on these products, such as fabricated metals and non-metallic mineral products.

Approximately 98% of the volume of South Africa's exports outside of Africa is conveyed by sea⁵². The nature and volume of shipped exports from South Africa to non-African countries is shown in Table 4.11 (using most recently available figures).

⁵² In this, South Africa is very similar to most developing countries. Sachs and Warner (1997:339) note that..."only certain goods can be economically shipped by air, and most countries still import and export the majority of goods by the sea".

Table 4.11: South African Exports conveyed by Ship, 1991/2

COMMODITY	TOTAL TONNAGE
Coal and coke	47097
Iron ore	15345
Steel	4303
Wood chips	2920
Manganese ore	1534
Rock phosphate	1421
Sugar	1267
Ferro-alloys	1243
Other timber	1237
Deciduous fruit	1232

(Source: Pretorius, 1997:2-6)

About 90% of South Africa's exports per sea are shipped through foreign registered vessels. More than 40 foreign shipping lines are currently offering regularly scheduled services to and from South Africa, making use of seven commercial ports. These ports are Richards Bay, Durban, East London, Port Elizabeth, Cape Town, Saldanha Bay and to a lesser extent, Mossel Bay (Naudè, 1999a).

Some specialisation in the handling of goods has occurred at South African harbours over the past decades. Table 4.12 shows the main commodities that are exported through the different ports, as well as the approximate distance from the source of extraction or final production of the goods in question. The latter measure is to provide an indication of the likely importance of domestic transport infrastructure and costs for exporters (Naudè, 1999a).

Table 4.12: Bulk Commodities exported through South Africa's Ports and Distances from Sources

PORT	MAIN COMMODITIES	TON ('000)	MAIN SOURCE	APPROXIMATE DISTANCE FROM SOURCE
Richards Bay	Coal	49	Welkom	703
	Wood chips	3.6	Nelspruit	585
	Chrome ore	1.3	Phalaborwa	806
		1.1	Rustenburg	721
Durban	Steel	3.2	Middelburg	856
	Timber	1.9	Pinetown	30
	Coal & Coke	1.7	Welkom	564
	Chemicals	1.2	Vereeniging	569
East London	Copper	0.1	Prieska	710
			Okiep/ Nababeep	1420
Port Elizabeth	Manganese Ore	1.4	Meyerton	952
	Fruit	0.3	Meyerton	952
Cape Town	Prepared Fruit	0.3	Ceres	110
Saldanha Bay	Iron ore	16.6	Sishen	993
Mossel Bay	Various	N/a	N/a	N/a

(Source: Pretorius, 1997:2-6; own calculations)

From Table 4.12 can be seen that the principal port for coal is Richards Bay, for steel Durban, for copper East London, for manganese ore Port Elizabeth, for prepared fruit Cape Town and for iron ore, Saldanha Bay. The approximate distances from the location or source of extraction can be seen to be in most cases (with the exception of prepared fruit) to be in excess of 400 km from the nearest port. Export industries in South Africa may thus be subjected to locational disadvantages. Dehlen (1993:29) remarks that "South Africa has no navigable rivers, there are long distances inland between raw material sources, manufacturing facilities, and harbours, and there are long distances between the harbours and airports and the places of consumption overseas. Inappropriate past policies of decentralisation have exacerbated the problem". Transport infrastructure and transport costs may thus have a significant impact on the competitiveness of these commodities in international markets, and are possibly significant variables to take into account in regional

manufacturing/decentralisation incentives of the nine newly created provinces (Kleynhans, Naudé & Suleman, 1998:3)

4.6 Transport Costs

4.6.1 *Domestic Transport Costs in South Africa*

It is frequently claimed that domestic transport costs in South Africa is, relatively high. If this is the case, then given the above transport costs will be a significant obstacle to exports. Dehlen (1993:29) recognises in this regard that "There is no doubt that for those industries which have to obtain most of their raw materials from the interior their rapid development into export industries will only be possible if their transport costs can be reduced substantially".

The government-appointed "Reynders Commission of Inquiry into South Africa's export trade" - who paved the way for the eventual shift in South Africa's manufacturing development strategy away from import substitution (Holden & Jenkins, 1996) - recognised as early as 1972 that an efficient transportation system, could affect South Africa's ability to export to a significant extent (RSA, 1972).

Despite the importance of transport and transport costs for South African exporters, and the official recognition thereof, claims that domestic transport costs are negatively impacting on exports are difficult to substantiate. Pretorius (1997:1-5) claims "a wide range of South Africa's export industries share the belief that their competitiveness in foreign markets is limited by unnecessarily high total distribution costs, especially high domestic transport costs" (Naudé, 1999a).

Comparative figures presented by Pretorius (1997, chapter 5) casts some doubts on this anecdotal evidence. She concluded that the "South Africa's inland transport costs compare favourably to those of selected overseas countries". Table 4.13 taken from Pretorius's (1997) theses on

domestic transport costs, indeed shows South Africa to be competitive at least as far as rail transport (important for bulk exports) is concerned.

Table 4.13: Comparative Rail Transport Costs for Six Meter Containers, 1997

COUNTRY	ORIGIN	DESTINATION	DISTANCE	COSTS (R/KM)
South Africa	City Deep	Durban	720	1.53
Britain	Tilburg	Glasgow	681	2.40
France	Le Havre	Paris	228	6.82
Belgium	Zeebrugge	Luxemburg	349	3.97
Spain	Barcelona	Madrid	724	2.35
Italy	Naples	Spezia	625	1.16
Netherlands	Rotterdam	Delfzidi	545	2.86
Germany	Hamburg	Ingoldstadt	710	2.56

(Source: Pretorius, 1997:3-16)

Table 4.13 shows that South Africa's rail transport costs of R1.53 per km to be the lowest, apart from Italy from a sample of developed countries.

Data presented by Martin (1995) supports the above findings. He calculated that the total land cost as a percentage (%) of the total costs of exporting a container from Johannesburg to Rotterdam to be around US\$ 370 per ton (amounting to 21% of total costs). This compares favourably with export costs from the USA, where overland costs as a percentage of total costs varies between 27% (Atlanta to Tokyo) to 52% (Chicago to Rotterdam). It also compares favourably with data from other developing economies that are available. For instance, Amjadi, Reinecke, and Yeats (1996) have found that port charges for clearing a six-meter container in Cote d'Ivoire and Senegal to be US\$ 1100 and US\$ 910 respectively, compared to shipping costs to Europe of around US\$ 1400 (Naudè, 1999a).

Whilst the difficulty in substantiating the perception of high domestic transport costs is evident from the available data, a word of caution is in order. Transport costs in South Africa, as elsewhere, is difficult to quantify and are in most cases proprietary information. The beliefs of exporters therefore, have to be taken seriously and may warrant further

investigation. In this regard, findings by Dehlen (1993:56) on South Africa's port charges and handling times at harbours may explain in part the negative perception of exporters. Table 4.14 below summarises Dehlen's (1993) data.

Table 4.14: Comparative Terminal Handling Charges (rand per 6 Meter Container)

COUNTRY & EXPORT PORT	TERMINAL HANDLING CHARGES
South Africa: Durban	229 but 719 (including ad valorem wharfage)
United Kingdom: Tilburg	336
France: Le Havre	408
Belgium: Zeebrugge	305
Spain: Barcelona	613
Italy: Napels	447
Netherlands: Rotterdam	431
Germany: Hamburg	468

(Source: Dehlen, 1993:41)

Table 4.14 contains data on terminal handling charges (THC), expressed in Rand per standard six-meter (20 feet) container. It indicates that THC in South Africa compares favourably with those of other ports – but only if South Africa's almost unique ad valorem wharfage is excluded. Including ad valorem wharfage, THC at Durban is R 719 per six meter container, higher than those of other ports in the sample. For imports and exports ad valorem wharfage in South Africa is currently levied at 1.8% and 0.9% respectively. Because these ad valorem wharfage charges are a significant source of revenue for Portnet (the state owned enterprise responsible for all ports in South Africa), their abolition seems unlikely, particularly since Portnet is currently both regulator as well as operator of South Africa's harbours (Naudè, 1999a).

In addition to THC (inclusive of ad valorem wharfage) as a reason for the belief in high domestic transport costs, Pretorius (1997:5-13) reports that South Africa's port handling may be inefficient in loading and unloading vessels five times slower than ports in Europe or the United States. Slower turnaround times in South African ports impose storage and other

warehousing costs on exporters and are mainly the cause of congestions. In addition to ad valorem wharfrage and slow turnaround times of ships in South African harbours, the structure and functioning of the South African transport system may also be forwarded as explanations for the belief of high domestic transport costs in South Africa.

4.6.2 *International Transport Costs from South Africa*

Little attention has been paid to international transport cost (e.g. shipping costs) from South Africa as a factor inhibiting the competitiveness of exports. The major focus of attention, also in the official Reynders Commission Report (RSA, 1972) has been on domestic transport costs. Having established in chapter two that the new economic geography suggest that international transport costs may be a significant determinant of a country's trade patterns, export success and eventual level of development, and in sections 3.3 above that domestic transport costs are unlikely of adversely affect exports, this sections presents evidence on the international transport costs from South Africa.

The Moving South Africa (MSA) proposals acknowledged existing trends in global shipping, which if utilised would enable South Africa to capture and influence the global shipping dynamics to its advantage. These proposals are (Anon, 1999a)

- Reduced transit. Transit times for containers could be reduced by 3 to 4 days if exported to Europe from a West Coast port.
- Reduce the number of ports of call. The average container traveling to or from South Africa does so on a vessel that makes three calls along the coast. If all export or import containers were to be channeled through either an East coast or a West-coast port a real cost saving of 11% per TEU could be realized.
- Increase average ship size. The average container vessel calling at South African ports has a capacity of about 1900 TEU's. Harvey said that modeling carried out suggested that an increase in average

vessel size to 3100 TEU's would reduce the unit cost by some 17% in real terms (Anon, 1999a).

The question of international transport costs as a factor impacting on South Africa's exports is relevant in light of South Africa's and many other developing countries' adoption of trade liberalisation measures and regional integration (such as South Africa's Free Trade Agreement with the EU and its signing of the SADC Free Trade Protocol). The adoption of trade liberalisation measures in Africa especially stems much from the example set by the East Asian economies. However, as suggested by Radelet and Sachs (1998:2) geographically remote countries (such as South Africa) may not realistically be able to replicate the East Asian model of rapid growth based on the export of labour-intensive manufactures.

Radelet and Sachs (1998:6-7) state that the most important consequence of high international transport costs is the detrimental impact on firms' competitiveness in international markets. Firstly, for small countries such as South Africa that exert little impact on world prices, the higher international transport costs, the more firms in that country will have to pay for imported intermediate goods, and the less they will receive for their exports. More specifically, if a country faces a perfectly elastic supply of imports or a perfectly elastic demand for its exports, changes in international transport costs will be translated one-for-one into changes in domestic prices. In competitive global market, higher transport costs would have to be offset either by lower wages or by reduced costs somewhere else in the production process (e.g. through better logistics management) to allow firms to compete. Secondly, countries with higher international transport costs would be less likely to attract foreign investment in export activities (Radelet & Sachs, 1998:7) Thirdly, for exporters of primary products, such as South Africa, higher international transport costs would reduce the rents earned from natural resources thereby lowering aggregate investment and thus growth. Fourthly, higher international transport costs would increase the price of all imported

capital goods, which would reduce investment, the rate of technological transfer and thus reduce economic growth (Naudè, 1999a).

Due to a lack of data, it has become customary to use the CIF-FOB band on import costs as a proxy of international transport costs (see Radelet and Sachs, 1998). The FOB (free on board) costs of imports measures the costs of an imported item at the point of shipment by the exporter. The CIF (cost insurance freight) price measures the costs of the imported item at the point of entry into the importing country, inclusive of the costs of transportation. Using the CIF-FOB band as a proxy, Radelet and Sachs (1998:4-5) find that for a sample of 97 developing countries, the mean CIF-FOB band in 1965 was 12.9%. For coastal economies in their sample this average was 11.8%, while for the 17 fully landlocked economies the average was 17.8% - this implies that the costs of international transport for landlocked developing countries was on average 50% higher than for coastal economies. If one takes into consideration that more African countries tend to be landlocked than elsewhere, then regional integration to promote seamless transportation (as in SADC) may be important to improve the attractiveness of investment in export-oriented industries in these countries (Naudè, 1999a).

Table 4.15: Incidence of transportation costs, 1988-1991

(Transportation costs = Imports (c.i.f.-f.o.b)/f.o.b)

	1988	1989	1990	1991	Average
EC/EU	-0.01	-0.01	-0.01	0.00	-0.01
Industrialised Countries	0.01	0.01	0.02	0.02	0.02
Developing Countries	0.05	0.05	0.06	0.04	0.05
World	0.03	0.03	0.03	0.04	0.03
South Africa	0.07	0.08	0.06	0.07	0.07

(Source: IMF International Financial Statistics)

Table 4.15 indicate that the CIF-FOB band on imports has been on average 0.07 (7%) in South Africa over the period 1988-1991. This compares very unfavourably with the world average of 0.03 (3%) and

even the average for developing countries of 0.05 (5%). International transport costs to and from South Africa is 30% higher than the average for developing countries and more than 50% higher than the world average.

Table 4.16: Different components of transport as part of inputs in the twenty five manufacturing industries

	Sector	Total transport	Total freight	Sea	Air	Other transport (road/rail)
1	Food Processing	4.00%	3.75%	0.11%	0.06%	0.07%
2	Beverages	1.65%	1.46%	0.08%	0.07%	0.04%
3	Tobacco products	2.87%	2.67%	0.09%	0.05%	0.06%
4	Textiles	2.04%	1.52%	0.33%	0.12%	0.06%
5	Clothing	1.59%	1.24%	0.13%	0.18%	0.04%
6	Leather Products	1.53%	1.10%	0.30%	0.09%	0.04%
7	Footwear	1.45%	1.14%	0.15%	0.13%	0.03%
8	Wood & Wood Products	2.18%	1.92%	0.13%	0.08%	0.06%
9	Furniture	1.46%	1.26%	0.08%	0.09%	0.04%
10	Paper & Paper Products	1.91%	1.65%	0.10%	0.10%	0.05%
11	Printing & Publishing	1.83%	1.40%	0.04%	0.31%	0.07%
12	Chemical Products	2.22%	1.34%	0.49%	0.29%	0.10%
13	Petroleum Products	9.22%	6.25%	2.28%	0.40%	0.29%
14	Rubber Products	1.74%	1.24%	0.17%	0.24%	0.08%
15	Plastic Products	1.49%	1.08%	0.10%	0.24%	0.06%
16	Non-Metallic Mineral Products	4.22%	2.37%	0.53%	0.21%	0.14%
17	Ferro	5.49%	3.80%	1.21%	0.31%	0.17%
18	Iron & Steel Basic Industries	6.31%	4.37%	1.39%	0.36%	0.19%
19	Non-Ferrous Metal Basic Industries	2.59%	1.76%	0.60%	0.14%	0.08%
20	Metal Products	1.10%	0.61%	0.16%	0.23%	0.11%
21	Machinery	1.28%	0.87%	0.18%	0.17%	0.06%
22	Electrical Machinery	1.50%	0.92%	0.14%	0.36%	0.09%
23	Motor Vehicles & Motor Vehicle Parts	0.71%	0.47%	0.10%	0.11%	0.04%
24	Other transport equipment	1.17%	0.42%	0.31%	0.36%	0.08%
25	Other Manufacturing	1.66%	1.23%	0.18%	0.21%	0.04%

(Input-Output Tables, 1996)

As indicated in table 4.16, the sectors in which the transport as part of total inputs is the highest includes food processing, petroleum products, non-metallic mineral products, ferro products as well as iron & steel basic industries. By investigating the components of the total transport

contribution, it is clear that total freight forms the most significant part of total transport that indicates the importance of overland transport and overland transport costs in the competitiveness of industries.

If the total imported inputs of manufacturing sectors are investigated, the total transport as a percentage of the total inputs is 5.14% and once again total freight transport contributes the most with 1.72% then follows sea 0.43%, air 0.86% and other transport (road, rail etc.) 0.16%.

4.7 Summary

As argued in chapters one two and three, transportation plays a significant role in international as well as national trade of goods and services. It is therefore important to determine how South Africa's exports are effected by national as well as international transport costs and to determine which of the two costs has the most significant impact on the exports and then solutions may be identified to decrease the high cost.

The transport sector's contribution to GDP has increased over time from 5.97% in 1971 to 8.25% in 1998, which indicates the increase importance of transport in the country's economy. In terms of the transport sector's contribution to imports and exports, transport service exports accounted for 5.6% of South Africa's total in 1996 and 7.9% of imports. This 7.9% share in imports is the largest of any service sector in South Africa and the 5.6% in exports the second largest. Transport services are an important intermediate input in the South African economy and together with distribution services it make up more than 90% of the services inputs of the South African economy.

In addition to the perception that deteriorating transport infrastructure is contribution to the raising transport costs in South Africa (as explained in chapter 3), so is the fact that the main transport service providers in South Africa have been government regulated and dominated. Since 1910, the government owned South African Transport Services (SATS) enjoyed a

monopoly in the South African transport market due to protective legislation. Since April 1990 the SATS was reformed into Transnet, remaining government owned but having to operate according to business principles. Transnet is therefore the government body regulating part of the road, rail, air and sea transportation in South Africa. Due to this deregulation of government control over the transport market the private sector service providers increased immensely over the past years up to now.

In section 4.4.1 a global profile of transport services was discussed focussing on road (only freight), rail and maritime transport. Road transport tend to represent between 2 and 6 per cent of countries' GDP and employment, depending on their geography, the structure of their transport network and their level of development. In South Africa, freight transport by road has become the dominant (national trade/transport) mode (80%), exceeding that of rail (20%). The provision of rail transport is in most countries characterised by "classic" public monopolies with high infrastructure costs, indivisibility and substantial externalities. Because of these features, governments in most countries have imposed controls over entry, withdrawal, technology, operating practise, capital formation, pricing, frequency, the financial structure and accounting practises (like Transnet in South Africa). Maritime transport is a major global service sector. Bulk cargo accounts for 80% by volume of total world trade. Over 90% of all South Africa's exports are carried by ship and the majority is bulk cargo. As far as transport services and the GATS are concerned, South Africa has made commitments for the GATS treatment only for passenger and freight transport; with exemptions for market access and national treatment on the presence of natural persons.

South Africa is a major exporter of primary products, especially of break bulk and bulk raw materials. About 98% of the volume of South Africa's exports is conveyed by sea. By evaluating the distances that South African exports from sources, it could be argued that export industries in South Africa may be subjected to locational disadvantages. Transport

infrastructure and transport costs may therefore have a significant impact on the competitiveness of commodities in international markets.

Domestic transport costs in South Africa was concluded to compare favourably to those of selected overseas countries. The negative perception of exporters regarding domestic transport costs may be explained by the port charges and handling times at South African harbours that lead to increased transport costs. Apart from this the structure and functioning of the South African transport system may also be forwarded as an explanation for the belief of high domestic transport costs.

Little attention has been paid to international transport costs (e.g. shipping costs) from South Africa as a factor inhibiting the competitiveness of exports. The most important consequence of high international transport costs is the detrimental impact on firms' competitiveness in international markets. By using the CIF-FOB band on import costs as a proxy of international transport costs, South Africa's average over the period 1988-1991 was 7%. This compares very unfavourably with the world average of 3% and even the average for developing countries of 5%. This has a very unfavourable impact on the South African economy because of the significant impact of transport costs in the different manufacturing industries.

Chapter 5

ESTIMATING THE IMPACT OF INTERNATIONAL TRANSPORT COST ON EXPORTS

5.1 Introduction

In chapter four it has been established that as far as the relative importance of domestic and international transport costs is concerned, it may be that the latter presents the more significant obstacle to export growth. Thus, whilst the (scant) evidence seems to suggest that domestic transport costs in South Africa are comparable to those elsewhere (if one ignores *ad valorem* wharfage and logistic management), the evidence from the International Monetary Fund's (IMF) International Financial Statistics (IFS) seems to suggest that international transport costs from South Africa is relatively high.

Whilst admitting to inadequacies in data, this chapter attempts to quantify the impact of international transport costs on exports of merchandise (thus excluding gold) from South Africa, and to determine the significance of the relative importance of international transport costs to domestic transport costs.

5.2 Methodology and Data

In order to estimate the impact of international transport costs on South Africa's merchandise exports, a standard export demand function for South Africa will be estimated. Quarterly, time series data spanning the period 1972 (1) to 1998 (2) will be used. Data was obtained from the IMF's International Financial Statistics (IFS) as well as the Quarterly Bulletins of the South African Reserve Bank. As in Radelet and Sachs (1998) international transport costs (ITC) are proxied by the CIF-FOB band on imports.

Thus transport costs (ITC) are proxied by the CIF-FOB band on imports. Thus

$$ITC = \frac{CIF}{FOB - 1} \quad (3)$$

Although international transport costs apply in both export and import directions, imports are used here since data on imports CIF and imports FOB are generally available from the IMF. Although subject to shortcomings, Radelet and Sachs (1998:3) maintain that "...this data are relatively consistent and complete, and provide a good starting point for examining the general costs of international shipping for almost all countries in the world".

5.3 Time Series Model

The determinants of countries' trade (and exports) have generated a significant theoretical literature dating back to the time of Adam Smith and David Ricardo. In these classical models trade was unambiguously beneficial to all countries, and the extent and type of a country's exports and imports was essentially determined by cost advantages (both absolute and comparative) enjoyed by a country in production (Krugman & Obstfeld, 1991). Under the assumption of perfect competition a country's real exchange rate would reflect the relative prices between its traded and non-traded goods and indicate the welfare-maximising allocation of resources between the production of tradables (including exports) and non-tradables (see Dornbusch, 1974). In light of many countries' practice of determining of fixing nominal exchange rate the real exchange rate is seen as a crucial determinant of exports. Perkins (1997:512-513) explain the importance of the real exchange as determinant of exports by stating that it will be profitable for domestic firms to export if their domestic resource cost ratio is less than the real exchange rate.

Adam Smith further saw exports as a “vent” for surplus domestic production implying that firms may export due to a lack of sufficient demand in domestic markets. Domestic capacity utilisation in manufacturing as well as the world demand for a country’s goods are hereby implied as possible significant determinants of a country’s exports.

Extensions to the classical trade model by Heckscher and Ohlin emphasised the importance of the availability of production factors for trade patterns between countries, and brought the distributional consequences of international trade under increasing scrutiny. From this followed the Stolper-Samuelson (1941) theorem and the idea of factor-price equalisation (Samuelson, 1948) which proposed that trade liberalisation (i.e. the removal of import restrictions) would all be beneficial for a country’s exports as it will benefit the input used most intensively in its production. In addition Lerner’s (1936) symmetry argument described the removal of import protection as symmetrical to and export subsidy reinforcing the notion that a country’s access to imports at world prices is an important determinant of its exports.

In more recent times the effects of imperfect competition, economies of scale and geography on trade patterns have been analysed, mainly as part of the so-called endogenous growth literature and the strategic trade policy as discussed in chapter two. The gist of this literature is that a country’s integration into the world economy, and share of its exports in world trade, is a significant determinant of its level of prosperity. As far as policy is considered, the recent literature is making significant departures from the classical and neo-classical models in that successful integration of a country into the world economy (and increasing export shares) is seen to require increasing competitiveness of products which may depend on strategic government intervention, for instance to enhance the productivity of domestic manufacturing firms through protection which

could result in lower per unit costs⁵³ and greater investments by firms in new technology. It was shown in chapter two that the “new economic geography” literature has recently been incorporating transport costs as a significant variable to explain regional economic integration, the location of firms as well as the international business cycle (see also Amadji & Winters, 1997; Frankel, Stein & Wei, 1995). Moreover, it is shown by Radelet and Sachs (1998) that international transport costs (as measured by shipping costs) have a significant impact on the exports of manufactured goods.

There has also recently been a debate, following many developing countries’ adoption of more flexible exchange rate regimes, as to the effect of exchange rate volatility on exports. In this regard, Helleiner (1995) argues that a stable exchange rate is the best single explanation of successful exports in the medium term. However, as discussed by Smit (1991:23) both the theoretical arguments and the empirical evidence on the effect of exchange rate volatility on exports is ambiguous. Moreover, for the case of South Africa Smit, (1991:24) “found no proof of any systematic negative relationships between the variability of the external value of the rand and South Africa’s non-gold export volumes”.

Transport cost can be modelled by following the Samuelson (1954) ‘iceberg’ transportation model, in which goods simply melt in transit as stated in chapter two section 2.3.3. It has two advantages as a modelling track. First, it eliminates the need to introduce transportation as an additional sector. Second, it implies that the elasticity of demand with respect to a firm’s f.o.b. price is the same as that with respect to its c.i.f. price, eliminating many potential complications.

⁵³ Ocampo and Taylor (1998:1525) refer to Scitovsky’s (1954) earlier arguments that export growth may be stimulated through the establishment of domestic industries with scale economies, especially when transport costs and other factors drive wedges between border prices of imports and exports

Based on the above discussion, and the discussion in chapters 2 to 4, the following general export supply function for South Africa may be justified.

$$\text{EXPt} = \Phi(\text{REERt}, \text{QSA}_t, \text{QUSt}, \text{CIF/FOB}_t, \text{DUMMIES}) \quad (4)$$

Where

EXPt = Real value of merchandise exports FOB (excluding therefore gold and other mining exports) from South Africa in year t.

REERt = Real effective exchange rate of the rand in year t.

QSA_t = Real GDP in South Africa in year t.

QUSt = Real GDP of the United States as proxy for world demand in year t.

CIF/FOB_t = A proxy for international transport costs given by the imports CIF/imports FOB differential.

DUMMIES = Various indicator variables to account for structural breaks in the data as well as seasonal dummies.

5.3.1 Testing for Stationarity

Since the contributions by Granger and Newbold (1974), Dickey and Fuller (1979) and Nelson and Plosser (1982) and others it is known that estimation of an equation such as (4) using data in levels may be subject to spurious regression results if the data is non-stationary. If a data series is stationary, it may be described as integrated of order zero, denoted $\sim I(0)$. If however, a data series is not stationary but requires to be differenced d-times in order to become stationary, then it is said to be $\sim I(d)$. A special case, which is however found most often in economic time series (see Nelson & Plosser, 1982) is when a data series is $\sim I(1)$. In this case the data series is said to contain a unit root.

Due to the inability to draw valid inferences if data is used that contain unit roots, it has become customary to pre-test all data for unit roots. The Augmented Dickey-Fuller (ADF) test proposed by Dickey and Fuller (1979) and the Perron-test (Perron, 1988) are the most widely used tests for this purpose.

The ADF test is used in this paper to detect the possible existence of unit roots in the variables that enter in to equation (4) above. However, the simple ADF test needs to be expanded to allow for seasonality and structural breaks in the data. For the latter, the extension of the ADF as proposed by Perron (1989) is used. This consists of estimating the following equation for each of the variables in the model:

$$\Delta X_t = \gamma X_{t-1} + \alpha_j \sum_{j=1}^n \Delta X_{t-j} + \mu + \mu t + dummies + \xi_t \quad (5)$$

In the present case $n = 5$ was found to be adequate to ensure that ξ_t is white noise.

The dummies in (5) will consist of $D=t$ for $(t > k)$ and $D=0$ (for $t \leq k$) if there is a structural shift in the trend of a series (where k is the time of the break) and/or $D=1$ (for $t > k$) and $D=0$ (for $t \leq k$) if there is a structural shift in the mean of the series. Furthermore, seasonal dummies will be included in (5) since quarterly data is used. Ghysels, Lee and Noh (1994) show that the usual ADF test is still valid, as long as sufficient number of the seasonal terms in the data. Seasonal unit roots, with reference to South African macroeconomic data series' are discussed in Naudé (1996). Osborn (1990) found that seasonal unit roots are not encountered often in macroeconomic time series.

If the coefficient γ in equation (5) is significant the null hypothesis of a unit root is rejected and it may be concluded that the data in question is $\sim I(0)$. If however, the estimated value of γ is insignificant, then it may be concluded that the levels data contains a unit root, i.e. it is $\sim I(1)$. In such

a case the appropriate modelling strategy is to take first-differences of the data and repeat the above test.

The critical values for the ADF t-test on γ with dummies for structural breaks are contained in Banerjee, Lumsdaine and Stock. (1992). Following Naudè (1999a), the timing of structural breaks was identified and can it be established that all variables exhibited shifts in means rather than trends.

Defining the appropriate dummies for structural shifts in the means, equation (5) was estimated for each of the variables. The results form the OLS estimation of (5) for the variables in (4) with lags of up to order 4 (seeing that quarterly data is used) are summarised in Table 5.1.

Table 5.1: Results of Unit Root Tests on Logs of Variables

VARIABLE	T-RATIO ON FOR LEVELS	T-RATIO ON FOR DIFFERENCES	ORDER OF INTEGRATION
EXP	-1.587	-11.407*	~I(1)
EXP(-1)	-1.142	-6.517*	
EXP(-2)	-1.408	-4.673*	
EXP(-3)	-1.829	-5.072*	
EXP(-4)	-1.319	-4.298*	
REER	-2.488	-9.001*	~I(1)
REER(-1)	-2.677	-8.159*	
REER(-2)	-2.169	-4.665*	
REER(-3)	-2.935	-4.090*	
REER(-4)	-3.127	-3.888*	
CIF/FOB	-4.899*	-11.192*	~I(1)
CIF/FOB(-1)	-4.509*	-11.473*	
CIF/FOB(-2)	-3.013**	-8.442*	
CIF/FOB(-3)	-2.628	-7.729*	
CIF/FOB(-4)	-2.096	-5.794*	
QSA	0.742	-9.29*	~I(1)
QSA(-1)	0.727	-6.54*	
QSA(-2)	0.749	-5.35*	
QSA(-3)	0.749	-4.13*	
QSA(-4)	0.776	-4.11*	
QUS	-1.633	-8.608*	~I(1)
QUS(-1)	-1.835	-5.828*	
QUS(-2)	-1.995	-4.863*	
QUS(-3)	-2.008	-3.825*	
QUS(-4)	-2.275	-3.313*	

(An ** indicates significance at the 95% level and a * at the 90% level)

Table 5.1 shows that for the series in equation (4), all the variables - with the exception of CIF/FOB that is stationary - are non-stationary in levels, and integrated of order 1, - i.e. as the third column of table 5.1 show, first differencing is required to achieve stationarity.

A drawback of estimating an equation only in differences is that potentially valuable long-run information contained in the levels of the variables may be lost. In first-and second differences, equation (4) will only be able to estimate the short-term dynamics of export supply in South Africa and long-run adjustments of exports to changes in its determinants will not be modelled.

5.3.2 *Testing for Cointegration*

This drawback may be avoided if equation (4) can be estimated in the form of an error-correction model. An error correction model contains a term in levels to capture long-term adjustments. However, in order for the levels term to be stationary, would require that the variables in the model be cointegrated.

In cases such as the present, involving more than two variables, there may be more than one cointegrating vector. In such a case the Engle and Granger (1987) two-step procedure has no systematic way for the separate estimation of the multiple cointegrating vectors. Furthermore, the two-step Engle-Granger procedure is open to the criticism that any errors introduced in the first step may be carried into the second step (Enders, 1995:385). The Johansen (1988) and Johansen and Juselius (1990) maximum likelihood estimator circumvent the use of two-step estimators and can estimate and test for the presence of multiple cointegrating vectors.

Testing for multivariate cointegration commences from the following vector autoregressive (VAR) model:

$$\mathbf{X}_t = \Pi_1 \mathbf{X}_{t-1} + \Pi_2 \mathbf{X}_{t-2} + \dots + \Pi_n \mathbf{X}_{t-k} + \mathbf{e}_t \quad (6)$$

In the system denoted by (6), a bold-faced variable indicates a vector. Here \mathbf{X}_t is a vector of m endogenous variables and \mathbf{e}_t a vector of identically and independently distributed errors. In the present case $\mathbf{X}_t = (\ln \text{EX}_t, \ln \text{REER}_t, \ln \text{IMP}_t, \ln \text{TSP}_t)$. Since it has been established in table 6 that the variables in \mathbf{X}_t are all $\sim I(1)$, it is necessary to estimate (6) in its first-differenced form. However, as has been remarked above, first differencing removes much of the valuable information about the equilibrium relationship between variables. Following Johansen (1988) and Johansen and Juselius (1990) an error correction representation of equation (6) can be obtained by re-writing equation (6) to obtain the following equation:

$$\Delta \mathbf{X}_t = \Gamma_1 \Delta \mathbf{X}_{t-1} + \Gamma_2 \Delta \mathbf{X}_{t-2} + \dots + \Gamma_{k-1} \Delta \mathbf{X}_{t-k+1} - \Pi \mathbf{X}_{t-k} + \mathbf{e}_t \quad (7)$$

This differs from the first-differenced version of the VAR in equation (7) only by the presence of $\Pi \mathbf{X}_{t-k}$. This term contains information about the long-run equilibrium relationship between the variables in \mathbf{X}_t .

The rank of Π is equal to the number of independent cointegrating vectors. If $\text{rank}(\Pi) = 0$ then the matrix is null and it will be necessary to estimate the VAR only in first-differences, i.e. if $\text{rank}(\Pi) = 0$ then all variables contain unit roots in levels. If Π is full rank (in the present case if $\text{rank}(\Pi)=5$) then the vector process is stationary.

The rank of Π is equal to the number of its eigenvalues that are significantly different from zero. The Johansen methodology allows one to determine the number of eigenvalues that are statistically different from zero. There are two related test statistics proposed by Johansen (1988),

namely the trace-test (λ_{trace}) and the maximum-eigenvalue test (λ_{max}). Given in the present case that Π can obtain four eigenvalues, λ_1 , λ_2 , λ_3 and λ_4 , these test statistics are calculated as follows:

$$\begin{aligned}\lambda_{\text{trace}} &= -T \sum \ln(1 - \hat{\lambda}_i) \\ \lambda_{\text{max}} &= -T \ln(1 - \hat{\lambda})\end{aligned}\tag{8}$$

Where T = the number of observations.

The critical values for the λ_{trace} and λ_{max} statistics are provided in Johansen and Juselius (1990).

The λ_{trace} statistic tests H_0 : p cointegration vectors, where $p = 0, 1, 2, 3, 4$ or 5 in the present case, against H_1 : $> p$ cointegrating vectors

The λ_{max} statistic tests H_0 : p cointegrating vectors against H_1 : $p+1$ cointegrating vectors

Using the econometric package PCFIML, the VAR in equation (8) was estimated and the eigenvalues of the Π - matrix calculated. These are respectively respectively $\lambda_1 = 0.262791$, $\lambda_2 = 0.230999$, $\lambda_3 = 0.183824$, $\lambda_4 = 0.166546$, $\lambda_5 = 0.0789124$ and $\lambda_6 = 0.00639366$. The calculated values of the test statistics and their 95% critical values are shown in table 5.2.

Table 5.2: Johansen tests for Multivariate Cointegration

H_0 : rank = p	λ_{max}	95% critical value	λ_{trace}	95% critical value
$p=0$	96.86	104.9	28.35	42.5
$p \leq 1$	68.5	77.7	24.43	36.4
$p \leq 2$	44.07	54.6	18.89	30.3
$p \leq 3$	25.18	34.6	16.94	23.8
$p \leq 4$	8.241	18.2	7.645	16.9
$p \leq 5$	0.5965	3.7	0.5965	3.7

Table 5.2 shows that according to both test statistics the null of rank (II) = 0 cannot be rejected – the tests thus fail to reject the null of no cointegration. Accordingly there exists no cointegrating relationship between the variables and no error correction representation of equation (4) is possible. The results of estimating equation (4) in first differences are set out in the next section.

5.3.3 Regression analysis

The regression results from estimating equation (4) in first differences are contained in table 5.3. First it should be noted that all data were logarithmically transformed. Furthermore, a general-to-specific modelling strategy was followed, and the results in table 5.3 reflect the most parsimonious fit obtained (see Doornik & Hendry, 1994:224-229). It should be noted that only in the case of international transport costs were lags (two periods) found to be statistically significant. A trend and seasonal dummies were also included in the model but likewise found to be statistically insignificant. The diagnostic results are available on request but indicated no evidence of misspecification (including autocorrelation).

Table 5.3: Regression Results: Export Supply Equation for South Africa, 1975(2) – 1998(1) (Dependent Variable : First difference of Real Merchandise Exports)

VARIABLE	COEFFICIENT	STD. ERROR	t-VALUE
Constant	0.0309	0.01228	2.518*
$\Delta REER_t$	-0.76044	0.19652	-3.869*
ΔIMP_t	-0.34705	0.088477	-3.915*
ΔQSA_t	0.10721	0.084773	1.265
ΔQUS_t	0.06639	0.80419	0.083
$\Delta CIF/FOB_t$	-0.0484	0.023477	-2.064*
$\Delta CIF/FOB_{t-1}$	-0.0114	0.0209	-0.545
$\Delta CIF/FOB_{t-2}$	-0.03266	0.022759	-1.435**
$R^2=0.27$ SE = 0.0934			

(An asterisk, *, indicates significance at a 95% level of confidence and ** significance at a 90% level of significance)

From table 5.3 can be seen that the significant determinants of export supply for South Africa are the real exchange rate, the value of imports (fob) and international transport costs (CIF-FOB band). The changes of the coefficients for the real exchange rate and international transport costs are of the right sign (negative) – indicating that an appreciation of the real exchange rate and an increase in international transport costs to South Africa will have a significant negative effect on South African exports. Due to a lack of available data, the effect of domestic transport costs could not be modelled. It can also be seen from table 5.3 that the value of imports has a significant negative effect on exports. This may seem counterintuitive when one considers the anti-export biases of import restrictions in other countries. However, in the present case it may be reflecting increases in domestic demand. Increases in domestic demand would give rise to increased import demand, and a shifting of production for foreign markets towards domestic markets. In other words, the finding in table 5.3 provides some indication of the possible validity in the South African case of the vent-for-surplus theory of Adam Smith.

From table 5.3 can also be seen that, although international transport costs are statistically significant in reducing South African exports, the magnitude of the effect is relatively small (the elasticity of changes in exports with respect to changes in international transport costs is around 0.08%). Changes in exports react more substantially to changes in the real exchange rate (-0.76% elasticity)⁵⁴ and imports (-0.34% elasticity). In a developing country such as South Africa, high international transport costs may thus be compensated for through appropriate exchange rate management. This finding supports the views of Yeats and Finger (1976) and Milner (1997) that trade policy barriers may be more significant

⁵⁴ The price elasticity of exports of -0.76 can be compared to averages for developing countries found in the literature. For instance, Reinhart (1995) estimated the price elasticity of exports to be on average -0.44 for developing countries, while Senhadji & Montenegro (1998) estimate it to be on average around -1.44. The latter study makes use of a much larger sample (37 countries vs 10) and also includes more Asian countries where the export price elasticities tend to be higher than in other countries.

barriers to international trade (and thus a country's openness) than transport costs.

5.4 Summary

In order to determine the significance of international transport costs on South African exports, an export supply equation for South Africa, using quarterly data over the period 1975 to 1998 was estimated. The regression results obtained indicated that the significant determinants of export supply for South Africa are the real exchange rate, the value of imports (fob) and international transport costs (CIF-FOB band). The changes of the coefficients for the real exchange rate and international transport costs were of the right sign (negative) – indicating that an appreciation of the real exchange rate and an increase in international transport costs to South Africa will have a significant negative effect on South African exports. Although international transport costs are statistically significant in reducing South African exports, the magnitude of the effect is relatively small (the elasticity of changes in exports with respect to changes in international transport costs is around 0.08%). Changes in exports react more substantially to changes in the real exchange rate (-0.76% elasticity) and imports (-0.34% elasticity). In a developing country such as South Africa, appropriate exchange rate policy may be crucial to lessen trade barriers due to geography. This conclusion may also serve to reinforce the consensus that overvalued exchange rates are a major cause of low economic growth in developing countries – particularly those in Africa where natural barriers to trade are significant.

Chapter 6

SUMMARY AND CONCLUSIONS

Most countries recognise the benefits of globalisation and thus of being competitive in a global economy. Competitiveness benefits a country's exports. The South African economy has been opening up to international trade and globalisation since the early 1990s by reducing import tariffs. To benefit from globalisation, a country needs to improve its competitiveness in order to survive global competition. This is very important for South Africa seeing that out of 48 countries South Africa is ranked in 42nd place by the World Competitiveness Report.

An inadequate transport system could place South Africa's development strategy at risk because exports could lose competitiveness as a result of expensive and unreliable transport. Under-investment in infrastructure required for international trade, inappropriate technologies, high transport costs and uncompetitive conditions might create "natural" barriers to trade.

It may thus be argued that the role of transport and logistics has so far been neglected in South Africa. This study analysed the contribution of transport and logistics to South Africa's international competitiveness. Both a literature and empirical analysis were used. An overview of the new economic geography and a discussion on the role of transport costs in international trade theory were given in chapter two. Chapter three outlined the transport infrastructure system and service providers as well as logistics, supply chain management and the current state of transportation and logistic management in South Africa.

Chapter four discussed transportation of South Africa's exports as well as domestic and international transport costs in and from South Africa. A model to estimate the impact of international transport costs on South African merchandise exports was explained in chapter five.

Despite the importance of transport costs in international trade, development and manufacturing, it has only been recently that the theory of international trade and development has began to incorporate transport costs and logistics into theoretical and empirical analysis. The historical development of transport in trade and economic development suggested that transport systems, and their ability to reduce transport costs, is important to increase the international competitiveness of a country or a region.

Geography is a previously neglected subject that has a significant affect on international trade and transport costs. Recently economists like Krugman and Martin have started to emphasise this subject's importance to international trade with the "new economic geography". The "new economic geography" embraces four main research programmes namely, spatial agglomeration of economic activity, the dynamics of regional growth convergence, the effect of differentiated physical geography on development and the effects of geography on regional integration. In these programmes linkage between trade barriers, especially transport costs and export performance (international competitiveness) has been identified as important.

Transport infrastructure is an important element needed to facilitate regional trade. Transport costs, which are determined by the state of the available infrastructure, play a significant role in the improvement of integration and thus trade between countries.

International business cycles focus on the economic connections among countries and on how much of an impact these connections have on the transmission of aggregate fluctuation across countries. In international business cycle literature the attention is focused on the role of transport costs in accounting for the high volatility in terms of trade and real exchange rates. The transport cost was found to affect the terms of trade in two ways, first by increasing import cost. Secondly, since transport costs have an impact on imports, the direct link between the terms of trade

and the marginal rate of substitution between foreign and domestic goods are broken.

Transport infrastructure is an important element to development and economic growth because infrastructure facilities produce services that countries need to modernise and diversify their production, to attract foreign investment and to be competitive internationally as well as to improve the health and productivity of the poor. Although South Africa's transport infrastructure compares favourably in southern Africa, there are still some backlogs and gaps in the sufficiency of the existing infrastructure and transport system.

Logistic costs is vital in the competitiveness of a country's exports because it can consist up to 21% of the total sales cost. Logistic costs comprise of a number of different costs and can include, transportation costs, warehousing costs, customer service costs, administration costs as well as inventory carrying costs. Globalisation has raised the demand on the effectiveness and efficiency of logistical activities and therefore, the important goal of integrated logistics management is to minimise the total cost of logistics rather than to try and reduce the cost of individual components.

The South African logistical system has undergone significant changes in recent times particularly in transport and distribution. But despite of changes and improvement in the logistical field, South African companies still need a lot of improvements concerning logistic and supply chain management.

Recent contributions to the "new economic geography" have been pointing to the possibility that geographical considerations may, through higher transport costs, hinder the integration of some developing economies into the global economy. Many of these economies, such as South Africa, have in recent years implemented significant trade liberalisation measures in order to open up their economies and improve

their international competitiveness. However, to the extent that transport costs (especially shipping costs) are exogenous to policy makers, it may be a significant obstacle in the success of trade liberalisation by adversely affecting the competitiveness of these countries' exports on global markets.

High international transport costs will adversely affect a country's competitiveness in international markets through the following channels. Firstly, for small countries such as South Africa that exert little impact on world prices, the higher international transport costs, the more firms in that country will have to pay for imported intermediate goods, and the less they will receive for their exports. In this study it has been established that the higher South Africa's import requirement, the lower its exports. In competitive global markets, higher transport costs would have to be offset either by lower wages or by reduced costs somewhere else in the production process (e.g. through better logistics management) to allow firms to compete internationally successfully.

Secondly, countries with higher international transport costs would be less likely to attract foreign investment in export activities. Again this has been borne out in the present study by the finding that South African exports tend to be residual, i.e. firms export when domestic demand is slack.

Thirdly, for exporters of primary products, such as South Africa, higher international transport costs would reduce the rents earned from natural resources thereby lowering aggregate investment and thus growth.

Fourthly, higher international transport costs would increase the price of all imported capital goods, which would reduce investment, the rate of technological transfer and thus reduce economic growth.

In light of the above, both domestic and international transport costs was investigated in this study for the case of South Africa, a typically developing country. It was established that claims that domestic transport costs are negatively impacting on exports are difficult to substantiate. Indeed, South Africa's inland transport costs compare favourably to those of selected overseas countries. The major problem as far as domestic transport costs are concerned may be the taxation of international trade through ad valorem wharfage fees. In this regard it was established that terminal handling charges (THC) in South Africa compares favourably with those of other ports – but only if South Africa's almost unique ad valorem wharfage is excluded. Including ad valorem wharfage, THC at Durban is R719 per six-meter container, higher than those of other ports in the sample. For imports and exports ad valorem wharfage in South Africa is currently levied at 1.8% and 0.9 % respectively. Because these ad valorem wharfage charges are a significant source of revenue for Portnet (the state owned enterprise responsibly for all ports in South Africa), their abolition seems unlikely.

In addition to THC (inclusive of ad valorem wharfage) as a reason for the perception of high domestic transport costs it was found that South Africa's port handling may be inefficient - loading and unloading of vessels take on average five times slower than ports in Europe or the United States. Slower turnaround times in South African ports impose storage and other warehousing costs on exporters.

The structure and functioning of the South African transport system was also forwarded as explanations for the perception of high domestic transport costs in South Africa. Roads and rail infrastructure are generally deteriorating. Furthermore, the main transport service providers in South Africa have been government regulated and dominated. Since 1910, the government owned South African Transport Services (SATS) – previously the South African Railways and Harbours – enjoyed a monopoly in the South African transport market due to protective legislation. Road transport could only be provided by the private sector if a valid permit was

obtained and other prohibitive stipulations were met. When the SATS were commercialised in 1990, the South African government did not take over the liability of its pension fund.

As far as transport costs are concerned, domestic transport costs in South Africa are not per se problematic - South Africa's weaknesses are more in logistics management overall than the specific element of transport costs. Improvements in harbour management, taxes and coordination with trading partners, as well as overall logistics management by firms may be important in improving the competitiveness of South African exports. However, it was also established that international transport costs, rather than domestic transport costs, is an obstacle to South African exports. For instance, the CIF-FOB band on imports (a crude measure of international transport costs) has been on average 0.07 (7%) in South Africa over the period 1988-1991. This compares very unfavourably with the world average of 0.03, and even the average for developing countries of 0.05. Indeed, international transport costs to and from South Africa are almost 50% higher than the average for developing countries.

It is clear that transport costs, transport infrastructure and logistics plays a vital role in the South African economy through international trade. By improving those elements, South Africa's trade, international competitiveness and eventually its economic growth will be improved.

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