





Executive Summary

☐ THE BIG PICTURE

The performance and growth of the South African logistics industry are both inputs to and outflows from the performance and growth of the South African economy – especially in the primary and secondary sectors. The exchange rate, inflation rate and interest rate directly impact the cost performance of the industry. Other macroeconomic issues such as the structure of the South African economy, balance of payments, budget deficits and the human resource problem affect the economy as a whole, which influences the demand for logistics services.

Simultaneously, the performance of the logistics industry - specifically the cost of logistics - has a bearing on the global competitiveness of South African industries. This year's survey looks back over a decade of measuring logistics costs while breaking ground by providing, for the first time, a forecast of the current calendar year's costs. In 2012 the absolute cost of logistics was R393 billion (showing that the estimate for 2012 published in the 9th State of Logistics[™] survey deviated by only 3%). Logistics costs are estimated to have been R423 billion in 2013 and is forecast in 2014 to be at least R456 billion, R470 billion if fuel inflation is 15%, or even more if fuel inflation exceeds 15%.

Logistics costs as a percentage of GDP have remained at a stable level of 12.5% for 2011 - 2013 due to the growth in the tertiary sector and are forecasted to show a slight increase in 2014 depending on the magnitude of fuel inflation. However, logistics costs as a percentage of transportable GDP have grown significantly over the past four years. A deeper investigation of individual cost components and cost drivers show that the increase in logistics costs is perhaps not so much the result of deteriorating efficiency in the industry but the disproportionate growth in cost drivers - especially fuel. To change the trends in underlying cost drivers or significantly mitigate their impact requires more than just operational efficiency enhancements. It requires bold steps in addressing the ingrained issues that stifle the economy as well as new directions in managing supply chains.

☐ TRENDS IN SOUTH AFRICAN SUPPLY CHAINS

South African supply chains have moved beyond survival mode to optimised mode, where costs, inventories and lead times have been minimised within individual supply chain functions. End-to-end integration of supply chain functions is the next major shift required in South Africa to make business more customer-centric and competitive.

Affecting this requires radical changes in how supply chain partners collaborate and how information technology is leveraged to provide end-to-end visibility and real-time decision making. An integrated supply chain approach unlocks logistics efficiencies that were previously unavailable as illustrated by Nissan SA's recent successes.

☐ CRITICAL LOGISTICS ENABLERS

While South African companies need to change the way they manage their supply chains, the public sector needs to create an enabling environment for effective logistics. Appropriate logistics infrastructure and a greater drive towards intermodalism are key enablers to reduce costs and improve performance in South Africa's logistics industry.

Investment in rail, road, port, pipeline and airport infrastructure continues to be a high priority for the country with hundreds of billions of rand invested annually in various projects. As is the case globally, funding for mega infrastructure projects is a significant constraining factor, thus public private partnerships (PPPs) are becoming essential to realise the country's ambitious infrastructure expansion plans. Transnet in particular is actively pursuing private sector engagement to drive forward its plans to promote intermodalism. The private sector

is greatly interested in working together with the public sector to promote intermodalism and infrastructure development. Great consideration must, however, be given to the risk, level of involvement and true financial viability of projects before companies can commit to partnerships.

Transnet's aggressive strategy to win back rail-friendly cargo over the past few years is starting to show results in the annual freight-flow statistics. By providing additional capacity and improving reliability on the bulk mining and agriculture lines and successfully implementing intermodalism, many tonnes could be shifted from road back to rail.

The country's national road network has remained in a good condition between 2009 and 2013 under the jurisdiction of SANRAL. Unfortunately, many provincial road networks have deteriorated considerably – partly due to the accelerated wear caused by trucks carrying rail-friendly freight. Analyses show that by focusing first on upgrading 'Poor' and 'Very poor' sections to a 'Fair' condition will save more vehicle operating costs than upgrading 'Fair' roads to a 'Good' or 'Very good' condition. The institution of the Provincial Road Maintenance Grant (PRMG) on 1 April 2014 is expected to spur a turnaround in provincial road asset management.



☐ TRANSPORT EFFICIENCY

Fuel costs are by far the most significant and volatile cost driver in transport (and therefore logistics) costs. Despite expectations by some that the crude oil price may actually decrease in the short term. South Africa's diesel price is also very dependent on the exchange rate and additional levies added to the base price of fuel. Calculated scenarios show how sensitive overall logistics costs are to changes in the exchange rate and crude oil price. Instead of trying to control economic drivers outside the industry's reach, drastic changes should be made to reduce the overall demand for fuel. Shifting freight from road to rail would have a decided effect on fuel consumption, but the fuel efficiency of South Africa's road transport sector still offers great margins for improvement. Externality costs, especially emissions and accident costs, will also be greatly improved by reduced fuel consumption and congestion, and better road safety.

Smart Trucks, a product of the performance-based standards (PBS) initiative driven in South Africa by the CSIR, is a road transport initiative that holds great promise for increasing transport efficiency in tandem with modal shift imperatives. Demonstration projects have shown average improvements in fuel efficiencies of 14% along with a drastic reduction in road wear and larger payloads which result in fewer trips. Full-scale adoption of PBS and encouragement of Smart Truck technology by government is expected to

result in about 15% – 20% of road freight using this more efficient technology. This would have a significant impact on national fuel consumption, emissions and congestion on freight corridors.

☐ THE HUMAN BACKBONE

Undoubtedly a lack of skilled personnel at all levels hampers the performance of supply chains. From industry surveys it appears that tertiary degrees and professional certifications do in fact teach students the required 'hard' skills for day-to-day supply chain work, but there is a great gap in terms of 'soft' skills and practical exposure. In comparison to other BRIC countries the quality of South Africa's tertiary degrees in the field are on par, but membership of industry associations and professional certifications lag behind. This indicates that a critical gap can be filled by organisations such as SAPICS that provide a platform for industry exposure, networking, knowledge sharing and professional certification.

Only about a fifth of students currently study supply chain-related degrees due to a passion for the industry, with other motivations being more discipline-generic. This indicates that perhaps more needs to be done to show students what supply chain management is in the working environment to ensure the right candidates are drawn and graduates are not lost to other industries.

☐ CONCLUSION

The global economic situation and rising cost drivers spell out increased competition and tighter margins. Thus driving down the cost of logistics, making South Africa more competitive and capitalising on growth potential in Africa and global commodity

markets will require no less than BOLD STEPS FORWARD. Greater supply chain integration, modal shift, transport efficiencies and successful PPPs will require proactive effort, courage and innovation from both the private and public sectors.





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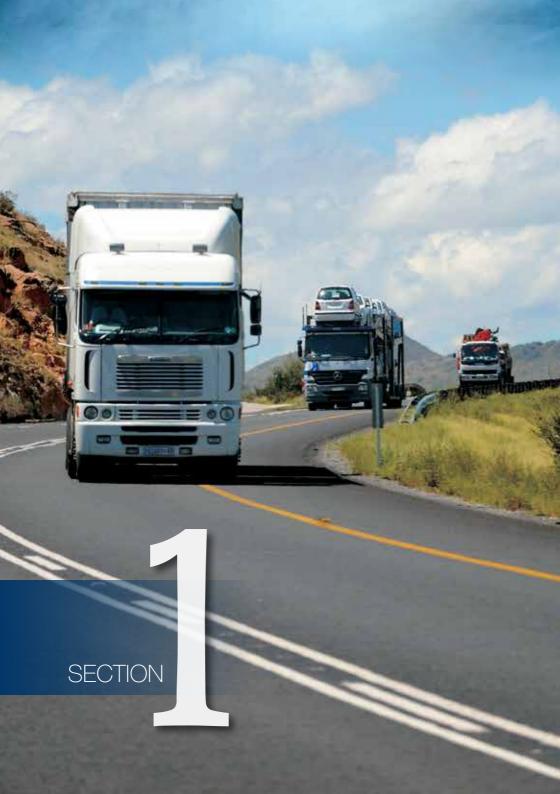
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The big picture

THE LOGISTICS PIECE IN THE ECONOMIC PUZZLE

Any economy, independent of its size, operates within the framework of government policies. Therefore, planned business strategies take into account and adhere to government policies. In South Africa the labour dispensation, health and safety as well as environmental regulations are important aspects of government policies that are taken into account. However, the most important aspects are the monetary and fiscal policies that provide any economy with the broad guidelines within which it will have to operate in any given period.

In this regard, it has to be realised that the South African economy remains a very open economy and is to a large extent exposed to international economic, financial and commodity market trends. It is therefore no surprise that in recent years our authorities have always indicated that these international trends have influenced and still do influence their decisions.



☐ INTERNATIONAL ENVIRONMENT

Planning and decision-making paradigms are very different between the public and private sectors. Key differences relate to the scale of investment, geographic boundaries of decisions, the consensus and approval processes, planning horizons and timing, the objectives of the decisions and the decision-making attitude. Nonetheless, there are six important international trends taken into account by the public and private sectors alike when planning policies and strategies.

Growth prospects

Forecasts predict that most major industrialised economies will show improved. but modest real growth in 2014 and 2015 with an anticipated global growth of less than 3%. Notably, China, the second largest economy in the world, is facing a further slowdown with growth forecasts of less than 7.5% in 2014 and approximately 7% in 2015. Although modest, no recession is anticipated in the next two to five years. Given the expected growth in the short term, international trade is anticipated to show positive, albeit modest expansion. An increase in international growth holds promise for South Africa's strong export sector in terms of improved business opportunities, but it will remain a very competitive environment.

Unemployment

Although unemployment is declining in the major industrialised countries due to positive real growth, it is still considered to be at unacceptable levels in most. In the US, unemployment is at just more than 6.5%, in the UK at just more than 7%, in the European Union at 12% with some countries like Spain and Greece at levels of more than 25%, while China and Japan have unemployment rates of approximately 4%. The focus of the authorities in these countries remains to support growth in an effort to cut unemployment levels further or prevent them from rising from current levels in the case of China.

Inflation

Inflation remains under control in all the major industrialised countries as well as in China. Over the next two years, inflation will remain at levels of approximately 2% in most of these countries. Currently fears exist that the European Union could even experience some deflation in coming months and even years.

Interest rates

Given the outlook for modest real growth as well as inflation remaining under control in most of the major industrialised countries and in China, indications are that short-term interest rates will remain stable at current low levels up until at least the end of 2014. Forecasts indicate that US long-term interest rates will rise modestly in the following two years and will influence the trend of long-term interest rates in the other countries as well.

Commodity markets

Although commodity markets benefit from forecasted global growth, China remains one of the most significant influencers due to the

sheer magnitude of its commodity demand and imports. Moderated growth in China and a drive from Chinese authorities to redirect consumption expenditure domestically could taper imports. The boom period evidenced from 2003 to 2008 is something of the past and competition in commodity markets will intensify. Logistics plays a major role in giving countries the competitive edge in these markets.

Energy

The cost of energy plays the greatest role in transportation costs. Recent political unrest in the Middle East. North Africa and now the Ukraine and Russia spurs price volatility for oil and natural gas. Nonetheless, forecasts indicate that the growth in the supply of energy in the next few years - oil, natural gas, coal, nuclear, wind, solar and biofuels - will be stronger than the growth in the demand for energy. Therefore the dollar cost of energy is expected to decline in the following five years. In a country like South Africa, however, the cost of energy will also be dependent on the value of the currency. If the rand weakens more than the dollar cost of energy, it will still have a negative impact on the costs to be borne by the local logistics industry. In addition, the cost of electricity in South Africa depends greatly on Eskom's capacity to service demand, not only the dollar price of commodities like oil.

☐ SOUTH AFRICAN CONTEXT

Over the past 20 years, growth of the South African economy has relied mostly

on consumption expenditure. This was the result of government policies supporting demand rather than production in the domestic economy. Demand found support from central government cutting taxes for lower income groups, expansion of welfare payments to large and growing sectors of the population, easy credit being available at some stages, cutting interest rates to relatively low levels and the granting of salary and wage adjustments in excess of the inflation or productivity rates. At the same time, the business sector had to cope with service tariffs rising at rates in excess of the inflation rate, volatility in the financial markets - especially the foreign exchange market – strikes disrupting production, salary and wage settlements in excess of the inflation rate and productivity improvements and the abrupt cut in tariff protection following the 1994 election.

The huge demand-supply imbalance in South Africa is serviced by imports of mainly manufactured and consumer goods. The value of these imports is far greater than the value of the millions of tonnes of bulk commodity exports the country sells to finance its demand. Add to this the fact that these imports and exports travel very far with the primary demand centre, Gauteng, about 600 km from its nearest port and the sources of export commodities – coal, iron ore and manganese in particular – deep in the interior. South Africa's economic setup is highly transport intensive. A short-sighted view may argue that more demand for logistics is good



for the industry, but this is not true. A transport hungry country has a far higher landed cost to the consumer (to accommodate increased logistics costs) and is a less attractive environment in which to do business. Seeing as the logistics industry exists purely because companies buy and sell goods and services, whatever hurts the economy hurts the logistics industry.

On the flipside of the coin, logistics has a role to play in changing the underlying structure of the economy. Government, through the Department of Trade and Industry (the dti), is driving an agenda to increase the country's production output through the National Development Plan, the Industrial Policy Action Plan and a number of initiatives stemming from these such as the designation of special economic zones and tax incentives for research and development expenditure. The logistics industry can facilitate or hamper these initiatives greatly by either being proactive about creating additional service capacity and improving the cost of logistics, or not.

The following challenges hamper growth in South Africa:

Balance of payments

With imports being far higher in value than exports the country lives beyond its means, leaving the trade account of the balance of payments showing large and rising deficits. Added to this deficit is the traditional deficit of the services account, taking into account mainly dividend and interest rate receipts

and payments as well as tourism. In 2013 this resulted in a current account of the balance of payments deficit of just less than R200 billion.

An inflow of mostly short-term foreign capital finances this deficit. Unfortunately South Africa is not attractive to large volumes of long-term capital and the short-term nature of our inflows makes the country vulnerable to sudden reversals of these capital flows. Short-term capital can be withdrawn almost overnight not only due to developments within the domestic economy, but also due to international developments that are not controlled or foreseen by us. This leaves not only the balance of payments vulnerable, but also the domestic financial markets and has implications for the development and refurbishing of capital-intensive organisations such as Transnet or South African Airways. It also has implications, of course, for road transportation as the cost of purchasing new or replacing old fleets of trucks becomes more expensive and uncertain in volatile financial markets.

Therefore, South Africa needs to focus on the benefits of improved export earnings by selling to the larger world markets. Better growth rates, improved living standards and more balanced and stable financial markets are some of the benefits derived from enhanced export earnings. Improved financial stability makes it easier to plan and is likely to lure more capital inflows from abroad.

Budget deficit

Since 2009, South Africa has been facing large central government budget deficits. In the latest financial year, this deficit was 4% of the gross domestic product (GDP), compared to 4.3% the previous year. If it is to be sustainable in the long-term, this deficit should be 3% or less of the total economy. Furthermore, it is of concern that the focus of government spending remains on social security and salaries and wages.

The budget indicates that more than R800 billion is to be spent on infrastructural development, but it remains doubtful as to whether these projects will be executed on time. In general, it appears as if government's focus remains rather on stimulating consumption by way of social security payments as well as creating jobs within the public sector rather than in the private sector. Currently about 16 million people, or just less than a third of the population, are dependent on security payments. Is this situation sustainable in the longer term? It would be better to establish an environment where the private sector can be competitive, profitable and create jobs, than to expand social security payments every year.

The rand

The rand remained volatile up until the general election held on 7 May 2014¹. It is affected by international and domestic political and financial developments,

the in and outflow of foreign capital as well as the labour unrest in the country. The outcome of the election can also influence the value of the rand if the ruling party loses more than anticipated support and this affects government policies. The international and domestic foreign exchange markets remain volatile in the short as well as the long term.

Inflation

A forecast of the average inflation rate, as reflected by the consumer price index (CPI), is that it will rise above the 6% target level in 2014. Current forecasts are that the average inflation rate will be less than 6% in 2015. The upward pressure on prices emanates mainly from the weakness of the rand, tariff increases of more than the inflation rate as well as salary and wage increases of more than the inflation rate or productivity improvements. Forecasts of the production price index, that provide better information about the cost pressures in the business sector, indicate levels of approximately 7% in 2014 and just more than 5.5% in 2015.

Interest rates

Indications that the inflation rate will rise further, prompted the Reserve Bank to increase its interest rate by 50 basis points. This resulted in the prime lending rate charged by the commercial banks to rise to 9% from 8.5% and lead to speculation that local interest rates could rise further in the rest of the year as well as in 2015.

¹ At the time of going to print the impact of the election results on the rand was not yet apparent.



However, the weakness of the domestic economy as well as the unacceptably high unemployment rate limits the possibility of increasing interest rates. Long-term interest rates are influenced by international capital market trends, the in or out-flow of foreign capital to and from South Africa as well as the strong demand expected from the public sector infrastructural spending in the next three years or more. It will be more expensive to do business in South Africa in general if interest rates continue rising and in the logistics industry in particular, as inventory carrying cost would increase proportionately.

Human resources

South Africa spends more than 20% of its budget on education. It however remains doubtful whether this money is well spent. It is plainly visible across industries that the current education system does not provide the human skills needed in the public and private sectors. Without the appropriate human capital the country will not sustainably obtain a growth rate of more than 2-3%, which in turn will cause a further rise in the official unemployment rate of 25%. Skills are either unavailable due to an inadequate education system or unattainable due to unrealistic wage requirements and stringent employment regulations.

☐ GROWTH PROSPECTS FOR THE SOUTH AFRICAN LOGISTICS INDUSTRY

The logistics industry benefits from growth in the domestic economy as well as growth in international trade. Modest real growth forecasts both globally and at home mean intensified competition across the board. Logistics will play a pivotal role in making South Africa more globally as well as regionally competitive. The private sector appreciates the role supply chain management (of which logistics is a major constituent) plays as creator of competitive advantage. In the latest supplychainforesight² survey by Barloworld Logistics, 55% of respondents ranked "Using supply chain as more of a competitive advantage" as one of their top three strategic business objectives. Furthermore 83% and 54% of respondents ranked "Growth and expansion into new markets" and "Introduce new products and services into my business", respectively, as business objectives – indicating a keen drive from South African freight industries to expand their business.

The question remains, however, how competitive and efficient the South African logistics industry really is. In the most recent biennial report of the World Bank where the logistics performance of countries are determined through surveys and compared,

the point is made very strongly that "if service delivery is poor, good physical connectivity is not enough"3. The Logistics Performance Index (LPI) of South Africa has decreased to 34th out of 160 countries (LPI 3.43) from 23rd out of 155 countries (LPI 3.67) two years ago. Not only is it the first time South Africa is not positioned within the first 30 countries, it is also the lowest position since 2007 when the World Bank started these surveys. Of the six factors considered in determining the LPI, customs (ranked 42nd compared to 26th in 2012) and tracking and tracing (ranked 41st compared to 16th in 2012) are the worst for South Africa strengthening the point around service delivery. However the infrastructure factor for South Africa is ranked 38th compared to 19th in 2012, clearly decreasing significantly as well. Both good service delivery in the logistics environment and good infrastructure are under pressure in the country. Attaining 34th position out of 160 is still reasonably good but the indicators are all going the wrong direction and this should be a matter of concern.

On a more granular level, in the 2014 supplychainforesight⁴ survey, individual companies ranked the following as the top South African supply chain and logistics constraints:

- Cost of transport
- Ineffective processes and systems

- Reactive vs proactive approach
- Supply chain information and intelligence
- Internal and external silo-based mentality
- Lack of overall supply chain strategy and tactics
- · Availability of supply chain skills
- Efficiency of ports and harbours
- Labour unrest
- Reluctance or foresight to change/innovate

LOGISTICS COSTS AND EFFICIENCY

From the first to the eighth edition of the State of LogisticsTM survey for South Africa, logistics costs were reported with a two calendar year lag (i.e. in the 8th State of LogisticsTM survey published in 2012, the 2010 logistics costs were published). The reason for the reporting delay was the time it takes to collect and process the economic and freight-flow data that are the basis of the model. Much of the required data are only released towards the middle of the following calendar year and then require months of work to process.

To make research more current and relevant in the 9th State of Logistics™ survey, published in June 2013, the researchers adapted the methodology to also produce an estimate of the previous calendar year's (2012) costs. This was done by estimating 2012 freight flows based on the known data of two calendar years ago (2011) and then

³ Arvis. J-F., Saslavsky, D., Ojala, L., Shepherd, B., Busch, C. and Raj, A. 2014. Connecting to Compete: Trade Logistics in the Global Economy: The Logistics Performance Index and its Indicators

⁴ Barloworld Logistics. 2014. 2014 **supply**chain**foresight** – The rise and fall of customers and companies



applying the actual cost drivers for 2012. This estimation proved satisfyingly accurate for a first attempt – only missing the mark on total cost of logistics by 3%.

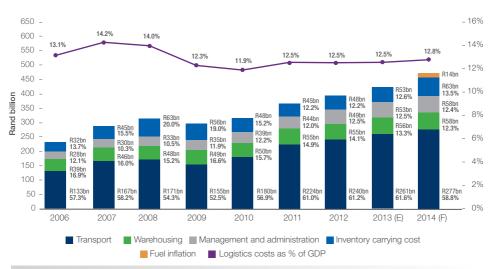
In the 10th State of Logistics™ survey this is taken one step further – forecasting the cost of logistics for the current year, subject to fuel inflation. The forecast uses the projected freight flow volumes and cost drivers. Fuel is the most volatile of all cost drivers and has a significant impact on total logistics costs, hence in the forecast, fuel inflation is modelled separately⁵.

The total cost of logistics in 2012 was R393 billion; the 2013 estimate is R423 billion and the forecast for total cost of logistics for 2014 is R456 billion, if the fuel price is equal to the average of the 2013 fuel price. A fuel price increase of 15% from the 2013 average would result in an increase of R14 billion in 2014 transport costs, amounting to R470 billion for total logistics costs.

Figure 1 shows the component breakdown of the cost of logistics over the past 10 years with an estimate for 2013 and a forecast for 2014.

FIGURE 1: Total national logistics costs and the components from 2006 – 2014 (F).

Source: Stellenbosch University

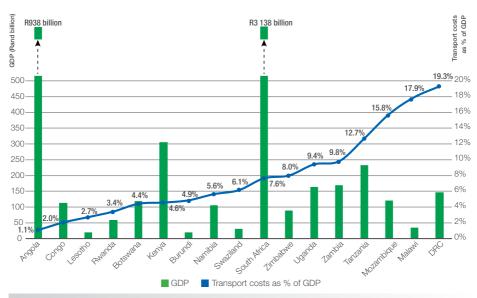


5 A GDP growth rate of 9% is predicted between 2013 and 2014. The average price of diesel for 2013 was R11.99 per litre. On 15 April 2014, the wholesale price of diesel was already R13.35 – an 11.3% increase from the average. Assuming an upper limit of 15% growth in the diesel price is, therefore, conservative. The largest cost component of total logistics costs throughout the past decade has always been transport costs. In 2012 transport costs accounted for 61.2% of logistics costs, in 2013 this percentage is estimated at 61.6%. In 2003, the global average for transport costs' contribution to total logistics costs was 39%. The fact that South Africa is a spatially challenged economy is one of the primary reasons for its high percentage. In the USA, which is also considered spatially challenged, transport costs' contribution to logistics costs have been more than 60% since 2003. The primary cost drivers for transport costs are fuel and wages (see Figure 17, Section 4).

Transport costs as a percentage of GDP equated to 7.6% in 2012. Comparing this to a selection of other African countries in proximity to South Africa highlights interesting findings. Figure 2 shows the GDP and the transport costs as a percentage of GDP for 17 African countries for 2012.

Angola and Congo have very low transport costs as a percentage of GDP due to the heavy reliance on crude oil exports that take place by sea and therefore do not add to land transport costs, but contributes to the GDP. Botswana and Namibia both export high-value precious stones that increase the GDP but do not contribute significantly to land transport costs.

FIGURE 2: Transport costs as a % of GDP for selected African countries. Source: Transnet.



- 6 Roberts, P.O. 2003. Supply Chain Management: New Directions for Developing Economies. Presented at the PSD Professionals' Forum.
- 7 Compiled from annual State of Logistics reports as published by the Council of Supply Chain Management Professionals (CSCMP).



Each country's underlying economic structure has an influence on its relationship between transport costs and GDP, therefore one should be careful to make rash comparisons without more in-depth research.

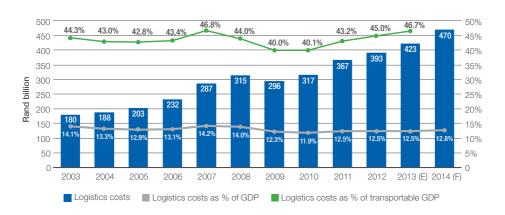
Total logistics costs as a percentage of GDP observed a decreasing trend from 2008 to 2010. Interestingly, after an increase to 12.5% in 2011⁸, this percentage remained constant for 2012 and is estimated to remain constant for 2013 as well. In 2014 it is likely to increase only by a few decimal points, due primarily to fuel inflation (12.8% of GDP if the average fuel price in 2014 is 15% higher than the average in 2013).

Logistics costs as a percentage of GDP have three underlying drivers. If the GDP increases but the transport required to earn that GDP does not increase proportionately, the country is effectively earning more GDP per tonne-km, lowering the percentage. This is typically observed when the tertiary sector grows as it does not require much logistics.

Therefore one must also consider logistics costs as a percentage of transportable GDP⁹; this has increased quite significantly since 2010, standing at an estimated 46.7% of transportable GDP in 2013.

FIGURE 3: Logistics costs as a % of total and transportable GDP.

Source: Stellenbosch University.



⁸ Revised GDP figures from Statistics South Africa have been used and therefore percentages may differ slightly from percentages reported in the 9th State of Logistics™ survey.

⁹ Transportable GDP is the GDP that emanates from the primary (agriculture and mining) and secondary (manufacturing) sectors, thus excluding the tertiary (services) sector.

FIGURE 4: Logistics cost components per tonne of freight (deflated).

Source: Stellenbosch University.



An increase in logistics costs as a percentage of transportable GDP could mean that either more tonne-km are required to transport the same value of goods – i.e. logistics are becoming less efficient, or that the same number of tonne-km are required but the cost drivers are growing faster than the commensurate growth in the value of the goods.

Figure 4 shows the deflated logistics cost components in rand per tonne over the past decade. For warehousing, management and administration and inventory carrying costs, the long-term trend has been virtually constant. Transport costs show a slight overall increase since 2003 with a slight decrease over the past three years.

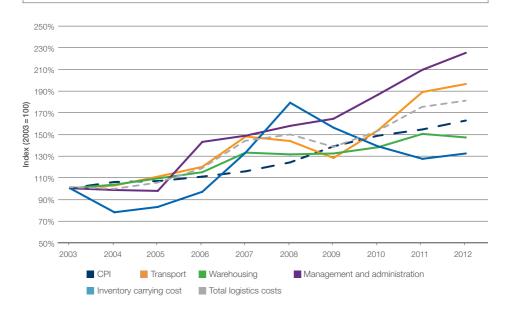


Figure 5 shows the growth in cost components relative to the consumer price index (CPI). Growth in warehousing and inventory carrying costs was below inflation for the past few years whereas transport costs have recently grown at a higher rate than inflation. The soaring price of fuel is regarded as the primary culprit in growing transport costs while record low interest

rates and increased efficiencies in inventory management practices are credited for the slower growth in warehousing and inventory carrying costs. The trend in the growth of management and administration costs is attributed to more employees (excluding drivers) in the transport sector and a growth in the wages of these individuals that is above the inflation rate.

FIGURE 5: Growth of logistics cost components compared to CPI, 2003 – 2012.

Source: Stellenbosch University.



Intelligent, integrated warehouse management systems together with passionate and creative individuals result in more effective storage and reduced costs associated with holding stock.

More companies outsourcing warehousing expertise. Engineering News, 25 October 2013. David D'Oliveira.

The conclusion is thus that although the absolute logistics costs and the logistics costs as a percentage of transportable GDP are rising, it is not a question of logistics efficiency, but rather of the increase in the underlying cost drivers. To a great extent these cost drivers cannot be controlled by the industry and efficiency gains are the only respite companies may have.

However, efficiency improvements can be made only up to a point and, when compared to rapid growth of the cost drivers, may offer only marginal savings.

The rising trend of logistics costs poses a real challenge to all concerned in South Africa. Innovative and bold thinking with potentially far-reaching consequences is now required.

SUMMARY OF THE BIG PICTURE

The performance and growth of the South African logistics industry are both inputs to and outflows from the performance and growth of the South African economy – especially in the primary and secondary sectors. The exchange rate, inflation rate and interest rate directly impact the cost performance of the industry. Other macro-economic issues such as the structure of the South African economy, balance of payments, budget deficits and the human resource problem affect the economy as a whole, which influences the demand for logistics services.

Simultaneously, the performance of the logistics industry, specifically the cost of logistics, affects the global competitiveness of South African industries. Logistics costs as a percentage of transportable GDP have grown significantly over the past four years. A deeper investigation of individual cost components and cost drivers shows that the increase in logistics costs is perhaps not so much the result of deteriorating efficiency in the industry but the disproportionate growth in cost drivers – especially fuel. To change the trends in underlying cost drivers or significantly mitigate their impact requires more than just operational efficiency enhancements, it requires bold steps in addressing the ingrained issues that stifle the economy as well as new directions in how supply chains operate.



Trends in South African supply chains

MOVING TOWARDS INTEGRATION

According to the 2014 supplychainforesight¹⁰ survey,
South African companies are realising the importance of being
more customer-centric. To achieve this, alignment is needed
between overall business strategy and supply chain strategy.
More than 50% of respondents to the survey ranked the
following objectives as one of the top three in their supply chain:

- Improving service levels to customers;
- Integration of technology;
- Lowering procurement costs and reducing order lead times;
- Improving visibility in the supply chain;
- Improving the flow of business intelligence; and
- Aligning with key players in the supply chain.

All of these objectives can be achieved through better integrated supply chains. An integrated supply chain enables organisations to look into business processes across multiple customers and suppliers and across different technology platforms. This enables businesses to have visibility of materials and components wherever they are in the value chain and empowers businesses to respond quickly and make agile business decisions. Although greatly facilitated by intelligent and seamless technology platforms, integration starts with the process view – simply overlaying technology onto a supply chain that is not integrated from a process perspective may cause other problems.

10 Barloworld Logistics. 2014. supplychainforesight – The rise and fall of customers and companies.



Integrated supply chains are powerful incentives for customers to commit to doing business with an organisation. Businesses can obtain a broad-spectrum view from a variety of data sources, including supply chain systems, sales and marketing, customer service and field service systems, internal database information, and knowledge gathered from unstructured interaction with customers. Integrating supply chains helps businesses differentiate their offerings and increase profits by gaining a better understanding of customer wishes for customised products and services.

THE SOUTH AFRICAN EXPERIENCE

South African organisations have over the past decade functioned in some of the toughest environments to date. Research projects recently conducted by KPMG^{11,12,13,14,15} analyse a number of supply chain integration themes. During these projects a series of person-to-person interviews were conducted with supply chain directors (or their equivalent) from 80 companies in KPMG's network of member firms. Respondents represented a broad cross-section of industries and sectors including consumer packaged goods,

retail, diversified industries, logistics providers, utilities, and telecommunications. These inputs provided valuable insights and the most relevant ones are presented here.

Customer focused

For the past decade the supply chains in South Africa have been experiencing declining customer service levels. Some of the biggest constraints to customer-focused businesses were the lack of appropriate skills and inescapable silo-based corporate cultures. Ineffective or non-existent change management programmes prevented the shift from silo-based management to integrated organisations. Many companies could therefore not make the required adjustment from these traditional practices.

In response to this dilemma, South African companies are adapting to the shift in consumer power and are realigning their supply chain strategies and business models to meet customer expectations by designing their supply chains to be customer focused. Organisations are achieving this with varying degrees of success. Some 70% of supply chains mostly or always attempted to be customer focused, while 27% of the supply chains partially implemented strategies to be

- 11 KPMG. 2014. Driven By Demand.
- 12 KPMG. 2013. Global Manufacturing Outlook Competitive advantage: enhancing supply chain networks for efficiency and innovation.
- 13 KPMG. 2013. Delivering the Goods: Understanding and leveraging the critical links in supply chain management.
- 14 Kumar, D. 2013. 3PL and Retailers. Supply Chain Today. September.
- 15 Kumar, D. 2013. South African supply chains use CTCO. Supply Chain Today. October.

customer focused. The essentiality of being customer focused is widely accepted, which is a positive indicator of supply chain best practice within South African organisations.

Agility in supply chains

South African organisations are on average not placing emphasis on designing agility into their supply chains. Only 50% of retail organisations are barely or partially incorporating agile design, while 68% of manufacturing organisations barely or partially design agility into their supply chains. Practical agility requires integrated supply chain structures.

Collaborating with supply chain partners

In 2004 the approach of silo-based, incremental improvements gave very little acknowledgment to establishing outward-facing demand networks needed with customers and suppliers. This inability of organisations to synchronise their end-to-end supply chains prevented companies from achieving their goals.

A decade later, 46% of South African organisations still never or rarely collaborate with their supply chain partners, while 46% of South African supply chains are only partially managing to successfully collaborate and fully utilise aligned incentives within their supply chains. Aligning incentives and roles across supply chain partners are leading practice strategies. There is a major gap between

the knowledge of supply chain management and the successful implementation of supply chain collaboration strategies within South African organisations.

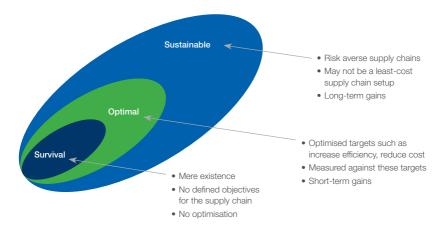
Supply chain maturity

Supply chains in the fast-moving consumer goods (FMCG) industry are far more customer focused and demand driven than those in industries dealing with semi-durable and durable products as well as industrial products and feedstock where product 'freshness' is not so much of a performance metric. This is evidenced by the fact that 62% of FMCG supply chains were found to be mature while only 44% of supply chains in these other industries made the grade.

In general, over the past decade (2004 - 2014) South African supply chains have migrated from 'survival' to 'optimised' mode, allowing organisations to harness efficiencies, reduce costs and improve service levels. While many supply chains have shown this progress, it was, however, noted that the degree of maturity of the 'optimised' mode differs among supply chains. In developed nations, supply chains are migrating to the 'sustainable' mode, an area where South African supply chains are lagging behind. Main challenges faced in reaching 'sustainable' mode include a lack of infrastructure, advanced technology, skills and embedded processes.



FIGURE 6: Different levels of supply chain maturity. Source: KPMG.



Technology within South African supply chains

Many South African companies are working from severely fragmented enterprise resource planning (ERP) and supply chain management systems that have been designed for an individual company. This is in stark contrast with the technology requirements of a globally connected world. Information best practices are not generally held in high regard within South African supply chains. This impairs their integration capabilities as the key frameworks available for integrated supply chain management rely heavily on the use of information best practices to monitor and successfully integrate a supply chain.

In South Africa, as in most emerging markets, most companies are focused on incremental upgrades, tweaking and customisation to unlock functionality from existing enterprise-wide technology. In fact, many companies are actually still in the throes of implementing enterprise-wide technology to replace legacy systems that are simply too old to cope. In part, this focus on smaller-scale technology change is a result of both the economic climate (in which OpEx investment is scarce) and the rapid pace of change within the industry itself which leads to uncertainty about purchasing decisions. The maturing of cloud technology is a case in point as many organisations are still waiting to see how it could change their operations before committing.

When companies do embark on large-scale technology implementations such as ERP systems, the primary consideration is on the financial functionality of the technology and not necessarily the supply chain integration requirements.

Planning, forecasting and replenishment strategies

One of the greatest challenges for South African companies has been a lack of planning capabilities. Larger and more crossfunctional organisations have far greater planning difficulties as internal integration is, in many cases, still but a dream. However, sustained investment and focus on the implementation and successful management of supply chain coordination control methods - especially in terms of planning, forecasting and replenishment - has been noted. The effective use of supply chain coordination control methods can be particularly noted within the manufacturing sector participants. South African organisations appreciate that improving their planning processes is still a significant area of opportunity.

Inventory management

In general, South African companies hold large amounts of buffer stock, from mining to manufacturing and even retail. Notable exceptions may be the recent implementation of just-in-time supply models in retail and automotive supply chains. Responsive and flexible inventory management, drilling right down to individual line items in different stores, is also becoming apparent in some retail chains.

Inventory carrying costs rose from contributing 16.6% to total logistics costs in 2003 to contributing 20% of costs in 2008. Rising interest rates was the primary driver of this increase which amounted to R33 billion

in absolute terms. Integrated supply chain systems will be a key enabler in driving down excess buffer stock in South African supply chains.

INSIGHTS FOR THE FUTURE

Demand-driven supply chains

Demand-driven supply chains (DDSC) describe a setup where supply chain partners are tuned in to the demand signal that originates at the furthest point of consumption. It is this signal that triggers supply chain processes, creating greater alignment, responsiveness and efficiencies along the chain. DDSC has game-changing potential for supply chains, drastically increasing customer satisfaction.

The full benefits of DDSC come from viewing the extended enterprise as a network, sharing critical supply and demand information across the network of suppliers and customers. Companies with a networked DDSC have more balanced cash flow, experience 1 – 4% improvement in revenue, and see 20 – 30% reduction in working capital. Companies with advanced visibility and collaboration also claim that supply chain resiliency improves. Increased investment in DDSC capability is witnessed in virtually every industry.

Since there is only so much improvement organisations can make within their own four walls, supply chain executives are looking for better alignment of information and decisions across boundaries with supply



chain partners. But information latency – the time lags that occur in transmitting supply, demand and financial data among supply chain partners – remains a massive hurdle to DDSC in the South African context.

Cloud-based supply chain management

Cloud-based technology is undoubtedly the next generation of opportunity for today's supply chain. Indeed, while cloud is a relatively new technology, its benefits are already becoming blatantly obvious to supply chain directors and their executives. Organisations will be able to enjoy real-time access to critical information, achieve greater transparency across the extended supply chain, reduce their costs to serve, gain flexibility and scalability from their technology, and gain the capability to respond to demand and supply pressures as they occur.

Although most supply chain operators are positively salivating at the potential offered by cloud, the reality is that few seem to actually be implementing solutions. In part, this is because of lingering concerns and barriers related to data security. Ironically, the security deployed by most cloud-based technology providers now far outstrips that of the organisations they serve. Security, in other words, is a reason to go to the cloud, not avoid it.

All indications point to the fact that – even if cloud only delivers half of the promise that is being discussed – its application to the supply chain will be revolutionary.

Talent

Leading companies appreciate the value of talent across all organisational levels. Having extremely well-qualified, talented people at the senior levels in an organisation can be a wasted investment if these people are not supported by equally well-qualified and skilled staff at each level and for each supply chain function. World class logistics and supply chain people development programmes are:

- a. inclusive, catering for personnel at all levels:
- b. supported from the highest level within the organisation to ensure continuity; and
- based on learning outcomes and objectives which are aligned to business objectives.

While learning is a crucial enabler of success and the delivery of organisational business objectives, employees need good role models and champions who understand that the ever-changing demands of the profession should not be underestimated.

Collaboration

In a recent global study conducted by the Economist Intelligence Unit regarding the outlook for manufacturing in 2013, KPMG found a strong emergence for companies to establish close-collaborative ties with their suppliers. Such companies have realised significant gains in profitability by being more responsive to volatile customer demand. Beyond optimising inventory and logistics processes, collaboration is opening doors

to joint innovation and shared research and development between partners. Companies are seeing their partners as a network rather than a chain with valuable insight that can lead to mutual benefit. Shared logistics – where companies pool warehousing, distribution and transport resources – is also fast becoming a very attractive reason for companies in parallel supply chains to collaborate, especially given the rising trends in South African logistics costs.

The role of third party logistics (3PL) and other service providers (software vendors, trainers and infrastructure companies) cannot be discounted in creating an integrated supply chain. Their hand in achieving efficiency and creating visibility has made its mark in the last decade, however much more can still be done.

Clients are seeking end-to-end logistics solutions that will support their competitive advantage. To achieve this, clients have become more collaborative, sitting down with their service provider to draw up an appropriate logistics strategy to meet their objectives ??

Increased demand for outsourced warehousing solutions. Engineering News, 29 October 2013. Henry Lazenby.





Nissan SA case study

Many South African companies are starting to harness the benefits of integrated supply chains, the recent successes of Nissan SA being a case-in-point. Nissan SA has been awarded a Platinum Logistics Achiever Award in 2013 for improving in and outbound logistics through collaborative supply chain management. In 2011 Nissan Global launched a six-year plan to increase global production and sales volumes while containing costs. In response, Nissan SA embarked on a programme to become a Top 10 manufacturing plant within the global Renault-Nissan Alliance by 2015.

To up its game on this global platform Nissan SA had to overcome a few problems that are very common among South African supply chains. The relative inefficiency of Nissan SA's supply chain was a decided disadvantage in securing global export contracts. High transport costs, the landlocked position of the plant, and frequent production line stoppages due to a lack of parts' availability were handicaps to competitiveness. In 2011 Nissan SA spent 27% more on production parts logistics per vehicle compared to its benchmark global competitor. Local supply chain and outbound logistics costs also had opportunities for improvement.

Long firm-build schedules and low integration levels with global systems also limited export opportunities and caused higher than ideal inventory levels. The system was inflexible with a fixed four-month production schedule. Compounding the problem was the infrequency of outbound shipments using specialised vehicle carrying (Ro-Ro) vessels to some destinations.

Existing logistics facilities and infrastructure were not aligned to global best practice. Warehouses were not centralised resulting in long travel distances between areas and causing high overtime in the back-end of warehouses.

An integrated strategy

The Nissan SA supply chain management (SCM) division established a multi-faceted strategy culminating in several projects that addressed almost every aspect of the supply chain, with inbound supply chain, in-plant supply chain and outbound supply chain being the three main focus areas.

The strategy was pervasive – changing supply chain structure, systems, design and finally employee mind-sets and actions.

The Douki Seisan system was introduced to streamline production and supply chain activities. It is a customer-driven production

philosophy that synchronises supply chain partners to ultimately cut lead times.

This level of synchronisation was made possible by the successful implementation of the Nissan Manufacturing UK (NMUK) mainframe ERP system that enabled full integration with all global engineering and ordering systems. This system replaced SAP and seamlessly integrates with:

- the Global Nissan bill of material and engineering design systems;
- the Nissan Europe vehicle ordering system (SCOPE); and
- the Nissan and Renault global parts ordering hubs.

The system is stable and reliable, and provided the integrated platform needed to further improve the supply chain. It ultimately allows any dealership within the AMIE region full visibility of Nissan SA's build schedule and also opened several new export markets to Nissan SA.

To overcome systemic issues relating to South African transport systems, Nissan SA had to re-evaluate the status quo of their transport decisions. To overcome the infrequency of Ro-Ro vessels, Nissan SA switched to containerising vehicles destined for certain international destinations at the

new on-site vehicle containerisation facility. This greatly improves lead times and shipping frequency to these international destinations. Nissan SA now also mainly use containerised rail transport in preference to road transport for imported production parts. Working closely with their supply chain partners, including DHL, Bidvest Panalpina Logistics (BPL) and CHEP to establish these and other innovative supply chain solutions was essential.

The achievements resulting from this SCM breakthrough activity over a 12 month-period include:

- Full delivery timing visibility for all customers;
- Flexible vehicle ordering capabilities allowing changes in specifications up to four weeks before production without any lead time repercussions;
- The Cross Functional Team (including sales, exports, SCM and production control) activity reduce finished vehicle inventory by 20%;
- Domestic market volume flexibility improved from 20 to 12 weeks;
- Domestic market-mix flexibility improved from 15 to 4 weeks;



Nissan SA case study

- Improved Nissan SA's cost competitiveness to benchmark levels for key export markets like the Gulf Coast Countries:
- A 21% reduction in supply chain CO₂ footprint;
- A R387 million improvement in free cash flow;
- A R206 million year-on-year logistics cost reduction; and

- The cost gap between Nissan SA and its global competitors eliminated as a result of the following cost reductions:
 - 34% in parts logistics costs per vehicle;
 - 30% in local supply chain logistics costs:
 - 73% in abnormal logistics costs per unit;
 - 86% in abnormal logistics costs (airfreight and demurrage);
 - 22% in finished vehicle inventory; and
 - 21% in production parts inventory.

SUMMARY OF TRENDS IN SOUTH AFRICAN SUPPLY CHAINS

South African supply chains have moved beyond survival mode to optimised mode, where costs, inventories and lead times have been minimised within individual supply chain functions. End-to-end integration of supply chain functions is the next major shift required in South Africa to make business more customer centric and competitive. Affecting this requires radical changes in how supply chain partners collaborate and how information technology is leveraged to provide end-to-end visibility and real-time decision making. An integrated supply chain approach unlocks logistics efficiencies that were previously unavailable as illustrated by Nissan SA's recent successes.





3

Critical logistics enablers

LOGISTICS INFRASTRUCTURE CAPACITY

The dilemma faced worldwide with respect to infrastructure in general is depicted by the following:

"In a world suffering unprecedented economic and environmental challenges, the importance of infrastructure is being recognized by populations and politicians alike. The long-term issue of funding (who pays?) and the shorter-term options for financing of infrastructure (how do we pay?) are becoming hugely important questions for policy makers and the government officials responsible for creating and maintaining the assets that enable 21st-century cities (read countries) to function. In this turbulent period of low growth and government deficits, economies need fiscal stimulus and creation of employment. Spending on infrastructure offers both of these benefits and, if wisely directed, this investment delivers improved quality of life to the affected community" 16.

16 Urban Land Institute and Ernst & Young. 2013. Infrastructure 2013: Global Priorities, Global Insights.



The performance of South Africa's logistics industry is very dependent on its transport infrastructure, logistics services provision, cross-border trade facilitation and telecommunications systems. Transport infrastructure, arguably the most important component of these, is a critical ingredient for economic growth, development and wealth creation. Transport infrastructure investments are key determinants of performance in the transport sector¹⁷.

South Africa still stands way above all the other countries on the continent by quite a margin as far as transport infrastructure is concerned¹⁸. Egypt, the African country in the 2nd position according to the World Bank LPI ranking is placed only 62nd whereas South Africa is ranked 34th. The rail network in South Africa still accounts for 80% of the total network in Africa. This should. however, not be a reason for complacency. With substantial transport infrastructure investments by international investors, specifically China, in countries such as Zambia, Angola, Nigeria and Ghana the gap is closing fast. South Africa can therefore no longer be considered as the only gateway into the Southern African Development Community (SADC). In the longer term this could limit South Africa's future growth potential into SADC that could be detrimental for the South African logistics industry and local logistics service providers.

An assessment is given here of the current state and major developments in infrastructure for all the different modes of transport over the past number of years. For each of the modes a perspective is also given of future developments and plans that are in the pipeline. Furthermore, capital expenditure and funding are highlighted. Since 1994 infrastructure investments have been made in South Africa, and increasingly so over the past number of years. This is in contrast to what happened in many other African countries after their independence. Issues and challenges facing each of the transport modes are briefly discussed.

☐ RAIL INFRASTRUCTURE

Transnet Freight Rail (TFR), one of the operating divisions of Transnet, a State-owned-Enterprise, is solely responsible for rail freight transport and associated rail activities in the country. The TFR rail network coverage is fairly comprehensive across the country, with 95% of the route network already built by 1938¹⁹. Some 40% of the network has electrified traction with three different voltages at various points in the network. Nevertheless there is almost full interoperability between the diesel and electrified sections. The majority

¹⁷ OECD. 2013. Understanding the Value of Transport Infrastructure — Guidelines for macro-level measurement of spending and assets.
OECD Task Force report

¹⁸ BMI. 2014. SOUTH AFRICA Infrastructure Report: Includes 10-year forecasts to 2022. Business Monitor International.

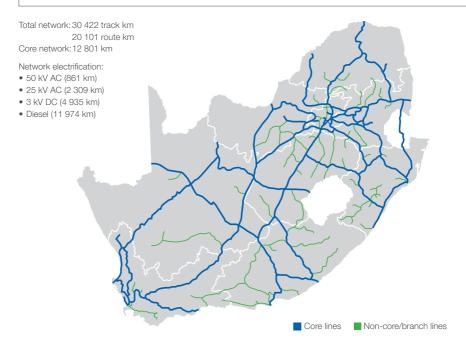
¹⁹ SAR&H. 1938. Report of the General Manager for the Year Ended 31st March 1938, South African Railways and Harbours, 1938. p 209.

of the signalling systems that are being used date back to before the 1960s while most of the locomotives and rolling stock are also aging. Finally, South Africa also has a narrower rail gauge which poses its own challenges.

Up to 2005 very little investment in rail infrastructure took place (see 'Rail in South Africa – the legacy and way forward' for a discussion on the development of rail in South Africa). It is from this dismal base of complex

and aging infrastructure systems that TFR started rebuilding the rail network through consistent investment since 2006²⁰. Although the majority of Transnet's annual investments go to TFR, it must be kept in mind that a large component of the investment goes towards maintaining existing capacity. In 2013, for instance, R16.2 billion of the R27.5 billion invested across all Transnet divisions was spent on maintenance of existing infrastructure (Figure 7).

FIGURE 7: South Africa's rail network. Source: Transnet²⁰.



20 Transnet. 2013. 30-year Long-term Planning Framework, 2013 edition.



In 2012 Transnet introduced a very ambitious Market Demand Strategy (MDS)²¹ with the aim of expanding and modernising the country's ports, rail and pipeline infrastructure over a period of seven years. It is envisaged that R300 billion will be invested in the seven-year period with about R200 billion earmarked for rail infrastructure alone. The MDS aims to grow annual rail volumes from 200 million tonnes (mt) to 350 mt. Recent capital investment has been on the following major projects²²:

- a. Expanding the iron ore export line from Sishen to Saldanha. Both rail and port capacity will be affected with ore volumes increasing to 59.5 mt in 2014 and exceeding 70 mt annually after the MDS implementation. An additional 32 locomotives will be acquired of which 16 have been delivered. The total investment for the 2012/2013 year amounted to R920 million.
- b. Expanding the export coal line from Mpumalanga to Richards Bay to increase current capacity to 81 mt and ultimately to 97.5 mt. The total investment for this project over the seven years is estimated to be R31.6 billion. For this project 110 Class 19E locomotives have already been delivered. In 2012/2013 the total investment on this project was R1.3 billion.

- c. Investments into General Freight Business (GFB) rail solutions. In total, R13 billion was invested for the upgrading and maintenance of infrastructure and rolling stock to serve the GFB segment during 2012/2013. One hundred Class 43 locomotives have been delivered, a further 43 locomotives have been ordered plus an additional 95 locomotives. Transnet have also built 2 481 wagons for the GFB. Very recently it was announced that Transnet awarded contracts to two Chinese and two North American railway groups to the value of R50 billion for the building of 1 064 electric and diesel locomotives by 2019²³.
- d. Hubs and terminals²⁴: Transnet's longterm aim is to secure 80% of rail-suitable transportation of containerised traffic. This means that Transnet is targeting the line-haul portion of container movements along the major corridors especially connecting Gauteng with the major ports. Such a shift requires significant expansion of ship-to-rail infrastructure at the ports as well as new generation rail-to-road intermodal terminals within Gauteng. The City Deep terminal capacity was expanded to 280 000 TEUs in 2012 through infrastructure upgrades and additional cranes. Plans are underway to further increase the City Deep terminal capacity to 400 000 TEUs by 2016. An additional

²¹ Transnet. 2013. Market Demand Strategy (MDS). 2013.

²² Transnet. 2013. Transnet Annual Report 2013.

²³ Business Day. 2014. Transnet awards R50bn worth of locomotives contracts. 17 March.

²⁴ Transnet. 2013. 30-year Long-term Planning Framework, 2013 edition.

4 million TEU handling capacity is forecast to be required in the Gauteng area by 2042. It is envisaged that Gauteng will require seven 'standard' container terminals, one or two 'standard' automotive terminals and four 'standard' palletised terminals by 2042. To achieve this it would operationally be more efficient to develop a few super terminals rather than many smaller ones. At least three locations (Pyramid, Sentrarand and Tambo Springs) have been identified for the development of these super terminals.

Indications are that many branch lines are being reinstated after being 'closed' for a number of years²⁵. Originally branch lines were closed due to unprofitability and the demise of the 'single wagon load' business model, but these lines played a critical role in serving rural communities and the agriculture industry. Together with changes in regulation to control freight on road, much freight shifted from rail to road in these parts. This shift onto road had a massive negative impact on the condition of provincial roads that were not geared for it. For a developing country, where rural development needs to be stimulated, government should play a bigger role in ensuring these rail links to the rural areas remain operational by providing the required financial support to ensure financial viability of the branch lines.

□ ROAD INFRASTRUCTURE

South Africa has a comprehensive road network consisting of approximately 535 000 km of proclaimed roads. Of these, 366 872 km are non-urban roads with the rest being urban roads. Just over 300 000 km of the proclaimed roads are gravel roads²⁶. Three spheres of government, namely national, provincial and municipal, have jurisdiction over this road network. The condition of the road infrastructure across the country differs widely and the impact of these varying conditions on transport costs is discussed under 'The state of the road network'.

National roads

The South African National Roads Agency Limited (SANRAL) is an independent, statutory company of the South African government. It is represented by the Minister of Transport as the sole shareholder and owner of SANRAL. SANRAL has a distinct mandate - to finance. improve, manage and maintain the national road network of the country: this network currently consists of 19 704 km of the country's roads. This network seamlessly connects major cities, towns and rural areas, supporting economic growth and social development and contributing to job creation in the country. SANRAL has two primary sources of income. Non-toll roads (84.2% of the total national road network) are funded from allocations made by the National Treasury while toll roads (15.8% of the total national road network) are funded from borrowings on capital markets²⁷.

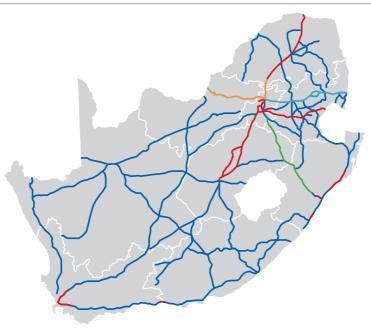
²⁵ Transnet. 2013. 30-year Long-term Planning Framework, 2013 edition.

²⁶ SANRAL. 2014. SANRAL Network.

²⁷ SANRAL. 2013. SANRAL Annual Report 2013.



FIGURE 8: SANRAL national road network. Source: SANRAL²⁸.



SANRAL toll roads Bakwena concession N3TC concession TRAC concession SANRAL non-toll roads

Over the past five years SANRAL has built 88 km of new roads, excluding the Gauteng Freeway Improvement Project (GFIP). The GFIP mostly added new lanes to existing highways. Furthermore, around 3 173 km of existing roads were strengthened and/or improved. More than 84% of the national road network under SANRAL's jurisdiction is in a fair to very good condition.

Total operational and capital expenditure over the 10 years preceding 2013/14 amounted to

R55.7 billion on non-toll roads and R41.3 billion on toll roads.

Numerous major projects are in the pipeline such as Phase 2 and 3 of the GFIP; the N1/N2 in the Winelands projects; and the N2 Wild Coast project. The implementation of these projects depend on funding availability (investment estimated at R150 billion) as well as public opposition relating either to tolling strategies or environmental concerns.

28 SANRAL. 2014. SANRAL Network. Available: http://www.nra.co.za/live/content.php?Category_ID=46#

SANRAL is also involved in some of the Strategic Infrastructure Projects (SIPs) that were initiated in 2012. SANRAL is directly responsible for SIP 4 – Unlocking economic opportunities in the North West; a major player in SIP 1 – Unlocking the northern mineral belt with Waterberg as catalyst; SIP 2 – Durban–Free State–Gauteng logistics and industrial corridor; and SIP 3 – South eastern node and corridor development. Numerous other major projects are also underway.

Provincial and urban roads

Provincial roads, or secondary roads, are the responsibility of provincial authorities while urban roads fall under the jurisdiction of metros and municipalities. In both cases data availability is very limited.

It is estimated that across all provinces over the past five years 90 km of new roads were built in total, while in metros the estimate is 1 477 km. There is no expenditure data publicly available, nor is there information regarding upcoming projects.

Road conditions vary amongst provinces (see 'The state of the road network').

The Provincial Road Maintenance Grant (PRMG) is effective from 1 April 2014 and requires, amongst other criteria, that provincial authorities implement and maintain effective asset management systems. This will have a positive impact on the road condition in the medium to long term.

□ PORT INFRASTRUCTURE

South Africa has eight commercial ports with Transnet National Ports Authority (TNPA) the landlord and Transnet Port Terminals (TPT) the primary ports operator for most terminals. The eight ports and their main operations are as follows²⁹:

- Port of Cape Town the port provides container, bulk and general cargo-handling services. It handles around 10 mt with a predicted 30-year increase to 25 mt;
- Port of Durban the premier multipurpose port of the country currently handling 64 mt of cargo with an expected increase to 175 mt. Major growth areas for the port are seen to be in containers, bulk liquid handling and break bulk cargo. Major expansion projects in the short term include the second phase of the Pier 1 container terminal and development of a new dedicated passenger terminal. Medium-term projects include the infill and stack reconfiguration of the Durban Container Terminal and the berth deepening and channel widening of Maydon Wharf;
- Port of East London a smaller river port that handles primarily industrial and agricultural cargo totalling 2.4 mt and with a predicted increase to 5.3 mt in a 30-year period;
- Port of Mossel Bay a smaller port that handles limited freight totalling

29 Transnet, 2013. 30-year Long-term Planning Framework, 2013 edition.



30 000 tonnes per year, mainly servicing fishing and off-shore oil and gas industries;

- Port of Ngqura a new generation port that handles 5.5 mt of cargo annually increasing to 85 mt in the long term;
- Port of Port Elizabeth the port handles containers, manganese ore, vehicles and general cargo. Total cargo handled is 10 mt per year with an increase to 14 mt predicted in a 30-year period;
- Port of Richards Bay a new generation port that is the largest in South Africa by tonnage, handling around 98 mt of cargo per year which equate to 40% of South Africa's total port demand. The 30-year forecast predicts around 157 mt of cargo per year. Major growth areas for the port are seen to be dry-bulk and break-bulk cargo handling; and
- Port of Saldanha a new generation port with the deepest draft which handles 65 mt of cargo per year, mainly iron ore, with a predicted cargo 30-year forecast of 165 mt.

Although all the ports have growth opportunities, the older ports have limited back-of-port space due to their close proximity to major cities. The expansion plans of the new generation ports are therefore more ambitious. With the shift over the past number of years to containerisation, the ports had to be adapted to handle ever-

increasing numbers of containers. Some of the major recent projects include the following³⁰:

- a. Durban Container Terminal (DCT):

 The capacity of the container terminal was increased to 2.9 million TEUs through a re-engineering project. The funding amounted to R44 million in 2012/2013.

 In addition, seven fully assembled tandemlift ship-to-shore cranes were delivered and this required construction of associated infrastructure. Container handling equipment was constructed at DCT, Maydon Warf and the Point. All of this required R1 440 million funding:
- b. Cape Town Container Terminal:
 Expansion of the container terminal in
 Cape Town increased capacity to
 1.4 million TEUs and this expansion
 amounted to R228 million in 2012/2013;
- c. Ngqura Container Terminal: This port was formally opened in February 2012 and added 800 000 TEUs to the total national port system. This capacity has been increased to 1.5 million TEUs and ultimately the port will be able to handle 2 million TEUs; and
- d. Durban International Airport (DIA) site: This site was acquired for R1.85 billion and is earmarked for the Durban Dig-Out Port for demand requirements in the container, liquid bulk and automotive sectors up to 2040. A number of project-related feasibility studies are currently underway.

☐ PIPELINES

Transnet Pipelines (TPL) is the main provider and operator of pipelines in South Africa while private sector companies own private pipelines such as Sasol that owns and operates a gas pipeline from Mozambique to Secunda, linking at Sasolburg.

TPL transported 16.7 billion litre of liquid fuel and 494 million of gas during the 2012/13 financial year³¹. This is achieved through a number of pipelines, such as the Durban-Johannesburg Pipeline (DJP) that runs from Durban to Alrode. The line is currently utilised for petrol to the Alrode and related depots and both petrol and diesel to the southern section of the line consisting of Ladysmith, Bethlehem and Kroonstad, During 2014. upon completion of new accumulator terminals, the DJP will be decommissioned and a new 24-inch Multi-Product Pipeline (24MPP) will convey multiple products. The 24MPP includes the Durban to Jameson Park trunk line from where it ties into the inland network. On completion, this pipeline will be used to transport diesel, petrol and also jet fuel. The currently installed capacity of the 24MPP trunk line is 8.76 billion litre per annum. A third pipeline is the dedicated Jet Fuel Pipeline (Aviation Turbine Fuel Pipeline) which transports iet fuel from the Natref refinery in Sasolburg to OR Tambo International Airport (ORTIA) over a distance of 60 km. The installed capacity of the

pipeline is 1.3 billion litre per annum. A future dedicated jet fuel line is planned from Jameson Park to ORTIA. TPL also has a Crude Oil Pipeline (COP), an 18-inch pipeline that was commissioned in 1971 to transport crude oil from Durban to the inland crude refinery, Natref. The installed capacity of the COP is 7.3 billion litre per annum. Finally the Lilly line carries methane-rich gas from Secunda to Durban with off-take points at Newcastle, the Pietermaritzburg area and the Durban area. The maximum capacity of the pipeline is 23 MGJ per year. It is expected that demand will exceed the line capacity in the early 2020s.

The main capital investment of TPL over the past number of years has been the 24MPP with a total estimated cost of R23.4 billion on completion. The construction of the pipeline started in 2006 and by 2012/2013 R18.2 billion had already been spent.

For Sasol, gas is transported to customers from Mozambique and Secunda via a supply pipeline network of around 2 500 km, including an 865 km pipeline linking the gas fields in Mozambique to Sasol's South African network. This pipeline was expanded by a further 156 km that links Secunda and Sasolburg, increasing network capacity and providing backup supply³².

Recently Sasol showed huge interest in 'gas monetisation' based on the significant gas discoveries in the Rovuma basin, offshore

³¹ Transnet. 2013. Transnet Integrated Report, Transnet Issue 1, 2012/2013, p 14.

³² Sasol. 2014. Available: http://www.sasol.co.za/about-sasol/south-african-energy-cluster/sasol-gas/operations-sasol-gas



northern Mozambique, where it is estimated that more than 65 trillion cubic feet of recoverable natural gas exists³³.

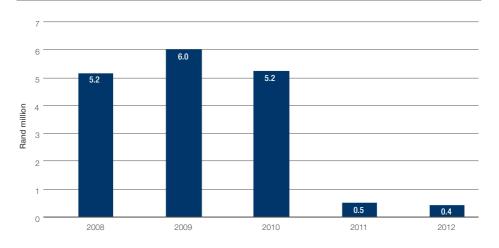
Worldwide the gas environment is changing dramatically and this will also impact and affect what happens in South Africa. It would require additional infrastructure both in terms of pipeline infrastructure but also gas terminals at a number of ports in the country.

Transnet is seriously considering the impact and requirements associated with natural gas in order to provide pipeline and port infrastructure when needed.

☐ AIRPORTS

Air cargo forms a fairly small component of total freight transported in South Africa. In the five years leading up to the hosting of the 2010 FIFA World Cup Soccer Tournament, the Airports Company of South Africa (ACSA) embarked and concluded a five-year capital expenditure programme amounting to close to R20 billion³⁴. The emphasis was almost solely on passenger handling infrastructure. These investments led to a network of 10 international airports that are world class and fully modernised. See Figure 9 depicting capital investments before and after 2010.

FIGURE 9: ACSA capital expenditure from 2008 - 2012. Source: ACSA³⁵.



- 33 Engineering News. 2014. Sasol eyeing northern Mozambique gas 'monetisation' prospect. 10 March.
- 34 Kriel, E. 2014. E-mail correspondence with E KrieL, ASCA Chief Airport Planner. 8 March.
- 35 ACSA. 2012. ACSA Annual Report 2012. p 44.

Air cargo tonnage has grown to around 400 000 tonnes per annum, the bulk – around 80% – gets flown in the bellies of international-scheduled passenger flights. The growth in air cargo is thus almost directly related to growth in passengers. The average annual passenger volume growth rates between 2008/2009 – 2010/2011 and 2011/2012 – 2012/2013 have been -3.7% and -1.5% for domestic and 1.7% and 2.9% for international flights, respectively. In the past few months, the domestic market has started growing again.

ACSA is currently developing a strategy around air cargo at ORTIA. With envisaged improvements to the existing facility it is estimated that cargo-handling capacity will increase to more than 450 000 tonnes annually at ORTIA alone. For the next 10 years up to 2024/2025, ACSA intends spending over R30 billion on new capacity and major refurbishment to provide an additional cargo complex at ORTIA at the Midfield site by 2020, with automated capacity to handle at least an additional 100 000 tonnes per annum.

☐ PUBLIC PRIVATE PARTNERSHIPS

The planned infrastructure investments outlined by the likes of Transnet (rail, port and pipeline) and SANRAL (national roads) require multi-billion rand investments in the short to medium term. In South Africa. with its unique social challenges of poverty and unemployment, government is not in a position to fulfil all the commitments expected of the state from a fiscal point of view. Transnet does not use taxpayers' money for their infrastructure investments but must fund it themselves. Therefore the availability of funding is greatly dependent on the income generated, which depends in turn on variable freight volumes, and the ability to raise loans. The argument is made that Transnet is a State-owned-Enterprise, serving the mandate handed down by its stakeholder, the Department of Public Enterprises, and therefore government should also contribute to the investment. In the case of SANRAL. the non-toll roads are funded solely from the fiscus while toll-roads are either funded and operated by SANRAL or by private concessionaires.



These funding constraints are placing the potential of public private partnerships (PPP) – or private sector participation (PSP) as referred to within Transnet – in the limelight.

Innovative funding solutions are required.

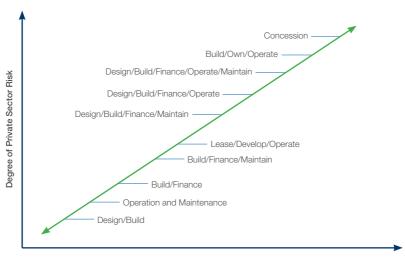
There are various PPP models – each offering a different level of involvement and risk as shown in Figure 10.

There is a need for innovative financing, and [for] setting up capital funds to take equity in projects and financing projects where there is a clear potential for a positive return on investment. ""

Urban Land Institute and Ernst & Young. Infrastructure 2013: Global Priorities, Global Insights. p 34

FIGURE 10: Private sector risk and involvement in different PPP models.

Source: Urban Land Institute³⁶.



Degree of Private Sector Involvement

36 Urban Land Institute and Ernst & Young. 2013 Infrastructure 2013: Global Priorities, Global Insights.

SANRAL already has three successful PPPs in place with concessionaires – the N3 Toll Concession (Pty) Ltd (N3TC), the N1/N4 Bakwena Platinum Concession Consortium (BAKWENA) and the N4 Trans African Concession (TRAC). Transnet has also recently signed three Memoranda of Understanding (MoU) with private companies to facilitate future collaboration in multimodal solutions (Imperial Logistics³⁷ and Barloworld Logistics³⁸) and technology transfer (Kirilo Savic Institute (KSI) from Serbia) with the potential of evolving into PPPs in future.

INTERMODALISM

FREIGHT FLOW ON ROAD

AND BAIL FROM 2011 – 2013

For a number of years now the topic of a drastic shift of freight from road back to rail has been on the cards. There is general consensus from the public and private sectors that for the sake of driving down our country's logistics costs, preserving our

roads, reducing congestion and generally making South Africa more competitive, rail-friendly freight must get back onto rail. The MDS focuses on this imperative. Currently TFR has a 'captured' market in terms of exporting iron ore, coal and manganese. In cases where these bulk mining commodities are still carried on road it is reported by cargo owners to be a case of insufficient rail capacity. Similarly, in the agricultural dry-bulk sector indications are that if reliable rail capacity existed on the long haul and export lines, a shift back to rail from road would happen naturally. The segment of freight that requires a bit more effort is therefore long-haul General Freight Business (GFB). In this case it is going to be a real and major challenge to convince and attract customers to make use of rail. The World Bank statement "if service delivery is poor. good physical connectivity is not enough" applies directly here and a huge step-up in service delivery will be required to achieve this necessary 'shift' to rail.

We support infrastructure spend being weighted towards rail and are positioned to assist government and parastatals in a professional partnership capacity. As a company of professional engineers, who subscribe to a professional code of conduct, we are obliged to act on behalf of the public. We know it is in the long-term interest of society to find the right balance between road and rail usage.

Dewald Potgieter, GIBB. Transport Focus, April 2014, p 33

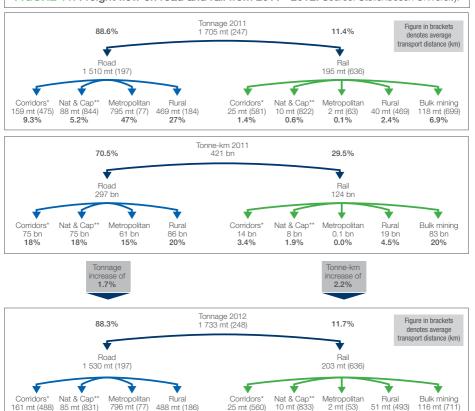
³⁷ Engineering News. 2013. Transnet, Imperial ratify road-to-rail alliance. 4 October.

³⁸ Transport World Africa, 2013, Collaboration in Road to Rail, 23 October,



Figures 11 and 12 show the modal splits between road and rail and its growth between 2011 - 2012 and estimated growth between 2012 - 2013, respectively.

FIGURE 11: Freight flow on road and rail from 2011 - 2012. Source: Stellenbosch University.





25 mt (560)

1.4%

0.6%

2 mt (53)

0.1%

2.9%

6.7%

28%

85 mt (831)

4.9%

9.3%

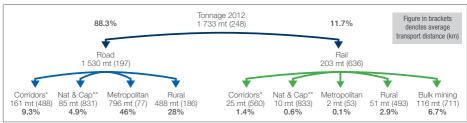
796 mt (77)

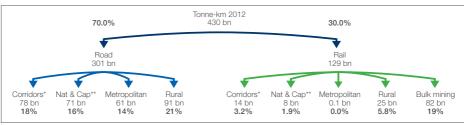
46%

Remaining corridors excluding the two main corridors

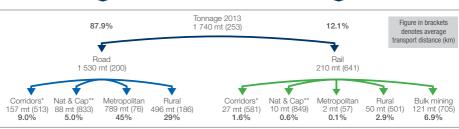
Nat & Cap represent the two main corridors of Gauteng - Natal (Nat) and Cape - Gauteng (Cap)

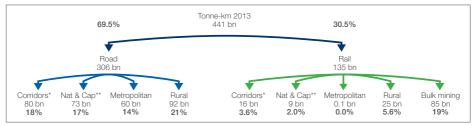
FIGURE 12: Freight flow on road and rail from 2012 - 2013 (E). Source: Stellenbosch University.











^{*} Remaining corridors excluding the two main corridors

^{**} Nat & Cap represent the two main corridors of Gauteng - Natal (Nat) and Cape - Gauteng (Cap)



Overall rail market share has grown slightly in terms of tonnage (11.4% in 2011 to 11.7% in 2012 and an estimated 12.1% in 2013) and in terms of tonne-km (29.5% in 2011 to 30% in 2012 and an estimated 30.5% in 2013). In terms of freight on the corridors, there has been a very slight increase in rail market share, which hopefully signals the beginning of an upward trend, and some ground has been gained in rural freight – albeit a few decimal points.

A successful road-to-rail shift would see a far greater proportion of the tonne-km on Natcor and Capecor and the other corridors on rail with a far shorter average traveling distance for the corridor tonnes on road. This would imply that the line-haul portion of this freight's movement is on rail while distribution activities at the origin and destination are still executed by truck.

Tonnages transported by rail have breached historical annual tonnage records for the past three consecutive years and rail has started to claw back market share. Provided that Transnet continues to invest in the rail system, continually improve productivity and efficiencies and develop skills – the business is set to positively contribute to national competitiveness and reduction of logistics costs.

☐ RAIL IN SOUTH AFRICA – THE LEGACY AND WAY FORWARD

The rail industry in South Africa has undergone profound changes in the past three decades. This evolution has had an impact on the role that rail has played in the economy and competitiveness of the country since its inception in 1910. Globally, strategies for rail revival are all aimed at improving the contribution of rail to national growth objectives, greater competitiveness of the country and reducing the cost of logistics.

Rail industry developments and challenges – the legacy

The challenges facing the freight transport industry today are largely derived from an evolution of historical events and have been well documented. Major events are summarised:

- Since inception, rail transport was applied in the economic development of the country and its agriculture and mining resources. The railway was used as an instrument in the execution of contemporary national policies and objectives – such as job creation, training and providing transport access to rural areas;
- Competition from road was kept at bay by regulatory practices favouring rail transport. Rail held common carrier status with published tariffs and little incentive to provide competitive and reliable services;
- In the mid-1970s, the two heavy-haul iron ore and coal lines had been constructed

to contribute to the nation's export drive. In 1977, regular intermodal container services began for both domestic and import traffic. These infrastructure developments were catalysts for economic growth and improved the nation's capacity to trade globally and regionally;

- Starting in 1975 and culminating in the late 1980s, the land freight transport market was deregulated. These policy developments ultimately affected rail's capacity to compete with road. At this time, investment in rail infrastructure was severely cut back, contributing to poor service delivery and reduced competitiveness of rail over the long term;
- Transnet Limited was incorporated in April 1990. Market demand could still be met with surplus capacity from assets which had reached the end of their economic life. The overall condition of freight and passenger assets was deteriorating while the maintenance and modernisation investment backlog was increasing steadily; and
- Corporatisation encouraged the implementation of business principles, corporate governance, marketing and financial management thus improving the commercial management of the business. Ring-fencing of the transport modes into autonomous divisions improved accountability, allowed for transparency and rectification of particular divisional weaknesses. With all divisions remaining under the Transnet 'umbrella',

the multimodal competence was maintained – in practice the logistics and intermodal development was however immature and required much greater investment in innovation and technology.

The net result of these historical events was that Transnet – and the largest division, Transnet Freight Rail (TFR) – had lost market share to road and had significantly reduced capacity through rationalisation over approximately 20 – 25 years. A huge backlog in maintenance of infrastructure and rolling stock had accrued. Road transport had been allowed to grow, unchecked, through free market principles with dire consequences for the road network.

A turnaround for rail

In South Africa and worldwide, railways had experienced a declining rail industry whilst highways were developed and transport markets were liberalised in response to 'just-in-time' production practices and growing globalisation. In many cases, rail reforms implemented over the past 15 years have successfully turned the tide for rail. More recently, the drive for more environmentally friendly utilisation of rail, growth in transport demand and the implementation of intermodal logistics solutions have started to mark a clear trend for the revival of rail.

Transnet and TFR have begun implementing strategies to advance the role of rail. Starting in 2005, TFR embarked on a strategic turnaround programme to stabilise, re-engineer and position the business for growth.



In addition to the development of revised strategies for branch lines, the business also transferred Mainline Passenger Services to the Passenger Rail Agency of South Africa (PRASA). Strategies were implemented for the remaining freight business focusing on customer service, operational efficiency, safety, development of people and a capital investment programme to address the backlog of the past 20-plus years and to create capacity for the nation's growing demand for transport.

The MDS, adopted in 2012, aims to:

- intensify the transportation of freight volumes;
- support operational efficiencies;
- · create jobs and develop skills; and
- champion transformation and deliver sustainable economic, social and environmental outcomes.

Transnet has committed to investing more than R300 billion in the development of the nation's transport system. The bulk of this capital programme is being invested in TFR. The switch of rail-friendly volumes back to rail and the reduction of logistics costs are cornerstones of the MDS.

Collaborating with road

Transnet cannot address the systemic issues surrounding the road-rail modal split alone. Transnet is keen to see the private sector invest, first and foremost in their loading facilities, but also in other critical

infrastructure in order to ensure that PSP initiatives are promoted and a joint investment philosophy between the private and public sectors is created. South African companies need to have a common objective to alleviate the pressure on the road system and to bring back to rail the commodities and containers that are suitable for rail transport.

There has to be an optimum split (and cooperation) between these two modes of transport. Furthermore, solutions need to be found that optimise South Africa's end-to-end supply chain, and more efficient border management in the African region. Optimisation of the system includes the way that South Africa's rail, road, inland terminals and ports complement each other to compete with other global supply chains. The combined efforts of Transnet, logistics service providers, road hauliers and the private sector can ensure that these objectives are achieved.

Developing intermodal solutions

In response to industry requirements,
TFR is mobilising its Intermodal Strategy
– a multi-faceted strategy that entails the
integration of technology solutions, revised
operating models as well as the development
of intermodal facilities with the objective
of reducing logistics costs and improving
efficiencies for customers, rail and logistics
service providers. An integrated road and
rail solution will therefore have to be less
costly than that of either mode used on
its own.

Key principles for intermodal solutions are:

- The rail leg will consist of block train loads between rail hubs with wagons reserved on trains to improve predictability;
- The road haulage component should ensure adequate connectivity between the hubs and the origins and destinations;
- Improved efficiency time to deliver, quality of service, condition of goods, security en-route and information flows;
- Terminals offering a broad spectrum of required logistics services could be operated by TFR, outsourced or privately built and operated;
- Achieving high traffic density is key to reduce per unit cost of a predominantly fixed-cost business:
- Transnet real estate and facilities could be utilised to manufacture, pack and store products within close rail proximity;
- Agricultural terminals should be developed and strategically positioned to consolidate volumes from a number of farms; and
- Multipurpose terminals that combine the loading of bulk and break-bulk commodities into either container or bulk wagons.

TFR is seeking partnerships with freight logistics service providers who would complement the goal of offering customers an integrated intermodal solution. In this regard TFR has already entered into MoUs with Imperial Logistics³⁹ and Barloworld Logistics⁴⁰ aimed at exploring collaboration opportunities. The value of such alliances lies in combining the rail core competency in long-haul rail transportation with the logistics service provider's expertise in road freight logistics, distribution and end-to-end value chain management.

The new positioning for rail requires a paradigm shift in that rail is reaching out to cooperate with traditional competitors. This illustrates a move towards an era of intermodalism as envisaged by emerging transport policy and one that aims to improve national competitiveness and drive down logistics costs.

³⁹ Transnet. 2013. Transnet Freight Rail and Imperial Logistics partner to collaborate in road to rail migration. Media release. 4 October.

⁴⁰ Transnet. 2013. Transnet Freight Rail and Barloworld Logistics partner to collaborate in road to rail migration. Media release. 22 October.



Challenges facing South Africa's 'road-to-rail' imperative — A Private Industry perspective

There should be no doubt that the Market Demand Strategy (MDS), which aims to create logistics infrastructure capacity ahead of demand, must succeed to enhance South Africa's competitive position. This investment is essential in facilitating improvement in logistics efficiency and economic growth. Unfortunately, Private Industry – as Transnet's customers and users of this infrastructure – is quite sceptical of the investment. Three key concerns need to be addressed to instil confidence in the programme.

- 1. At the outset, some concerns are raised about the quantitative basis of the MDS; i.e. the expected freight volume that would shift from road to rail. Private Industry wishes to be engaged by its service providers to ensure that its requirements are considered. Has Transnet asked its customers which volumes need to be moved, at what cost and service expectations? This customer-centric approach will undoubtedly complement the comprehensive freight-flow modelling that underpins the MDS.
- 2. The expected cost of the required investment is of further concern specifically the amount of capital that needs to be spent to catch-up with history and provide for future growth. Private Industry understands that all investment needs to be recovered from service pricing but just cannot compute the financial viability. Has Transnet considered a more transparent approach to cost and pricing? Such a commercially minded approach would complement the extensive engineering planning undertaken by Transnet.
- 3. The third question relates to the operating capability of Transnet the process, people and systems capabilities to enable effective operations. Private Industry expects professional service from both their people and their service providers. Has Transnet done enough to acknowledge current operating deficiencies and considered how to partner with others to acquire operating capabilities? Such a collaborative approach would complement the internal transformation initiatives undertaken by Transnet.

Beyond these concerns lie some even more practical challenges which need to be addressed. Private Industry simply cannot commit to the essential shift of freight volumes from road to rail until more clarity is achieved on at least these aspects:

- Private Industry cannot merely trust that capital investment will rectify Transnet's poor reliability record. As with all service providers, Transnet has to commit to service-level performance and has to accept the commercial consequences of underperformance. This does not mean that unreasonable penalties should be contracted in, but it requires a commercial mind-set that should drive operational excellence;
- Private Industry cannot commit to longterm conversion to rail transport without pricing transparency and predictability.
 As with road transport alternatives,
 Transnet has to include index-based increase mechanisms in their contracts.
 More importantly, Transnet has to commit to annual improvement targets to improve its competitiveness;
- The current 'take-or-pay' type of contractual arrangements are not acceptable to Private Industry.

- Some form of flexible capacity commitment is required to share the risk associated with operational variability and unpredictable prospects between Transnet and its customers:
- Limiting supply options always causes discomfort for Private Industry and a single-source supplier represents a major risk. Transnet has to find ways to guarantee that operating efficiencies are improved over time; and
- Rail, pipeline and port infrastructure and operations will only add value to Private Industry as part of end-to-end logistics solutions. Transnet needs to work closely with service provider partners to be able to provide intermodal services.

The challenge is thus for Transnet to engage with its customers – and even its current competitors – on medium and long-term imperatives for change, while continuing to provide day-to-day services. The future discussions require a very different environment to the status quo of interactions to date. Private Industry also needs to recognise this challenge and make its own contribution to facilitate 'safe' engagement about the future.



Response by Transnet Freight Rail to

Challenges facing South Africa's 'road-to-rail' imperative – A Private Industry perspective.

Transnet Freight Rail (TFR) values the opportunity to respond to concerns by sharing some organisational developments. Transnet has communicated and consulted widely with its customer base regarding the road-to-rail conversion.

Since rail tariffs are up to 60% cheaper than road, a great expectation from our customers is that we accelerate the road-to-rail project in order to reduce the logistics costs and thus contribute to making them more competitive in the markets in which they operate. Based on TFR's interaction with its customer base, it does not believe that the 'Industry Perspective' represents the sentiments of Private Industry as a whole, but rather is the view of a few players.

In the General Freight Business (GFB), the pricing philosophy is one of ultimately reducing the cost of doing business in South Africa so that, in time as more volumes are transported by rail, the total freight cost will decline. In the GFB sector TFR is in heavy competition with road and in fact has only 14% of market share.

Clearly market share can only be increased by providing a more competitive service.

Acknowledging this, TFR started its
Organisation Development and Performance
Department 18 months ago, which has
assessed operational gaps and uses
the lean six sigma philosophy to effect
performance improvements.

In fact, where Transnet has invested capital and acquired new rolling stock, significant operational efficiency improvements of up to 35% have been witnessed, which is an indication that TFR is pursuing both a capital and operational efficiency strategy – supported by specific strategies addressing customer service, skills and safety. The business units were designed in such a manner to specifically focus on customer interface, service delivery and cost-effective operational execution

The MDS is a partial response to a scientific freight flow model that Transnet developed and is the most comprehensive freight demand model in South Africa – modelling is done at a very detailed level i.e. freight

flows by magisterial district. In the model Transnet has targeted some, not all, rail-friendly cargo that can be converted in terms of its road-to-rail capability, given a limited budget to effect this.

TFR is not a single supplier of supply chain services to industry and as such does not consider itself monopolistic in that regard.

In the case of the bulk mineral export lines TFR enjoys a high market share because of the globally acknowledged efficiencies of those lines.

While TFR will defend the rights of 'Private Industry' to make comments, we believe that comments made out of context do

not aid the collaborative approach we have adopted as evidenced through the recent MoU with Barloworld Logistics and Imperial Logistics. Some comments are unwarranted when made without fully understanding that Transnet's DNA and character are rapidly changing.

We would welcome any discussions outside this study to bring Industry up to speed with our scientific approach.

I am confident though that our customers will vouch for a rapidly improving customer service and operational capability.

Siyabonga Gama

Chief Executive, Transnet Freight Rail



☐ THE STATE OF THE ROAD NETWORK

A discussion on intermodalism that focuses solely on the rail network is one-sided. As mentioned, the condition of South Africa's road networks varies greatly depending on the managing authority responsible. The unchecked shift of rail-friendly freight onto the country's road networks resulted in accelerated wear of the road surface which, coupled with decades of underinvestment in maintenance and expansion, left a huge infrastructure backlog. To a great degree SANRAL has been effective in addressing this backlog on the country's national roads over the past few years, but road conditions are still not ideal on many parts of the network.

It is widely acknowledged that inadequate road conditions can have many negative effects on the logistics cost and operations in a country. Various studies proved that a strong correlation exists between the condition of roads and the vibrations experienced by the vehicles travelling on the roads^{41,42}. These increased vibrations could potentially result in structural

damages to vehicles, leading to increased vehicle maintenance and repair costs and consequently higher logistics costs⁴³. In addition, these increased vibrations are also experienced by the goods transported on the road, leading to additional freight damages during transportation⁴¹.

The entire national road network of South Africa is paved and under the jurisdiction of SANRAL. Conversely, the provincial road network is under the jurisdiction of provincial authorities and about 25% of these roads are paved. Of the remaining roads in South Africa, it is estimated that 400 000 km is managed and maintained by various metros and municipalities in the country, and approximately 140 000 km of gravel roads are currently not under the jurisdiction of any authority⁴⁴.

The overall condition of South Africa's primary road network has generally been acceptable in the past decade or so, which is unfortunately not the case for the country's secondary road network. This is illustrated in Figure 13, which provides a comparison of the South African road network conditions in 2009 and 2013⁴⁴.

- 41 Steyn, W.J.vdM., Bean, W.L., Pretorius, C.J. and Van der Walt, G. 2012. The Potential Effects of Bad Roads on Transported Cargo. 8th Annual State of Logistics Survey for South Africa 2011: Gearing Up for Change.
- 42 Jarimopas, B., Singh, S.P. and Saengnil, W. 2005. Measurement and analysis of truck transport vibration levels and damage to packaged tangerines during transit. Packaging technology and science, 18(4) p 179.
- 43 Bean, W.L. and Steyn, W.J. vdM. 2013. The Potential Effects of Deteriorating Road Conditions in South Africa. Proceedings of the 32rd Annual Southern African Transport Conference 2013. Pretoria. July 8 – 11.
- 44 Kannemeyer, L. 2014. SANRAL. Personal communication regarding SA road conditions.

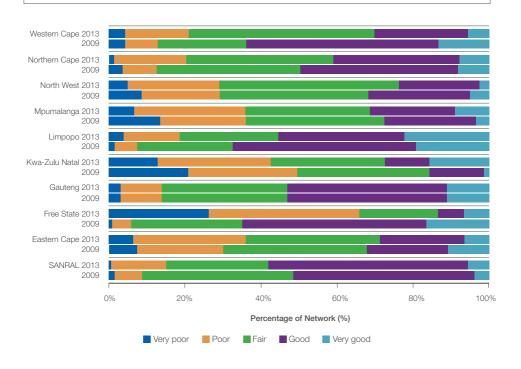
The data in Figure 13 are based on factors such as riding quality and visual condition.

From this graph it is apparent that the condition of the national road network (SANRAL) improved somewhat while the condition of Gauteng and the North West remained constant. KwaZulu-Natal and

Mpumalanga have shown improvements in overall road conditions while the Eastern Cape, Northern Cape, Western Cape, Limpopo and Free State have all shown deterioration in overall condition. The weighted average riding quality for all roads in Figure 13 decreased slightly from 2.02 to 2.10 between 2009 and 2013.

FIGURE 13: Comparison of South Africa's road network condition in 2009 and 2013.

Source: SANRAL⁴⁵.



45 Kannemeyer, L. 2014. SANRAL. Personal communication regarding SA road conditions.



Impact of road condition on logistics costs

The most important cost components affected by road roughness are fuel consumption, vehicle repair and maintenance and tyre wear. When road roughness increases by 1 m/km (International Roughness Index (IRI) scale), fuel consumption of heavy trucks increases by around 1% at 96 km/h and around 2% at 56 km/h. For vehicle maintenance and repairs, the effect of road roughness only starts to become significant for IRI values of over 3 m/km. When this value increases to 4 m/km, vehicle repair and maintenance cost increases by 10% for heavy trucks and at an IRI of 5 m/km. this increase is 50%. An increase of 1 m/km in IRI increases the tyre wear of heavy trucks by 1 percent at 88 km/h⁴⁶.

Chatti and Zaabar⁴⁶ verified and calibrated relationships for quantifying the effects that deteriorating road condition can have on vehicle operating costs (VOCs) in the US. These formulas were used to obtain a quantitative analysis of the potential effect of deteriorating road conditions on VOCs in South Africa. The basis of the formulas is similar to the World Bank's Highway Development and Management

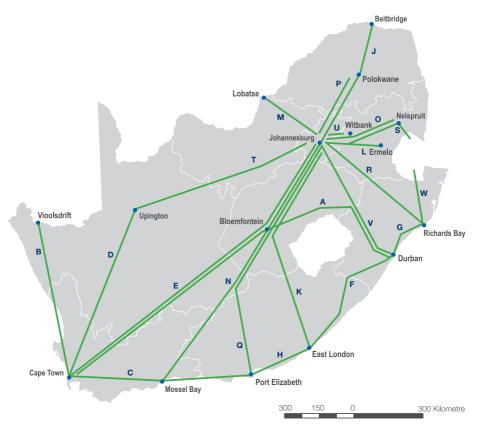
(HDM IV) model⁴⁷. Previous studies conducted in South Africa have indicated that the quantum of these numbers is similar to South African values⁴⁸. It should be noted that a process has been launched to calibrate these formulas specifically for South African conditions.

The potential effect of changing road conditions on the VOCs incurred on South Africa's 22 main freight corridors (Figure 14) has been analysed. A weighted riding quality was determined for each corridor. Fuel consumption, tyre costs, and repair and maintenance costs due to vehicle vibrations have been calculated:

- Using 2009 national road network conditions and 2009 freight volumes (tonne-km);
- Using 2009 provincial road network conditions and 2009 freight volumes (tonne-km);
- Using 2013 national road network conditions and 2012 freight volumes (tonne-km); and
- d. Using 2013 provincial road network conditions and 2012 freight volumes (tonne-km).
- 46 Chatti, K. and Zaabar, I. 2012. Estimating the Effects of Pavement Conditions on Vehicle Operating Costs, National Cooperative Highway Research Program (NCHRP) Report 720. Transportation Research Board (TRB).
- 47 Bennett, C.R. and Greenwood, I.D. 2003. Volume 7: Modeling Road User and Environmental Effects in HDM-4, Version 3.0, International Study of Highway Development and Management Tools (ISOHDM), World Road Association (PIARC). ISBN 2-84060-103-6.
- 48 Steyn, W.J.vdM., Bean, W.L., Pretorius, C.J. and Van der Walt, G. 2012. The Potential Effects of Bad Roads on Transported Cargo. 8th Annual State of Logistics Survey for South Africa 2011: Gearing Up for Change.
- 49 Ittmann, H., Schoeman, C., King, D. and Mashoko, L. 2011. Global Perspectives South Africa. Council of Supply Chain Management Professionals.

FIGURE 14: Main road freight corridors taken into account in the study.

Source: Ittmann et al.49



Corridor Name:

- A: Cape Town-Durban
- B: Cape Town-Namibia
- C: Cape Town-Port Elizabeth
- D: Cape Town-Upington
- E: Capecor
- F: Durban-East London
- G: Durban-Richards Bay
- H: East London-Port Elizabeth
- J: Gauteng-Beitbridge
- K: Gauteng-East London
- L: Gauteng-Ermelo

- M: Gauteng-Lobatse
- N: Gauteng-Mossel Bay
- O: Gauteng-Nelspruit
- P: Gauteng-Polokwane
- Q: Gauteng-Port Elizabeth
- R: Gauteng-Richards Bay
- S: Gauteng-Swaziland
- T: Gauteng-Upington
- U: Gauteng-Witbank
- V: Natcor
- W: Richards Bay-Swaziland



The results of the analysis are shown in Table 1. Keep in mind that between 2009 and 2012 there was a 1.6% growth in tonne-km on these corridors, thus any increase greater or smaller than 1.6% in the various cost elements can be considered disproportionate.

TABLE 1: The change in vehicle operating costs due to the change in road conditions on the main freight corridors. Source: University of Pretoria.

	National road conditions (a, b)		Provincial road conditions (c, d)	
Total VOCs	% Change	Disproportionate	% Change	Disproportionate
on all	between 2009	change	between 2009	change
corridors	and 2013	(correcting for	and 2013	(correcting for
		growth in		growth in
		tonne-km)		tonne-km)
Fuel consumption	1.6%	-	1.9%	0.3%
Tyre costs	1.6%	_	2.2%	0.6%
Repair and maintenance costs	1.2%	-0.4%	10.6%	9%

The data indicate that if the corridors consisted only of national roads, VOCs would not have increased disproportionately as the average road condition remained stable. In fact, in the case of repair and maintenance costs there would have been a decrease in costs as these costs are affected by 'Poor' and 'Very poor' roads and the percentage of these roads in this category reduced between 2009 and 2013 on the SANRAL network.

In contrast, if the corridors consisted only of provincial roads then VOCs would have increased disproportionately across the board. The repair and maintenance costs saw a great increase as a large proportion of provincial roads became 'Poor' or 'Very poor' over the past few years.

Conducting a similar analysis of the corridors on a provincial level the following significant changes were noted:

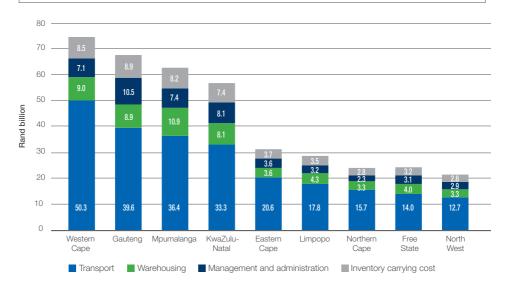
KwaZulu-Natal and Mpumalanga:
 The improvement of the road network resulted in less 'Poor' and 'Very poor' roads; consequently repair and maintenance costs were actually decreased by 5% in KwaZulu-Natal (where tonne-km increased by 2%) and

- did not increase at all in Mpumalanga despite a 4% increase in tonne-km;
- Free State: Repair and maintenance costs increased by 32% (growth in tonne-km was only 4%) as a result in the proportion of 'Poor' and 'Very poor' roads in the province; and
- Limpopo and the Western Cape: Both provinces saw a disproportionate increase in repair and maintenance costs resulting from the increase in roads rated as 'Poor' and 'Very poor'.

The proportion of 'Poor' and 'Very poor' roads in a province has a marked impact on the VOCs incurred in that province and therefore more attention should be directed to making poor roads acceptable instead of making acceptable roads even better.

Figures 15 and 16 show the update of provincial logistics costs for 2011 and 2012 as well as logistics costs as a percentage of the provincial GDP. Not much has changed in the ratios of these costs since they were first reported in the 8th State of Logistics™ survey for South Africa. The Western Cape incurs most costs as it ships many tonnes to Gauteng and also ships many tonnes from Gauteng and other provinces. Gauteng has a large consumer population that requires many tonnes shipped from the coastline. Mpumalanga ships millions of tonnes of coal and agricultural goods. KwaZulu-Natal also ship great volumes to Gauteng, albeit over shorter distances than the Western Cape. The remainder of the provinces do not, proportionately, generate as much freight activity.

FIGURE 15: Provincial logistics costs, 2012. Source: Stellenbosch University.



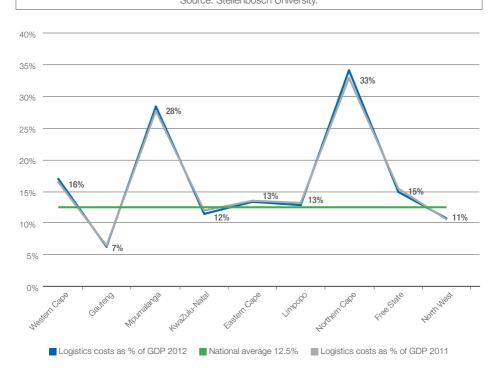


Considering logistics costs as a percentage of provincial GDP, the Northern Cape and Mpumalanga have the highest percentages due to the relatively low density of freight movement and dispersed transport networks. Goods from these provinces are also mostly primary sector goods

and therefore generate low revenues. The Western Cape has an unexpectedly high percentage as most freight must travel very far to/from its destinations/origins whereas the size of Gauteng's tertiary industry pushes up provincial GDP in relation to logistics costs.

FIGURE 16: Provincial logistics costs as a % of provincial GDP for 2011 and 2012.

Source: Stellenbosch University.



Consistent measurement for continued maintenance

The recent implementation of the Provincial Road Maintenance Grant (PRMG) will surely provide great motivation and means for provincial authorities to track and maintain their road networks better. Now that an upto-date road asset management database is

available for the majority of the national and provincial road network, it is important to expand this effort to the metro and municipal spheres, as this type of data enables objective cost calculations to be made, upon which road maintenance investment decisions can be made using appropriate benefit-cost analyses and related techniques.

SUMMARY OF CRITICAL LOGISTICS ENABLERS

Appropriate logistics infrastructure and a greater drive towards intermodalism are key enablers to reduce costs and improve performance in South Africa's logistics industry.

Investment in rail, road, port, pipeline and airport infrastructure continues to be a high priority for the country with hundreds of billions of rand invested annually in various projects. As is the case globally, funding for mega infrastructure projects is a significant constraining factor, thus public private partnerships (PPPs) are becoming essential to realise the country's ambitious infrastructure expansion plans. Transnet in particular is actively pursuing private sector engagement to drive forward its plans to promote intermodalism. The private sector is greatly interested in working together with the public sector to promote intermodalism and infrastructure development, but great consideration must be given to the risk, level of involvement and true financial viability of projects before companies can commit to partnerships.

Transnet's aggressive strategy to win back rail-friendly cargo over the past few years is starting to show results in the annual freight-flow statistics. By providing additional capacity and improving reliability on the bulk mining and agriculture lines and successfully implementing intermodalism, many tonnes will be shifted from road back to rail.

The country's national road network has remained in a good condition between 2009 and 2013 under the jurisdiction of SANRAL. Unfortunately many provincial road networks have deteriorated considerably – partly due to the accelerated wear caused by trucks carrying rail-friendly freight. Analyses show that by focussing first on upgrading 'Poor' and 'Very poor' sections to a 'Fair' condition will save more vehicle operating costs than upgrading 'Fair' roads to a 'Good' or 'Very good' condition. The institution of the Provincial Road Maintenance Grant (PRMG) on 1 April 2014 is expected to spur a turnaround in provincial road asset management.



4

Transport efficiency

THE FUEL CONUNDRUM

Transport costs is the largest component of logistics costs (61% in 2012 and 2013). In turn, fuel is the largest component of transport costs (see Figure 17 on page 60) and also happens to be a volatile cost driver largely beyond the control of the South African logistics industry.

Figure 18 (on page 61) shows the components of the fuel price. The basic fuel price includes the cost of crude oil as well as the cost of refining the crude into the finished product. Diesel contains a significant fuel levy and contribution to the Road Accident Fund (RAF).

A relevant question would be what the fuel levy is assigned to and whether there is scope to reduce it in the interest of stimulating logistics competitiveness in the country.



FIGURE 17: Components of transport costs. Source: Stellenbosch University.

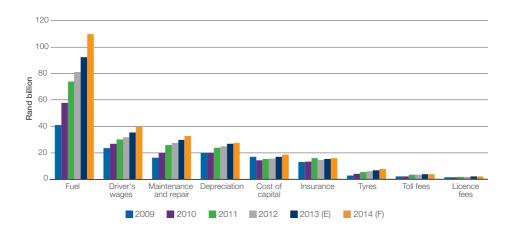
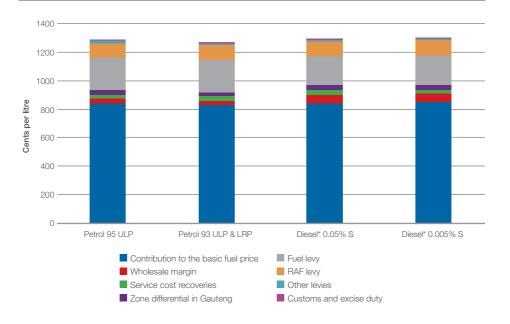




FIGURE 18: Components of the wholesale diesel price. Source: Adapted from Shell⁵⁰.



50 Shell. 2014. The pricing structure of petrol, diesel and IP.

Available: http://www.shell.com/zat/products-services/on-the-road/fuels/petrolprice.html



☐ FUEL SCENARIOS

Figure 19 is an alternative rendition of logistics costs as depicted in Figure 1; it calculates the transport costs component assuming that fuel prices stayed the same as in 2009. Additional costs resulting from fuel inflation are reported separately. It is interesting to note that fuel inflation from 2012 onwards contributes only slightly less towards total logistics costs than the other cost components (excluding transport). This alarming trend poses the question of what could happen given more drastic changes in crude oil prices and the exchange rate.

Scenarios were executed using 2012 data for a range of exchange rate and crude oil price values. Results are tabulated in Table 2. It is clear that even if crude oil prices were to remain the same, a spike in the exchange rate could have grave repercussions. Of course, any increase in the crude oil price affects costs in a big way as crude and refinement costs together constitute more than 50% of the diesel price. This illustrates clearly how transport costs are affected by these two components and the dire consequences significant changes to these could have on the logistics industry specifically and the country in general.

FIGURE 19: The impact of fuel inflation on logistics costs since 2009.

Source: Stellenbosch University.

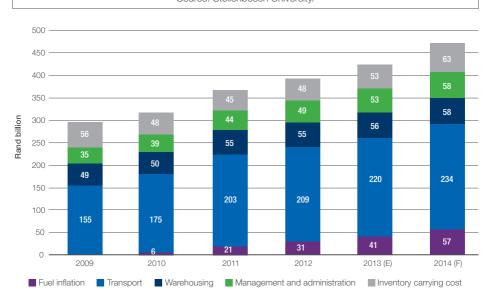


TABLE 2: The potential impact of the crude oil price and the exchange rate on national logistics costs in 2012. Source: Stellenbosch University.

	Change in total logistics costs R (billion)	Change in logistics costs as % of GDP										
	Crude oil price US\$ 50		Crude oil price US\$ 100		Crude oil price US\$ 150		Crude oil price US\$ 200		Crude oil price US\$ 300		Crude oil price US\$ 500	
6	-30.14	11.5%	-14.11	12.1%	1.93	12.6%	17.97	13.1%	50.05	14.1%	114.20	16.1%
8	-24.80	11.7%	-3.41	12.4%	17.97	13.1%	39.36	13.8%	82.12	15.1%	167.66	17.8%
10	-19.45	11.9%	7.28	12.7%	34.01	13.6%	60.74	14.4%	114.20	16.1%	221.12	19.6%
12	-14.11	12.1%	17.97	13.1%	50.05	14.1%	82.12	15.1%	146.28	17.2%	274.58	21.3%
16	-3.41	12.4%	39.36	13.8%	82.12	15.1%	124.89	16.5%	210.43	19.2%	381.50	24.7%
20	7.28	12.7%	60.74	14.4%	114.20	16.1%	167.66	17.8%	274.58	21.3%	488.42	28.1%



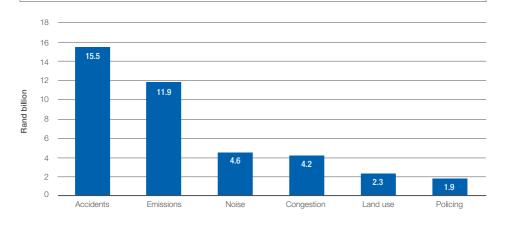
☐ EXTERNALITY COSTS

Another transport cost element that is yet to be reflected on the financial statements of companies is externality costs. These are the costs incurred by the public due to the transport of freight. Emissions costs are usually the first externality that comes to mind and in 2012, if emissions tax had been implemented⁵¹, it would have added an additional R12 billion to the country's transport bill. Charging emissions tax could have unintended impacts on the job creation imperative. Adding additional costs to an industry where margins are already tight could force smaller players out of business. Similarly, larger companies could cut back on employment costs to offset the burden.

However, emissions costs are not actually the highest externality cost. With South Africa's dismal road accident track record, it is estimated that road accidents involving freight vehicles amounted to another R15 billion that was not reflected in the transport costs for 2012. Noise, congestion, land use and policing are other externalities incurred by the public. Together externality costs amounted to R40 billion in 2012 – this would have been a 10% increase in total logistics costs for 2012 if these costs were reflected on financial statements.

While modal shift (enabled through intermodalism) will definitely drive down fuel consumption and externality costs, much can still be done to make transport – especially road transport – more efficient.

FIGURE 20: The cost of transport externalities in 2012. Source: Stellenbosch University.



51 Emissions tax is calculated using the rates proposed by National Treasury in 2011 and adjusted according to inflation.

GREATER ROAD EFFICIENCIES THROUGH INNOVATIVE REGULATION

The regulation of the use of vehicles on the road network is aimed at ensuring acceptable safety and recovery of road maintenance costs, as well as minimising congestion, road wear, excessive noise and air pollution. The traditional approach of regulating heavy vehicles is prescriptive, enforcing regulations that primarily limit the mass and dimensions of these vehicles. This approach is generally favoured because such regulations are easy to understand and enforce. However, an underlying disadvantage is that the prescriptive approach does not always safeguard the dynamic performance of heavy vehicles adequately while travelling on the road. Performance-based standards (PBS) are primarily aimed at specifying desired outcomes, rather than how these outcomes should be achieved. Under a PBS approach, performance measures (such as low-speed swept path, rearward amplification, load transfer ratio and high-speed off-tracking) are utilised to specify the performance required from vehicles. Although more complex to regulate, a PBS approach has a number of potential benefits such as improved vehicle

safety, improved productivity, reduced infrastructure wear and emissions, a more optimal use of the existing road network, and the encouragement of innovation in vehicle design.

As a result of successful initiatives in Australia, New Zealand and Canada. the introduction of a PBS (or Smart Truck) approach in the heavy vehicle sector in South Africa was identified by the CSIR as a research area warranting funding because of the potential benefits in terms of transport efficiency, road/vehicle safety and the protection of road infrastructure. A need was identified to design, manufacture and operate a number of PBS demonstration vehicles in South Africa in order to gain practical experience in the PBS approach and to quantify and evaluate the potential benefits⁵². Operators of Smart Trucks are required to be certified through the Road Transport Management System (RTMS) self-regulation accreditation scheme^{53,54}.

PBS demonstration project

For the purpose of the South African PBS demonstration project, it was decided to make use of international heavy vehicle PBS research, development and implementation. After reviewing the PBS initiatives in Australia,

- 52 Nordengen, P.A., Prem, H., Mai, L. 2008. An initiative to introduce a performance-based standards (PBS) approach for heavy vehicle design and operations in South Africa. Proceedings of the Tenth International Symposium on Heavy Vehicle Transport Technology. Paris, France.
- 53 Nordengen, P.A., Oberholtzer, F. 2006. A self regulation initiative in heavy vehicle transport to address road safety, accelerated road deterioration and transport productivity in South Africa. Proceedings of the Ninth International Symposium on Heavy Vehicle Weights and Dimensions. Pennsylvania, USA.
- 54 Standards South Africa. 2007. ARP 067-1: Road Transport Management Systems: Part 1: Operator Requirements Goods. ISBN: 978-0-626-19331-7. SABS, Pretoria, South Africa.



Canada and New Zealand⁵⁵, the Australian PBS scheme⁵⁶ was selected as the basis for the South African PBS project. It was recognised that if this scheme was adopted by the South African Department of Transport in the long term, it would need to be adapted to accommodate South African-specific conditions e.g. maximum vehicle width is 2.5 m in Australia and 2.6 m in South Africa.

After consideration of both the safety and infrastructure performance standards contained in the Australian PBS scheme, it was decided that only the safety performance standards would be used. Infrastructure performance standards would be developed based on existing approaches in South Africa for pavement and bridge design and assessment⁵⁷.

The infrastructure performance standards for the PBS demonstration project are based on South African pavement (read paved road) and bridge design loading approaches. For pavement, the current South African mechanistic-empirical design and analysis methodology (SAMDM)58, which is the basis of the South African pavement design manual for flexible pavements, TRH459, is used to assess the relative road wear of the proposed PBS vehicle combination and a representative baseline vehicle. The baseline vehicle is usually the vehicle that is being used in the transport operation which the proposed PBS vehicle is intended to replace. The requirement for PBS demonstration vehicles is that the road wear per ton of payload of the PBS vehicle must be less than the equivalent road wear of the baseline vehicle. As the number of different PBS demonstration vehicles increases, the intention is to develop a set of road wear benchmarks (for different vehicle configuration categories) against which proposed PBS vehicles can be assessed.

For the purpose of the protection of structures, the Smart Truck Review Panel decided to apply the more complex, but less conservative 'Abnormal Load' bridge formula⁶⁰ to PBS vehicles rather than the standard

- 55 Nordengen, P.A. 2013. The development and evaluation of a performance-based standards approach for regulating the use of heavy vehicles in South Africa. PhD thesis, University of KwaZulu-Natal, Pietermaritzburg, South Africa.
- 56 NTC. 2008. Performance based standards scheme The standards and vehicle assessment rules. National Transport Commission, Melbourne. Australia.
- 57 Nordengen, P.A., and Roux, M.P. 2013. Evaluation of a Performance-Based Standards approach to vehicle design to reduce pavement wear. IRF World Roads Meeting, Riyadh, Saudi Arabia.
- 58 Theyse, H.L., De Beer, M. and Rust, F.C. 1996. Overview of the South African Mechanistic Pavement Design Analysis Method. Paper 96-1294, 75th Annual Transportation Research Board Meeting, Washington, D.C., USA.
- 59 DoT. 1996. TRH4: Structural design for flexible pavements for inter-urban and rural roads. Technical Recommendations for Highways. Department of Transport. South Africa.
- 60 DoT. 2010. TRH11: Dimensional and mass limitations and other requirements for abnormal load vehicles, 8th ed. Department of Transport, Pretoria, South Africa.

bridge formula that is applicable to all legal heavy vehicles. The adoption of the abnormal load bridge formula for PBS demonstration projects is based on the premise that the PBS vehicles operate in a more controlled environment, including the RTMS self-regulation accreditation requirement, than the general heavy vehicle fleet and this has been shown to be the case. Hence the risk of non-compliant behaviour, including overloading, speeding and reckless driving is reduced considerably.

In order to facilitate the participation of transport operators, consignors, consignees and trailer manufacturers in the PBS demonstration project, a set of guidelines was developed providing a step-by-step approach for submitting applications, obtaining approval, design development, assessment and commissioning⁶¹.

For the purpose of the Smart Truck demonstration project, PBS assessments of both the baseline and the PBS design vehicles are required. This enables a quantification of the improvement in safety performance of the PBS vehicle compared with the baseline vehicle. It also provides the opportunity to identify design weaknesses of typical vehicles in the South African heavy vehicle fleet.

Smart Trucks on the road

The first two Smart Trucks commenced operations in KwaZulu-Natal in November and December 2007, respectively, and the monitoring of the first eight months of operation was reported on in March 2010 at the HVTT11 symposium in Melbourne⁶². As a result of the positive performance of these two PBS vehicles, the KwaZulu-Natal Department of Transport decided to increase the number of permits for Smart Truck demonstration vehicles in their area of jurisdiction. To date, 63 operational Smart Trucks exist, with a further 47 vehicles that are in the manufacturing or commissioning phases. Most of these vehicles are in the forestry and mining transport sectors in the provinces of KwaZulu-Natal, Mpumalanga and Limpopo. A number of other PBS vehicles for operation in other sectors are in the design phase. In March 2014, the national Department of Transport's Abnormal Load Technical Committee (ALTC) approved a new roadmap for car carriers in South Africa, which stipulates that all new car carriers that are required to operate under permit (overall height up to 4.6 m and/ or overall length up to 23.0 m) must be PBS compliant. In anticipation of this new framework for car carriers, the five major car carrier operators have become RTMScertified during the past three years.

⁶¹ CSIR. 2013. Smart Truck programme: Rules for the development and operation of Smart Trucks as part of the performance-based standards research. National Department of Transport, Pretoria, South Africa.

⁶² Nordengen, P.A. 2010. Monitoring results of two PBS demonstration vehicles in the forestry industry in South Africa. Proceedings of the Eleventh International Symposium on Heavy Vehicle Transport Technology. Melbourne, Australia.



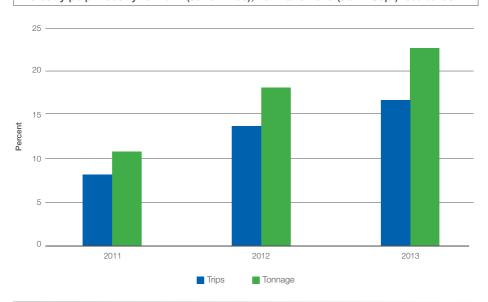
Figure 21 shows the percentage of PBS vehicle trips and tonnage transported by PBS vehicles in the forestry industry from 2011 to 2013⁶³, which indicates the steady growth of timber transport by Smart Trucks in forestry.

As a result of the increased payload capacity of the Smart Trucks, the number of trips saved during 2012 (48 operational Smart Trucks) and 2013 (60 operational Smart Trucks) was 10 260 and 59 400, respectively. This represents approximately 11 trips saved per vehicle per month during the sample period.

Fuel efficiency and emissions savings

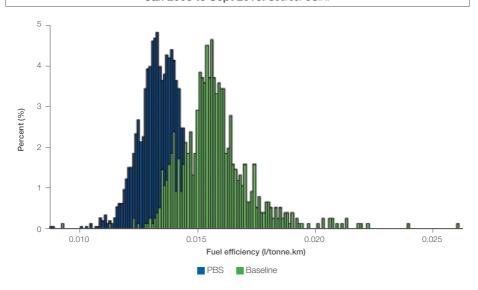
The histograms in Figure 22 show the distribution of fuel efficiency for the PBS and baseline vehicles for the period January 2008 to September 2013, representing 78 545 PBS vehicle trips. The fuel efficiencies were calculated from the data submitted by the PBS operators. The mean fuel efficiencies for the two groups are 0.0157 ℓ /tonne-km for the baseline vehicles and 0.0135 ℓ /tonne-km for the PBS vehicles, an average improvement of 14.0%.

FIGURE 21: Percentage of PBS vehicle trips and tonnes transported in the forestry pulp industry for 2011 (June – Dec), 2012 and 2013 (Jan – Sept). Source: CSIR.



63 Nordengen, P.A. 2013. The development and evaluation of a performance-based standards approach for regulating the use of heavy vehicles in South Africa. PhD thesis, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

FIGURE 22: Histograms of fuel efficiency for baseline and PBS vehicles, Jan 2008 to Sept 2013. Source: CSIR.



Based on these improved fuel efficiencies for the Smart Truck operators in the forestry industry, the estimated fuel savings amount to approximately 1.85 million litre of diesel or an average of 66 000 ℓ /month during the sample period. The equivalent tonnes of CO_2 , using a conversion factor of 2.8 kg of CO_2 per litre of diesel burnt⁶⁴, results in a reduction of 5 175 tonnes of CO_2 emissions in total during the sample period as a result of using the PBS rather than baseline vehicles. This amounts to approximately 185 tonnes of CO_2 per month. The savings

of 5 175 tonnes of CO_2 is equivalent to 2 021 tonnes of coal or 7.33×10^6 kWh⁶⁵. An average fuel efficiency improvement of 0.0022 ℓ /tonne-km between the baseline and PBS vehicles translates to a reduction in CO_2 emissions of 0.0062 kg/tonne-km. Based on an estimated 306 billion tonne-km of road freight in South Africa during 2013 (see Figure 12), and assuming 10% of this freight was transported by PBS vehicles similar to those participating in the PBS demonstration project, give an estimated reduction in CO_2 emissions of 189 000 tonnes per annum.

⁶⁴ OECD. 2011. Moving Freight with Better Trucks: Improving Safety, Productivity and Sustainability. ISBN 978-92-821-0293-0. OECD Publishing, Paris, France.

⁶⁵ EPA. 2013. Green Power Equivalency Calculator Methodologies. [Internet] United States Environmental Protection Agency. Available from: http://www.epa.gov/greenpower/pubs/calcmeth.htm



Reduction of road wear

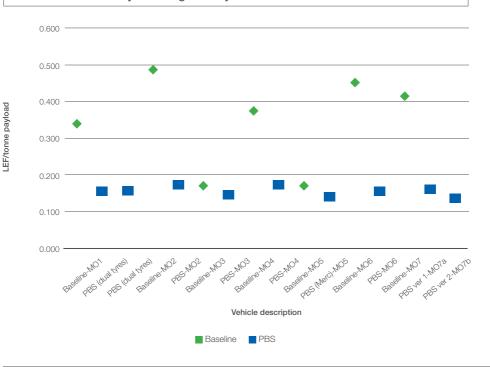
The road wear effects of Smart Trucks relative to their corresponding baseline vehicles are assessed by calculating the load equivalency factor (LEF) per tonne of payload. Figure 23 shows the LEFs/tonne payload of various mining baseline and PBS vehicles.

Five of the seven mining baseline vehicles were fitted with single tyres on all the trailers. In all these cases the LEF/tonne payload exceeds 0.300, ranging from 0.340 to 0.487. In some cases, the baseline vehicle causes between 100 and 200% more road wear than

the corresponding PBS vehicle. In the two cases where the baseline vehicles were fitted with dual tyres (Baseline M03, and Baseline M05), these baseline vehicles cause 16.5 and 22.1% more road wear per tonne of payload than the corresponding PBS vehicles.

This performance-based approach makes provision for designing more productive vehicles (trip reduction and fuel efficiency improvements) while at the same time reducing the road wear and ensuring a minimum acceptable standard in terms of on-road safety performance.

FIGURE 23: Summary of mining industry PBS road-wear assessments. Source: CSIR.



The future of Smart Trucks in South Africa

Smart Trucks hold much promise for the South African transport sector. Not only are the trucks more fuel efficient, reducing both costs and emissions, but they are safer and cause less damage to the road per payload. In fact, using Smart Trucks reduces the number of trips required as larger payloads can be handled without increased road wear – which means that Smart Trucks could potentially lessen truck congestion on major corridors as well.

To date the PBS demonstration project has dealt with industries that move very heavy. arguably rail-friendly, goods such as the mining, forestry and sugar cane industries. Although Smart Trucks provide a marked benefit for cargo owners in these industries, it is still far from matching rail alternatives i.t.o. cost. fuel and emissions efficiencies. Currently there is not enough rail capacity for all the freight in these industries to be transported by rail and, inevitably, millions of tonnes are transported by road. Smart Trucks offer a better road solution in the short to medium term while Transnet rolls out its planned infrastructure and service delivery improvement projects.

Despite the proven benefits, there have been some barriers to the adoption of PBS and Smart Trucks in the road freight industry. Firstly, PBS is an innovative form of regulation and as such it is still met with some resistance from certain provinces. However steady progress is being made, with more and more provinces actively participating in the Smart Truck research initiative.

Secondly, Smart Trucks are more expensive to manufacture and the assessment process can be costly and time-consuming. If Smart Trucks are to be accepted in South Africa in the long term, a more practical design approach is suggested where semi-standard or 'pro forma' designs are specified with allowed variations for non-critical parameters.

In Australia, the National Transport Commission estimated that adoption of PBS, which was formally approved as part of their road transport legislation earlier this year, will only be in the order of 15 to 20% of all road freight transport. A similar uptake is expected in South Africa if PBS is fully adopted by government. Even at 15 to 20%, these Smart Trucks will definitely make a difference in reducing fuel consumption and road wear and improving vehicle safety performance. Furthermore, experience of the PBS approach by South African trailer manufacturers will inevitably result in the improvement of designs of prescriptive 'non-PBS' vehicles. This trend has already been observed in the forestry transport industry.



SUMMARY OF TRANSPORT EFFICIENCY

Fuel costs are by far the most significant and volatile cost driver in transport (and therefore logistics) costs. Despite expectations by some that the crude oil price may actually decrease in the short term, South Africa's diesel price is also very dependent on the exchange rate and additional levies added to the base price of fuel. Calculated scenarios show how sensitive overall logistics costs are to changes in the exchange rate and crude oil price. Instead of trying to control economic drivers outside the industry's reach, drastic changes should be made to reduce the overall demand for fuel. Shifting freight from road to rail would have a decided effect on fuel consumption, but the fuel efficiency of South Africa's road transport sector still offers great margins for improvement. Externality costs, especially emissions and accident costs, will also be greatly improved by reduced fuel consumption and congestion, and better road safety.

Smart Trucks, a product of the performance-based standards (PBS) initiative driven in South Africa by the CSIR, is a road transport initiative that holds great promise for increasing transport efficiency in tandem with modal shift imperatives. Demonstration projects have shown average improvements in fuel efficiencies of 14% along with a drastic reduction in road wear and larger payloads, which result in fewer trips. Full-scale adoption of PBS and encouragement of Smart Truck technology by government is expected to result in about 15–20% of road freight using this more efficient technology. This would have a significant impact on national fuel consumption, emissions and congestion on freight corridors.





5

The human backbone

THE TALENT GAP

South Africa's skills shortages have been well documented over recent years. As far back as the 2006/7 scarce skills list⁶⁶, numerous skills that are critical to the success of supply chains were identified, providing some indication of the extent of the supply chain skills shortage in the country. The 2008 national scarce skills list⁶⁷ supported this view and expanded the list of required supply chain related skills.

⁶⁶ Department of Labour. 2007. State of skills in South Africa, 2006/7.

⁶⁷ Department of Labour. 2009. National Scarce Skills List 2008



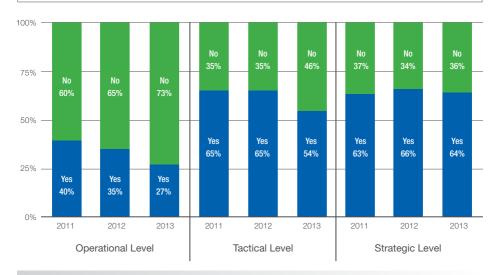
The skills shortage in South Africa remains critical. The World Economic Forum's Global Competitiveness Report 2013-2014⁶⁸ identifies that an inadequately educated workforce is the most problematic factor for doing business in South Africa. The 2014 Barloworld Logistics' annual supplychainforesight report⁶⁹ identifies the lack of relevant skills/talent as the key strategic business constraint and the fourth highest supply chain constraint. The University of Johannesburg has, over the past three years, conducted extensive industry surveys to gain further insight into South Africa's supply chain skills shortage.

It is evident from the industry surveys that the skills shortage in the supply chain has not been significantly alleviated over the past few years.

Companies are still experiencing difficulty recruiting talent at all levels, but especially on the tactical and strategic level (Figure 24). This appears to indicate either that insufficient numbers of people are being trained to enter the industry, that educational institutions are not providing the skills that supply chains require or that South Africa is not managing to retain its supply chain talent.

FIGURE 24: Difficulty of filling positions at various employment levels.

Source: University of Johannesburg.



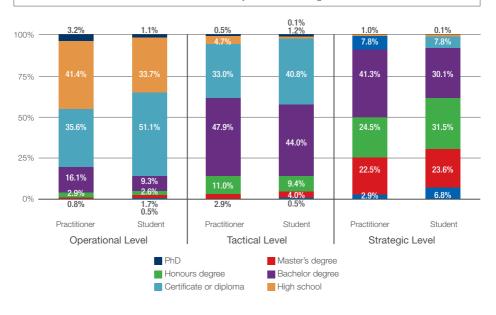
- 68 World Economic Forum, 2013. Global Competitiveness Report 2013 2014.
- $\textbf{69} \quad \text{Barloworld Logistics, 2014. 2014} \ \textbf{supply} \\ \text{chain} \\ \textbf{foresight} \\ \text{The rise and fall of customers and companies}$

A comparison between responses from industry practitioners and students indicate that, in general, practitioners seem to place a far higher premium on education than students (Figure 25). The results indicate that the majority of student respondents consider a certificate/diploma as the required tertiary qualification to gain an entry-level

position, whereas practitioners place a slightly higher emphasis on a Bachelor degree as a requirement for operational-level positions. For tactical-level positions, practitioners indicated a higher requirement for graduate and post-graduate degrees as opposed to certificate or diploma qualifications as indicated by students.

FIGURE 25: Perceptions of education requirement by practitioners and students.

Source: University of Johannesburg.





When asking students why they study supply chain-related courses, a passion for the industry was cited by only 17.3% of the respondents, whereas enhancing skills (32.1%) and being more employable (23.7%) were far more prevalent motives. Other motives were also discipline-generic such as obtaining a qualification, seeking promotion or being employed in an industry that is growing and has a skills gap. Apart from the respondents that were "passionate about the industry", most of the respondents could easily be tempted to switch careers or degrees. However, the responses also

show that students recognise that they require appropriate and more skills to become more employable in the industry.

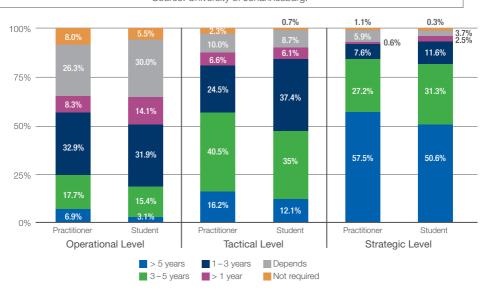
Practitioners also set a far higher bar for work experience requirements than students do (Figure 26). Work experience is critical on all levels, but especially on the strategic level.

KEY SKILL AREAS

Based on a review of various international comparative studies⁷⁰, a preliminary list of 66 skills areas were identified and considered as important skills required by logistics and supply chain managers.

FIGURE 26: Perceptions of experience requirements by practitioners and students.

Source: University of Johannesburg.



70 Heyns, G.J. & Luke, R., 2012. Skills requirements in the supply chain industry in South Africa, Journal of Transport and Supply Chain Management, 6(1), pp 107-125.

A panel of six academics and experts in the field of logistics and supply chain management were used to consider the initial list of skills perceived to be relevant in the logistics and supply chain environment. The panel agreed on an initial set of 38 skills (reduced to 30 in 2012)⁷¹, which were further grouped into six skills groups, namely: general management; behavioural/interpersonal skills; logistics awareness; logistics analytical; logistics information technology; and environmental awareness.

To ascertain the trends and statistics with regard to the current logistics skills gaps in South Africa, two industry surveys were conducted in 2011 and 2012 and a student perception survey was conducted in 2013. Table 3 compares the Top 10 skills ranked by practitioners and students. Although six of the 10 skills in the list coincide, it is clear that practitioners place far greater emphasis on soft skills than students do.

TABLE 3: Skills ranking comparison between practitioners and students.

Source: University of Johannesburg.

Rank	Skills Item - Practitioners*	Rank	Skills Item – Students
1	Customer focus	1	Transport management
2	Ability to plan and prioritise	2	Decision making
3	Business ethics	3	Ability to plan and prioritise
4	Ability to see big picture	4	Customer focus
5	Team work	5	Communication skills
6	Problem solving	6	Problem solving
7	Ability to think outside the box	7	Warehousing/Materials handling
8	Communication skills	8	Knowledge of the industry
9	Business process improvement	9	Team work
10	Decision making	10	Laws and regulations

^{*} Represents the results of the combined practitioners survey data sets

⁷¹ Heyns, G.J. & Luke, R. 2013. Skills shortages as a barrier to the development of South Africa's global supply chains.
Proceedings of the Pan-Pacific Conference XXXI: Forging the legacies of emerging economies. Johannesburg, South Africa, pp 99-101



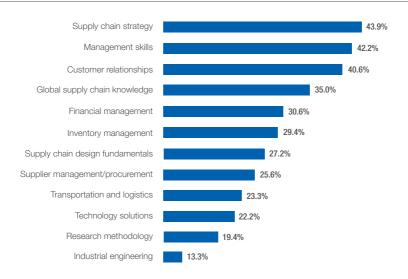
THE ROLE OF EDUCATION PROVIDERS

The question is thus whether practitioners believe that current supply chain education is adequately preparing students for the workplace? Results from the surveys indicate that almost half of the respondents felt students were prepared very well or extremely well for day-to-day supply chain

work while only 5% responded negatively. However, it is interesting to note that when asked in which areas practitioners felt students could be better prepared a number of hard skills ranked quite highly (Figure 27), but management and customer relationships – regarded as soft skills – still ranked as the second and third most important areas in which students could be better prepared.

FIGURE 27: Areas where candidates need to be prepared better for the workplace.

Source: University of Johannesburg.



When asked what universities could do to prepare students better for a career in the supply chain industry, respondents provided a clear need for more practical education and training, as indicated by the three highest cited potential solutions, i.e. more hands-on experience, contact with practitioners and case study teaching (Figure 28). The need to improve 'soft' skills was also again clearly highlighted.

While practical experience and exposure to industry can be built into undergraduate degrees, it can sometimes be difficult to balance the need for solid theoretical training with show-and-tell opportunities and training in the softer skills. This is a gap that can be filled more easily through vocational associations, graduate training programmes, post-graduate degrees and short courses or certifications. The point being that

many aspects can prepare candidates and continuously improve their skills and competence and no single qualification can address all.

South Africa has a number of prestigious universities offering a range of undergraduate and post-graduate degrees in supply chain management with many of these faculties also starting to offer short courses, certificates and diplomas. According to the APICS Operations Management Body of Knowledge Framework (OMBOK), South Africa, when compared to other BRIC countries, is on par in terms of the tertiary education offered in the supply chain discipline but is below par in terms of industry association memberships and certifications⁷². Perhaps the South African supply chain industry should capitalise more fully on skills enhancing opportunities provided outside of tertiary institutes.

FIGURE 28: How universities could prepare students better for the workplace.

Source: University of Johannesburg.



72 Kumar, D. 2012. The strongest contributor or the weakest link: the role of people in Africa's supply chains. SAPICS 34th Annual Conference. June.



SAPICS, the Association for Operations Management of South Africa, is focused on the development of the supply chain management profession in South Africa by promoting learning, networking and collaboration among its members. SAPICS is most known in the South African industry for its annual conference in June that attracts over 1 000 professionals as attendees. many local and international speakers, 50+ exhibitors and hosts multiple workshops and presentations of new and current topics. This conference as well as the many professional development events organised by SAPICS chapters throughout the year are efficient ways to address some of the issues raised in Figure 28.

Learning is also facilitated in a more structured way through accredited certification programmes. SAPICS has evolved into a one-stop-shop to find education in world best-practice courses and certifications. The international certifications currently endorsed and promoted through SAPICS are:

The APICS CSCP – Certified Supply Chain Professional. This targets the top supply chain managers and is recognised across the world as a respected certification that indicates the highest standard of competence. It deals with strategic-level issues and helps to understand decisions taken that affect cross-enterprise supply chains.

The APICS CPIM – Certified in Production and Inventory Management. This targets the middle to top level operations manager and empowers him/her with skills and knowledge that facilitate improvement in their environment.

The IBF CPF – Certified Professional Forecaster. This targets current and aspiring demand planners and managers, giving them the tools to understand their environments to make better decisions.

These international certifications need to be kept current and evidence of involvement in the field is required to maintain the certification status. For the APICS certifications, this has to happen every five years, and for the IBF certification every three years. At the moment the following numbers of South Africans are certified and current:

- CPIM 1 037 certified, 148 current;
- CSCP 236 certified, 210 current; and
- CPF 33 certified, all current.

Apart from providing learning opportunities, the events hosted by SAPICS could also go a long way in showing students and young professionals the scope and potential of the industry – igniting a passion to stay in the field.

SUMMARY OF THE HUMAN BACKBONE

Undoubtedly a lack of skilled personnel at all levels hampers the performance of supply chains. From industry surveys it appears that tertiary degrees and professional certifications do in fact teach students the required 'hard' skills for day-to-day supply chain work, but there is a great gap in terms of 'soft' skills and practical exposure. In comparison to other BRIC countries the quality of South Africa's tertiary degrees in the field are on par but membership of industry associations and professional certifications lag behind.

This indicate that a critical gap can be filled by organisations such as SAPICS that provide a platform for industry exposure, networking, knowledge sharing and professional certification.

Only about a fifth of students currently study supply chain related degrees due to a passion for the industry, with other motivations being more discipline-generic. This indicates that perhaps more needs to be done to show students what supply chain management is in the working environment to ensure the right candidates are drawn and graduates are not lost to other industries.



Conclusion

The 10th State of Logistics[™] survey gives a perspective on important issues in this environment in South Africa. Many positive aspects are highlighted and mentioned. In general the logistics industry, in the broadest sense, is functioning well in South Africa. Companies and 3PLs are tackling challenges head-on and coming up with innovative solutions by introducing, in many cases, the latest supply change management and logistics best practice. The case study of what Nissan SA achieved exemplifies this as well as the introduction to performance-based standard and Smart Trucks

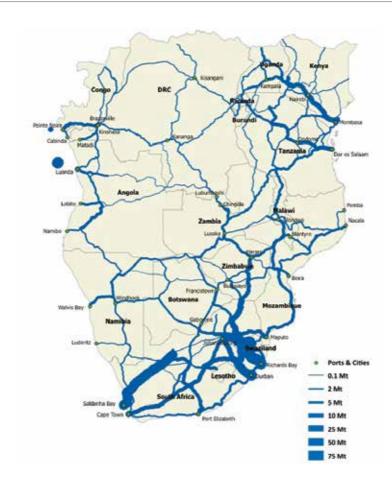
Possibly most critical is the fact that over the past number of years, infrastructure for all modes of transport have either been built or upgraded and great efforts have been made to address the maintenance backlog. Transnet is in the process of implementing a very ambitious strategy around infrastructure investment. Under the National Development Plan a number of Strategic Infrastructure Projects have been identified to address transport infrastructure and work is progressing on these. The private sector has also stepped up to the plate in a big way over the past few years by getting involved in the country's drive to provide appropriate logistics infrastructure and services. Despite the initial frustrations and inertia experienced by the

private sector in some of these initiatives, the willingness to engage is a positive sign.

In the context of Africa, South Africa is still a leader in logistics and infrastructure. Figure 29 presents a groundbreaking mapping of the volumetric trade flows for 17 countries in southern Africa for 2012. The simplified flows mapped here include all intra-regional flows between the countries and also imports and exports to and from other continents and the rest of Africa (domestic volumes are therefore not included). With the continent accelerating its investment in infrastructure and industrial growth (especially through foreign investment). South African companies are poised to capitalise on the demand for logistics services.

The global economic situation and rising cost drivers spell out increased competition and tighter margins. Thus driving down the cost of logistics, making South Africa more competitive and capitalising on growth potential in Africa and global commodity markets will require no less than BOLD STEPS FORWARD. Greater supply chain integration, modal shift, transport efficiencies and successful PPPs will require proactive effort, courage and innovation from both the private and public sectors.

FIGURE 29: Freight flow on the major corridors of sub-Saharan Africa. Source: Transnet.







Profile of Imperial Logistics

UNIQUE END-TO-END SOLUTIONS THE CATALYST FOR CLIENT COMPETITIVENESS

At Imperial, we improve our clients' competitiveness through customising our experience in outsourced value chain management. Our diverse experience and expansive capabilities extend from procurement to brand activation, and include all the logistics services in between. As a result, Imperial Logistics is the only company that can take materials and products from their original source – via manufacturing – to the end-consumer point of sale. "Get me there; sell my product; build my brand" is the way we describe our integrated, end-to-end value proposition. Our burgeoning African footprint is testament to our strategy of assisting clients in benefiting from the mass consumerisation of Africa – where we minimise the risk and complexity of doing business through our unrivalled understanding of the dynamic and ever expanding demands of the African consumer, as well as a profound comprehension of the continent's unique challenges.

For further information, please visit www.imperiallogistics.co.za



Profile of Stellenbosch University: Department Of Logistics

The Department was founded in 1960. It is the oldest tertiary academic department in South Africa to offer training in Transportation and Logistics. The Department is the home department for the following focus areas: Logistics Management, Quantitative Management, Operations Research and Transport Economics.

In common parlance, logistics often refers to the smooth execution of a complex or problematic operation. In a business context, it refers to the process of transporting resources from their place of origin, supporting the processing of these resources, and delivering the finished products on the intended time at a designated place at acceptable cost for consumption or use. In view of the fact that logistics adds value through the most profitable application of available means, adequate logistics competency gives firms and practitioners a competitive advantage.

The focus areas that are offered by the Department of Logistics can be taken in any of the four broad undergraduate programmes of the Faculty of Economic and Management Sciences. Operations Research can also be taken as part of the B.Sc. (Mathematical Sciences) programme.

If further information about the department and the programmes offered are needed, contact us at

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Profile of the Council for Scientific and Industrial Research

Through directed research, development and innovation, the CSIR improves the competitiveness of industry and the quality of life of the people of the country. South Africa's CSIR was established in 1945 as a science council by an Act of Parliament. It has a proud track record of multidisciplinary research and a bright and challenging future through science, engineering and technology (SET), undertaken by its innovative individuals and teams.

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

As an operating unit within the organisation, CSIR Built Environment creates innovative, cost-effective, sustainable solutions for uniquely South African and other global built environments. The unit's SET base is at the core of its multidisciplinary capabilities to deliver sustainable infrastructure development, asset preservation, socio-economic growth and global competitiveness in and for the built environment.

Included in the unit's transport systems and operations competences are groups dedicated to logistics system analysis and supply chain management; transport economics; transport infrastructure management systems; and public transport systems design. The impact of our track record resonates, among others, in transport and logistics networks, which benefit from effective systems and efficiency in service delivery.

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