7th ANNUAL STATE OF LOGISTICS™ SURVEY FOR SOUTH AFRICA 2010

VALUE CREATION TOWARDS GLOBAL COMPETITIVENESS AND SUSTAINABILITY

FAST MOVING FORWARD THINKING
IMPERIAL™ LOGISTICS

UNIVERSITEIT STELLENBOSCH UNIVERSITY

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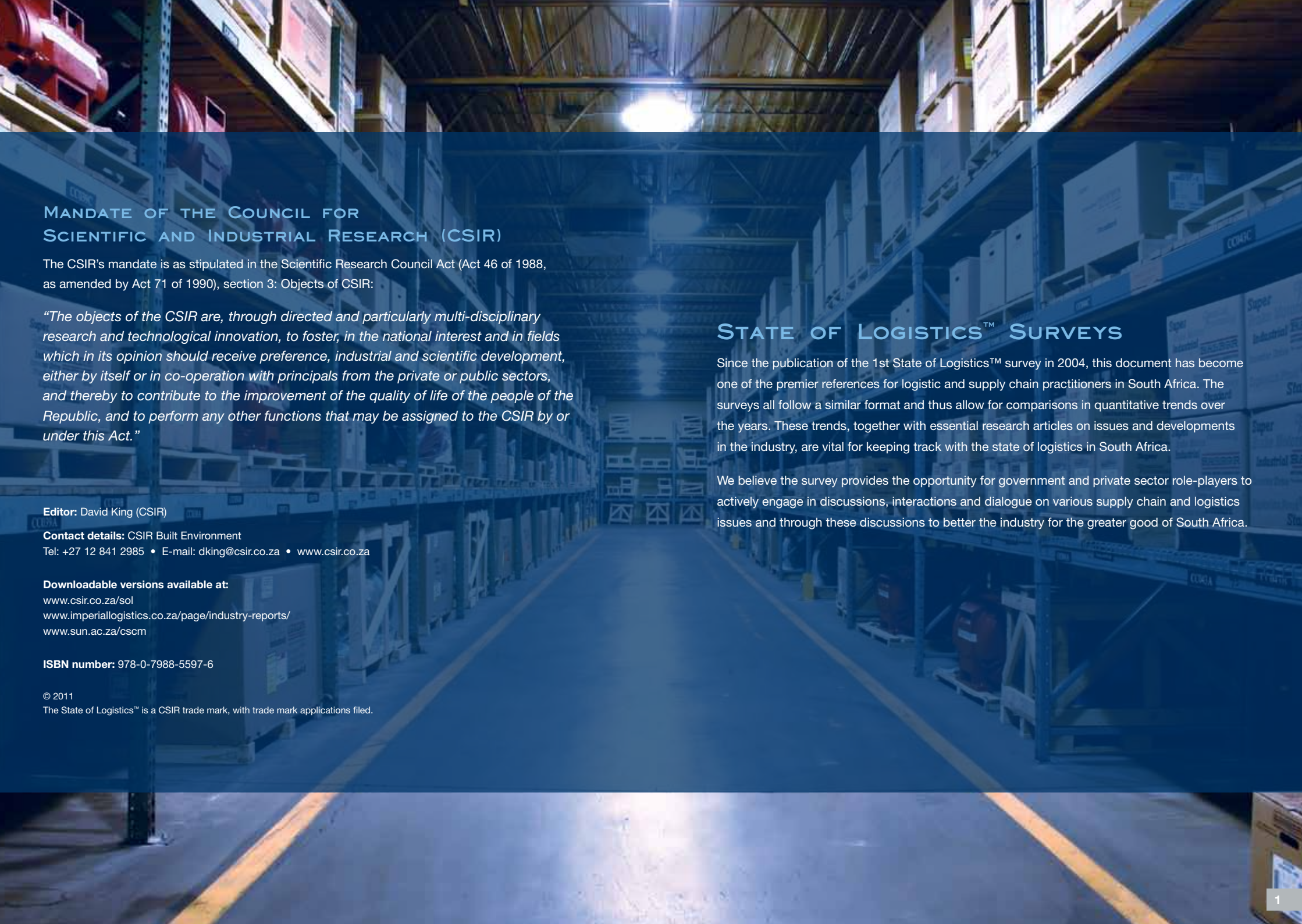

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ISBN number: 978-0-7988-5597-6

State of Logistics™ Surveys

Since the publication of the 1st State of Logistics™ survey in 2004, this document has become one of the premier references for logistic and supply chain practitioners in South Africa. The surveys all follow a similar format and thus allow for comparisons in quantitative trends over the years. These trends, together with essential research articles on issues and developments in the industry, are vital for keeping track with the state of logistics in South Africa.

We believe the survey provides the opportunity for government and private sector role-players to actively engage in discussions, interactions and dialogue on various supply chain and logistics issues and through these discussions to better the industry for the greater good of South Africa.

PREAMBLE

The Soccer World Cup was by all accounts a major success and by far the highlight for South Africa in 2010. Concurrently, the world economy has been slow at recovering. Nevertheless all the signs are there that matters are improving. The importance of solid supply chain strategies is always clearest during and after a recession.

With this realisation of the importance of supply chain management and logistics in this recovery process, it is apt that the theme of the 7th State of Logistics™ survey is 'Value Creation towards Global Competitiveness and Sustainability'. The CSIR, Stellenbosch University and IMPERIAL Logistics are pleased to present the report, which covers the 2009 reporting year from a data-analysis perspective. As envisaged at the outset of this annual survey, the report continues to add data trend points of critical factors that are crucial in the understanding of the South African logistics environment.

The publication of the State of Logistics™ survey acknowledges the importance of this sector to the South African economy, both nationally and internationally. This is reaffirmed by the New Growth Plan of the government that was released recently. The bottlenecks and backlogs in logistics were identified as areas of concern that also contribute to higher costs. The recognition that logistics and supply chain management are critical for the competitiveness of the country is a positive development. Supply chains are only as good as their weakest link. It is therefore essential that everyone who has a role to play in a supply chain should understand their specific role and responsibility. Ideally, as a recent study has shown, supply chains should provide one or more of six basic outcomes namely cost, responsiveness, security, sustainability, resilience and innovation.

The aim of the report remains to provide a perspective of the state of logistics in South Africa, incorporating a macro-economic view (top-down) and an industry-level perspective (bottom-up). One of the major findings reported on is the cost of logistics as a percentage of the gross domestic product (GDP). For 2009 this percentage is down to 13.5%, which is the lowest it has ever been. This is a direct reflection of the downturn in the economy during 2009.

Less freight was transported, which is in line with what happened in the USA during 2009 when the cost of logistics was down to 7.7% – also the lowest ever in that country. An area which received wide media coverage recently is the condition of the road infrastructure in South Africa. This situation affects the cost of logistics and the work conducted to calculate and quantifying the impact of bad roads is taken future in the 7th survey, with a benefit-cost analysis. A number of new, important issues are also introduced in the report – we believe that it will add to an increased understanding of logistics in the country.

More countries are starting to conduct similar studies, which allows for comparisons between countries. Some of these comparisons are included in this report. It is a very interesting exercise since we believe it would add hugely to a better understanding of logistics and supply chain management in a country.

However, one does need to be careful in doing these comparisons without taking into consideration the specific context of a country and we envisage studying this in greater depth in future.

The financial support from IMPERIAL Logistics is greatly appreciated and their continued commitment is acknowledged. We share their passion for enhancing the survey even more.

The contribution by Stellenbosch University to the report is critical. In this regard we acknowledge the Department of Transport for its contribution in agreeing and allowing us to publish the work conducted by the university's Centre for Supply Chain Management. It is again a pleasure to thank all those who contributed to the survey. It has become an essential and authoritative study on logistics in South Africa, acknowledged as such both nationally and internationally.

Hans W Ittmann
Executive Director, CSIR Built Environment, Pretoria, South Africa

February 2011

PREFACE FROM IMPERIAL LOGISTICS

Over the past year, the strategic importance of Africa and specifically, South Africa, as a trade hub has consistently been reinforced. Now a formal member of emerging market leadership, BRICS, the country plays a key role in the recovering global economy. However, there are still significant hurdles to be cleared if we were to heighten our global competitiveness.

The economy is geared for growth, according to BMI. Overall trade is expected to increase by an annual average of 7.2% over the next five years. Through its 'can do' attitude, South Africa has the potential to achieve, possibly exceed such forecasts. Yet to do this, substantial challenges must be overcome.

Inadequate rail capacity, bad road quality, skills shortages and insufficient collaboration plague the logistics industry. South Africa's total cost of logistics, substantially driven by transport costs, remains high. Costs are compounded by growing demand, as well as high and volatile fuel costs.

Solutions that optimise southern Africa's end-to-end supply chain must be identified, including the way that South Africa's rail, road, inland terminals and ports are integrated. This by no means presents an easy context within which to operate. If anything, it forces us to be more innovative. Furthermore, appropriate solutions require closer collaboration between the public and private sectors.

On the upside, as a result of the shift in power from developed to emerging markets, local logistics service providers (LSPs) are at the forefront of opportunity. It has been predicted that economic development within emerging markets could literally change world trade dynamics by 2030.

Taking this premise one step further, the 2010 World Bank Logistics Performance Index suggests that low and middle-income economies could boost global trade by 15%, just by improving logistics performance.

To fully take advantage of this 'trade evolution', a different approach for freight corridors is necessary. A dualistic national strategy that addresses both main freight corridor and rural services should be considered, with the ultimate objective being to reduce the country's total cost of logistics.

The 6th State of Logistics™ survey focused strongly on issues of sustainability, which continue to lead industry debate. IMPERIAL Logistics views these issues from both a people and planet perspective. Within the South African context, it is imperative to nurture human capital, as well as ensure environmental protection. Notably, the past year has seen innovative measures being taken on both fronts.

This year's State of the Logistics™ survey poses an important question. 'What will it take to generate responsible growth and thereby, sustainable value through logistics?' Simply put, accountability.

As the world emerges from a tough economic context and the environment becomes less predictable to deal with, answers to the problems facing business begin with this one principle.

Where we take from the planet and people, we should be giving back as much or more. Where we make promises, we should be honouring these, always. Where our partners in business rely on our people, they should be absolutely reliable. Where our employees contribute to our business growth, we should be investing in them.

When it comes to being accountable in business, living by the South African principle of Ubuntu enables leadership within our fast changing world.

"I am, because we are.
I affirm my own humanity by recognising yours.
When one diminishes we are all diminished.
When one succeeds, we all succeed."

IMPERIAL Logistics is proud to once again be a contributor to this authoritative annual survey. Through in-depth, insight-led analysis of key issues facing our industry, the 7th State of Logistics™ survey will generate greater accountability within South African logistics.

Marius Swanepoel
Chief Executive Officer, IMPERIAL Logistics, a division of IMPERIAL Group (Pty) Ltd

February 2011

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INTRODUCTION

Ittmann HW, King DJ (CSIR)

Globalisation continues to push logistics and supply chain management to the fore and resultant increases in freight flows have been a fundamental component of contemporary changes in global, regional and local economic systems[1]. Furthermore, a competitive network of global logistics can be seen as the backbone of international trade and the importance of efficient logistics for trade and growth is now widely acknowledged: *"Better logistics performance is strongly associated with trade expansion, export diversification, ability to attract foreign direct investments, and economic growth. In other words, trade logistics matter"*[2].

The importance of supply chain management and logistics for South Africa was reaffirmed by the New Growth Plan for South Africa that was released by the Economic Development Department towards the end of 2010[3], where bottlenecks and backlogs in logistics, energy infrastructure and skills were identified as important areas that hamper economic growth and raise costs. This awareness from government is highly welcomed. It brings renewed interest and a necessary focus on this critically important area for South Africa.

As we witness the world-wide economic recovery, the role of supply chains in national economic and business successes is imperative and must become a top-of-mind concern for all industry stakeholders. The competitive advantage that lean, streamlined and highly resilient supply chains brings cannot be over emphasised, especially when competing in the global market.

Trade

The past number of years were very difficult from an economic and trade point of view. However, there are very clear indications that the economies of many countries are recovering, although many will be suffering from strict cost containment by their respective governments. The International Monetary Fund (IMF) reports that risks to global financial stability have eased, but stability is not yet assured[4]. Furthermore, it is stated that: *"better growth prospects in many emerging economies and low interest rates in major economies have triggered a welcome resurgence of capital flows to some emerging economies"*.

South Africa recorded its lowest trade deficit in 2009 for the period 2005-2009, mainly as a result of the global economic downturn, with both imports and exports decreasing by 25.7% and 20.5%, respectively[5]. During 2009, China became South Africa's main trading partner and in December 2010, South Africa was formally invited to become part of the BRIC group of countries, which includes Brazil, Russia, India and China[6]. *"For South Africa, this new membership provides a shot of confidence and a boost to its goal of becoming an entry point for countries and companies looking to do business on the African continent"*[7].

Hopefully this new partnership will lead to a resurgence in international trade, which would lead to economic prosperity and social upliftment in South Africa.

Logistics costs

In 2009, the 'in-country' logistics costs as a percentage of GDP were 13.5%, a decline from 14.7% in 2008. There was also a decline in the total logistics costs from R339 billion in 2008 to R323 billion in 2009. The lower logistics costs as a percentage of GDP are in line with the decline experienced in the USA during 2009, where the percentage was 7.7%, the lowest ever. The basic reason for this is that less freight was transported due to the recession. However, one should analyse the underlining cost factors in the South African situation carefully since an even bigger reduction in the percentage was expected, but it did not realise.

Freight

The impact of the recession can be seen in the reduction of freight tonnage moved during 2009, although the difference is fairly small. The tonnage split of freight between road and rail remained almost the same, 88.7% on road vis-a-vis 11.3% on rail. Once again, the concern needs to be expressed that too much freight is being transported on road. While market forces

1 *Rodrigue, JP, Comtois, C, and Slack, B. 2006. The geography of transport systems. Routledge. UK.*

2 *World Bank. 2010. Connecting to Compete: Trade Logistics in the Global Economy. The Logistics Performance Index and Its Indicators. Washington DC USA.*

3 *Economic Development Department. 2010. Medium Term Strategic Plan 2010/11– 2012/13. South Africa.*

4 *IMF. 2010. World Economic Outlook – Rebalancing growth. Washington, DC USA.*

5 *WESGRO. 2010.*

6 *Source: http://www.sabcnews.com*

7 *Source: http://www.globalpost.com/dispatch/south-africa/110107/south-africa-be-bric*

determine these, one should nevertheless ask the question whether rail is indeed cheaper than road, when one considers the entire value chain. We are possibly dealing with a 'low cost, low service' situation compared to a 'high cost, high service' one.

Infrastructure and the effect of bad roads

Modern and properly-maintained infrastructure, be it roads, rail, ports, pipelines or airports, remains critically important for economic growth and development. Supply chains 'operate' on and are the main 'users' of this extensive infrastructure network.

South Africa has a comprehensive road network that spans the entire country. The primary network is well maintained, but the secondary roads, which are the responsibility of provincial and local governments, need serious attention. Damage to vehicles caused by potholes probably runs into millions of rand each year.

On the rail side, only profitable rail infrastructure is utilised, while large components – notably the branch lines – in the more rural areas are not used and are becoming increasingly dilapidated. It is interesting to note that the growth of freight on rural roads and rail has increased by 85% over the past six years, which is substantially more than on the traditional main corridors. It is therefore worrying that the infrastructure on which this freight is carried is deteriorating the fastest.

As in the previous two State of Logistics™ surveys, this report again highlights the effect of bad roads on total logistics costs. The research has progressed further and analyses are made of the benefit-cost between the cost to repair and maintain vehicles compared to the cost of maintaining roads. This is a very interesting and insightful addition to the report.

A recent study commissioned by the Ports Regulator sketches an alarming picture of our harbours in comparison with international harbours[8]. Not only is the Durban harbour the most expensive among 12 international harbours used for benchmarking in this study, but conversely, the productivity in Durban is the worst overall. As an example of productivity, the Durban harbour has an average of 30 crane operations per hour while Antwerp in Belgium has 94 crane operations per hour. Although the South African ports are by far the best on the continent, it is a concern that our ports compare so poorly internationally. Having said this, one needs to caution against making judgements without the proper context. For example, are all the ports used in this study operating in the same way and is it correct to compare the ports without an in-depth understanding of the environment of each port? It is therefore recommended that a more in-depth analysis be undertaken to determine the opportunities available to South Africa from this perspective.

8 *URBAN-ECON, August 2010. Economic Review of Participation in Ports Operation and Services in South Africa, pp 1-163, Study commissioned by the South African Ports Regulator.*

The upgrading of airports in the main centres in South Africa, coinciding with the very successful World Cup Soccer tournament held in June/July 2010, has resulted in the country having some of the most modern airports in the world. The freight that is transported by air within and into South Africa, however, remains very little in comparison with freight transported on other modes.

The upgrading of roads, rail, ports and airports, while very necessary and welcome, was very costly. A major concern is the effect of the recovery of these costs over the next few years. Tolling on the upgraded roads, for example, will be introduced shortly and this will no doubt have a significant impact on the cost of logistics.

Trends in supply chains

Participants in the Supply Chain Management 2010 and Beyond research initiative, conducted by a number of academics over a period of four years, provide interesting insights into supply chains of the future[9]. While traditional supply chains offer three primary benefits, namely reduced costs, faster delivery and improved quality, these advantages are no longer sufficient in the modern business world. A new paradigm is emerging where supply chains should also serve as a vehicle for developing and sustaining competitive advantage under a variety of performance objectives. Supply chains should be designed and managed to deliver specific outcomes.

The authors believe that supply chains should provide one or more of six basic outcomes, namely cost, responsiveness, security, sustainability, resilience and innovation. Critical supply chain characteristics and practices are influenced by the selected desired outcome(s). The supply chains of tomorrow must deliver varying degrees of these six outcomes.

Gilmore[10] provides the supply chain predictions of a number of gurus, some of which are listed here:

- Solutions based on Software-as-a-Service (SaaS) will continue to gain ground;
- Unless the organisation, people, skills sets, and culture are world-class, supply chain performance will be mediocre;
- Government interference and involvement;
- Supply chain leaders will focus on redesigning their demand management processes;
- Supplier risk will need to be managed better;
- Supply chain segmentation is gaining traction;
- There will be a rise in costs, also in the oil price;
- The year 2011 will see the emerging 'smart supply network' that converges cloud-computing, mobility, GPS, telematics, and Auto ID into a paperless supply network, utilising smart transactions to convey information across the network to the appropriate parties for global flow-control in real time;

9 *Melnyk, SA, Davis EW, Spekman RE and Sandor J, Winter 2010. Outcome-Driven Supply Chains, MITSloan Management Review, pp 33-38, Vol 51, No 2, 2010.*

10 *Gilmore, D, 2011. Supply Chain Guru Predictions for 2011, Supply Chain Digest, 13 and 20 January 2011.*

- Supply chain security has taken a back seat; and
- 'Co-opetition' – partnering with potential competition will become a supply chain management strategy.

Procter & Gamble[11] believes 'VUCA' (a volatile, uncertain, complex and ambiguous world) is the reality for the foreseeable future. To deal with this, a complete redesign of the company's supply chains was initiated. Add to this the prediction of Logistics Management[12] – transportation costs are going up! A gloomy picture emerges: *"Volatile oil and diesel prices, capacity shortages, another looming driver crisis, debilitating regulatory uncertainties, and an improving economy have led to one conclusion: shippers will have to shoulder some of the burden associated with escalating transportation costs".*

The impact of the rapid rise of e-Commerce will become increasingly noticeable. For UPS in the USA, residential delivery will account for a third of domestic shipping, up from 20% in 1997[13]. The company handles 15.1 million packages per day, which has led them to outsource delivery to a long-time rival, namely the US Postal Services (USPS). The latter is mandated by the US Congress to stop at every house, so UPS outsources the last-mile delivery to USPS! This ensures the company remains profitable.

Along the same lines, an internet-based bookshop in the UK now offers free delivery of books worldwide[14]. Because of this, the bookshop is competing globally, and very competitively, with all bookshops worldwide!

Green logistics and green supply chains are a reality and increasing pressure will be inserted on companies to focus on transforming their supply chains to meet the requirements of greening. The effect of logistics and supply chain management on climate change has increased mainly because of the realisation that global warming presents a much greater and more immediate threat than previously thought. Freight transport is estimated to contribute roughly 8% of energy-related CO_2 emissions worldwide[15], however, making logistics 'sustainable' in the longer term will involve more than just cutting carbon emissions.

In the recent past, the world has experienced many different types of disasters. The importance of the role of logistics in disaster relief cannot be over-emphasised[16]. With increasing numbers of incidents, relief supply chains will become more efficient and more effective.

South African companies need to take note of these trends, otherwise they will not be able to survive in the global market place.

11 Staff, 2010. P&G readies its supply chain for a "VUCA" world, Supply Chain Quarterly, 20 December 2010.

12 Burnson, P, 2011. Going Up!, Logistics Management, pp 28-32, January 2011.

13 Kingsbury, K, 2010. Road to Recovery, Time, pp 43-44, 17 May 2010.

14 Source: www.thebookdepository.com

15 Kahn Ribeiro, S and Kobayashi, S, 2007. Transport and its infrastructure, in Fourth Assessment Report: Climate Change 2007 – mitigation of climate change, Inter-government Panel on Climate Change, Geneva.

16 Banker, S, 2010. The Chilean Mine Disaster Relief Supply Chain: A UPS Case, Logistics Viewpoints, 21 October 2010.

17 Ojala, L and Solakivi, T. 2009. International Logistics Surveys. CSCMP's Annual Global Conference. Chigago, Illinois. September 20-23.

Comparing South Africa's logistics costs with other countries

Measuring national logistics performance provides ways in which comparisons between countries can be made. One way of doing this is through conducting logistics studies or surveys, such as the annual State of Logistics™ survey for South Africa. Evidence, however, suggests that the methods applied in conducting these studies and the focus and purposes vary considerably from one country to the next[17].

The World Bank is driving an initiative referred to as the Logistics Performance International Observatory (LPIO). The aim is to build capacity and provide pragmatic and relevant knowledge tools for rigorous analysis of logistics performance across nations. This process is, however, still in its infancy. During 2010, the World Bank released its second Logistics Performance Index (LPI) and associated indicators (as discussed in the 6th State of Logistics™ survey). The authors of this report state that the LPI and indicators are influential for advocacy, but remain coarse-grained metrics, which need to be complemented by in-depth country-specific data. In addition, policy-makers prefer to measure and breakdown performance in monetary terms (% of GDP or growth impact) or as a percentage of sales or turnover of firms rather than on indirect scales (such as the LPI)[18]. The results presented in this survey thus remain important for the South African government as well as private sector role-players and hopefully, by extending the survey in future, for other African countries too.

There is a growing interest internationally in computing logistics costs at a national level. In 1990, two such studies were conducted annually and this has increased to over 10 in 2009[19]. **Figure 1** shows a comparison of logistics costs as a percentage of GDP for selected countries. Most obvious is that

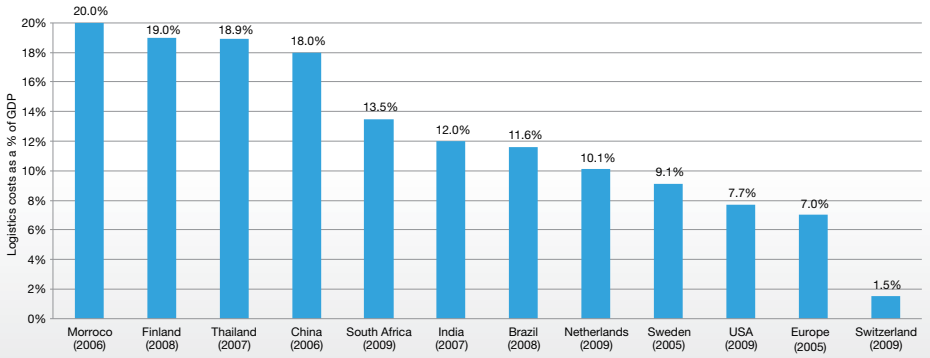

Figure 1: Total logistics costs as a percentage of GDP for selected countries

18 World Bank. 2010. A proposal for a Logistics Performance International Observatory (LPIO), concept note. Unpublished. Washington, DC.

19 Rantasila, K. 2010. Measuring national logistics costs. Master's thesis. Turku School of Economics. Finland. (South Africa and USA with updated figures and Brazil and India added).

developing countries generally have higher logistics costs when compared to developed countries (except for Finland, in this instance). When comparing these results it is important to remember that the results were computed differently. Two basic methodologies are used, namely modelling the costs or through survey-based questionnaires.

Nevertheless, valuable insights are gained when comparing these numbers. In **Figure 1** the costs are not all for the same calendar year, which already causes a problem.

A closer examination of **Figure 1** can lead to questions such as: Why are South Africa's logistics costs higher than those of India and Brazil, but much lower than those in China or Thailand? Why are Finland's costs double that of Sweden, its neighbour? Unfortunately, there is no easy answer to these questions. The logistics costs are a useful measure to assess the overall logistics performance of an economy. A proper analysis of this, component wise and over time and benchmarked with other countries, can enable policy directions, thereby providing further insight. If the logistics costs are broken down into transportation, warehousing, inventory carrying and administration costs for selected countries, as shown in **Figure 2**, it is interesting to find similarities in the cost components share of total logistics costs.

Transportation costs have always been the highest cost element in South Africa and it seems that this is also true for most other countries. It is interesting to note that South Africa has the second lowest transportation cost percentage, after Europe. Does this mean we are so much more efficient than other countries when transporting goods? Further analysis is surely necessary. Another obvious question is why the administrative costs in South Africa are so high compared to the other countries. The modal contribution for selected countries shown in **Figure 3** can provide more answers and insight.

While South Africa is very reliant on road transport, similar to India and Brazil, we have the added disadvantage of no inland waterways to transport freight. This might partially explain why South Africa has higher total logistics costs. However, when comparing the costs in the USA and China, which have similar modal configurations, China has much higher

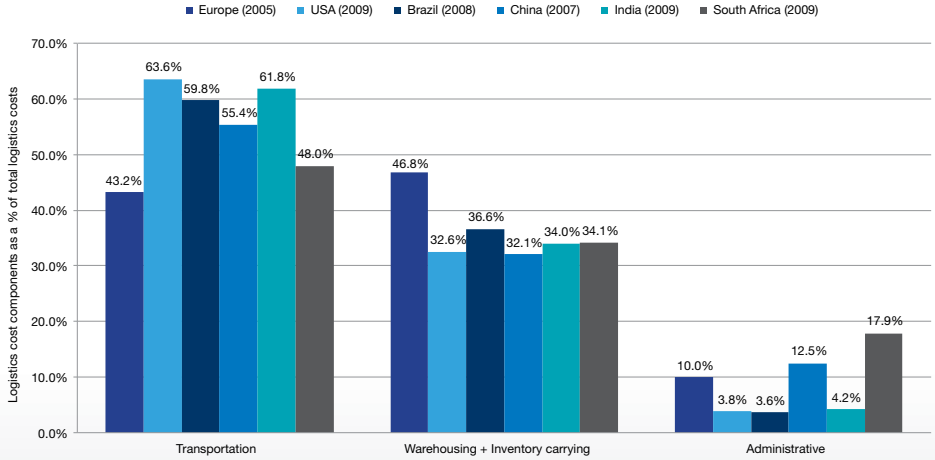

Figure 2: Logistics cost components as a percentage of total logistics costs for selected countries[20,21,22,23]

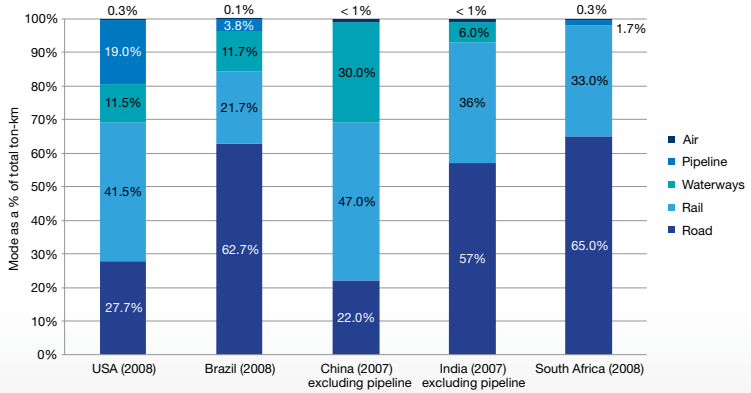

Figure 3: Modal contribution for land freight as a percentage of total ton-km for selected countries[24,25]

20 Rantasila, K. 2010. Measuring national logistics costs. Master's thesis. Turku School of Economics. Finland.

21 CSCMP, 2010. 21st Annual State of Logistics Report for 2009. http://cscmp.org/

22 Business Wire India. February 19, 2010. Logistics cost is 6.2% of India's GDP, says Frost & Sullivan. http://pr.watblog.com/2010/02/logistics-cost-is-62-percent-of-india%E2%80%99s-gdp-says-frost-sullivan/

23 ILOS, 2010. Logistics Costs in Brazil – Executive Summary. Instituto de Logistica & Supply Chain, Brazil.

24 ILOS, 2010. Logistics Costs in Brazil – Executive Summary. Instituto de Logistica & Supply Chain, Brazil.

25 McKinsey&Company. 2010. Building India, Transforming the nation's logistics infrastructure. www.mckinsey.com

total logistics costs. Pipeline usage in China is excluded, but it seems the logistics sector in China is just much more inefficient than that of the USA. How should these differences be compared and explained in a meaningful way – the question still remains, is it worth doing such comparisons and does this add any value?

Any comparison is worthwhile as it forces one to ask questions. However, comparisons must be done with utmost care. The numbers presented in the figures illustrate that it remains difficult to compare countries in absolute terms, while comparisons and conclusions drawn based purely on logistics costs as a percentage of GDP, are problematic. When analysing other factors, such as the various logistics cost components or modal contribution, no clear answers can be gained.

Two factors that are not usually taken into account when comparing these costs, which could explain the differences between countries, are the influence of hidden or opportunity costs on the system and the nature of the economies of each country. For instance, it is postulated that India's low logistics costs can be attributed to the hidden or opportunity cost of poor service (low cost equals low service). Furthermore, because India is a service-orientated economy, it could mean that its logistics costs would be lower than, for instance, China's manufacturing-orientated economy. It would therefore be worthwhile bringing in two other dimensions, i.e. service quality, and nature of economy, when comparing countries[26]. Further research into this is clearly required.

Conclusion

The South African State of Logistics™ survey is the only report outside the USA that is published annually. The value of what the survey reports on cannot be overstated. Not only are there useful trends of various important logistics factors within the country, but as this work progresses, more can be added and the research can investigate matters in more depth. This has been the case for the past number of surveys. In addition, comparisons can now be made between countries, since more and more countries are also looking at their environments. However, before comparisons can be made between countries, it is imperative to understand the internal and external factors that influence logistics costs in the respective countries, the service qualities of the countries, the nature of the country's economy, etc. A proper framework thus needs to be developed for these comparisons with the overarching goal always being that of continuous improvement in the way things are currently being done. ■

26 Tambi, A. 2010. Determining logistics cost of a country. http://it.toolbox.com/blogs/everything-anything-supply chains/determining-logistics-cost-of-a-country-39481

LOGISTICS COSTS
VOLATILITY, AGILITY AND FUTURE SHOCK

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transport
Department:
Transport
REPUBLIC OF SOUTH AFRICA

The research in this section is funded by the Department of Transport.

Introduction

In the light of the global economic upheavals experienced in 2009, the importance of annual macro-economic tracking of South Africa's logistics costs was further entrenched. Succinctly stated, if an economy declines by 1.7% in real terms, the crude oil price by 37.5% (the local price of diesel by 28.3%) and the average cost of capital in the economy by 28%, based on the repo rate (or 21%, based on the prime interest rate) a sizeable decrease in the cost of logistics relative to the GDP is expected.

It is, however, easy to be misled if figures are not understood clearly. Without analysing the underlying cost factors, it is impossible to deduce how South Africa's logistics industry adjusted to changes in product demand compared to installed logistics capacity – i.e. how agile and efficient the industry is in periods of upheaval.

The goals of this article are twofold. Firstly, to shed light on the industry's performance in the recent past but, secondly and perhaps more importantly, to develop scenarios based on the key cost drivers to inform policymaking and industry behaviours.

As expected, given the shift in macroeconomic indicators mentioned previously, in 2009 the cost of logistics in relation to the GDP declined to 13.5% from 14.7% in 2008 **(Figure 4)**. The significant decreases in the price of diesel and the interest rate however created expectations that logistics costs in relation to GDP would decline more. It would have been fair to have expected this percentage to drop to a level of closer to 12.5% given these major downward changes in the two most important cost drivers. Challenges within the transport and inventory carrying cost components, however, negated this.

The reduction in transport costs of 9.2% was much less than the fall in the price of diesel (28.3%). This points either to an increase in other transport cost drivers, or to changes within the structure of transport itself, such as higher demand relative to GDP. Ton-kms (the key indicator of transport demand), however, declined by 3.7% (i.e. less transport was required relative to the GDP) which means that other transport cost drivers did increase. Notably the load factor is a challenge – as the recession deepened it was increasingly difficult to compile full loads or avoid empty back-haul, rendering transport less efficient.

The drop in the interest rate combined with lower transport volumes should also have led to a sizeable decrease in inventory carrying costs. This did not happen due to more inventories being delayed in the supply chain and bottle-necks formed for longer periods of time, also leading to a slight increase in storage costs.

The logistics industry's major goal is the efficient solving of the time and place discrepancy between supply and demand. To improve transport arrangements and manage the

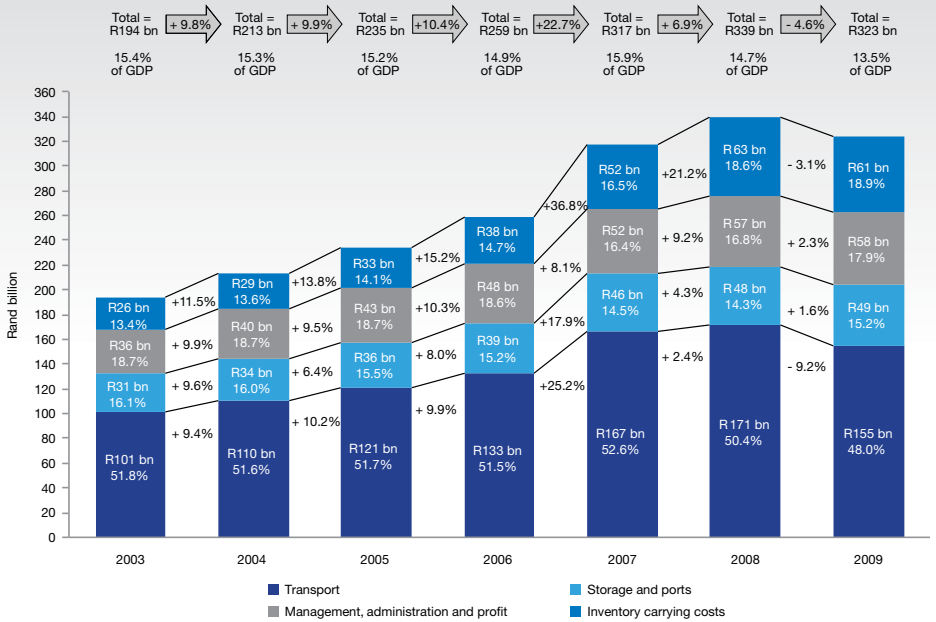


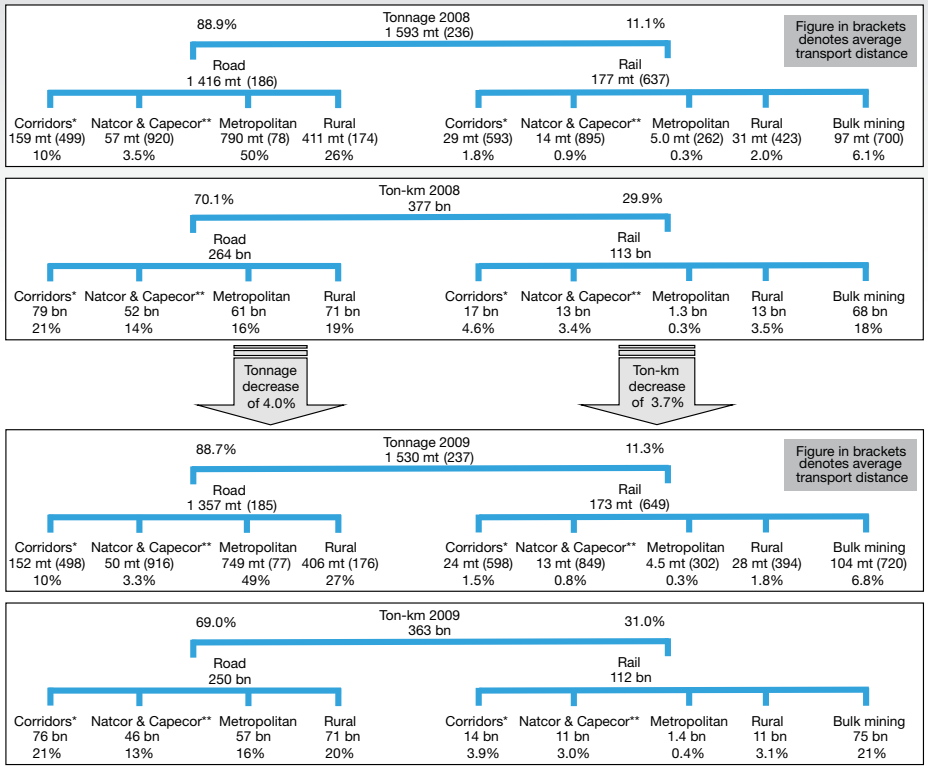
Figure 4: Logistics costs for South Africa

relationship between transport and inventory better, understanding demand is an imperative. In volatile times (with major cost driver shifts and recessions) this is difficult and the agility of the industry is tested. In summary, the cost of logistics relative to the GDP did improve, but the improvement – given the fuel price and interest rate decline – should have been more.

Transport activity

Total land transport activity in the economy is depicted in **Figure 5**. Both total tonnage and ton-km decreased, by 4% and 3.7%, respectively, with corridors being affected notably. This is the first time since the launch of the State of Logistics™ survey that there has been a decline in transport activity on all typologies, except bulk mining, as depicted in **Figure 6**.

In light of the decline on all other typologies, the change in bulk mining on rail deserves a mention, i.e. the growth of 7.2% achieved in tons and 10.3% in ton-kms. The growth is partly attributable to the fact that under normal conditions, the railways struggle to meet transport demand in this sector due to insufficient capacity, amongst other problems. Therefore, a drop in transport demand from the mining industry during a recession most likely still results in a demand higher than rail capacity, so any increases in rail capacity can still 'capture' some of this unmet demand. The railways are also re-investing in the bulk ore lines to meet growth expectations from the mines, resulting in more volumes to be transported in future as rail endeavours to bridge the gap to meet full industry demand.



* Remaining corridors excluding the two main corridors
** Natcor (KwaZulu-Natal–Gauteng) and Capecor (Western Cape–Gauteng) represent the two main corridors

Figure 5: Modal distribution of road and rail freight in South Africa

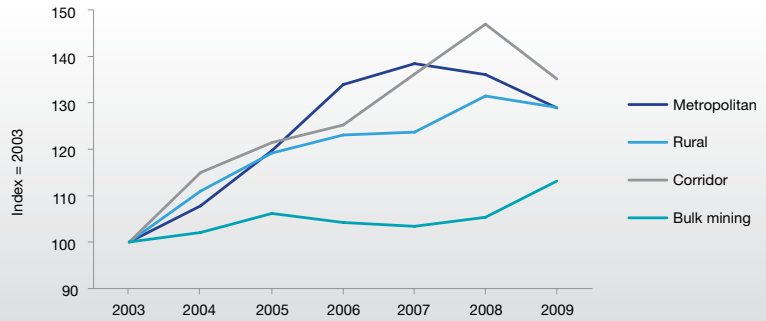


Figure 6: Changes in transport volumes since the inception of the survey

Transport for reward

Statistics South Africa (Stats SA) publishes a survey of the road industry, i.e. transport for reward (also referred to as outsourced transport)[27], which provides interesting data for correlation with the two freight flow models. The research presented here measures total freight transport activity. Using Stats SA's data, the volume of freight not outsourced could therefore be determined (unfortunately only in monetary terms – for road), as depicted in **Table 1**.

According to this analysis about one third of transport activity is outsourced. The major growth opportunity for road hauliers is not amongst available outsourced freight, but rather growth in outsourcing, often achieved by total logistics arrangements that can highlight savings on cost of ownership. Effective outsourcing can reduce logistics costs by optimising loads, orders and capacity.

Transport externalities

Externality costs were considered for the first time in the 6th survey and amounted to a cost of R34 billion (2008 data). The in-depth analysis of externalities in the 2010 survey required a restatement of the 2008 data to a downwardly adjusted R28.6 billion (or 16.7% of transport costs, excluding externalities). In 2009, this figure decreased to R22.7 billion (or 14.2% of transport costs, excluding externalities).

The externality costs per mode and per component are depicted in **Figure 7** and **Figure 8**, respectively. From a modal perspective, the majority of externality costs are caused by road transport, while accidents are the biggest cost component followed by the impact of emissions and congestion.

A comparison between the externality costs of South Africa and the United Kingdom

Table 1: In-house and outsourced road transport in monetary terms

	Total	Outsourced	In-house own account
2008	R155 billion	R54 billion	R101 billion
2009	R137 billion	R49 billion	R88 billion

27 Statistics South Africa, Land Transport Survey, Statistical Release p 1 762, 24 January 2011.

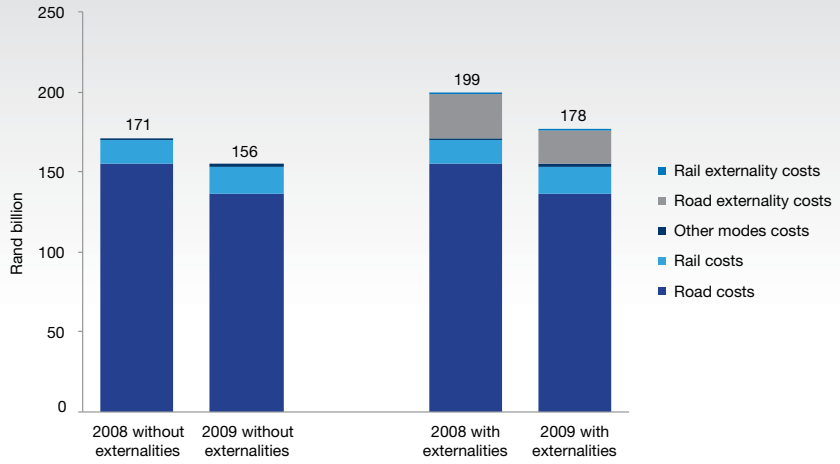


Figure 7: Externality costs per mode

is depicted in **Figure 9**. In the past it was assumed that emissions offset costs will always be the highest cost component of externalities, but this is clearly not the case in the United Kingdom where congestion is now a much bigger challenge.

In South Africa, there is considerable government focus on the implementation of an emissions tax and work in this regard has progressed substantially. It is clearly an important component, but the externality costs of accidents and congestion are significant. Further investigation in these areas is clearly required.

For more detail on emission externalities see the article on green logistics and for a view on the possible impact of emission externality costs on future transport prospects, see the scenario section in this article.

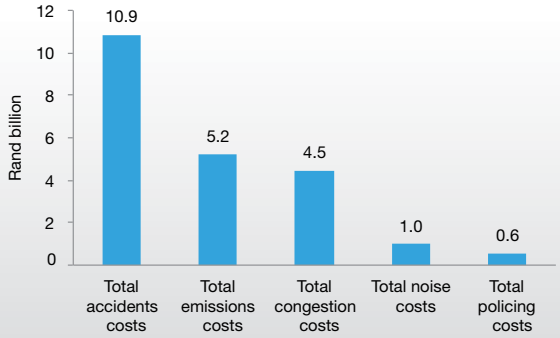


Figure 8: Externality cost components for South Africa, 2009

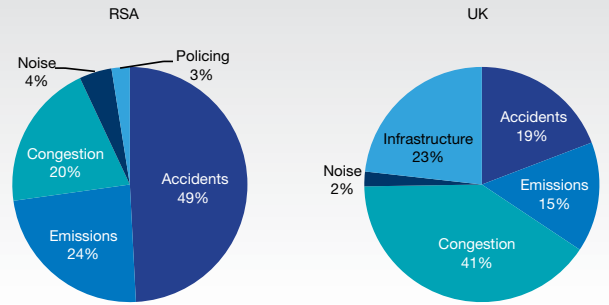


Figure 9: Externality comparison for South Africa and the United Kingdom

Other logistics costs

The other logistics costs in the economy that should be considered are inventory carrying costs (or the opportunity costs of investment in inventory), storage costs, and management and administration costs[28].

Inventory carrying costs

It has been suggested that the prime rate used to calculate the opportunity costs of investment in inventory is not strictly correct, and it is true on a company level[29]. The real investment for each business is determined by its hurdle rate, which differs from business to business. An average weighted hurdle rate for an economy cannot be determined – in fact, the prime interest rate should reflect the weighted average in this regard. The average inventory that required financing increased in 2009 with 23.5% nominally from R416 billion to R513 billion, an increase of 15.2% in real terms **(Table 2)**.

Table 2 also indicates that inventories relative to output increased from 17% in 2007 to 21% in 2009 – as the recession deepened, inventories built up due to lower consumption. This, in turn, led to larger inventory holdings that needed to be financed and also to less efficient transport due to lower volumes and more empty-hauls. (In 2008, inventories built up due to the spike in the fuel price, which is depicted in **Figure 10**).

Table 2: Value of inventories in South Africa

	Inventory at current prices (R billion)	Inventory at constant 2009 prices (R billion)	Inventory as % of GDP
2007	339.2	405.3	17%
2008	415.8	445.5	18%
2009	513.4	513.4	21%

28 Management and administration costs relative to demand did not decline substantially given the medium-term fixed nature of this expense, and are not analysed further.

29 Stock, JR and Lambert, DM Strategic Logistics Management, 4th edition, Boston: McGraw-Hill Irwin, 2001, p 196.

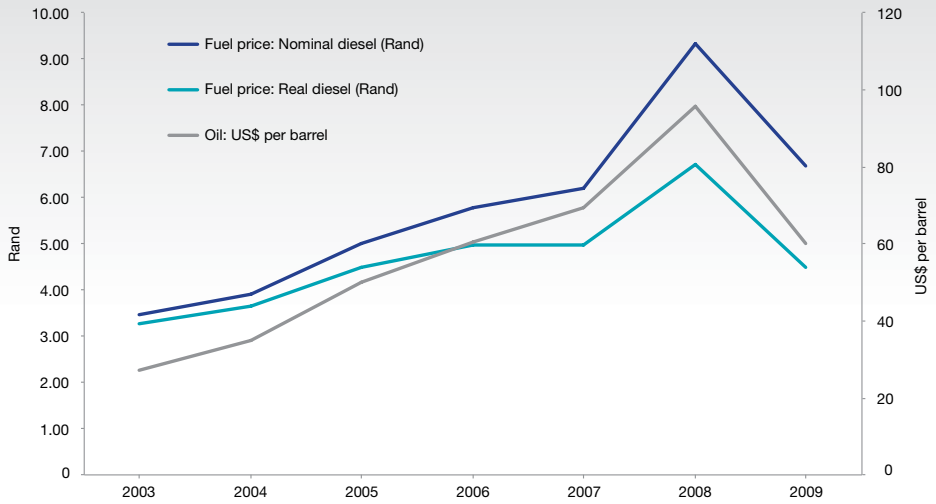


Figure 10: Fuel price history

These events highlight the difficulties experienced in the supply chain when adaptations to upheavals (such as fuel price spikes or deep recessions) are experienced. The point has often been made that South Africa's transport bill for logistics is much higher than the world average, but the indirect effect of this phenomenon is not always apparent. In trying to adapt to the more 'serious' issue, i.e. transport cost upheavals, lean inventory can also be a victim. The increase in inventory holdings was, however, mitigated by the reduction in the prime interest rate from 15.0% on average in 2008 to 11.9% on average in 2009, as depicted in **Figure 11**.

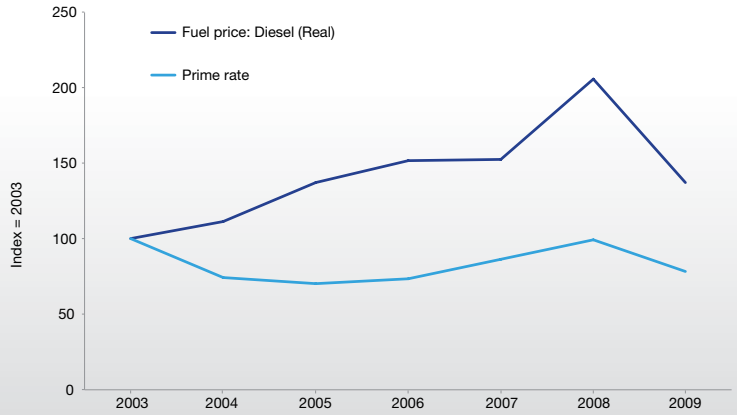


Figure 11: Prime rate and fuel price

Table 3: Storage costs

	Weighted average days in storage	Cost of storage, stuffing and picking at current prices	Cost of storage, stuffing and picking at 2009 constant prices	Storage, stuffing and picking as a % of GDP
2008	12	R48 bn	R52 bn	2.13%
2009	15	R49 bn	R49 bn	2.05%

The prime interest rate is also volatile and has been growing for the most part of the previous century. The gradual decline over the past decade should, however, be noted and the volatility of interest rates compared to the fuel price considered when long-term planning takes place.

Storage costs

Research indicated that inventory carrying times increased from 12 days to 15 days on a weighted average basis, leading to the rise in the average inventory level of the economy mentioned previously. The cost of storage, handling, stuffing and picking (at current prices) rose by less than the inflation rate, i.e. 3.6 % **(Table 3)**, alleviating the cost impact of rising inventory levels to some extent and leading to an overall increase in storage costs of 1.2%.

Scenarios

Scenario building is an important tool for the institutionalisation of change (i.e. the preparation of a system to be agile)[30]. For successful scenario building, the external risks (that proportion of risk which is outside of the entities' control) with the biggest impact as well as the highest likelihood of occurrence, must be identified. As highlighted in previous surveys, the fuel price and the exchange rate (due to crude oil imports) are two of the biggest (and potentially most volatile) drivers of logistics costs in South Africa. In this survey, the emissions tax has been identified as another key cost driver that could be introduced in the short to medium term.

Figure 12 outlines four scenarios that consider the impact of the oil price and exchange rate on

Fuel price estimation – *Ceteris paribus*

OIL PRICE	R7 = 1 US$	R10 = 1 US$
$200/b	**Twilight economy** Fuel price estimation: R11.32 per litre	**Constricted economy** Fuel price estimation: R14.41 per litre
$100/b	**Growth economy** Fuel price estimation: R7.71 per litre	**Volatile economy** Fuel price estimation: R9.26 per litre

EXCHANGE RATE

Figure 12: Fuel price scenarios

30 *De Geus, AP. Planning as Learning, Harvard Business Review, March-April 1988.*

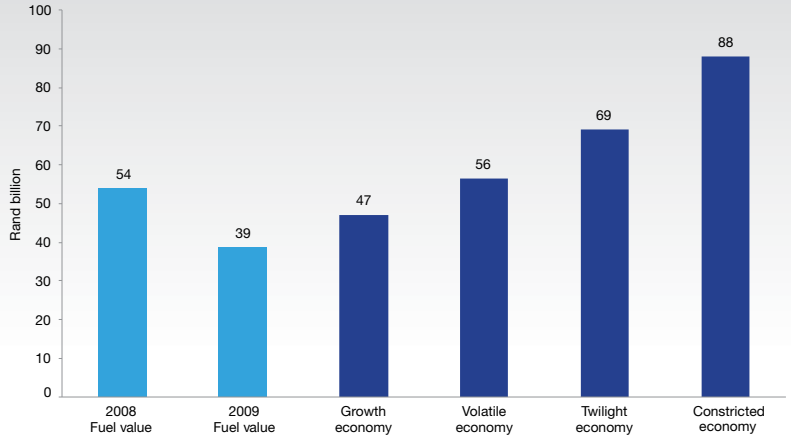


Figure 13: Fuel costs for logistics given various scenarios

the fuel price. Subsequently, emission charges were added (which are currently an externality, but on the brink of becoming an internal cost amidst huge uncertainty about the actual levels of these taxes).

For this analysis, the worst-case scenario an exchange rate of R10 to the dollar, is assumed, and an oil price of $200 a barrel (not too unlikely given fluctuations in the recent past), while the best-case scenario is assumed around levels of R7 to the dollar and $100 per barrel.

Clearly, the impact on South Africa's fuel price, and resulting logistics costs, will be significant. If the constricted economy values were applied to South Africa's 2009 volumes shipped, transport costs would rise by R49 billion, transport as a percentage of logistics costs to 55% and logistics as a percentage of the GDP to 15.5% **(Figure 13)**.

If the constricted economy values were applied to South Africa's 2040 transport volume forecast (at current prices), the difference between the logistics costs for the growth economy and constricted economy scenarios would be 14.5% (or R117 billion), as depicted in **Figure 14**. This means that the high fuel price in the constricted economy scenario would add an amount almost equal to the entire fuel bill of the growth-economy scenario.

Finally, the outside limits of a possible emissions charge (being the tax rate or actual offset costs) could be added to the scenarios. In the best case (growth economy scenario) Treasury's indication of a minimum emission tax of R75 per ton was used. (See the article on *Green Logistics* for more on South Africa's proposed emission taxes.) For the 'constricted economy' scenario a R2 000 cost impact per ton was adopted in accordance with Maibach[31]. This is illustrated in **Figure 15**.

31 *Maibach, et al proposes an upper limit value of €180 per ton by 2050. Maibach, M, Schreyer, et al. Handbook on estimation of external cost in the transport sector, Delft: Institut System- und Innovationsforschung, 2007.*

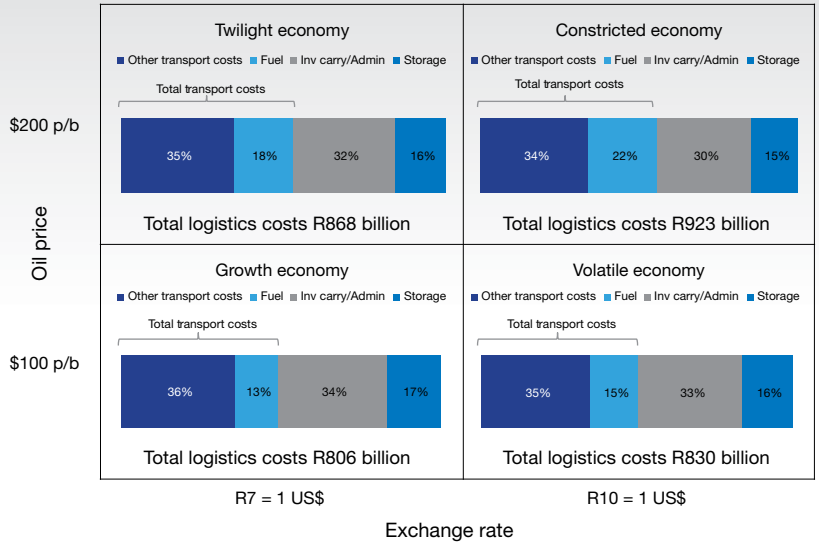


Figure 14: Scenarios for the future (freight demand in 2040 tons at 2009 prices)

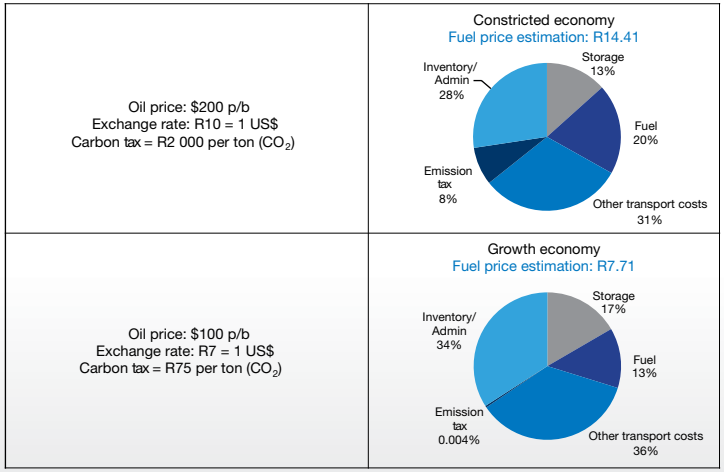


Figure 15: Scenarios for the future with emission costs added

The two extreme limits of these scenarios indicate a difference of R197 billion. Broadly speaking, this indicates a 24.4% 'variance' in logistics costs due to unknown, external risks. In 2009 terms, that is an increase in logistics costs as a percentage of the GDP to 16.8% (compared to the actual 13.5%).

Annexure: Transport modelling and market share

Transport activity in the economy is measured by two models. One is the National Freight Flow Model (NFFM), the one usually reported in the State of Logistics™ survey. The NFFM model, sponsored this year by the Department of Transport, uses vehicle counting as a starting point and could therefore be described as a supply-side model. The other is the Freight Demand Model (FDM), sponsored by Transnet, and is a gravity model. It predicts how freight should flow, given demand, and therefore is usually described as a demand-side model. Some of the results of the FDM become available from time to time at various forums and it is necessary to explain the alignment between the two models.

The FDM is the preferred model as it provides information on a commodity level (which is obviously not possible with vehicle observations). It can, however, by the nature of its design not determine secondary distribution which is, by design, included in the NFFM. (The demand for a product in one area and supply in another area cannot, for instance, determine the route that the product would take through various distribution centres – FDM, but both vehicles that do the primary and secondary haul will be observed – NFFM).

Furthermore, the FDM's corridor classification for Natcor and Capecor uses slightly different (shorter) cut-off points for freight to be included and therefore only 90% of the length should be used. Given these facts, the two models are aligned on typologies as shown in **Table 4**.

Secondary haul is much more evident in metropolitan areas, while the other typologies will also attract a degree of redistribution. A corridor correlation is depicted in **Table 5**. Small differences between the two models could be expected, but the correlation is satisfactory.

Table 4: Road typology alignment between FDM and NFFM

Road typology	Tons (million tons)			Ton-kms (billion ton-kms)		
	FDM		NFFM total	FDM		NFFM total
	Primary haul	Secondary haul (included in NFFM but not FDM)		Primary haul	Secondary haul (included in NFFM but not FDM)	
Rural	238	168	406	39	32	71
Metro	121	628	749	5	52	57
Corridor	156	46	202	88	34	122
Total	**515**	**842**	**1 357**	**132**	**118**	**250**

Table 5: Road corridor correlation between FDM and NFFM for ton and ton-kms

Road corridor	FDM (million tons)	NFFM (million tons)
Western Cape–Gauteng corridor	20.4	18.6
Gauteng–KwaZulu-Natal corridor	28.3	31.7
PE/EL/Mossel Bay corridors	13.4	13.1
Shorter remaining corridors	78.8	138.6
Sub-total	**140.9**	**202.0**
Secondary haul and shorter portions of the two main corridors	61.2	
Total	**202.1**	**202.0**

Table 6: Rail market share

Rail	Total		Corridors	
	2008	2009	2008	2009
Ton-kms	29.9%	31.0%	18.7%	17.0%
Tons	11.1%	11.3%	16.8%	15.2%

The issue of rail market share also requires some clarification, as the figure is often quoted in reporting, and used without context and clarification. Rail transports a large volume of bulk commodities over long distances at low prices, which skews the picture. It is therefore necessary to deconstruct market share for tons shipped and ton-kms. It is also more useful to consider corridor market share, as the railways are not contesting or collaborating much in the rural and metropolitan typologies, and road not that much with the export of bulk commodities. A market share summary (and changes from 2008 to 2009) is depicted in **Table 6**.

No major changes can be deduced over the two years but other observations are possible. Rail delivers around one third of transport supply (ton-kms) in South Africa, but since most of it is bulk mining, only 11.3% of total freight is shipped by rail. If metropolitan and rural areas are excluded, rail's market share for shipped tons is higher, i.e. 15.2% on corridors. This also describes the two major growth areas for rail, i.e. to increase export volumes where capacity is constrained, and to develop new channels (plus the underlying technology and capacity) to penetrate the corridor market. ■

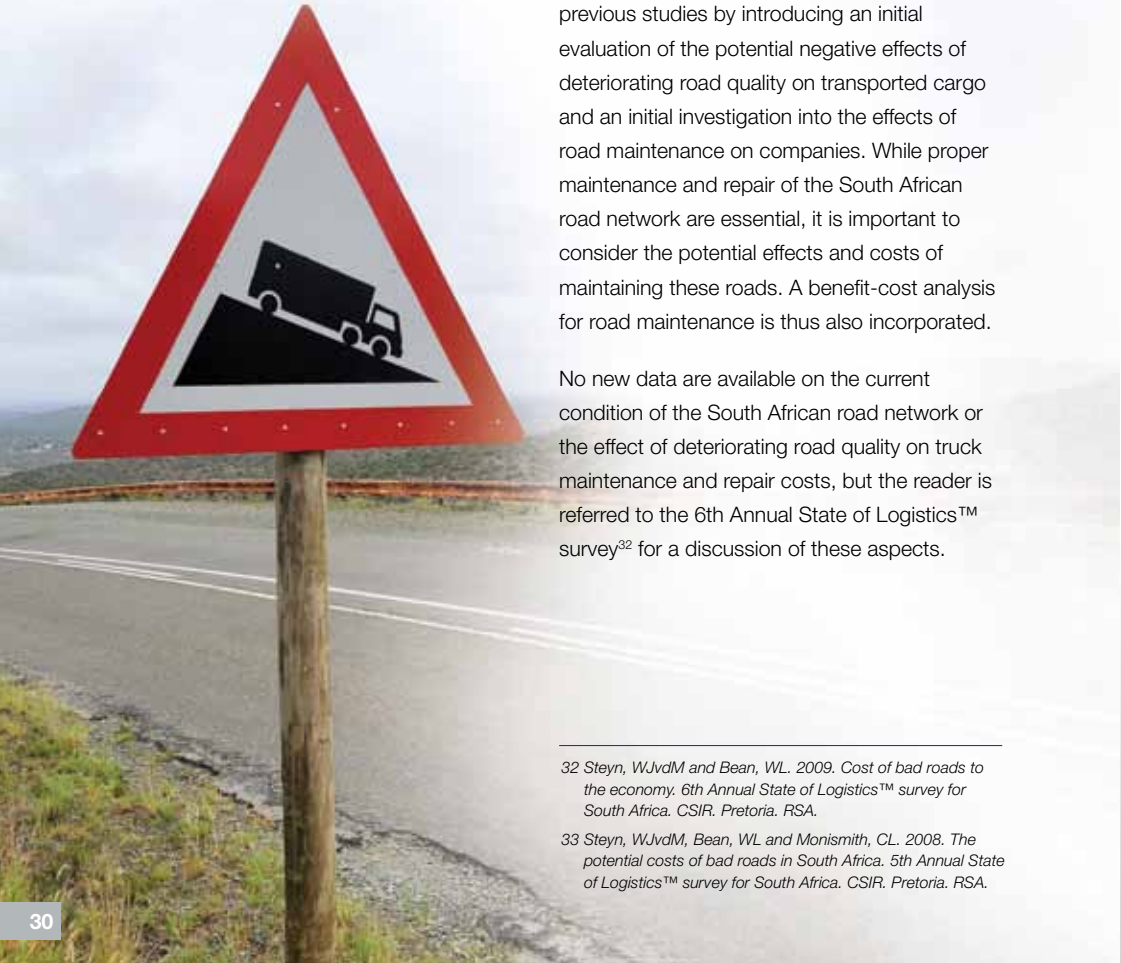
THE POTENTIAL EFFECTS OF DETERIORATING ROAD QUALITY AND MAINTENANCE IN SOUTH AFRICA

EXPLORING BENEFIT-COST ANALYSIS

Steyn WJvdM (University of Pretoria), Bean WL (CSIR)

Introduction

The potential effects that deteriorating road quality can have on vehicle maintenance and repair costs are widely recognised. In two previous studies[32,33], it was attempted to quantify the potential negative effects of bad roads on vehicle maintenance and repair costs, which ultimately translate into increased company logistics costs. It was found that deteriorating road quality can lead to drastic increases in vehicle maintenance and repair costs, resulting in sizeable increases in company logistics costs. In addition, increased vehicle maintenance and repair costs are not the only negative effect that can be caused by bad roads. Trucks travelling on bad roads ultimately experience increased vibrations, which can lead to damaged cargo. Other factors, such as increased fuel consumption and increased road and environmental damage, could also be unwanted consequences of trucks travelling on bad roads.



The aim of this article is to expand on the previous studies by introducing an initial evaluation of the potential negative effects of deteriorating road quality on transported cargo and an initial investigation into the effects of road maintenance on companies. While proper maintenance and repair of the South African road network are essential, it is important to consider the potential effects and costs of maintaining these roads. A benefit-cost analysis for road maintenance is thus also incorporated.

No new data are available on the current condition of the South African road network or the effect of deteriorating road quality on truck maintenance and repair costs, but the reader is referred to the 6th Annual State of Logistics™ survey[32] for a discussion of these aspects.

32 Steyn, WJvdM and Bean, WL. 2009. Cost of bad roads to the economy. 6th Annual State of Logistics™ survey for South Africa. CSIR. Pretoria. RSA.

33 Steyn, WJvdM, Bean, WL and Monismith, CL. 2008. The potential costs of bad roads in South Africa. 5th Annual State of Logistics™ survey for South Africa. CSIR. Pretoria. RSA.

The potential effects of bad roads on transported cargo

International studies indicate a link between the condition of a road and the vibrations experienced in a truck travelling on that road. Different types of cargo (i.e. fresh produce and glass articles) are sensitive to different vibration ranges and magnitudes. The vehicle type, properties and operating speed also affect the potential damage to the cargo. Since excessive vibrations can lead to cargo damages, it is important to investigate the actual effects that increased vibrations can have on transported cargo.

The position of cargo in the truck is important, as the dimensions of the truck will affect the level to which vibrations are transposed to different areas in the truck. Current local and international investigations indicate that cargo situated at the uppermost location to the back of the truck's trailer experiences the highest levels of vibration and damage. This phenomenon is visible in actual damage reports from (for instance) transporters of glass and fresh produce. An example of the damage experienced by fresh produce transported towards the back of a trailer over roads with high roughness is shown in **Figure 16**.

Although actual vibration data will eventually be used to quantify damages to transported cargo caused by deteriorating road conditions, sufficient data do not currently exist to achieve this. A monitoring programme was started in South Africa towards the end of 2010 and will be reported on in the next survey. However, initial data of vibrations experienced by cargo for different road conditions and locations on the vehicle indicate the range of vibration frequencies and magnitude of the amplifications the cargo experiences. This supports the evidence of damage as shown in **Figure 16**.

Figure 16: Typical damage experienced in fresh produce cargo due to road roughness

The potential effects of road improvement and maintenance

Regular and adequate road maintenance is the core solution to enable road infrastructure to operate in a good condition, thereby supporting adequate transport logistics in a country. However, maintaining a road could lead to unplanned stoppages and delays for a transport company. Stoppages along a route add to the turnaround time and delivery schedules of trucks. These stoppages may be due to decisions taken by the driver (excluded in this article) or unplanned stoppages due to either inadequate road conditions or road maintenance and construction.

Analysis was done on satellite tracking data obtained from trucks during 2010, operating on a route between Johannesburg and Port Elizabeth. On a 50-km section of single-lane road where only one lane was available for traffic due to road maintenance, a truck had to stop 18 times (at least 10 minutes each time), only managing an average speed of 20 km/h.

If the remainder of the road is assumed to be in a good condition and the truck can achieve an average speed of 60 km/h for the good section, the delay increases the travel time from 16.7 hours to 21.3 hours, a 27% increase in travel duration (assuming a 1 000 km distance). Data indicate that stop/start movements of a vehicle increase the accelerations imparted to transported cargo. More stoppages could therefore lead to the potential damage of cargo.

Road maintenance has to be planned such that it will minimise potential negative effects and traffic stoppages. Various models exist to enable the proper planning of road repair and maintenance[34]. These models can help decision-makers to determine the most suitable alternative for road maintenance by considering various options such as the use of bypasses, lane closures or using single-lane traffic over sections of the road. In addition, these models also assist decision-makers to determine the most suitable length of single-lane traffic sections from both maintenance and traffic flow viewpoints. This is important, as longer single lane sections may be better in some instances while shorter sections may allow traffic to flow faster through the system, all depending on traffic type and volumes and road geometry.

Communication regarding road works and stoppages on routes is important and can assist in minimising the effects of necessary road maintenance on transport companies. This allows for proper planning of alternative routes or staggering of travel times.

Benefit-cost analysis

It is clear that bad roads have many negative effects and one may argue that the most obvious solution to this problem is to repair and maintain the condition of roads in South Africa to address the root cause of the problem. The cost of repairing and maintaining roads is, however, extremely high (not even taking into account the current backlog) – the economic feasibility should therefore be investigated properly. To achieve this, a study on road maintenance costs required to maintain a good road quality on the Gauteng–Durban road corridor was compared to the potential savings in vehicle maintenance and repair costs gained and a benefit-cost ratio calculated for such an improvement.

To weigh the potential savings in vehicle maintenance and repair costs for transporting cargo on a good road with the cost of maintaining that road, the following assumptions are made[35]:

- Road maintenance is conducted annually to maintain a good road condition;
- An exponential decrease in road condition will occur if the road is not maintained on an annual basis[36];
- Truck volumes on the Gauteng–Durban corridor increase annually with 5%; and
- Road maintenance costs increase with 5% per annum due to inflation.

The annual road maintenance costs are derived from the actual road maintenance costs for 2006 on the Gauteng–Durban corridor[37]. The estimated road maintenance costs for 2009 is R150 000 per lane per kilometre. This is a total annual road maintenance cost of R600 000 per kilometre on four lanes.

It is assumed that the vehicle maintenance and repair costs on roads ranging from good roads to bad ones vary between R0.96 and R2.11 per kilometre[38]. However, the maintenance and repair costs are only a component of the total vehicle operating costs. The other components for the total vehicle operating costs are therefore obtained from the Fleetwatch database and include fuel, oil and tyre costs. The resulting total vehicle operating costs vary between R3.00 per kilometre for a good road and R7.00 per kilometre for a bad road.

The total vehicle operating costs at the start of the seven-year period is taken as R3.00 per kilometre and it increases exponentially over a period of seven years to a maximum of R7.00 per kilometre. The potential savings – when maintaining the road on an annual basis – are calculated over the seven years.

The total potential savings per kilometre are determined, based on the total truck traffic volumes on the Gauteng–Durban corridor in 2009[39]. Minimum and maximum traffic volumes are increased by 5% per year to derive future truck volumes. The minimum and maximum potential savings per kilometre are shown in **Table 7** and compared with the estimated annual road maintenance costs per kilometre. The results are shown in **Table 8**.

34 Lee, Eui-Bum and Thomas, DK. 2007. Accelerated Reconstruction of I-15 Devore Corridor. Public Roads, Vol. 70, No 4.

35 Steyn, WJvdM, Bean, W, King, D and Komba, J. 2011. Evaluating selected effects of pavement riding quality on logistics costs in South Africa. Paper presented at the 90th Annual Transportation Research Board meeting, Washington, DC.

36 ANON. 1997. The damaging effects of overloaded heavy vehicles on roads. PAD27 (Fourth Edition), Department of Transport, Pretoria, South Africa.

37 Morton, BS, Visser, AT and Horak, E. 2007. A life cycle cost analysis of the Gauteng to Durban freight corridor: initial road corridor infrastructure costing. In Proceedings of the 26th Annual South African Transport Conference. Gauteng, South Africa.

38 Steyn, WJvdM and Bean, WL. 2009. Cost of bad roads to the economy. 6th Annual State of Logistics™ survey for South Africa. CSIR. Pretoria. RSA.

39 South African National Roads Agency Limited. 2010. SANRAL Traffic Counting Yearbook 2009. Pretoria.

Table 7: Potential savings in vehicle operating costs

Year	Total vehicle operating costs (R/km)	Potential savings (R/km/vehicle)	Traffic volumes		Potential savings	
			Minimum	Maximum	Minimum	Maximum
0	3.00	–	536 550	992 070	–	–
1	3.50	0.50	563 378	1 041 674	281 689	520 837
2	3.80	0.80	591 546	1 093 757	473 237	875 006
3	4.10	1.10	621 124	1 148 445	683 236	1 263 290
4	4.60	1.60	652 180	1 205 867	1 043 488	1 929 388
5	5.20	2.20	684 789	1 266 161	1 506 536	2 785 553
6	6.00	3.00	719 028	1 329 469	2 157 085	3 988 406
7	7.00	4.00	754 980	1 395 942	3 019 919	5 583 768

Table 8: Benefit-cost ratio of keeping a road in a good condition

Year	Road maintenance costs (R/km)	Potential savings (R/km)		Benefit-cost ratio	
		Minimum	Maximum	Minimum	Maximum
1	600 000	(318 311)	(79 163)		
2	630 000	(156 763)	245 006		
3	661 500	21 736	601 790		
4	694 575	348 913	1 234 813		
5	729 304	777 232	2 056 250		
6	765 769	1 391 316	3 222 637		
7	804 057	2 215 862	4 779 711		
	Total	**4 279 985**	**12 061 043**	**1.88**	**3.47**

Comparing the estimated annual road maintenance costs per kilometre with the potential savings in vehicle operating costs, shows significant benefits can be realised when keeping the road in a good condition. It is important to note that only truck traffic volumes were used in this analysis – the actual benefit-cost ratios should therefore be higher than the figures presented in **Table 8**. Although a different set of assumptions will probably lead to different ratios, these ratios are considered to be important indicators of the positive effect of road maintenance on vehicle operating costs.

The minimum and maximum benefit-cost ratios of 1.88 and 3.47, respectively, imply that the potential benefit – in terms of vehicle operating cost savings – that could be realised over a seven-year period is between 1.88 and 3.47 times the cost of maintaining the road. Seeing that a benefit-cost ratio of 1 implies that the benefit and cost are the same, any benefit-cost ratio above 1 is acceptable. The benefit-cost ratio range of 1.88 to 3.47 therefore shows that maintaining roads in a good condition could indeed be the best solution. However, this analysis considered only the Gauteng–Durban transport corridor – a road that is generally kept in good condition – and is not necessarily representative of all the roads in the country. It is important for similar analyses to be performed on other road segments before the best solution for those segments can be determined.

Concluding remarks

The potential effects of deteriorating road quality extend far beyond increased vehicle maintenance and repair costs. Trucks travelling on bad roads experience more vibrations that could increase damage to transported cargo. An initial investigation of the potential effects of bad roads on transported cargo is presented here. A more detailed investigation is currently underway and will be reported on in future. Road maintenance, it is argued, can also have some unwanted effects such as unplanned stoppages and delays and damages to cargo. The delays caused by these stoppages can result in late deliveries and unnecessary increases in vehicle operating costs. It is therefore critical to ensure that road maintenance is planned in a way that minimises these potential negative effects.

A benefit-cost analysis for the maintenance of the Gauteng–Durban corridor showed that major benefits can be realised when keeping a road in good condition. Traffic volumes play a major role in the analysis and it is therefore important to perform similar analyses for other road segments before the most suitable solutions for those sections are determined.

This study has as its ultimate goal the finding of solutions that will benefit the country as a whole. Finding the best global solutions is a critical approach that should be adopted to ensure that South Africa can compete in a sustainable manner with the rest of the world. ■

GREEN LOGISTICS

Schoeman C (CSIR), Fourie PF (Stellenbosch University)

A developing-country perspective

A significant global development is the economic advancement and robust growth of large developing countries – specifically the BRICS countries, comprising Brazil, the Russian Federation, India, China and recently South Africa[40]. In 2010 the BRICS represented over a quarter of the world GDP, up from 18% in 1990. In 2008, these five countries represented 31% of global energy use and 35% of CO_2 emissions from fuel combustion. If their current strong economic performance continues as expected, the energy and emission shares of these countries are likely to rise much higher in future. **Table 9** illustrates CO_2 emissions from fuel combustion of these countries[41].

South Africa – already the largest African CO_2 emitter from fuel combustion – needs to institute measures to curb its future emission and energy consumption.

The Stern Review on the Economics of Climate Change estimates that if no action is taken to mitigate climate change, overall damage costs will be equivalent to losing at least 5% of global GDP each year, with higher losses in most developing countries[43].

It is widely accepted that logistics is key to enabling trade, foreign direct investment, development and economic growth[44]. It has, however, significant externality effects on the environment, which need to be curtailed. Transport's adverse impacts on the environment range from air pollution (primarily CO, CO_2, NO_X, SO_X, HC, lead and particulate matter), smoke, odours, water contamination (e.g. from NOX), noise, vibrations, depletion of finite resources, land usage, and wear of infrastructure, to accidents, delays and congestion[45].

Table 9: CO_2 emissions from fuel combustion by sector with electricity and heat allocated to consuming sectors in 2008 (in million tons of CO_2)

Country	Total CO_2 emissions from fuel combustion	Other energy industries[42]	Manufacturing and construction	All transport	Road transport	Other sectors
Brazil	364.6	27.9	128.2	149.7	134.6	58.8
Russian Federation	1 593.8	193.9	536.0	274.0	131.9	589.9
India	1 427.6	50.7	652.8	147.4	121.1	576.7
China	6 550.5	467.4	4 143.4	482.2	334.4	1 467.5
South Africa	337.4	16.2	163.1	49.5	42.3	108.6

40 South Africa was officially invited to form part of the BRIC countries on 24 December 2010. http://www.sabcnews.com and http://www.globalpost.com/dispatch/south-africa/110107/south-africa-be-bric

41 CO_2 emissions from fuel combustion. International Energy Agency. 2010.

42 Include emissions from own use in petroleum refining, the manufacture of solid fuels, coal mining, oil and gas extraction and other energy-producing industries.

43 TIPS Trade and Climate Change. SADC. 2009.

44 World Bank. Logistics Performance Index. 2010.

The triple bottom line principle

Very relevant to emerging countries – where economic growth and social development are foremost on the agenda, but climate change constitutes a major threat in terms of vulnerability – is the concept of the triple bottom line. The triple bottom line advocates a simultaneous concern for economic, ecological and social sustainability in organisational decision-making. These three approaches were traditionally seen to be at odds, but recent thinking aims to reconcile them to enable sustainable business performance. To add to the complexity, environmental and social problems as well as challenges relating to economic activities are not contained within company boundaries, but permeate their supply chains from raw material extraction to final product delivery. To have a non-localised impact, companies' decisions thus need to be aligned with their upstream and downstream supply chain partners. Furthermore, within the logistics arena the triple decision criteria have to be integrated into an effective national freight transport system (See **Figure 17** for a simplified graphic depiction).

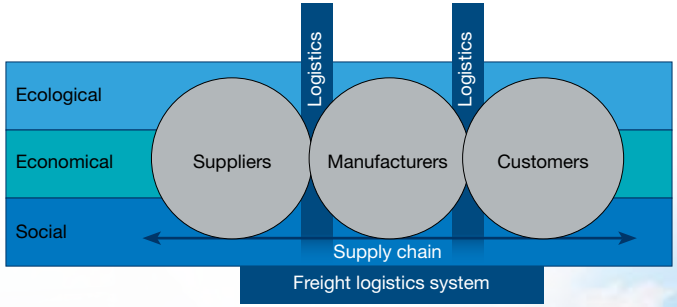


Figure 17: Holistic supply chain decision framework enabling sustainable performance

45 Kohn, C. Centralisation of Distribution Systems and its Environmental Effects. Linkopings University. 2005. Adapted from Lumsden, K. Logistikens grunder – Teknisk logistik, Studentlitteratur. Lund, Sweden. 1998.

If these interdependencies are not functioning effectively within this holistic decision framework, the system as a whole will underperform. This is illustrated in the South Africa Environmental Outlook report, which found that planned and proposed national emission reduction measures aimed at regulating fuel composition and new vehicle technology are projected to be negated by increasing vehicle activity and the ageing of the national vehicle fleet[46]. The case study in the following article addresses both economic and environmental impacts involving upstream and downstream partners in the supply chains.

South Africa's freight transport emission externalities

The transport sector (freight and passenger movement) consumes 27% of South Africa's total final energy, 78% of its liquid fuels and 1.6% of its electricity. The transport sector depends on liquid petroleum fuels for 98% of its energy, and on electricity for 2%. Road transport accounts for 87% of energy consumed by the transport sector, with aviation using 11% and rail just 2%. The energy-efficiency ranking for freight transport rates pipelines the most efficient mode, followed by rail, then road, and air as the least efficient mode[47].

In 2009, 23 million tons of green house gasses were emitted in South Africa due to land freight transport activities. This amounts to 49% of transport emissions and just over 5% of total emissions for the country. Road freight contributed 20.3 million tons and rail 2.7 million tons[48], which translate to R4.6 billion and R0.6 billion in costs to the environment (see the section on externalities in the cost of logistics article).

The cost of emission externalities could in future become an internal logistics cost due to the implementation of carbon taxes as proposed by Treasury. However the full impact and probability of this need to be understood and researched in more detail. Offset costs (such as for the dubious relationship between road user costs charged through the fuel levy, toll fees and licence fees and the actual damage caused by vehicles) are a difficult concept for consensus. It is a relatively new field of research, and $30 per ton of emissions is often quoted, but a range between $10 and $90 has been observed.

Initial indications from Treasury were that these emissions could be taxed at around R165 per ton, though the proposed tax range can be between R75 and R200 per ton. The worst case scenario for carbon tax in Treasury's proposal is R750 per ton, however a 'constricted economy' scenario with a R2 000 cost impact per ton was demonstrated (in accordance with Maibach's[49] recommendation) in the cost of logistics article under the "Scenarios" section. Given Treasury's R75 – R200 tax range per ton, it could add R1.7 billion to R4.6 billion to South Africa's freight bill, if implemented.

46 South Africa Environmental Outlook. Department of Environmental Affairs and Tourism. 2006.

47 Department of Transport. National Transport Master Plan 2050 (NATMAP). The implications of global oil depletion for transport systems in South Africa. 2009. Department of Transport. 2009.

48 For rail, both diesel usage and emissions from electricity generated at power stations were used.

49 Maibach, et al proposes an upper limit value of €180 per ton by 2050. (Maibach, M, Schreyer, et al. Handbook on estimation of external cost in the transport sector, Delft: Institut System- und Innovationsforschung, 2007.

Logistics companies and emission externalities

The GHG Protocol is the most widely accepted approach to identifying and categorising emissions-releasing activities from a company's activities. The protocol distinguishes between direct emissions (due to activities owned and controlled by the company – scope 1) and indirect emissions (due to company activities but occurring at sources not under its ownership/control in the value chain – scope 2: energy-related and scope 3: other). The protocol directs companies to not only take responsibility for and manage their own direct emissions, but also to understand the impact and influence of their suppliers and customers[50].

Seeing that road is the major energy consumer in the transport industry, shippers and logistics service providers can have a key impact in emission reduction by optimising the factors affecting emissions, such as vehicle parameters (vehicle characteristics, control systems, maintenance, etc.), operating conditions (speed, loads and start modes), fuel parameters and environmental conditions (altitude, humidity, temperatures, etc.)[51]. Perceptibly, fuel and environmental parameters are largely beyond company control, but two levers that can be employed to achieve greener logistics are **optimising equipment** (improving the emission characteristics of transportation equipment) and **optimising movement** (improving the efficiency of logistics operations and superior network design)[52]. As an example of the latter lever, sub-optimal routing and scheduling of deliveries and cargo loading/space utilisation can add significant additional emissions through unnecessary distance travelled and wasted space. This is addressed in the case study in the next article.

A recent study among 335 enterprises with green initiatives showed rewards in lower transportation costs, lower energy costs, lower operations and facilities costs, and lower supply costs, in addition to improved reputation. It is therefore not surprising that market-leading businesses are the ones committed to green logistics as an add-on to traditional bottom-line cost objectives. By being early adopters, these companies can transform their business with more autonomy than waiting for external regulation[53]. **Table 10** lists the most popular green transportation and logistics initiatives, as well as barriers to their adoption, according to an international survey of 235 companies[54].

In South Africa, the 2010 **supply**chain**foresight** survey found that among the top supply chain objectives of South Africa's biggest businesses, *reducing the environmental impact of supply chain operations* ranked last. However, those industries reporting the biggest planned

50 James, K. Is Green the new Black? – Greening the Supply Chain.

51 Onursal, B and Gautam, SP. Vehicular Air Pollution: Experiences from Seven Latin American Urban Centers. World Bank. Technical Paper No. 373. Washington DC. 1997.

52 Reconciling Green Transportation Logistics and Cost Optimisation. Whitestein Technologies. 2009.

53 Ibid.

54 Eyefortransport. Green Transportation and Logistics Report. 2008.

Table 10: Green transportation and logistics initiatives and barriers to their adoption

Current/Planned initiatives	Barriers to adoption
• Improving energy efficiency • Emission measuring and/or reductions • Vehicle rerouting to reduce miles • Strategic warehouse and/or distribution centre placement • Switching to more fuel-efficient road vehicles • Trial and/or use of alternative fuels • Using more environmentally-friendly logistics providers • Switching to more fuel-efficient modes of transport • Requesting emission data from suppliers.	• Costs are too high • Payback period is too long • Not high enough on list of priorities • Not enough people /nobody driving the process internally • Customers won't pay a premium • Not enough knowledge to start the process • Lack of necessary customer demand • Lack of partner support to start process • Not a top priority for management • Negative impact on the supply chain • LSP's responsibility • Not convinced the green trend will continue.

investment in green projects and technologies both in terms of revenue and time, were those involved in heavy transport-related emission and hazardous chemical production – the agribusiness, logistics and FMCG sectors[55]. The case study in the next article involves the latter two sectors. ■

*55 Barloworld Logistics. **supply**chain**foresight** 2010 – Growth in Adversity. South Africa.*

MEASURING 'EXTRA DISTANCE'
A CASE STUDY

De Swardt A (IMPERIAL Logistics), Potter A (Cardiff University), Robinson A (Volition Consulting Services), Sanchez-Rodrigues V (University of Plymouth)

Background

Uncertainty within logistics operations can cause significant disruptions throughout the supply chain. Over and above this challenge, volatile energy costs drain company resources substantially. New government regulations will require that companies cut energy use or pay penalties. In addition, pressure from customers, shareholders and advocacy groups continues to mount for companies to cut energy usage, and reduce carbon and other harmful emissions and wastage.

Transportation, essentially the link between shippers and logistics service providers (LSPs), should not be undervalued in terms of its impact on delivery of value to the end customer. However, transport has historically been considered as a marginal activity within supply chains[56] and as a result it is not taken into account in supply chain uncertainty frameworks[57]. In economic terms, companies pay a premium in respect of their total landed costs for taking this approach.

When it comes to the issue of environmental responsibility, until recently, freight transportation was a negligible consideration in company strategy. However, current business practices such as international sourcing and quick turnaround times have rocketed 'green' issues up the corporate ladder. The ultimate challenge remains to find ways in which 'green' can simultaneously reduce costs, increase revenues and improve the environment.

Extended transportation distances and lead times burden increasingly complex supply chains, both economically and environmentally.

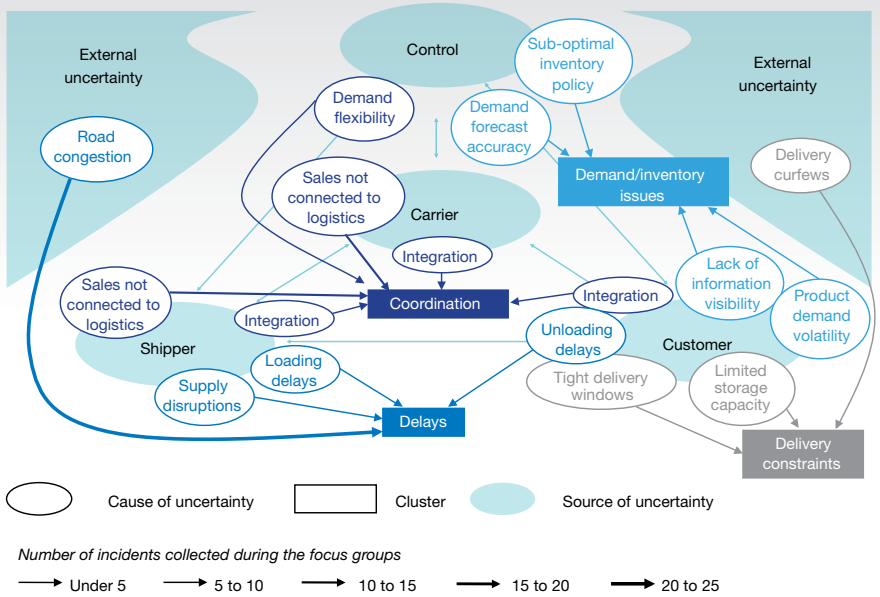


Figure 18: Transport-focused uncertainty model, a mirror image for the contexts in South Africa and the United Kingdom

In 2010, the transport uncertainty model depicted in **Figure 18** was tested[58] empirically to evaluate the causes of supply chain uncertainties impacting transport operations in the United Kingdom (UK). Phase I of the research validated causes such as delays within the supply chain, variable demand and/or inaccurate forecasts, lack of supply chain coordination and delivery restrictions. Interestingly, during Phase II of the South African study, it was noted that the UK transport-focused uncertainty model mirrors the local industry scenario.

Two critical consequences result from uncertainty within transport operations, namely either 'extra distance' travelled by the vehicles, or a time delay in delivery.

These two dynamics motivated Phase II of this study, which continued the use of this concept to quantify the impact of transport uncertainty.

56 *Stank, T and Goldsby, T. 2000. A framework for transportation decision making in an integrated supply chain, Supply Chain Management: An International Journal, Vol. 5, pp 71-77.*

57 *Sanchez-Rodrigues, V et al. 2008. Establishing a transport operation focussed uncertainty model for the supply chain, International Journal of Physical Distribution and Logistics Management, Vol. 38, pp 388-411.*

58 *Sanchez-Rodrigues, V et al, 2010. Evaluating the causes of uncertainty in logistics operations, International Journal of Logistics Management, Vol. 21, pp 45-64.*

Phase II: 'Extra distance' case study

Applying the 'extra distance' measurement as a means of cost saving and limiting CO_2 emissions in secondary distribution networks in South Africa.

Context and definitions

Phase II of the 'extra distance' case study continued the analysis and related supply chain performance improvement that were reported in the previous survey[59]. The study was undertaken through a partnership between IMPERIAL Logistics, the University of Plymouth, Cardiff University and two blue chip FMCG/retail companies.

This phase of the project applied the 'extra distance' tool to two FMCG/retail secondary distribution networks based in Gauteng. The tool measures any non value-added or unnecessary distance travelled in a distribution network due to supply chain uncertainty. The metric of 'extra distance' is defined as the difference between the distance that vehicles actually ran and the distance that they would have needed to have run if:

- The transport operation had received accurate and timely information on the volumes to be moved;
- There had been no unexpected delays at loading or unloading points;
- There had been no operational failures within the distribution network; and
- There had been no congestion on the journey that could have been foreseen.

Whereas Company A was a retailer implementing the second phase of the study, Company B, a dry ambient goods manufacturer, was undertaking the analysis from scratch. The retailer has over 300 outlets throughout the country, serviced by a network of three distribution centres (DCs). The manufacturer required over 300 multi-drop deliveries a day to a total of 1 800 locations. The transport operations within these networks are outsourced to an LSP, as indicated in **Figure 19**.

The team aimed to build on lessons learnt within 'extra distance' Phase I, through further testing and extending the supply chain performance improvement through quantitative analysis. Not only was it important to understand the root causes of unnecessary travel distance generated by various supply chain functions and external factors, but it was a priority to design accurate, sustainable monitoring processes to ensure maintenance of current performance, and ensure future improvements.

Method

Following a managerial-level forum to select the relevant DCs for each company, data gathering was initiated. Using initial data sets that were gathered in January 2009 as a base, further data were sourced to measure the effects of network improvement initiatives. The data collection weeks were considered to be typical or average weeks that represent activity over a 12-month period.

Additional data were gathered from reports that recorded the unexpected trips run after

59 Refer to pp 46-51 of the 6th Annual State of Logistics™ survey for South Africa.

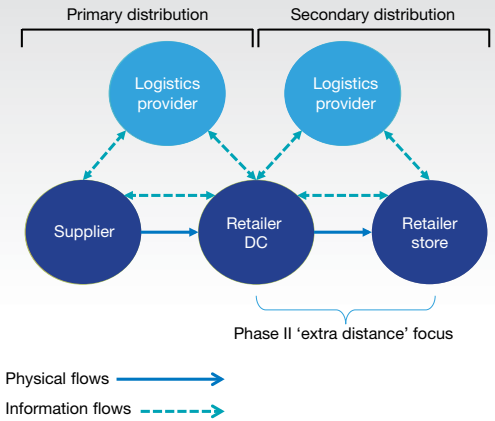


Figure 19: Logistics provider position within FMCG/retailer supply chain

the transport plan was elaborated. Detailed information about these trips was recorded including delivery location, kilometres run, 'extra distance' source, visible cause and root cause. For each source of 'extra distance' calculated in kilometres, frequency and impact were calculated.

To further interrogate the root causes, informal interviews and discussions were held with managers and transport planners within the secondary distribution operations. Following data analysis, feedback was presented to the LSP's management team, which resulted in the validation of the findings and provision of a starting point towards identifying the potential mitigation strategies to reduce 'extra distance'.

Results, analysis and initiatives

Through improved transport planning, Company A decreased 'extra distance' within the supply chain by a further 5.9% – from 6.7% to 0.8% compared to Phase I. This represents an additional cost saving of around R20 million and the elimination of 518 tons in CO_2 emissions between the project phases. Network efficiency improved significantly, with vehicle utilisation improving from 50% to 69% and an increase in units moved per kilometre from 4.63 to 4.72 (See **Table 11**).

Heightened accuracy in transport planning was achieved through three initiatives, throughout which efficiency-driven behavioural change was imperative to maximise impact.

These were:

- Volume forecasting based on historical volumes per outlet instead of an average across all outlets;
- Day-time deliveries were made more dynamic through, for example, revising the plan monthly to ensure improved utilisation of vehicles; and
- Picking time was moved earlier to ensure timeous completion of loading at the DC.

Table 11: Results summary for both companies

	Retailer (Company A)		Manufacturer (Company B)
	Phase I	Phase II	
'Extra distance' per year ('000 km)	11.5	1.3	3.6
'Extra distance' (%)	6.7	0.8	16.8
'Extra distance' costs ('000 R)	22 000	2 470	2 042
'Extra distance' CO_2 emissions (tons)	941	148	109
Total distance per week ('000 km)	172	178	22
Total volume per week	798 000 units	840 000 units	48 000 cases
Average vehicle utilisation (%)	50	69	82
Volume moved per kilometre	4.63 units	4.72 units	2.19 cases

Table 12: Company A, causes of 'extra distance' recorded during both phases

	'Extra distance' (km)		
Cause of 'extra distance'	Phase I	Phase II	Improvement initiatives linked to the reduction in 'extra distance'
Late notification of extra volume to be moved	5 538	1 020	• Volume forecast based on historical volumes per store instead of average across all store regions • Making day-time deliveries more dynamic
Product not loaded at the DC	6 000	288	• Complete picking and sorting of products on time

In terms of 'extra distance' causes, it was found that 'late notification of extra volume to be moved' and 'product not loaded at the DC', as shown in **Table 12**, were the primary issues. At 6 000 kilometre per week, the latter had been the major cause of 'extra distance' during Phase I. Notably, a reduction to 1 020 kilometre per week was achieved.

In addition, through DC process improvement, from unloading of products from supplier collections to the loading of products for store deliveries, products were ready for despatch on time in most instances in Phase II.

Company B faced an interesting challenge, with an associated variable cost of R2 million attributed to 'extra distance', of which 75% was generated directly by customer behaviour. Of the distance travelled, 16.8% was 'extra distance'.

It was found that a 19% transportation saving could be realised by cutting out these kilometres and as indicated in **Figure 20**, with 109 tons of CO_2 eliminated in a year.

In essence, just three factors drove Company B's unnecessary kilometres. Those originating from within the network were 'late notification of

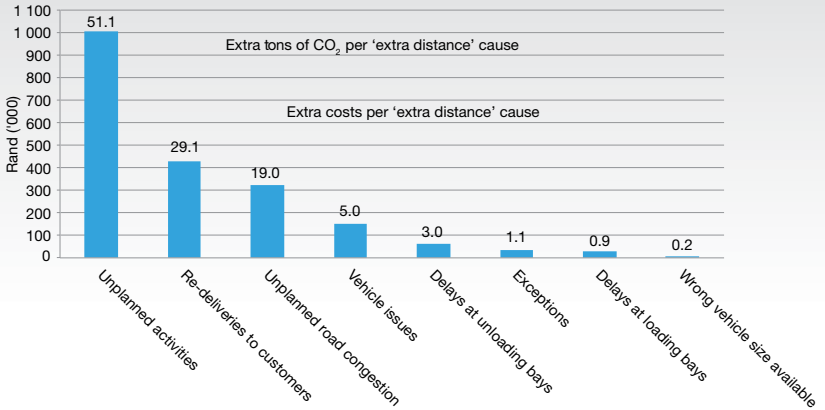


Figure 20: Company B, CO_2 equivalent per 'extra distance' cause

volume to be moved' and 'unplanned returns to customer facilities', both impacted significantly by the customer. The third factor of 'unplanned road congestion' is an external factor that cannot be controlled to a large extent **(Table 13)**.

These three causes of 'extra distance' were linked to the inefficiency originated by the excessive complexity within the network, generated by direct deliveries executed to every single store in the network[60]. In fact, 80% of 'extra distance' travelled was collectively due to delays on delivery, at outlets. One of the large retailers was in the process of establishing a centralised DC, thereby increasing the proportion of deliveries made to customers' DCs. The effect of this on the network's 'extra distance' is due for assessment in 2011.

Table 13: Company B, causes of 'extra distance' recorded

	'Extra distance' (km)	
Cause of 'extra distance'	Kilometres	%
Late notification of 'extra volume to be moved'	1 697	46.7
Unplanned returns to customers' facilities	967	26.6
Unplanned road congestion	669	18.4
Vehicles breakdowns	164	4.5
Delays at unloading bays	102	2.8
Delays at loading bays	29	0.8
Wrong vehicle size	7	0.2

60 Sanchez-Rodrigues, V et al. 2010. Evaluating the impact of uncertainty on FMCG distribution networks: A comparison between the UK and South Africa, Working Paper.

Company B charges fixed rates per volume to its customers equally, regardless of their efficiency, so the costs of unexpected events are assumed by the LSP. The LSP is planning to negotiate a contractually-binding variable rate with its customers. In this way, customers would be encouraged to improve their efficiency, especially in the processes of volume demand forecasting and product unloading[61].

Conclusion

Sustainable supply chain optimisation does not require a choice between making economic sense and ensuring that environmental factors are addressed. It needs a fine balance between both. The concept of 'extra distance' provides a quantitative way in which these two elements can be impacted positively, simultaneously.

Of the transportation-related elements that generate uncertainty, the majority can be controlled for higher levels of predictability. Analysis, paired with practical action plans, can be implemented successfully through close collaboration between a shipper, an LSP and other stakeholders. However, as seen in the cases of both companies, it is only through collaborative efforts that successful performance enhancement within the supply chain can become a reality.

Companies that are serious about improving their business performance by tapping into the supply chain as a change agent should ask themselves and their LSPs challenging questions. These could include: *Where does our supply chain utilise unnecessary assets, resources and time? What can we do to monitor and measure our supply chain waste so that we clearly understand its root causes? How can we apply an approach such as 'extra distance' to enable our supply chain to deliver a sustainable competitive edge? Can we use in-house performance measures such as staff's key performance indicators and LSP service level agreements to maintain a leaner, greener supply chain?*

Ultimately, 'extra distance' provides us with a way to assess how efficient or inefficient a distribution network is, the root causes of blockages within the transportation system and the potential costs and CO_2 emission savings that can be made. 'Extra distance' provides the facts and forecasts for supply chain management teams that are willing to achieve consistent improvement. ■

61 Ibid.

SUPPLY CHAIN RISK MANAGEMENT
PERCEPTIONS AND PRACTICES

Swanepoel G (Volition Consulting Services), Arntzen B (MIT Center for Transportation and Logistics)

Introduction

Between November 2009 and February 2010, the Massachusetts Institute of Technology (MIT) Center for Transportation and Logistics (CTL) led a global survey of supply chain risk attitudes and risk management practices. The research aimed to assess the impact of regional and/or cultural differences on supply chain risk prevention and mitigation strategies.

The importance of the study lies in today's increasingly global supply chain reach. *"Supply chains are going global like never before. And these far flung supply chains now encompass suppliers and customers from many diverse regions and cultures around the world. The safety and performance of many companies' supply chains depends on trading partners that they have never met or have perhaps visited only once"*[62]. Business reality often presents companies with trading partners who not only operate across continents and speak different languages, but subscribe to varying cultural norms and ethics.

The results provide the global and South African logistics industry with initial insights into where both internal and external risk management priorities lie, as well as attitudinal risk-related differences across countries. The survey poses important questions, such as: What should managers of far-flung international supply chains know about the risks in other parts of the world? Which risks occur most frequently? Which risks are considered to be the most important and why? Do your trading partners share your priorities? What should you do if they don't?[63]

Survey methodology

The online survey was completed by just under 1 500 respondents from over 70 'supplier' and 'consumer' countries, with the analysis subsequently split into three phases. Phase I looked at South African-specific risks and related actions, focusing on the internal relationship between risks and causal factors. The aim of Phase II was to broaden this view by comparing South Africa internationally, to better understand global best practise and how we relate to this. Phase III will focus on applied research where specific elements of the survey will be assessed in greater detail, within company-specific contexts, in order to provide practical future scenarios.

To achieve the global reach required, MIT CTL established research teams in 10 regions with the Association for Operations Management for Southern Africa (SAPICS), the Supply Chain Council and IMPERIAL Logistics driving South Africa's participation.

In South Africa, the survey attracted 250 visitors, of which 142 responses were submitted, with strong representation among middle-management level professionals. Though executive-level participation accounted for only between 3% and 9% of the local sample, approximately one third of South African companies that participated would be considered 'blue chip' companies in the global context.

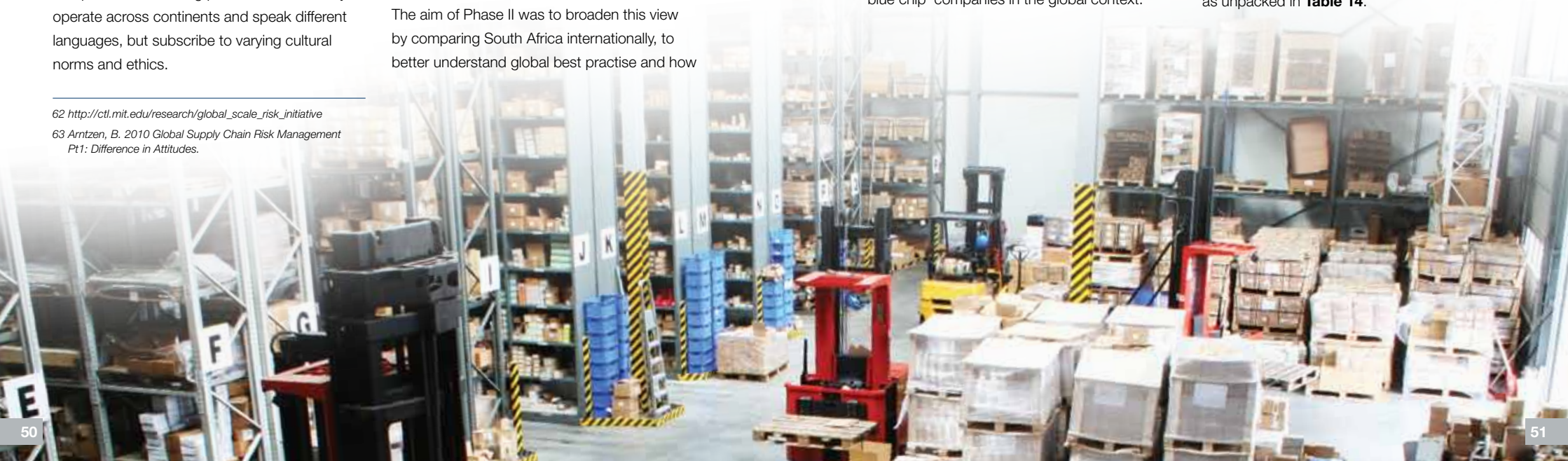
Phase II of the survey, with a focus on international benchmarking, was underway at the time of publication, and will be followed by Phase III dealing with applied research.

Key findings

At the time of the survey, the effects of the global recession were still evident. In South Africa, anticipation relating to the 2010 FIFA World Cup™ was escalating, the market was tackling issues such as regular labour strikes and high volumes of job losses. The Eskom price hikes still in question were high on the business community's radar.

Global perspectives

Looking broadly, key findings can be categorised into three sections, namely attitudinal differences, differing frequencies and priorities, and differences in practice, as unpacked in **Table 14**.



62 http://ctl.mit.edu/research/global_scale_risk_initiative

63 Arntzen, B. 2010 Global Supply Chain Risk Management Pt1: Difference in Attitudes.

Table 14: Different views relating to supply chain risk management

Category	Key international findings	Key South African findings
Attitudinal	• Risk prevention* is more important than preparedness, across most job roles, with only 16% of respondents rating risk preparedness** as being more important. • In terms of risk tolerance***, the majority of respondents considered their company to be successfully mirroring their customers' sense of urgency when it comes to supply chain performance, yet simultaneously rated their suppliers as being mediocre in this regard. The survey noted a disconnect based on these statistics, questioning whether companies are actually performing as well as they believe they are.	• South African respondents replicate these international findings with the majority of respondents believing in a 'prevention is better than cure' outlook. • Interestingly, South African companies also believe that their customers have a better perception of their performance than what the case is in reality, given the differing perceptions of supplier and customer alignment. This correlates with international perceptions, as identified by the survey, however, South Africa still falls into the lower end of alignment perceptions.
Frequencies and priorities	• Internal risks were universally judged to occur far more frequently than external risks. *"Though the frequency and mix of external risks varied significantly from one country to the next, some locations such as Mexico and West Africa seem to have more than their fair share of internal risks"*[64]. • The survey indicated that supply chain and business managers have a 'risk comfort zone', due to the significant majority considering internal risk factors to take higher priority than external risk factors. *"Managers have likely experienced these risks multiple times in their careers and feel empowered to prevent them ... People seem to think about the 'point' impacts of risk events but do not think about their 'network' impacts"*[65].	• In South Africa, internal risks were seen to occur more frequently than risks that are outside the control of the organisation. It could, however, also be argued that internal risks are typically less severe than the likes of protracted labour disputes (strikes) and prolonged electricity supply problems, typical and unique to the external risk environment in South Africa. • Internal operations disruptions (18% rate of occurrence of total disruptions frequency) take first priority when it comes to risk management, with less emphasis on elements that relate to customer/supplier linkages and elements outside the supply chain.
Practical application	• Slow progress was noted in terms of *"maturing supply chain risk management into a bona-fide function"*[66]. Only 32% of respondents indicated that their company has a risk manager or group that is effective, with 18% indicating that dedicated resources were allocated to the function, but that "it was not effective" and 39% indicated that there was no such group.	• According to the findings, South African companies typically work on risk mitigation plans through analysis of incidents and actively work on business continuity and risk management. They would typically not go as far as to simulate risk scenarios and set up the appropriate emergency operations centres.

* *Risk prevention: The measures taken prior to an incident occurring that aim to reduce the possibility of the occurrence.*
** *Risk preparedness: The measures taken to minimise the impact where an incident is imminent or has already occurred.*
*** *Risk tolerance refers to the degree of alignment between the two parties, where one parties will have to endure the effects of the misalignment.*

South African findings

In terms of supply chain risk prevention and mitigation, South Africans have the mindset that 'prevention is better than cure', believing that preventative actions are better directed in a centralised manner, whereas event response actions should be directed through a local, decentralised approach.

As per **Figure 21**, South African companies' most prevalent supply chain risks are 'raw material supplier failure', 'transportation carrier failure' and 'finished goods failure', followed by 'product quality failure' and the impact of the economic recession. In terms of being considered the first most important risk, 'economic recession' rated second after 'raw material supplier failure'. This risk factor grid also identified technological as well as pricing-driven risk.

The majority of companies in South Africa either do not work, or work ineffectively, with suppliers and customers to reduce overall supply chain risk. This proves that significant scope exists for greater collaboration between organisations with a strong risk management mindset.

Disruption within internal operations was rated to be the most frequently-experienced risk needing to be managed (see **Figure 22**), with just about half of this figure noted to take place monthly, weekly or almost daily. Communication-based issues were raised as the third highest risk in terms of frequency, after 'loss of supply of quality materials'. Internationally the top three most frequently occurring risks were 'loss of supply of quality materials', 'internal operations disruptions' and 'drop in demand', respectively.

Similar to global findings, South African respondents were more focused on addressing internal risks, with common factors including 'transportation carrier failure', 'raw material supply' and 'cost fluctuations'. Perceptions of external risk factors included concerns over electricity supply, protracted labour disputes and poor economic conditions.

Figure 23 plots root causes of supply chain disruption, comparing internal (blue) and external (dark blue) factors. Notably, the top four root causes for risk are external factors, with protracted labour disputes identified as the major disruptor of supply chains.

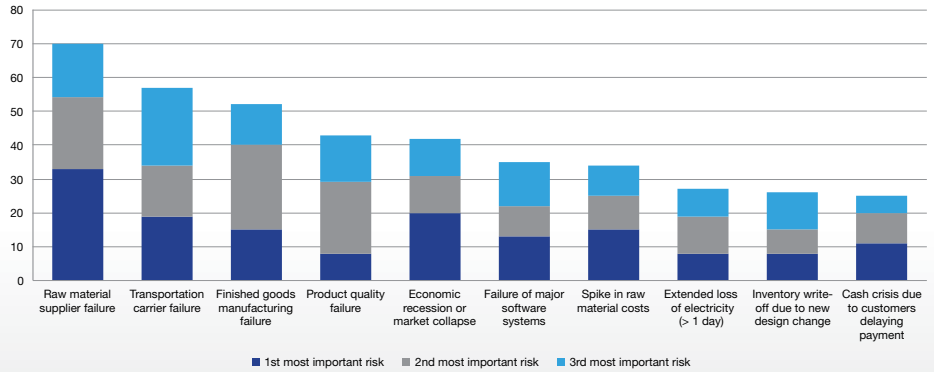


Figure 21: Top 10 supply chain risks, South Africa

64 http://ctl.mit.edu/research/global_scale_risk_initiative
65 Arntzen, B. MIT CTL, 2010.
66 http://ctl.mit.edu/research/global_scale_risk_initiative

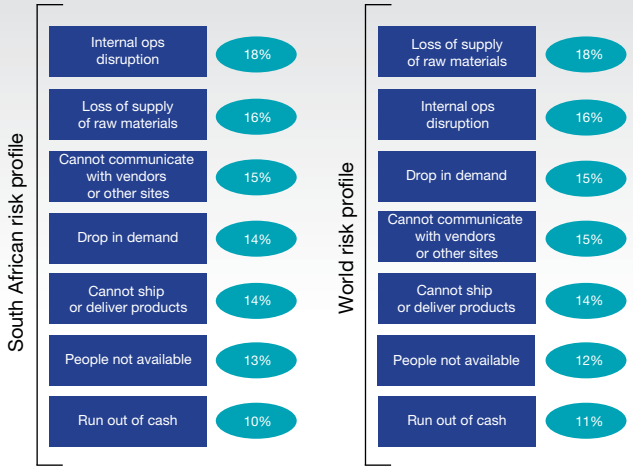


Figure 22: Supply chain risk frequency, South Africa compared with the world average

Heightened supply chain appetite for risk management

When it comes to a preferred risk mitigation approach, 33% of South African respondents believe that a greater focus is required on risk prevention, while only 9% take a reactive stance with the strategic focus on responding to a crisis. Furthermore, 28% of respondents believe in balancing both proactive and reactive stances simultaneously. This not only suggests that too little is being done to prevent risk-generated events from occurring, but indicates incoherent best practice relating to supply chain risk management.

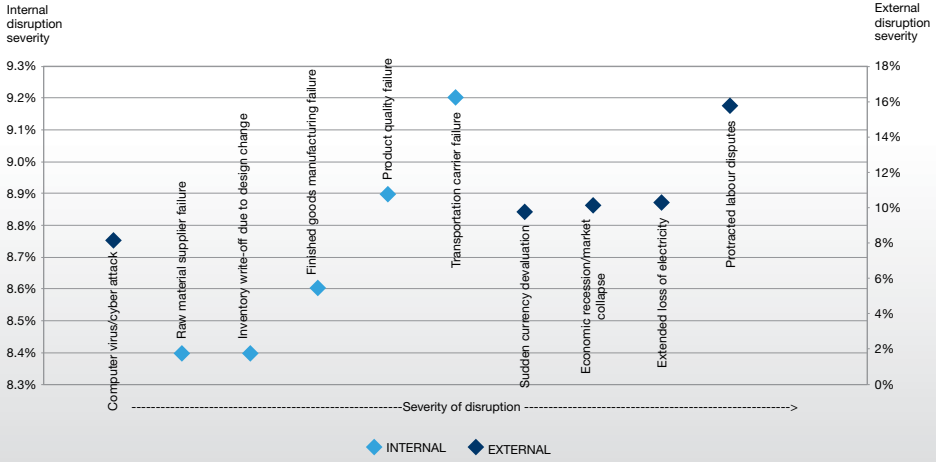


Figure 23: Top 10 supply chain disruption root causes

The survey indicates very low strategic importance being assigned to a dedicated role for supply chain risk management. As a result, *"supply chain risk managers are constantly being pulled in to fight fires to deal with small to large crises all across the supply chain. Having a compelling display of the end-to-end supply chain with the risk pathways highlighted will help management grasp the significance with greater ease."*[67]

From Phase II of the survey (as indicated in **Figure 24**), it can further be concluded that risk factors in South Africa are generally aligned to international perceptions. However, software system failure, finished goods manufacturing failure and extended loss of electricity differ significantly when compared to the world average. This phase also finds that South Africa fairs well when compared to 'consumer' nations. Importantly, worrying trends such as computer virus or cyber attacks, disease or infestation, employee theft and executive misdeed, extended loss of electricity and protracted labour disputes are noted, where risks are rated substantially higher than the supplier nation average.

In light of the pivotal role that supply chains play within company performance levels, it is critical that issues of risk, both internal and external, are evaluated and mitigated, with detailed operational and communications crisis management plans being put in place before a crisis occurs. The impact is far reaching, as companies will be able to better manage inherently unpredictable constituents of any supply chain. ■

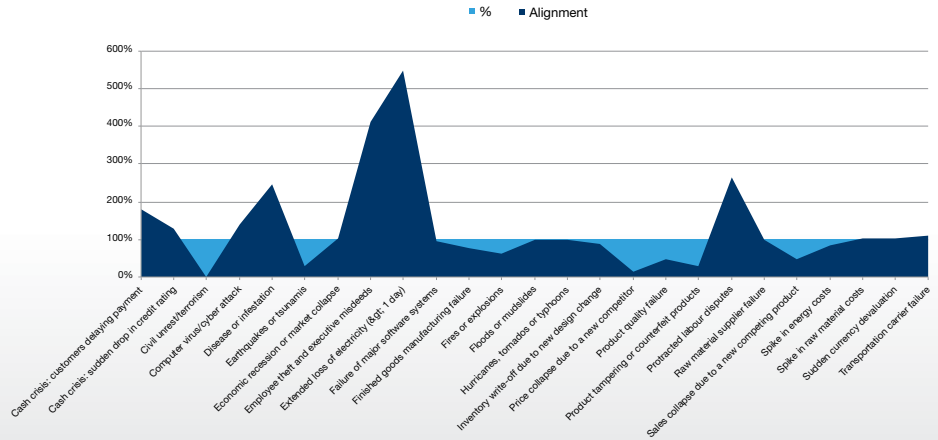


Figure 24: Top supply chain risk factors: comparing South Africa's alignment with the world average

67 Arntzen, B. MIT CTL, 2010

A REFOCUS ON THE SKILLS ISSUE

Kilbourn PJ (University of Johannesburg), Wessels C (IMPERIAL Logistics)

The skills development landscape in South Africa

With people being the central, most critical resource in a company, a close relationship exists between company success and the skills levels of its human resources. A skill is "the ability to do something well"[68], an ability that is strengthened either through qualifications or experience, and/or a combination of both.

It is widely documented that South Africa is experiencing skills shortages across many industries. A recent survey conducted by accounting firm, Grant Thornton, revealed that 34% of privately-owned businesses in South Africa considered the lack of a skilled workforce to have been the biggest constraint on business growth since 2007[69]. The logistics and supply chain industry has not escaped the scarce skills phenomenon.

Just as the 2010 FIFA World Cup™ brought with it high expectations on the job creation and skills development front, especially for the transport sector, so has government's allocation of R846 billion to infrastructural development. Looking back, a certain amount of skills development resulted from the intensive infrastructural upgrading that had taken place. This must, however, be sustained as transport corridor and shipping port development is rolled out.

According to a 2010 World Bank report on an investment climate assessment, South African companies invested around a third less than peer countries in skills training[70]. Not only must business investment be increased, but the problem tackled through focused training and recruitment. As a starting point, it is important to have accurate insight into the types of skills required and the related magnitude of scarcity. However, research is limited and few surveys have covered the issue of logistics skills shortages in-depth.

Logistics and supply chain skills requirements

The issue of skills shortages has featured on more than one occasion in the annual **supply**chain**foresight** study and was already identified as a major problem to supply chain improvement in 2004. Again, in 2008, the study found inadequate skills of supply chain staff to be one of the most consistent challenges of the sample group. The majority of skills shortages were found to be on a functional, operational supply chain level (64% of respondents), followed by supply chain management skills (59%) and supply chain strategy design and implementation (51%)[71].

The most recent information regarding skills shortages, as published by the Department of Labour (DoL), is the National Scarce Skills List 2008 for South Africa. Based on data drawn from 'SETA Sector Skills Plans', it indicates the scarce critical skills of the country. Data, used to validate the scarcities identified from the SETA plans, were also obtained from other government departments including Home Affairs, Education, Trade and Industry, Science and Technology, and Public Enterprises[72].

As detailed in **Table 15**, a number of occupational groupings directly related to the transport and logistics industry feature on the Scarce Skills List. This table also shows the magnitude of scarcity of some of the industry's critical skills and provides a comparison between 2007 and 2008 data[73].

Caution should be taken in reading too much into the Scarce Skills Lists of 2007 and 2008. The lack of more recent data limits the formulation of a clear picture of the skills currently required and prevents accurate trend review. Furthermore, the lists primarily provide insight into scarce skills per occupation type and not per level of skills (low skills, intermediate skills, and high skills as per the National Qualifications Framework) or any other classification of skills.

68 Oxford Advanced Learner's Dictionary.

69 Grant Thornton International Business Report, 2010, http://www.gt.co.za/News/Press-releases/International-business-report/2010/skills.asp

70 The World Bank Group, 2010. South Africa: Second Investment Climate Assessment. 2010.

71 Barloworld Logistics. Supplychainforesight 2008. Research results. South Africa.

72 National Scarce Skills List 2008, Department of Labour, http://www.labour.gov.za/downloads/documents/useful-documents/skills-development-act/Scarce

73 Department of Labour. The National Scarce Skills Lists 2007 and 2008 for South Africa.

Table 15: Multitude of scarcity of critical skills in the transport and logistics sector

Job Description	2007	2008	% Change
Transport services managers	90	70	-22
Air transport professionals	50	185	270
Forklift drivers	*	100	
Freight and furniture handlers	20	380	1 800
Delivery drivers	40	435	988
Marine transport professionals	570	435	-24
Transport and dispatch clerks	570	705	24
Train drivers	*	800	
Couriers and postal deliverers	100	2 000	1 900
Store persons	*	2 245	
Supply and distribution managers, including logistics managers	4 050	2 950	-27
Bus and coach drivers	225	3 190	1 317
Motor mechanics	2 865	4 205	47
Truck drivers	1 025	9 125	790
Purchasing and supply logistics administrators	1 600	9 235	477

** No information provided in the respective year*

Additional detail on the exact types of skills needed is imperative. Based on an extensive literature search, Rahman and Young (2008) identified a total of 62 logistics skills areas, which they grouped into four higher level skill-categories, namely logistics awareness, logistics analytical, logistics information technology, and environmental awareness[74]. This reflects on the complexity of the skills identification task on hand. However, it also provides a useful framework that can be leveraged in further skills shortages research, which should be conducted on a continual basis and should factor in a wide variety of features impacting on skills requirements.

Nevertheless, based on **Table 15**, it is evident that the transport and logistics industry experienced significant skills shortages during 2007 and 2008, with matters deteriorating significantly in 2008. With this industry being a significant role player in the South African economy, these skills shortages must have had a major negative impact on the country at large.

Impacting factors

Various factors impact the need for skills in the transport and logistics industry. To determine the need for skills effectively, it is important to consider, amongst others, economic cycles and employment levels.

When considering the data in **Table 15**, South Africa's economic context was one of strong economic growth, which no doubt impacted employment levels and therefore skills requirements in the industry. The South African Gross Domestic Product (GDP) grew year-on-year by 5.5% and 3.7%, respectively in 2007 and 2008,[75] prior to the market experiencing a sharp decline. This plummet in the market began in the last quarter of 2008 and lasted until mid-2009. As a result, the economy contracted by 1.8% (2009) before recovering to a growth rate of 3.9% in the first half of 2010[76]. According to the 2010 Annual Economic Report of the South African Reserve Bank, the transport and communications sector was one of few sectors to grow its GDP during 2009 (by 0.5%). By the first half of 2010, GDP growth in the industry amounted to 2.8%.

The question remains: How did these economic cycles affect skills shortages in transport and logistics? According to Statistics South Africa's Quarterly Labour Force Survey, Quarter 1, 2010, the transport industry was one of very few industries not to experience job losses between the first quarter of 2009 and that of 2010. In fact, 10 000 industry-relevant jobs were created to reach a total of 767 000 jobs. However, the Quarter 2 Labour Force Survey of 2010 indicated a contraction of 6.3% or 36 000 jobs in the transport industry during the second quarter of 2010. Common sense tells us that a further recovery in the economy will generate the need to fill the gap created by recent job losses. The rate at which this will unfold is however, unclear, as are the types of skills that will be in demand.

A view to 2016

In South Africa, the proposed 'National Skills Development Strategy' (NSDS III) 2011/12-2015/16[77] will guide skills planning and development over the next five years. The NSDS III is informed by key strategic documents, such as the new Medium Term Strategic Framework[78] and the Human Resources Development Strategy of South Africa (HRDSSA II).

Through the establishment of the Department of Higher Education and Training (DHET), public institutions of learning and institutions of skills development now operate under one department. This means that skills development through the Sector Education and Training Authorities (SETAs) and National Skills Fund (NSF) can more easily complement that of public learning institutions. The potential for these partnerships must be realised.

Governmental skills-development priorities

As indicated earlier, current data are inadequate for effective skills-development planning. A sector/industry analysis of skills needs (skills shortages and skills supply), as well as possibilities and constraints in the effective

74 Rahman, S and Yang, L. 2008. Skill requirements for logistics managers in China: An Empirical Assessment. IIMB Management Review, June 2009.

75 Standard Bank Report on World Economy, 2010.

76 South African Reserve Bank, Annual Economic Report, 2010.

77 Framework for the National Skills Development Strategy: 2011/12 – 2015/16, Department of Higher Education and Training: 29 April 2010.

78 Strategic Plan and Medium Term Expenditure Framework: 2011/12-2013/14, The Transport, Education and Training Authority (TETA).

utilisation and development of skills, economic development and employment trends are to be facilitated through each SETA's 'Sector Skills Plans'. Extensive consultation with all stakeholders, including business, will be a key determinant of the credibility of sectoral skills plans. One of the keys to tackling skills shortages successfully lies in broadening access to skills development initiatives for those groups that are currently experiencing various forms of exclusion. These include communities in rural areas, women, people with disabilities, the youth, the poor and those living with HIV/Aids.

Simultaneously, we must raise the levels of expertise across the skills base. The DHET will endeavour to strengthen the schooling system, but will look to industry to provide 'second chance' basic entry-learning opportunities to those who wish to study further, but who do not meet the entry requirements. This will include ABET programmes, as well as foundational entry-level learning opportunities. Government also considers improved access to further education and training (FET) colleges to be a key strategy in providing young adults with employable skills. Corporates need to explore partnerships with FET colleges, thereby providing much needed work experience to learners.

Information and career guidance and support are further priorities. Each SETA is currently required to prepare a comprehensive occupational profile of its sector and guide to employment opportunities, which must be made available nationally. Companies play an important part in application and distribution of this information. A further consideration is for the expansion of research and innovation capacity, to heighten access to high-level programmes in mathematics, science and engineering. Logistics businesses have a definite contribution to make in building South Africa's academic base, through collaboration-based investment.

Historically there has been a tendency to highlight short courses and thereby meet specific needs. In the context of current developmental priorities, programmes which lay a broader foundation for employment in a variety of contexts are imperative. This has led to the notion of 'PIVOTAL' (professional, vocational, technical and academic learning) programmes, i.e. programmes that generally combine tertiary education and/or institution course-work with structured learning at work. This is achieved by means of professional placements, work-integrated learning, apprenticeships, learnerships and internships.

Notably, learnerships through the relevant SETA attract a tax rebate of R60 000 per learner who completes a programme successfully, which translates into a net tax recovery of approximately R16 800. Further, if an organisation places black employees on learnerships to the extent of 5% of the workforce, it achieves maximum points in terms of the broad-based black economic empowerment scorecard learnership element.

Final remarks

Education and skills development are at the core of South African governmental policies, which begs the question: How can companies align their business strategies to embrace developmental priorities and policies, whilst meeting their own skills and talent development needs?

The answer lies in collaboration at various levels. From the identification of and investment in learnerships, internships, apprenticeships and skills programmes, to closer working relations with SETAs, workplaces, academia and social partners. Companies have many options to choose from, including government funding opportunities through SETAs and the National Skills Fund.

For business, incentives are not only financially based, but rewarding as a dynamic future workforce becomes a reality and peoples' individual careers develop. To be successful, skills development needs to take on a 'pay it forward' mindset. ■

DISPLACED RURAL SOUTH AFRICA
RELIEVING SPATIAL SEGREGATION THROUGH ICT

Maritz J (CSIR), Kandle W (SAP Research)

Introduction

South Africa serves as a fitting example of the complex relationships between society and space and it is especially evident when looking at past and present spatial planning, nationally and within towns, cities and rural areas. Past policies resulted in spatial segregation and this is most evident in the construction of the former 'homelands'. After the 1994-elections, the homeland territories were reincorporated within South Africa. Although the political boundaries of these separate territories have been erased, the spatial remnants (see **Figure 25**) remain. These homeland areas still contain nearly 20.1 million residents representing almost 43% of the total population of South Africa[79].

They exhibit traits not normally associated with rural settlements, which include populated areas of high density (81 people per km^2 on average with a maximum of 922 people per km^2), and with many isolated rural settlements not planned with service provision in mind. Residents within the boundaries of the old homeland territories are often far from towns and service centres as well as the main employment areas within South Africa. Some areas are even known for its long distance commuters[80], where residents travel every day to employment opportunities in the main cities. Due to the extent of spatial 'disconnectedness', these areas are also described as 'displaced rural areas'.

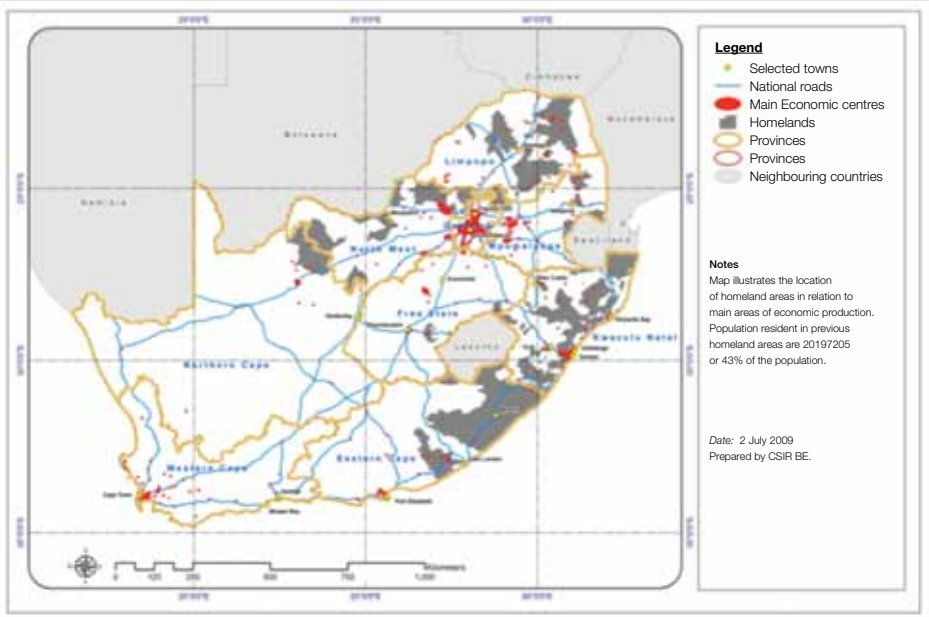


Figure 25: Location of 'homeland' territories in relation to economic centres

Residents of these displaced rural areas are also often the poorest in society, and many are mostly dependant on the financial support of family members working in cities, social grant payments and/or subsistence agricultural practices to sustain their livelihoods. For most people in these displaced rural areas, access to services, information and markets has become a fundamental requirement towards securing a decent livelihood. This applies to economic services, such as agricultural knowledge and credit, as well as to social services such as basic health care and education.

Rural road infrastructure is mostly in a poor condition with some areas unreachable by normal motor vehicles. There is thus a shortage of regular and widespread transport services. For many residents in these rural settings, walking is often the only mode of transport available, as many cannot afford to use motorised transport. In some areas non-motorised transport such as donkey carts or animal-drawn vehicles are used, but speed and range are limited. The reality is that the extent of services and infrastructure needed (including roads) in rural areas is still large and it

79 Geospatial Analysis Platform. 2007. CSIR Built Environment. Pretoria. South Africa.

80 Olivier, JJAB, JJ, 1983. The Apartheid City and the Politics of Bus Transportation. South African Geographical Journal, LXV, pp 124-134.

is unlikely that many areas will be improved in the foreseeable future. The pressure on government to overcome the service backlog has forced officials to look at other, more innovative means to improve people's access to services.

ICTs and service systems to the rescue?

Information and communications technologies (ICTs) have proven extremely valuable in the developed world and has had a revolutionary impact on the way we do business, live and learn – it has in many respects replaced the need for travel to access some services or facilities than would otherwise be the case. Arguably, the two most important ICTs are mobile phone technology and the internet. In the developing world, mobile phone technology has been very successful, but the cost of access to internet services is still very prohibitive, while other problems such as illiteracy and lack of awareness also hamper uptake.

It has been proven in many instances around the world that ICTs can help alleviate poverty, improve the delivery of education and health care, and make government services more accessible to citizens. Many countries, including South Africa, have therefore turned to ICTs to leapfrog the service backlogs, especially in more remote communities. South Africa's government has placed a strong emphasis on ICT sector development through the implementation of its National ICT Strategy. It advocates ICT penetration, particularly for disadvantaged segments of the society. The South African government has, through legislation, created the Universal Service and Access Agency to promote the goals of universal access and service in the under-serviced areas of South Africa.

Universal access indicates a situation where every person has a reasonable means of access to publicly-available telecommunication services. It aims to increase access on an institutional and shared basis, such as on a community or village-wide level. Apart from simply extending telecommunication services, this has also meant taking services to the people in the rural areas or placing facilities where they are easier to reach. Several local examples exist, including multi-purpose community centres (also known as Thusong Service Centres) equipped with computers and internet access, allowing users to source information without the need to travel vast distances.

A more recent development is to involve the communities themselves in the research and development of ICT-based solutions and service systems that address or overcome some of the accessibility constraints they are experiencing. Previously, a large percentage of applications or systems developed for rural communities failed, either through improper design methods or through insufficient involvement of the communities. New approaches, such as setting up 'rural living labs' (RLL), have been initiated to improve the way systems are developed and deployed, thereby attempting to improve the success rate of rural ICT-based systems.

RLLs typically involve setting up long-term relationships with the residents and stakeholders in an area usually consisting of several communities. The following case study illustrates how an ICT-based service system is used to overcome some of the accessibility constraints experienced within a displaced rural setting in the Sekhukhune district.

Case study – Rural informal shops procuring supplies

The emphasis of research conducted by the CSIR and SAP Research was to address the most common problem experienced by small informal general dealers (also known as Spaza shops[81]), namely that of procuring goods.

Typically, the small family businesses that operate within communities sell a limited range of goods, which is irregularly purchased and low-volume supplies (depending on cash flow). To replenish their stock would usually entail closing shop for the day and travelling to the nearest town by taxi or rented pickup to purchase a small number of supplies. This makes the cost of restocking extremely expensive and usually means a day of lost sales.

To overcome this, an initial system was developed that uses mobile phones to order a range of items from a predefined product catalogue. The order is sent via SMS to a local service broker (based at the local community service centre), who combines the SMS orders to create a larger volume, viable trip. A local bread company, operating regularly in the area, was approached and it agreed to act as a logistics service provider for delivery of the Spaza supplies. The combined order is sent electronically to the bread company which, while delivering bread, also delivers the ordered supplies to the individual shops.

The result is that the Spaza shops can be open for longer periods of time while also reducing the cost of procurement, thereby increasing their profit margin. A follow-up project (known as project RUSTICA) aims to expand the products offered substantially. It is moving from an SMS ordering system to using a mobile, collaborative procurement application, which will enable small-scale traders to place their orders electronically using smart phones. Here a large wholesaler provides a comprehensive catalogue of items that the small retailers can choose from. Until now, payment has been cash-on-delivery but electronic means of payment are being included to reduce the risks involved.

A final word

Systems such as these mentioned are part of a new phenomenon: to identify and address specific needs often not relevant in urban or more developed areas. These systems and ICT-based solutions are developed with the help of the users and other local stakeholders, making it more applicable to the local conditions and requirements, which in turn ensures a greater chance of success. It is unlikely that spatial segregation will disappear overnight, but by bringing infrastructure and services to communities through ICTs, one improves the livelihoods of those people still isolated and without the same levels of access than their urban counterparts. ■

*81 A **Spaza shop** is an informal convenience shop in South Africa, often run from home. The purpose of these shops is to supplement the household incomes of the owners or in some cases, can be the sole income for the household. These shops mostly sell everyday small household items. These shops grew as a result of sprawling settlements that made travel to formal (larger) shopping places more difficult or expensive.*

PROFILE OF IMPERIAL LOGISTICS

IMPERIAL Logistics, a division of the IMPERIAL Group (IPL), is a global logistics and supply chain leader that moves business and industry through innovation, inspiration and foresight. An employer of more than 21 000 people internationally, it delivers excellence in end-to-end logistics and supply chain management – enabling blue chip customers in almost every industry to grow in an efficient, proactive and cost-effective manner.

Established in 1975, today the brand is at the forefront of the logistics industry with extensive operations in Europe and Africa, including countries such as Botswana, the DRC, Namibia, Mozambique, Tanzania and Zambia. IMPERIAL Logistics is South Africa's largest employer of industrial engineers and logisticians.

Across South Africa and Europe alone, the Group handles and transports over 110 million tons annually. Internationally, it operates in excess of 6 000 vehicles, and manages around 3 000 sub-contractors with total storage capacity of more than 2 240 000 m^2 and under-cover warehouse capacity of approximately 1 500 000 m^2.

Its southern Africa division, comprising Transport and Warehousing, Consumer Products, Specialised Freight, Integration Services and Africa (detailed below) houses more than 70 operating companies. Furthermore, it has a number of support services companies that offer dedicated IT solutions, bulk fuel procurement, in-house insurance and anti-hijacking and tracking services. IMPERIAL Logistics International, comprising Panopa Logistik, neska, IMPERIAL Reederei and Brouwer Shipping, extends customer logistics and supply chain reach from Europe to the USA, India and the Far East.

IMPERIAL Logistics' differentiators lie in a combination of pre-eminent supply chain management skills and an extensive resource base of transportation, warehousing and storage, as well as best-of-breed technology systems. As a multi-branded business, it is in a position to optimise the benefits, scale and synergies that are derived from large businesses, while retaining agility, customer focus and an entrepreneurial flair that often characterises smaller businesses.

IMPERIAL Logistics is, undoubtedly, fast moving and forward thinking.

About IMPERIAL Logistics Consumer Products (ILCP)

Consumer Products provides an integrated supply chain solution to a wide range of FMCG and retail companies, as well as the agriculture and furniture markets in southern Africa. The Division distributes into top-end retail, mid-market trade and smaller retail environments, and offers express food distribution, selling and merchandising services.

About IMPERIAL Logistics Specialised Freight (ILSF)

Boasting the largest and most modern tanker fleet in South Africa, the Division provides dedicated, specialised transport services to tanker industries throughout Africa. It is the brand leader in the petro-chemical industry, with unrivalled expertise in managing HSEQ requirements. In addition, Specialised Freight provides transport solutions in the FMCG industry for the delivery of milk and other raw materials shipped in tankers.

About IMPERIAL Logistics Transport and Warehousing (ILTW)

This Division delivers full-spectrum logistics and supply chain services throughout South Africa and in neighbouring countries. Services include line-haul, local distribution, consolidation, warehousing and logistics, 4PL solutions, cross-border transport, and end-to-end logistics and supply chain management solutions. These include road, rail and world-class multi-modal solutions.

About IMPERIAL Logistics Integration Services (ILIS)

Integration Services focuses on business process outsourcing (BPO) in the operations management environment including logistics integration, operations planning, procurement, international logistics, security monitoring and asset maintenance services. These service offerings are further enhanced with advanced information technology offerings, including supply chain visibility, tailored software solutions and IT infrastructure. The Division also offers pragmatic consulting and advisory services focused on the design and implementation for strategic, tactical and operational improvements across end-to-end value chains. Internationally recognised as one of the top 20 IATA Agents through Megafreight Services, IMPERIAL Logistics provides freight forwarding and clearing services.

About IMPERIAL Logistics Africa (ILA)

With a track record of more than 40 years of moving business and industry in Africa, the Division has extensive, established operations that span 14 countries across the continent. A leading logistics service provider across most industries in Africa, it manages total cargo flow and end-to-end logistics using the appropriate mode of transport, whether air, sea, rail or road. ILA's integrated logistics services include transportation, warehousing and distribution, sub-routing, cross-docking, hinterland inter-modal services, infrastructure developments such as inland and dry ports, as well as rail logistics. Expansion plans include establishment of operations in East and West Africa, as well as the Great Lake region.

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With a track record spanning more than 65 years, the Council for Scientific and Industrial Research (CSIR) contributes to research development through integrated, multidisciplinary research across diverse areas of science.

The Scientific Research Council Act, 1988 (Act No. 46 of 1988) commits the CSIR to the pursuit of directed research, technological innovation and industrial and scientific development that contribute to the quality of life of the people of South Africa and the region.

The CSIR works closely – either as a partner or a client – with government departments, tertiary education institutions, other science councils, research institutions and a range of private sector organisations locally and abroad.

The CSIR has a staff complement of about 2 300, of which close to two-thirds make up the science, engineering and technology (SET) expertise base. Almost half of the SET base is qualified at Master's level and higher. The CSIR invests in human capital development through bursaries, internships and a range of training interventions to foster young talent and further develop expertise.

The CSIR's main site in Pretoria is a declared national key point of safety. Regional offices in proximity to applicable industries represent the CSIR in other provinces of South Africa. The organisation generates knowledge and research outputs to be applied or transferred as proven technologies through skilled people and projects that add commercial and social benefit.

Specific areas of focus are the built environment, health, energy, the natural environment, defence and security, as well as the needs of industry. These areas are underpinned by key enabling technologies such as information and communications technology, photonics, robotics, materials sciences, optronics and biotechnology, as well as leading scientific infrastructure.

Built environment

The built environment and infrastructure are powerful drivers of socio-economic development. Economic growth depends on, among others, quality transport infrastructure (such as roads, airports, railways and harbours), infrastructure for power generation and information and communications infrastructure. In addition, the effective operation of infrastructure relating to traffic management and effective logistics is crucial to economic welfare.

In the built environment arena, the CSIR supports the country's competitive performance and the welfare and quality of life of its people through knowledge-generation for the development of an efficient and globally competitive built environment system. Most of the CSIR's research and development (R&D) in the built environment arena resides in one of the organisation's operating units, namely CSIR Built Environment. The unit is situated on the CSIR's Pretoria campus, Gauteng, with a regional office in Stellenbosch, Western Cape.

CSIR Built Environment aims to be the premier R&D organisation in South Africa in the planning, design, construction, maintenance and management of the rural and urban built environment and its interaction with people.

R&D is conducted in collaboration with a number of local and international partners at universities and research institutions. Relationships are nurtured with a number of national and provincial government departments and parastatals, while opportunities are actively pursued to establish new relationships in the private sector.

As a key R&D partner of the public sector, CSIR Built Environment aims to provide technology solutions that will impact positively on the quality of life of the people of South Africa. Such solutions may assist government with the challenges of service delivery in a number of areas. Key priority areas for the next year include:

- Infrastructure design, materials and construction;
- Integrated planning of the built environment and modelling of complex environments; and
- Strategic infrastructure operations, municipal service delivery, modelling and management especially in housing, asset management, traffic management, public transport and logistics.

The CSIR's expertise in the built environment domain is consolidated in five clusters, each concentrating on specific research areas:

- Building science and technology;
- Infrastructure engineering;
- Infrastructure systems and operations;
- **Logistics and quantitative methods**; and
- Planning support systems.

Logistics and quantitative methods

The CSIR applies a multidisciplinary approach to conduct innovative R&D in the areas of logistics and supply chain management, and complex decision-aiding, using mathematical and statistical modelling. Quantitative methods have proved to be useful in many applications, with some being highly complex and challenging, and others requiring high levels of innovation. Expertise used in this area includes optimisation, stochastic process simulation, forecasting, statistical modelling, development of indicators, spatial modelling and geographical information systems, standards and their development, supply chain research and complexity science. Specific research areas include statistical modelling and analysis and advanced modelling and supply chain research.

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PROFILE OF STELLENBOSCH UNIVERSITY
CENTRE FOR SUPPLY CHAIN MANAGEMENT

The Centre for Supply Chain Management (CSCM) is an academic, consultative research centre within the Department of Logistics at Stellenbosch University. It creates value for global and local organisations and businesses.

The Centre facilitates a symbiotic relationship between the academic development of supply chain management theory and the practical application of the theory. It provides clients and the community with cost-effective research solutions in the field, but at the same time produces results that are publishable and contribute to the discipline. The CSCM team (core staff and a complement of associates) has provided successful consulting interventions to a number of leading South African and multinational companies and provides continuous strategic guidance to various small and medium-sized clients.

The core competencies provided are in the field of supply chain strategy, business strategy and positioning, market and economic research, freight flow modelling and transportation planning.

For enquiries about our services, contact:

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