SECTION 2 CREATING A GROWING AND SUSTAINABLE IRON AND STEEL VALUE CHAIN IN SOUTH AFRICA

AngloAmerican

KUMBA IRON ORE

2.1 EXECUTIVE SUMMARY

The South African Government's New Growth Plan and its developmental objectives have initiated a broad debate on the optimal way to grow and enhance the South African iron and steel value chain. Policy interventions can have positive, as well as potentially unintended negative consequences in relation to complex value chains such as the iron and steel value chain, which is affected by a number of competitive variables.

Kumba Iron Ore Limited (Kumba) is deeply committed to South Africa and to supporting the Government in achieving its objectives to stimulate sustainable growth, employment and development across the iron and steel value chain. It wishes to actively engage with Government, industry and other stakeholders, in the ongoing developmental debate in South Africa and, where appropriate, promote additional sustainable beneficiation.

South Africa needs a strong, competitive and growing iron and steel industry, across all four steps of the iron and steel value chain (being exploration and extraction, mining beneficiation, metallurgical beneficiation and shaping and conversion/fabrication and manufacturing/end-user industries).

Section 1 provided background information on the iron ore and steel industries in South Africa. Building on this background, Section 2 is designed to help answer the following questions:

- To what extent can growth in the iron ore and steel industries contribute to economy-wide growth in South Africa?
- What actions by Government are needed to help firms in the iron ore and steel sectors realize these growth opportunities (high road scenario)?
- Are there things that Government should be careful to avoid doing – things that might frustrate growth in the iron ore and steel sectors (low road scenario)?

A synthesis of the combined key messages from the two documents is found below:

Impact of state inventions:

- Successful Government interventions focus on industries that have/can have a structural competitive advantage.
- The ingredients for robust growth are present in the South African iron ore mining industry, but not in the steel industry.
- Government interventions in the South African iron and steel value chain could have unintended negative consequences.

Exploration & extraction and mining beneficiation (iron ore mining):

- The iron ore industry can more than double output in the next ten years, creating 14 000 new jobs and uplifting Limpopo and the Northern Cape.
- South Africa's Limpopo and Northern Cape reserves can best be developed through three iron ore hubs.
- These exciting growth opportunities will require supporting infrastructure and market based iron ore prices.
- Growth in South African iron ore mining is not viable at discounted prices.

Metallurgical beneficiation and shaping (steelmaking):

- South Africa has 10.3-11.6 mt of steelmaking capacity, of which approximately 50% is not needed domestically.
- South Africa is unable to export all of this excess steel capacity, given its costs are 30-35% higher than competitors; even iron ore for free would not close this gap.
- There is significant global overcapacity in steelmaking, further amplifying South Africa's export challenge.
- As a result, export volumes have destroyed economic value over the last ten years.
- The iron ore price will have a negligible impact on downstream industries.
- It would be difficult to reduce South Africa's steel costs through subsidised inputs, given that most costs are largely incompressible.
- The economics do not support new steelmaking capacity in South Africa. However, should Government policy require new steelmaking capacity there could be two potential steel growth opportunities, both requiring significant Government support and industry research and development
  - Kumba is engaged with the IDC to research emerging steel technologies.
  - An export slab mill would be the best option to build additional steel capacity in South Africa.

Conversion/fabrication and manufacturing/end-users (downstream industries):

- The ex-gate price of steel from steel producers is only 60-70% of the total steel price eventually paid by customers.

- International experience shows that the steel demand price elasticity is 0.2-0.3.

- Even aggressive input cost subsidisation/steel price control in South Africa would only create 1-3% of additional downstream steel demand.

In more detail, a summary of the key findings of Chapter 2 follows below:

- **Successful Government interventions focus on industries that have/can have structural competitive advantages:** Successful industries have competitive advantages such as scale, proximity to markets (ie the domestic producers do not face high transport costs to reach their customers), low labour costs, technical expertise and logistics capacity. Where these inherent structural advantages are not in place, Government interventions typically fail. In other words, Government interventions are generally not able to overcome inherent structural disadvantages.

  South African economic growth needs to build on the same principles to be sustainable in the long term. Specifically, for the iron and steel value chain, case examples from Australia demonstrate that having large deposits of iron ore and coking coal do not necessarily provide a country with a structural advantage in relation to downstream industries, which use iron ore as an input into their production processes. This is supported by the recommendations of the International Panel on ASGISA (May 2008): *"Greater processing of natural resource exports does not constitute an easy or natural next step in the process of structural transformation, especially in South Africa (…). Privileging beneficiation is unwarranted and it takes Government's attention from other opportunities that may have more potential to create export jobs in South Africa."* For example, resource rich Australia has successfully built its economy on a large and diverse mining sector, with recent strong growth in both employment and financial returns to the country. On the other hand, Australia's steel industry has experienced limited growth and is smaller than that of South Africa.

  By contrast, South Korea has built strong steel and manufacturing industries, based on its proximity to large end-user markets, high productivity and technological advancement, despite having to rely on imported iron ore and coking coal. The differences between the Australian and South Korean examples referred to above stem from the fact that iron ore and coking coal are globally traded commodities with well functioning markets for seaborne ore. Steel products, on the other hand, are typically sold domestically or regionally and deep-sea exports are financially challenged.

  Countries which have significant steel industries are generally characterised by various structural advantages (such as proximity to markets, economies of scale (from large regional demand), coastal location of production to minimise rail costs, and/or an ability to make high-quality, niche products. This is illustrated by the significant steel industries in South Korea and China where there is massive domestic demand for steel.

- **Exploration & extraction and mining beneficiation (iron ore mining):** Established iron ore mining companies and new junior mining companies (mainly Black Economic Empowerment (BEE) players) have the capacity to more than double South Africa's iron ore production by expanding Northern Cape iron ore mining operations and creating two smaller iron ore production systems in Limpopo. This growth will create more than 14 000 jobs, excluding potentially more jobs from new BEE mining companies, and add significant economic benefit to the two provinces, as well as to the country as a whole. These projects are based mainly on lower grade ores, which will need substantial beneficiation to produce marketable products.

  While most of these projects are economically viable under current market conditions, these projects would not be viable at prices below market prices. The projects will take approximately 10 years to reach full production and it is projected that by that stage the market price for iron ore will be half the current price. The development of these operations would also be reliant on significant additional infrastructure development (particularly logistical capacity such as rail, port and other forms of infrastructure such as electricity and water). This infrastructure would have to be available at affordable rates.

- **Metallurgical beneficiation and shaping (steel-making):** There is substantial domestic overcapacity in relation to metallurgical beneficiation and shaping in South Africa and South African producers are locationally disadvantaged in respect of deep-sea exports, given the fact that South Africa is located far from potential export markets.

  The economic case of for new steelmaking capacity in South Africa is not obvious. However, should Government policy require new steelmaking capacity there could be two areas for potential expansion of the South African metallurgical beneficiation and shaping sector:

  – *Investment in nascent steelmaking technologies:* Given the limited and decreasing global availability of metallurgical coking coal, emerging steel technologies for DRI (direct reduced iron)/ iron making will have to be successfully developed in the medium to long term. Some of these technologies are particularly suited to South Africa, as they would lead to the replacement of imported coking coal and high grade iron ore lump with thermal coal and iron ore fines, both of which are abundant in South Africa. Kumba actively supports the development of several of these technologies, such as ITMK3 and Circofer. These promising, though as yet unproven technologies, will require significant R&D investment (potentially Government-supported) and could be some years from successful commercialisation.

  – *Investments in export orientated steelmaking capacity*: Any new conventional steel-making capacity in South Africa would need to be export orientated. This is due to the following two factors:

- South Africa's existing steel production capacity exceeds domestic and regional demand for steel by a significant margin; and

- Both the existing steel producers and any new producer would not be able to achieve the scale or cost structure to enable it to export additional finished product on a sustainable basis (eg cold rolled coil).

If a strategic partnership could be formed with a player in the East: for example, from China, Korea or Japan – an intermediate product (slab) steel mill could potentially be viable at the coast, at Saldanha, Maputo, Richards Bay or Coega/Nqura. However, the viability of such a development would require:

- A foreign business partner, which would need to guarantee 100% off-take throughout the steel price cycle, preferably through an equity stake;

- World class capital productivity would be needed – pointing towards partnering with Chinese or Indian companies. Government assistance would be needed in the form of direct financial assistance/ preferential financing or subsidies which would reduce the required return on capital invested; and

- It may also require significant investments in rail and port capacity which would require considerable collaboration and capital contributions from Government and/or the private sector.

It should be noted that obtaining financing for the two expansion opportunities identified above will be challenging even on the basis of market related prices for steel. As a result of the significant structural disadvantages faced by the South African steel industry, it is unlikely that any other steel expansion or greenfield projects will be financially viable in the short to medium term. Moreover, this new steelmaking capacity would require the country to generate additional electricity as well as to import additional expensive coking coal.

Conversion/fabrication and manufacturing/end-users (downstream industries):

Growth in downstream industries will reflect the growth of the overall South African economy to a large extent. The crucial issue identified in Chapter 1, is that downstream industries have a competitive advantage where there is significant domestic demand, enabling the plants to achieve economies of scale. The cost of steel is generally a relatively insignificant portion of the input costs of the downstream sector. Downstream production levels cannot be meaningfully influenced by steel input costs since:

- Even if iron ore were supplied free to steel producers (with a concomitant lowering in the steel price), it would only yield a 0.7-1% cost benefit to downstream producers.

- Interventions to reduce domestic steel prices by 10-15%, would only generate a 1-3% increase in downstream consumption of steel.

Consequently, South Africa should focus on developing niche products which may have long term competitive advantages. This focus should include mining products as South Africa possesses globally competitive scale and technological expertise in this sector.

Should Government policy not be supportive of the high road, South Africa risks ending up taking the low road. In this scenario, South Africa would lose out on substantial potential growth opportunities, and its iron and steel value chain could even shrink. The low road could be reached through a combination of inaction and unintended policy effects.

Specifically, South Africa runs the following risks:

- **Exploration & extraction and mining beneficiation (iron ore mining)**: Inadequate infrastructure (rail, port, energy, water) and/or interference with market based pricing would lead to a stagnant mining industry and the loss of opportunity to create more than 14 000 jobs.

- **Metallurgical beneficiation and shaping (steel-making)**: Subsidised iron ore prices favour AMSA relative to scrap based steel companies, which would result in reduced competition and serve as a disincentive to further investment by AMSA's competitors. Murray & Roberts has already announced the closure of CISCO (with a concomitant loss of approximately 800 jobs) and interventions to reduce steel prices by 10-15% are likely to lead to the closure of other loss making EAF mills (eg Cape Gate and Scaw) as well as the gradual disinvestment by AMSA; potentially threatening 10 000 direct jobs.

- **Conversion/fabrication and manufacturing/end-users (downstream industries)**: Weakened steel-makers would be unable to supply downstream consumers with the required product range, and over time, South Africa would become increasingly reliant on steel imports. The minor potential (and hypothetical) increase in downstream beneficiation would have to be contrasted with the significant potential reductions in employment arising from the negative impact on the primary steel producers and the loss of additional employment opportunities in the iron ore sector in South Africa.

2.2 GROWING THE IRON AND STEEL VALUE CHAIN ON A SUSTAINABLE BASIS: Lessons from Australia and South Korea

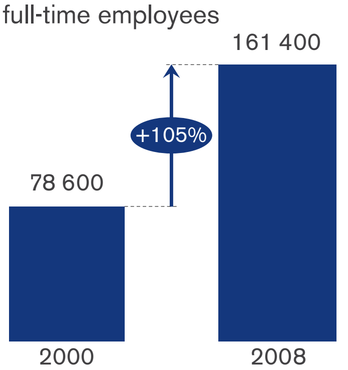
To grow the South African iron and steel value chain on a sustainable basis, it is vital to identify South African producers with a structural competitive advantage.

These producers possess the intrinsic characteristics to grow independently, although potentially requiring state support to start accelerating development – and in the longer term, will create sustainable benefits for the country. International case examples referred to in this document illustrate and confirm that creating long term, sustainable industrial sectors is contingent on properly identifying and leveraging a country's competitive advantages. For the iron and steel value chain specifically, this can be illustrated by the experience of both Australia and South Korea.

2.2.1 Australia – economic and employment growth through mining

EXHIBIT 2.1: EMPLOYMENT IN AUSTRALIAN MINING INDUSTRY

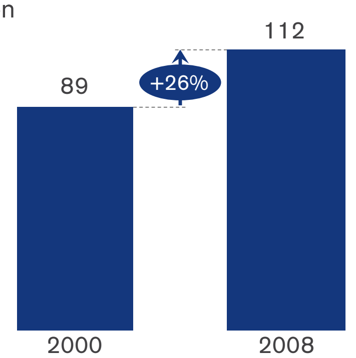
Number of full-time employees



SOURCE: Australian Bureau of Statistics

EXHIBIT 2.2: CONTRIBUTION OF THE MINING INDUSTRY TO AUSTRALIAN GDP

AUD Billion



SOURCE: Australian Bureau of Statistics

Australia has successfully focused development efforts on the mining industry, as it has a competitive advantage in relation to mining activities. In this regard Australia is similar to South Africa since:

- It is far from major markets; and
- It has large quantities of local resources (such as metallurgical coal and iron ore). Coking coal is one of the most significant input costs into the production of steel and a significant share of the coking coal required for the production of steel in South Africa is imported from countries such as Australia.

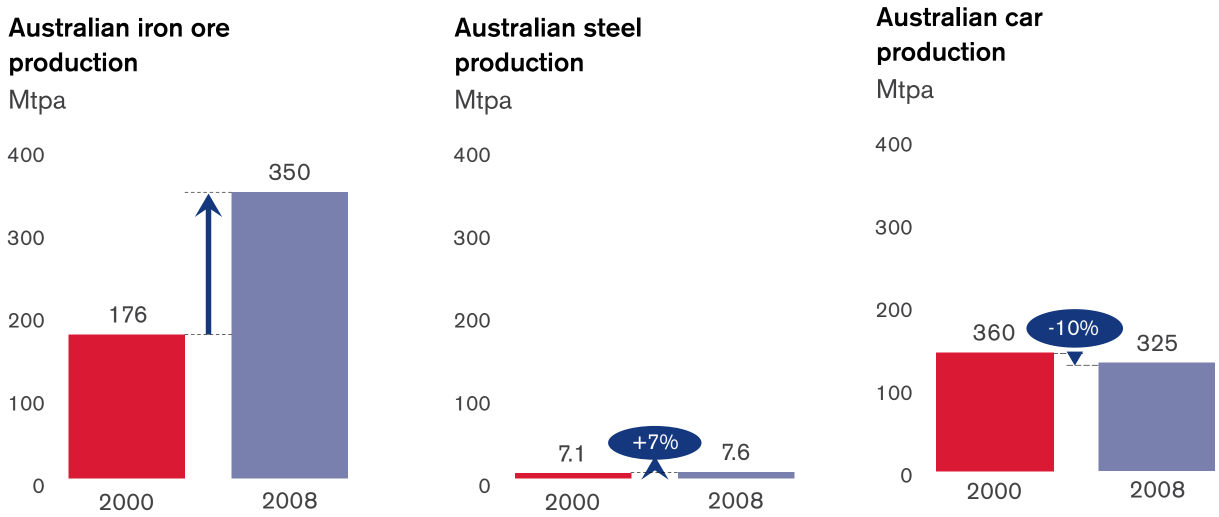
During 2000-08, employment in the Australian mining sector rose by 83 000 jobs (105%) and contribution to the GDP by A$23 bn (26%), as illustrated in *Exhibit 2.1* and *Exhibit 2.2*. The Western Australian Department of Mines and Petroleum estimates that each job created in the mining industry generates three new jobs in other sectors. As a result, more than 300 000 jobs were created through policies which were supportive of the mining sector in Australia.

In 2009, the Australian Government introduced the Exploration Incentive Scheme (EIS) to expand mining exploration and extraction in Australia.

In the Australian iron and steel industry, the upstream iron ore mining sector exhibits the same growth pattern as the mining sector as a whole, while downstream industries are characterised by limited growth or even a decline in

EXHIBIT 2.3: DURING 2000-08, THE AUSTRALIAN MINING SECTOR GREW BY CLOSE TO 100% WHILE THE STEEL AND AUTOMOTIVE INDUSTRIES WERE STAGNANT OR DECLINING

Unit of measure



SOURCE: VFacts; KAS; World Steel Yearbook 2009; United Nations

domestic Australian steel production (*see Exhibit 2.3*). This phenomenon can be illustrated further by the following facts:

- **Australian iron ore sector:** Currently, there are more than 20 iron ore mining companies operating in Australia. Several of these entities have only recently commenced operations and have made significant investments in new assets and infrastructure. These developments were mainly driven by high iron ore prices, Chinese demand and Government support for increased mining activity. For example:
  - Fortescue Metals Group started operations in 2008 and shipped 27 mt within its first year of operation (which exceeds the combined production of all of South Africa's iron ore mines other than the Sishen Mine).
  - During the period of 2000 to 2008 the volume of iron ore produced in Australia increased by almost 100%, from 176 mtpa to 350 mtpa, largely driven by Chinese demand.

- **Steel industry:** Australia has 2 significant domestic producers of steel
  - OneSteel, which produces long steel products, and
  - BlueScope, which produces flat steel products.

  Despite the fact that the Australian iron ore companies produce almost 10 times the volume of iron ore as South Africa (350 mt in 2008), as well as the fact that Australia has significant resources of high quality coking coal (Australia produced approximately 140 mt of coking coal in 2008 of which 136.9 mt was exported), Australia actually produces slightly less steel than South Africa (7.6 mt in 2008). The majority of its domestically produced steel is sold in Australia (steel exports and imports were 1.4 mt and 3.0 mt respectively in 2008).

  In addition, during the period of 2000 to 2008, despite significant steel price increases towards the end of this period, there were very limited increases in the levels of steel production. Efforts to promote downstream beneficiation in Australia have also largely failed. For example, an innovative HISmelt plant was built by Rio Tinto in 2002, but closed in 2008 as a result of high costs. This technology had been developed over a period of 20 years based on Government sponsorship.

- **The Australian downstream manufacturing (fabrication/converting and end-user) sector:** Production levels at Australian downstream manufacturing industries, such as the automotive industry, have declined in recent years.
  - Production of motor vehicles decreased by 35 000 vehicles pa from 2000 to 2008, and the Australian automotive industry consolidated in order to achieve economies of scale (there are currently only three domestic Australian automotive manufacturers – a significant decrease from 2000).
  - Direct support which was provided to industries which use steel as an input has also decreased over time. For example, the Australian automotive industry has been deregulated to facilitate international trade.

It is clear from the Australian example set out above, that having the raw materials required for steelmaking, (ie iron ore and metallurgical coal), does not necessarily guarantee or facilitate a successful steel or downstream industry.

It should be noted in this regard that Australia is in many respects better placed than South Africa, as not only does it have a larger taxpaying population, but it is closer to the significant export markets in the Far East. In addition, Australia produces far larger volumes of iron ore than South Africa and produces coking coal (which is one of the most expensive inputs in the production of steel). Despite these advantages and previous Government involvement, Australia's steel industry and downstream industries are not competitive with steel industries in countries such as South Korea or China. Consequently, it is sensible for countries such as Australia to focus on supporting the growth of industries such as mining, where it enjoys a competitive advantage as well as downstream industries where it has significant domestic demand.

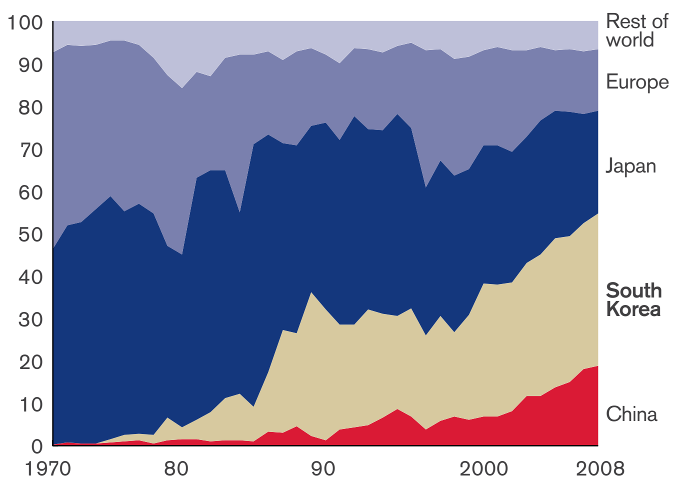
2.2.2 South Korea – from poverty to a flourishing manufacturing nation

South Korea's first five year plan, introduced at the start of the 1960s, was intended to industrialise a poverty stricken country. While the initial plan aimed to make South Korea self-sufficient in basic products such as food and clothing, later plans targeted investment in heavy manufacturing industries which could compete with exports on a global scale (eg shipbuilding). As mentioned below, South Korea enjoyed a number of significant structural advantages, which enabled it to initiate its industrialisation:

- **Low cost labour force:** South Korean labour was inexpensive and employees exceptionally hard working, resulting in a labour force that worked 30% longer than in Japan and the USA and at approximately 30% of the hourly cost. This enabled South Korea to compete with other industrialised exporting nations. Even though hourly labour rates increased with improved skill levels, the higher costs were offset by increases in productivity.
- **State support to export industries:** Manufacturing technology was initially obtained from Japan by way of reparations for the Second World War. Thereafter, select companies were chosen by South Korea as national champions – the *chaebols*, which were provided with:
  - Preferential financing which materially lowered their cost of capital (for example, Posco's cost of capital was only 7% as opposed to the market related cost of capital at 14%). This preferential financing was contingent upon these companies meeting specific export targets;
  - High import barriers were imposed to ensure that domestic producers were protected from global competition in Korea. Korea was not at that stage a member of the World Trade Organisation (WTO); and
  - Access to infrastructure, such as deep sea port facilities, was provided in order to unlock growth.
- **Proximity to large domestic and regional markets:** South Korean steel producers prospered owing to the fact that there was a significant increase in demand for steel in South Korea, as well as the fact that South Korea is adjacent to China and close to Japan. As a consequence, there were approximately 250 million people within a radius of 1 000 km from the Pohang Steel Mill. This is almost four times the current size of the population of South Africa and its neighbouring countries.
- **Nationwide skill building:** South Korea invested massively in a superior education system and improved workforce skill levels, increasing its literacy rate from 40% to approximately 98%. It took South Korea 40 years to achieve these literacy levels. Today, South Korea boasts the highest university enrolment rate in the world of approximately 95%.

EXHIBIT 2.4: SOUTH KOREA SUCCESSFULLY DEVELOPED A GLOBALLY LEADING POSITION IN THE SHIP BUILDING INDUSTRY

Global Ship Market[1], Percent of total market



[1] All ships excluding offshore platforms and military ships

SOURCE: MSI, Clarksons, expert interviews

The combination of these factors and South Korea's significant competitive advantages (particularly its location) enabled South Korea to develop into a competitive manufacturing nation and also to increase levels of employment within this sector.

A concrete example of South Korea's success is its shipbuilding industry, which has created 110 000 new jobs over the past 30 years. From the early 1970s, the South Korean Government grew the industry by:

- Initially leveraging low labour costs; and
- Offering subsidies such as "guaranteed first order".

The industry later benefited from investments in advanced technology and capabilities built up over the course of many years. The benefits of such investments can be clearly illustrated by the country's investment in steel and shipbuilding technologies that enabled the use of large body parts and components in construction. This superior technology enabled South Korea to produce larger ships more efficiently than its competitors.

These combined efforts allowed the country to move from being a marginal player to becoming a world leader. As illustrated in *Exhibit 2.4*, through these specific measures, South Korea was able to become a world leader in the production of ships. Even though South Korea's shipbuilding industry benefited from cheap steel prior to 1995, it was its technological advancements that proved to be the more important contributor to facilitating a long term competitive advantage.

2.2.3 South Africa – principles for creating a sustainable iron and steel value chain

What appears clearly from the case studies relating to Australia and South Korea is that the success and long term viability of downstream manufacturing industries is premised on the existence of structural competitive advantages and not on whether or not the relevant country has sufficient mineral resources. Despite a flourishing mining sector with large scale production of iron ore and coking coal, Australia's steel and downstream steel consuming industries are stagnant and characterised by a limited number of producers and lack of scale.

Although Australia is 2 700 nautical miles closer than South Africa to the major importer of steel, China, its level of production of steel and automobiles is lower than that of South Africa. By contrast, South Korea which does not have domestic producers of iron ore or coking coal has a large and prospering steel and manufacturing sector. South Korea's development also occurred at a specific period in history which was characterised by very different economic circumstances (including the ability to impose significant import barriers to protect nascent domestic industries).

In addition, Government interventions which are focussed on sectors of the economy which do not enjoy competitive advantages will ultimately be unsustainable and will result in distortions which will inhibit the economic development of the country.

In many ways, South Africa's area of competitive advantage is similar to that of Australia. Both South Africa and Australia have significant deposits of iron ore and are located far from the principal markets for downstream products (such as steel). In addition, as it appears from *Exhibit 2.5*, China is a further example of the fact that downstream beneficiation is likely to enjoy structural or competitive advantages not because of the existence of local sources of mineral inputs, but because of scale and the existence of large domestic demand.

In this regard, it should be noted that South Africa has a significant competitive (structural) advantage in respect of the production of iron ore as it has:

- **Large-scale, high-quality iron ore reserves:** South Africa is one of very few countries that can produce top quality iron ore, giving it a competitive advantage in respect of seaborne iron ore;

- **Sufficient global demand and logistics advantage:** Global demand for iron ore is high and it is transported over long distances to reach the relevant end consumers. South Africa is well positioned compared to the other major iron ore exporting countries: Australia and Brazil – for exports to most import regions (Europe, the Middle East and Asia); and

EXHIBIT 2.5: INGREDIENTS FOR ROBUST GROWTH ARE PRESENT IN THE SOUTH AFRICAN IRON ORE MINING INDUSTRY, BUT NOT IN THE STEEL INDUSTRY

	Requirements	South Africa	Australia	China	South Korea
Enablers of successful mining economies	Large scale, high quality iron ore reserves locally	✓	✓	✗	✗
	Sufficient global demand for iron ore	✓	✓	✓	✓
	Available and affordable infrastructure for mining	✓	✓	✓	✗
	Large scale, high quality coking coal reserves locally	✗	✓	✓	✗
Enablers of successful steel economies	Steel production of global scale, exposed to local demand	✗	✗	✓	✓
	Coastal location of production, close to export markets	✗	✓	✓	✗
	Low input factor costs versus competition, eg labour, capital	✗	✗	✓	✗
	Capability to make high quality/ niche products at scale	✗	✗	✓	✓

Mining economies (South Africa, Australia)

Steel economies (China, South Korea)

Transitioned from low labour cost and government subsidised financing in 1960-70's to high levels today (South Korea, low input factor costs)

SOURCE: Kumba

- **Available infrastructure:** South Africa has well developed rail and port infrastructure, from the Northern Cape to Saldanha. Both Brazil and Australia also transport iron ore from mines which are located inland via an extensive rail network.

By contrast, South Africa lacks many of the required structural advantages for developing a globally competitive export steel industry. Unlike China or South Korea, South Africa is not:

- **Proximate to a large scale local and/or regional market:** Owing to high logistics costs (when compared to the price of the end steel product), it is generally only economically viable to sell steel domestically or into neighbouring regions. As described in Section 1, over the economic cycle, the export of steel would usually not generate a sufficient return to cover the cost of capital required to develop a steel plant. South Korea and China both enjoy exposure to large regional markets, which makes them less dependent on exports. In any event, the large scale operations required to supply large domestic demand will also be characterised by lower per unit costs of production increasing the viability of exports.

- **Production facilities on a global scale:** To ensure a scale that is globally competitive, blast furnaces require a production capacity of greater than 5 mtpa. South Africa's largest blast furnace at Vanderbiljpark, has a capacity of 3.5 mtpa. In addition, the levels of capacity utilisation in South Africa are low.

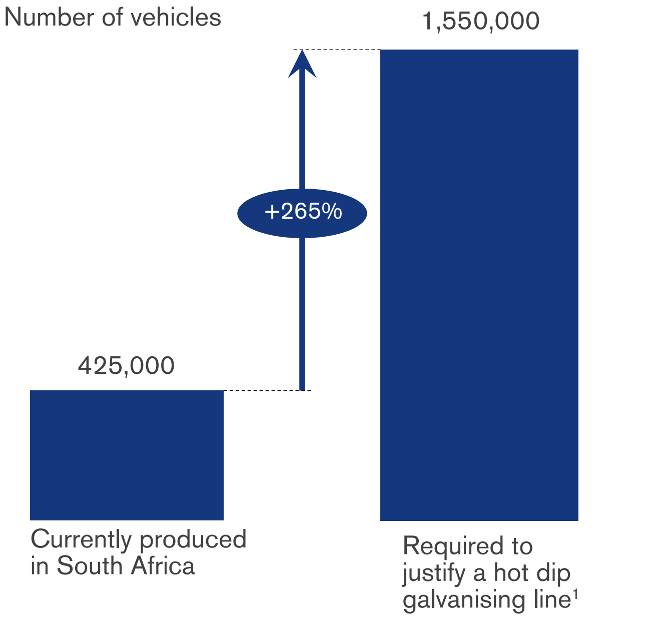
Moreover, South Africa is disadvantaged compared with other steel exporting countries in several important aspects:

- **Inland location of production, far from export markets:** In contrast to leading export steel manufacturers globally, most of South Africa's steel mills are located inland (one of the two coastal steel mills has recently closed). Steel exports need to be transported via rail to ports, and thus incur high logistics costs (>US$20/t) on inland freight. In addition, South Africa is located further from the principal steel importing countries (such as Asia and the Middle East) than other steel producing countries, such as South Korea, the Ukraine and China. This means that South African steel producers (or importers of South African steel) have to pay higher costs for ocean freight to transport the steel products to consumers. It should be noted that logistics costs can be substantial and that the factory gate price of steel is generally only 60-70% of the total steel price eventually paid by customers.

- **High costs of significant input factors:** Some countries (such as the Ukraine and Russia) are large exporters of low-quality steel, and have significant cost advantages in respect of labour and energy. South Africa cannot compete with these countries on an input cost basis and even if iron ore were to be supplied below cost, the reduction in input cost would not approximate the significant cost advantages enjoyed by the Ukraine or Russia.

- **Insufficient scale for high quality niche products:** Having a large domestic or regional market means that domestic manufacturers are able to invest in niche product lines as they will be able to produce these on a scale which makes their production economically viable. South Africa's domestic and regional markets are too small to warrant investments of this nature. For example, the automotive industry would need to increase in size by 200-300%; an increase of approximately 1 million cars produced domestically – before an investment in a modern automotive grade galvanised steel plant would be economically justifiable (*see Exhibit 2.6*).

EXHIBIT 2.6: SOUTH AFRICAN VEHICLE PRODUCTION IS NOT OF SUFFICIENT SCALE TO JUSTIFY AN AUTOMOTIVE GRADE HOT DIP GALVANISING LINE



[1] Capex assumptions: Average hot dip galvanising line has ~0.5 mtpa of capacity at a capital cost of $220. Average light vehicle consumes ~0.33 tonnes of hot dip galvanised steel (assuming 93% utilisation rate)

SOURCE: James F. King, VdEh Plantfacts 2009

In conclusion, as sustainable growth can be based only on industries with an inherent competitive advantage, South Africa should promote an environment conducive to investment in the mining industry. These growth efforts could also be directed at niche industries that supply the mining industry (such as grinding media, steel wire ropes or continuous mining equipment) and therefore operate on a globally competitive scale or have specialised characteristics.

South Korea is an example of a successful developmental state. The journey took 50 years and required significant resources. While this trajectory is not impossible for South Africa to emulate, there are several important contextual differences that make it difficult to replicate the South Korean example:

- South Africa would find it difficult to leverage the low labour cost which gave a significant impetus to the development of South Korea's manufacturing sector; given its current relative labour cost and the strong labour union position versus South Korea's approach of actively suppressing labour representation while supporting the *chaebols*.

- South Africa cannot leverage the protectionist measures that South Korea used to promote its industrialisation, owing to its membership of the WTO. South Korea had to remove its import barriers when it joined the WTO in 1995.

- There will be fundamental changes needed in the education system to achieve similar literacy and university attendance rates to those in South Korea (97.9% and 95% respectively). South African children are expected to attend school for four years less than their South Korean counterparts and to study for half as many hours per day. Significant reforms to the South African education system would be required and once the effects of these reforms are seen a South Korean model can be considered as an option for South Africa. This will take decades to achieve.

- To emulate the South Korean model, the Government would have to support targeted industries, for example, through subsidised financing or the development of infrastructure. While the Industrial Development Corporation (IDC) is co-investing in various industries, a lack of capital and subsidised financing still hampers South African entrepreneurs.

It should also be noted that even the successful South Korean example resulted in short to medium term losses for many years (meaning that it was only after a sustained period of investment that the South Korean manufacturers were globally competitive). Therefore, the impact of the requisite Government support on economic growth and job creation would need to be weighed against opportunities in other important sectors of the South African economy, such as healthcare, agriculture and mining, which may give rise to greater economic growth and job creation in a shorter period of time.

2.3 OVERVIEW OF POTENTIAL GROWTH OPPORTUNITIES

2.3.1 Exploration & extraction and mining beneficiation (iron ore mining)

Recap of the current situation

The South African iron ore mining sector is globally competitive and produced 48 mt in 2008 (53 mt in 2010). In addition to meeting South African domestic demand for iron ore, South Africa is the fifth largest exporter of iron ore worldwide. The South African producers of iron ore include a number of entities, namely Kumba, Assmang, Evraz Highveld Steel & Vanadium (through its activities at its Mapochs Mine) and Rio Tinto, as well as several junior BEE mining companies (Sekoko, Motjoli and Burk). South Africa's larger iron ore operations are located principally in the Northern Cape, which has world class iron ore resources. Various companies are considering developing new mines in the Limpopo and Northern Cape provinces.

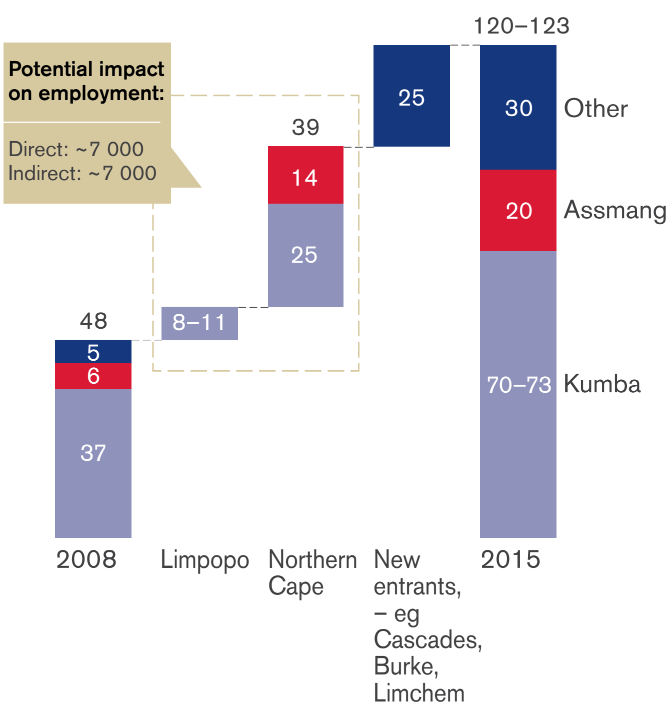
Overview of potential growth opportunities for South Africa

The high road in iron ore mining presents exciting growth opportunities. Iron ore volumes could more than double to over 100 mtpa from 48 mt in 2008.

The high road in the South African iron ore mining industry would have significant benefits for the overall economy including:

EXHIBIT 2.7: GROWTH PROSPECTS IN THE IRON ORE MINING INDUSTRY

mt



SOURCE: Kumba

- **Employment:** It would create 14 000 additional jobs (7 000 direct) excluding potential jobs from new BEE mining companies – nearly doubling the number of employees currently involved in the production of iron ore in South Africa (*see Exhibit 2.7*).

- **Economic growth:** The high road would increase the contribution of iron ore producers to GDP from R15.6 bn in 2008 to about R36 bn in 2015-20 and to the fiscus from R8.1 bn in 2008 to approximately R19 bn. Foreign exchange earnings would rise from US$2 bn in 2008 to around US$5 bn by 2015-20.

- **Transformation and rural development:** The high road would also enable several new BEE iron ore mining companies to start operations as well as enabling the development of relatively undeveloped regions in Limpopo and Northern Cape through mine expansions. In these areas, employment would increase. Also, training and skills development and medical and commercial infrastructure would improve.

- **Technological capabilities:** Achieving the high road would also result in the development and commercialisation of technologies to beneficiate iron ore sources previously considered either "stranded" or classified as "waste material", thereby increasing production and generating foreign exchange earnings through exports.

Three main iron ore hubs can be developed through the expansion projects. These are depicted in *Exhibit 2.8*:

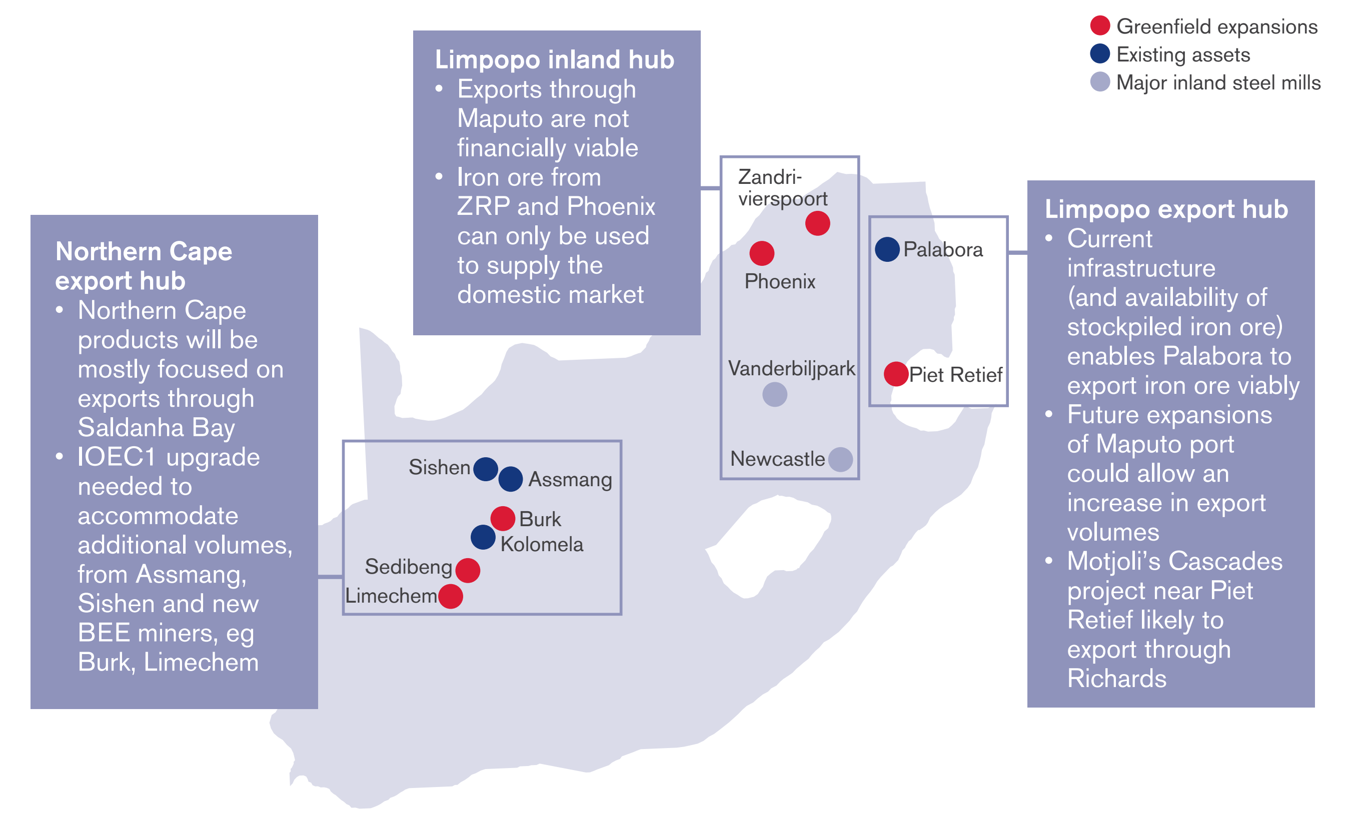
- A Limpopo inland hub, supplying iron ore to domestic inland steel producers;
- A Limpopo export hub, exporting iron ore from Palabora through Maputo; and
- A Northern Cape export hub.

Limpopo inland hub

This hub consists of several potential growth projects, including Phoenix (Kumba), Zandrivierspoort (AMSA and Kumba), as well as various junior BEE ventures, such as Capricorn and Vanmag, which could produce between 10 mt and 20 mt of iron ore a year. These mines would be developed to supply domestic steel producers which are located predominantly in Gauteng.

This hub could supply all steel producers located in Gauteng. In addition, the development of the Limpopo reserves presents an exciting opportunity to increase value for domestic steel producers. A greater portion of iron ore supply from Limpopo would create higher value-in-use owing to the characteristics of the Limpopo iron ore. It could, therefore, result in a reduction in the costs of producing steel, as well as increasing the levels of production at the inland steel plants.

EXHIBIT 2.8: THREE IRON ORE HUBS COULD BE DEVELOPED IN SOUTH AFRICA



[1] Iron Ore Export Corridor

SOURCE: Kumba, Hatch, expert interviews

However, in order to develop this exciting growth opportunity, the following would be required:

- **Investments in new sintering and pelletising capacity**, as a result of the fact that iron ore from the Limpopo region has a different set of characteristics to iron ore from the Northern Cape. AMSA's blast furnaces in Vanderbijlpark and Newcastle are configured to take a blend of iron ore from Northern Cape and Limpopo (Thabazimbi). Shifting the supply towards a larger portion of Limpopo iron ore would require investments in micro-pelletising, in combination with additional sintering capacity at the steel mills or pelletising plants at either the mines or steel mills, in order to convert the iron ore concentrate into a substitute for the lump ore from the Northern Cape mines. Even though additional capital expenditure will need to be incurred, the use of Limpopo ore will be hugely beneficial to AMSA's inland plants' operational cost structure and efficiency levels.

- **Investments in additional infrastructure** would be required to deliver increased iron ore volumes from Limpopo to the domestic market. This infrastructure could be developed privately or in a public-private partnership. For example, in order to transport 2.5 mtpa of iron ore from Zandrivierspoort to Vanderbijlpark and Newcastle would require an investment of about R3 bn in new rolling stock.

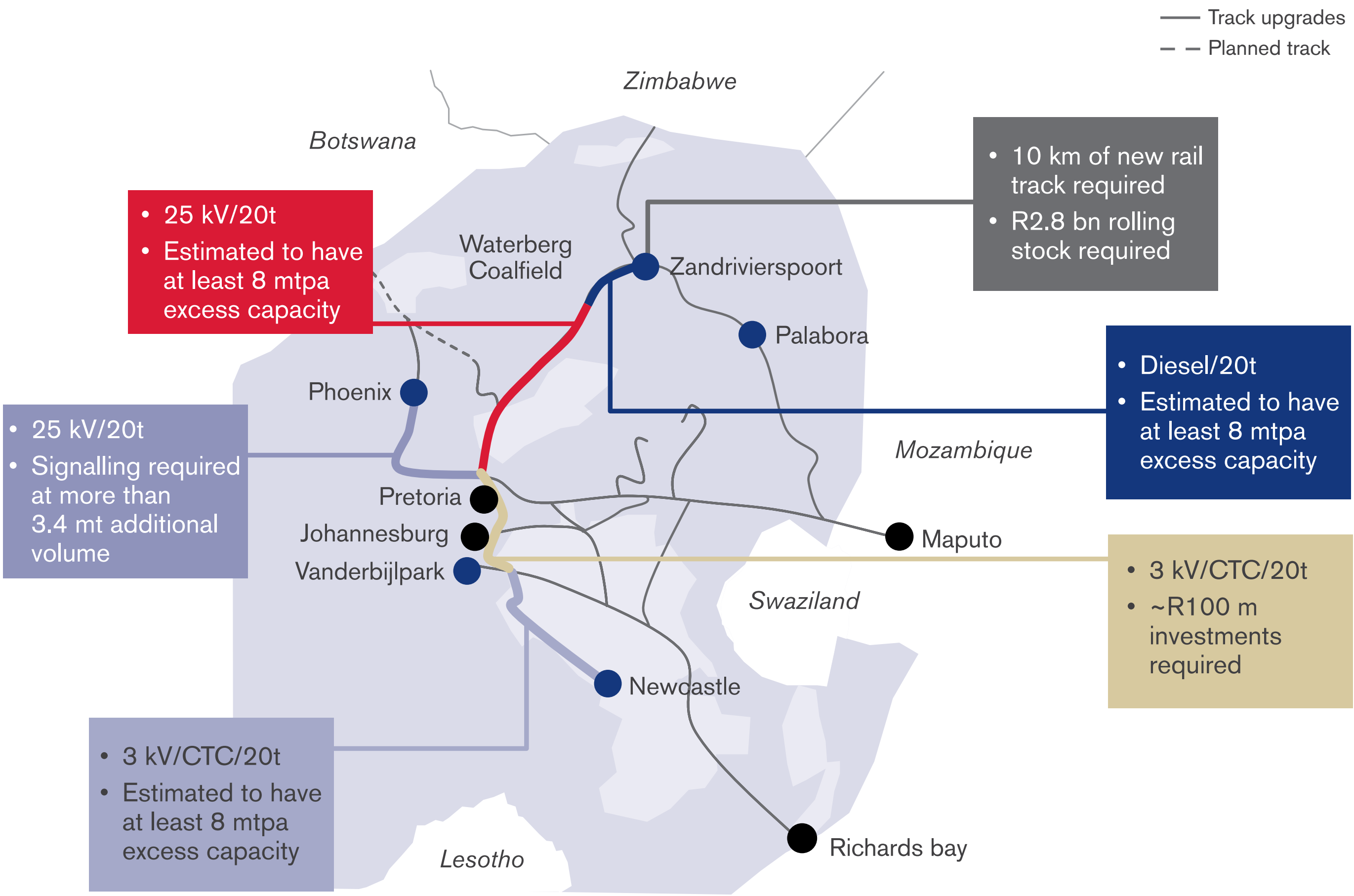
As illustrated in *Exhibit 2.9*, additional investments of about R100 m would be necessary to address congestion of the railway lines in Gauteng. These investments translate into expected rail tariffs of between R120 and R150/t. The project would be economically viable at tariffs in the lower end of this range.

- **Long-term market prices for iron ore** would be required, since the projects in Limpopo are only marginally viable from a financial perspective.

- **A collaborative approach between Government, mining companies and steel producers** would be required to realise the growth opportunities in the Limpopo inland hub. If all parties collaborate constructively, the growth projects could be developed over the next 5 to 7 years. In the absence of such an approach, these resources will be stranded and remain sterilised. This would mean that the perfect opportunity to create jobs in an impoverished part of South Africa would be lost.

In the long term, this hub could be expanded, complementing the development of the Waterberg coal reserves.

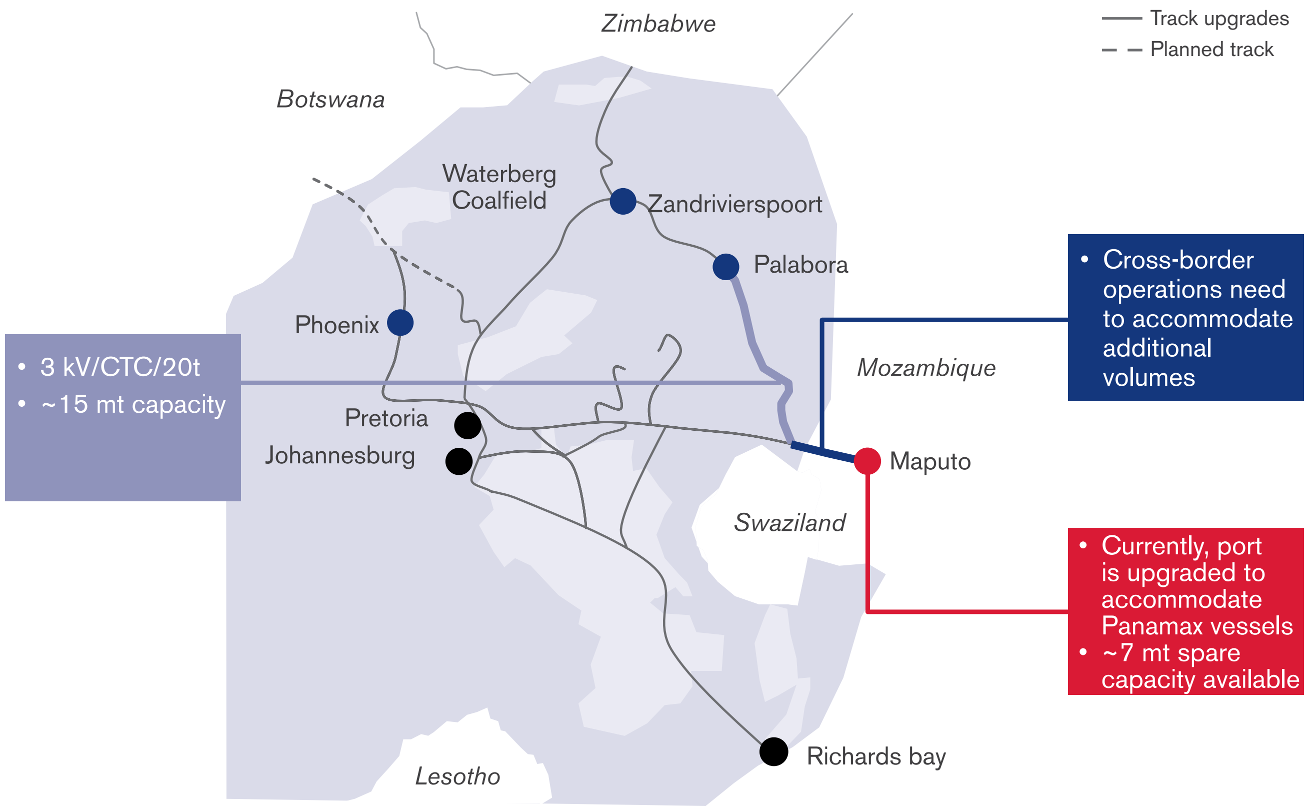
EXHIBIT 2.9: INFRASTRUCTURE REQUIREMENTS FOR THE LIMPOPO INLAND HUB



kV = Type of electrification system; CTC = Centralised traffic control; T= Axle weight

SOURCE: Kumba, Hatch, expert interviews

EXHIBIT 2.10: INFRASTRUCTURE REQUIREMENTS FOR THE LIMPOPO EXPORT HUB



kV = Type of electrification system; CTC = Centralised traffic control; T= Axle weight

SOURCE: Kumba, Hatch, expert interviews

Limpopo export hub

In addition to being able to realise opportunities to supply iron ore to domestic steel producers, it would also be possible to develop a smaller export hub in Limpopo. The Palabora mine is located in the eastern part of the Limpopo province, closer to the port of Maputo. Approximately 1 mtpa of magnetite iron ore is currently exported through Maputo. A stockpile of more than 200 mt of low grade magnetite iron ore is available at the Palabora mine, and could theoretically provide additional potential exports of iron ore.

Lack of infrastructure and demand for this low grade iron ore (which is magnetite with an iron content of 58% and which is also relatively high in impurities) presents the largest challenge to expanding export volumes from the Palabora mine through Maputo. Improved operational effectiveness at the border could facilitate exports of iron ore of up to 7 mtpa. This is illustrated in *Exhibit 2.10*. New rolling stock would be required to transport additional volumes of iron ore from Palabora to Maputo at an estimated cost of about R2 bn. Implied rail tariffs are R120-160/t and it is anticipated that Palabora should be able to export iron ore profitably at tariffs of this magnitude in the short term.

In the longer run, the development of an export hub based at Palabora could give rise to additional benefits by adding critical mass to permit the construction of a combined Zandrivierspoort and Palabora export pipeline for iron ore concentrate.

Northern Cape export hub

The Northern Cape region is expected to grow its mining activities substantially (by more than 100%) within the next 5 to 10 years. The expansions at Kumba's Sishen Mine could result in increased production of iron ore of up to 40 mtpa. Sedibeng Mining also plans to develop a mine at Postmasburg, which would produce approximately 1 mtpa and Assmang is ramping up its Khumani mine to produce 10 mtpa, with further potential to increase the volume of iron ore produced at this mine to 20 mtpa.

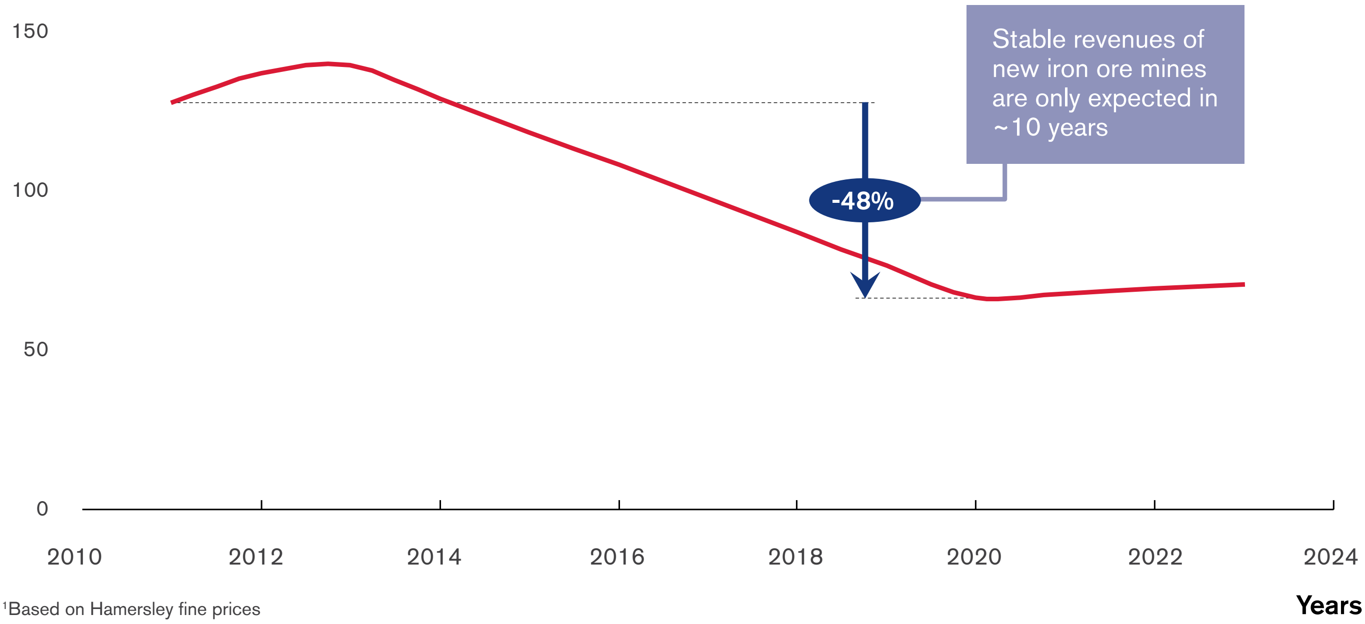
These mines would export iron ore through the port of Saldanha via the IOEC (Iron Ore Export Channel) rail and port system. Realising these expansion projects would require Transnet to undertake additional upgrades to the IOEC. Current expansion plans include upgrading capacity from 45 mtpa to 60 mtpa, at a cost of about R4.2 bn. However, to unleash the region's full potential, a further upgrade to the IOEC (including all rail and port facilities) would be needed, to over 100 mtpa – requiring significant capital expenditure. The resulting rail and port tariffs would need to be similar to the current tariffs which are levied, to ensure the proposed expansion in production at these mines is financially viable.

Limitations of iron ore growth opportunities

In the high road scenario for the iron ore mining industry, South Africa would develop all three iron ore hubs. About 14 000 jobs would be created through doubling volumes from the Northern Cape to export markets, developing the Limpopo inland hub to fully supply domestic demand, and exporting iron ore from the Palabora mine.

However, these growth projects would require approximately 5 to 7 years to be developed and approximately 10 years to reach full production. As depicted in *Exhibit 2.11*, it is anticipated that iron ore prices will drop by 48% by 2020. In addition, it should be noted that the expansion projects have a high sensitivity to iron ore price levels, since many of the proposed expansions are merely marginal at these forecast prices. As illustrated in *Exhibit 2.12*, even a 10% reduction in iron ore prices from the estimated market prices would result in 90% of all growth projects becoming financially unviable.

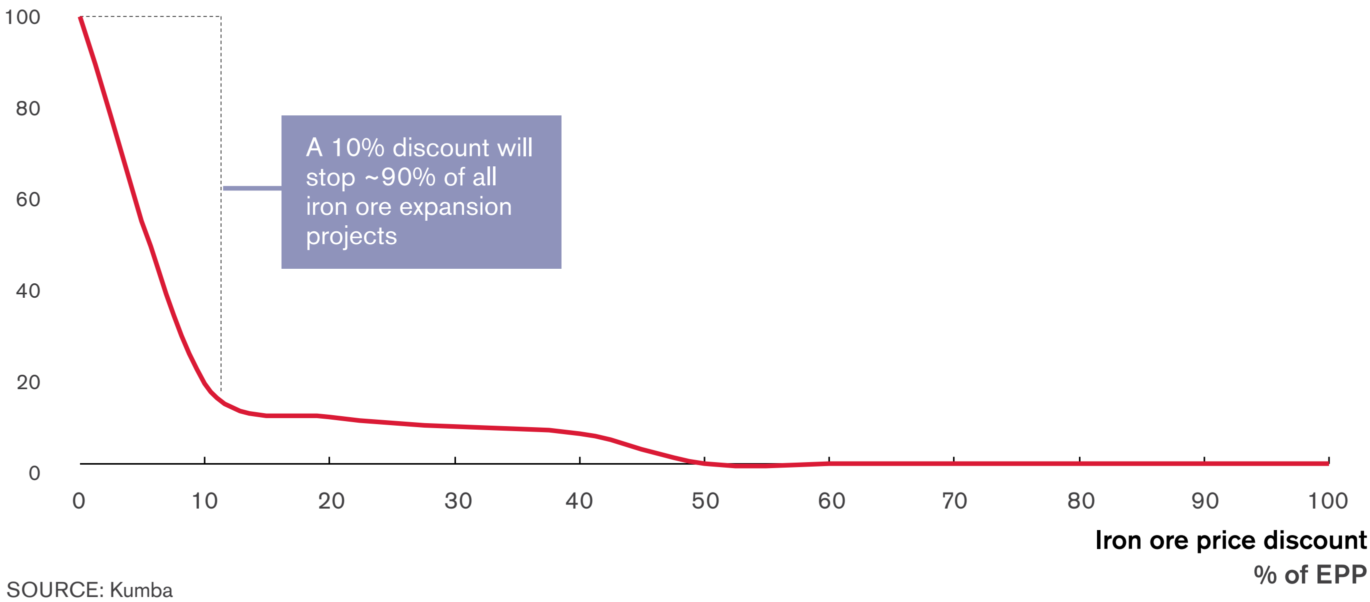
EXHIBIT 2.11: IRON ORE PRICES ARE EXPECTED TO HALVE IN THE NEXT 8 - 10 YEARS
Long term iron ore prices
US$ / tonne, Sishen fines[1], FOB Saldanha, Nominal



[1]Based on Hamersley fine prices

SOURCE: Analyst consensus – November 2010

EXHIBIT 2.12: AT A 10% DISCOUNT TO IRON ORE MARKET PRICE, 90% OF ALL NORTHERN CAPE IRON ORE EXPANSION PROJECTS ARE UNVIABLE
New iron ore volumes realised (Kumba example)
% of total expansion volume, 100% = ~47 mtpa



SOURCE: Kumba

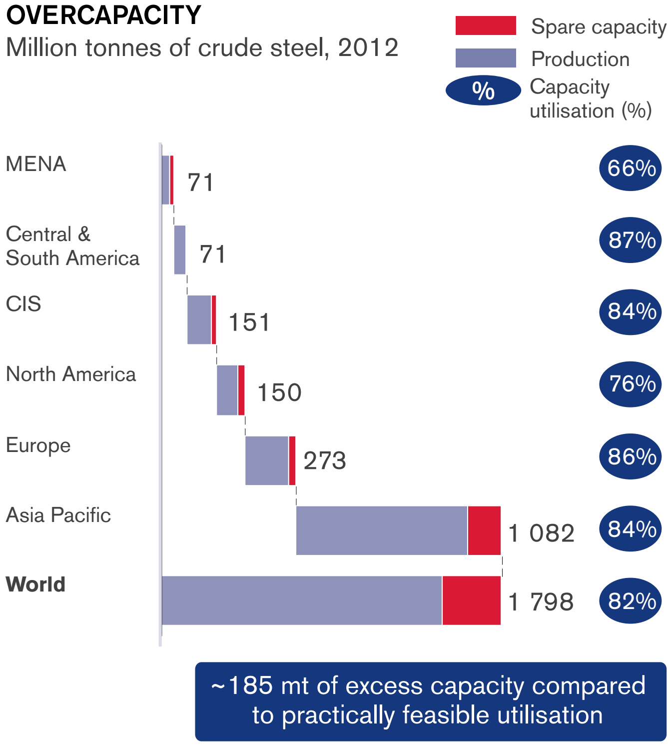
2.3.2 Metallurgical beneficiation and shaping (steelmaking)

Review of the current situation

The South African steel industry faces significant challenges that make the growth prospects in this step of the value chain very challenging:

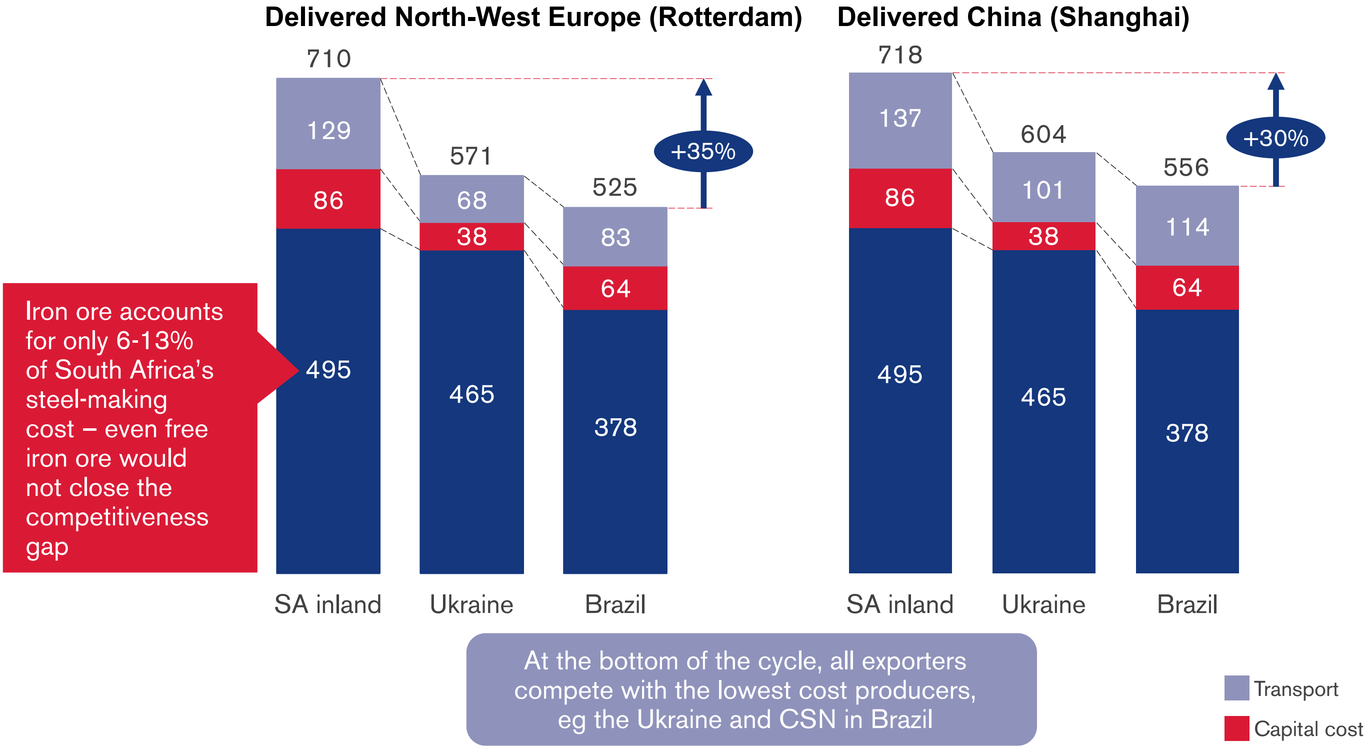
- Overcapacity of more than 50% relative to domestic demand and global overcapacity (*see Exhibit 2.13*);
- High labour costs relative to low cost global competitors;
- High cost of imported pellets and coking coal;
- Location disadvantages, meaning that the cost of transporting steel from the inland production facilities to the coast and then by sea to the relevant export destination, are likely to make South African steel uncompetitive in the relevant export destination (*see Exhibit 2.14*);
- Rising energy costs.

EXHIBIT 2.13: THERE IS SIGNIFICANT GLOBAL OVERCAPACITY
Million tonnes of crude steel, 2012



SOURCE: HSBC, Kumba

EXHIBIT 2.14: SOUTH AFRICAN EXPORTS ARE 30-35% MORE EXPENSIVE THAN INTERNATIONAL COMPETITORS
HRC full cost Q1 2010, US$/t



SOURCE: James F King, AMSA, Kumba

With the current domestic steelmaking overcapacity and anticipated local steel consumption growth rates of up to 3% a year, the existing surplus capacity could be fully utilised only by about 2035. The overland regional demand (Namibia, Botswana, Zimbabwe, Mozambique, Swaziland and Lesotho) for steel products is also small (0.7-1.0 mt in 2008), and is not expected to provide sufficient demand to match the current overcapacity of the domestic steel producers, despite current and anticipated strong growth rates.

However, should Government achieve its objective of approximately 6% annual GDP growth for a sustained period, steel consumption growth could accelerate to 3-5% per year, with excess capacity being fully utilised approximately 10 years earlier, ie by 2025. At this point, South Africa would be in a good position to build an appropriately located new steel mill (eg near a port) and thereby to introduce a new competitor or alternatively to give one of the smaller incumbents an opportunity to expand local production significantly.

Steel Authority of India Ltd (SAIL) has recently announced plans of building a 3-5 mt steel plant in South Africa in joint venture with the Afripalm Resources subject to the venture making business sense.

Overview of potential growth opportunities for South Africa

All analyses of the competitiveness and structure of South African steel industries indicate that there are currently no material growth opportunities in this part of the value chain. The structural disadvantages experienced by domestic steel producers in respect of exports and the limited potential domestic demand means that there is no real investment case to justify additional expansion of productive capacity.

The economic case of for new steelmaking capacity in South Africa is not obvious. However, should Government policy require new steelmaking capacity two innovative opportunities to expand this sector of the value chain could exist – although neither of the options is straightforward. The options include firstly, investing in commercialising new steel and ironmaking technologies and secondly, constructing an export orientated slab plant.

Achieving these growth projects could bring the following benefits to the South African economy:

- **Employment:** Create 3000 additional direct jobs.

- **New steel capacity:** Create additional steel capacity, possibly allowing a new entrant and/or enhanced competition in South Africa.

- **Economic growth:** Increase the industry's real contribution to GDP from R12.7 bn in 2008 to about R17 bn in 2015 and to the fiscus from R4.0 bn in 2008 to R4.3 bn. Increase the steel industry's contribution to foreign exchange earnings from US$1.8 bn to about US$4.3 bn.

- **Technological development:** Develop new, low cost steelmaking techniques to employ underutilised or stranded local resources, increasing production and generating foreign exchange earnings through exports.

Investing in nascent steel technologies

Given the limited and decreasing global availability of coking coal, new steel technologies for DRI/ironmaking will have to be developed to replace coking coal over time.

Some of these technologies (eg ITMK3 and Finesmelt) are particularly suited to South Africa, as they replace expensive, primarily imported coking coal and high grade iron ore lump with thermal coal and iron ore fines, which are both abundant in South Africa. While some of these technologies may be close to commercial production, most require significant investment in research and development and could take many years before they are economically viable. If these initiatives are pursued with vigour, the development of nascent steel technologies could significantly improve the cost position of South African based steel mills and unlock stranded inland iron ore resources.

To leverage the iron ore and thermal coal resources in South Africa, Kumba and the IDC are evaluating a number of technology options to convert these raw materials into DRI, pig iron or even basic steel products:

- Kumba and the IDC are jointly investigating four emerging technologies: ITMK3, Paired Straight Hearth (PSH), pellets and Circofer. In addition, the so-called "green pelletisation" minimises energy usage by not baking the pellets, and is being researched to transform lower grade fines at Zandrivierspoort and Palabora into feedstock which could be suitable for use by steel mills. ITMK3, PSH and Circofer are all processes which are intended to use iron ore fines and thermal coal to make DRI or pig iron.

- Kumba and the IDC have independently evaluated IMBS and its Finesmelt technology. The IDC has continued its investment in IMBS technology, which uses thermal coal and iron ore fines to create approximately 98% iron powder which is compressed into metallic briquettes. A commercial pilot plant (50 Kt/year) is under construction at Palabora.

- Kumba is helping Huludao Seven Star explore the feasibility of using concentrate in a Midrex-Corex combination to produce DRI for its 0.5 mtpa pipe mill in Boksburg. Kumba has provided slimes and concentrate samples for testing at Huludao's Chinese facilities.

- The IDC is also evaluating two other technologies: the potential of using iron ore found in discarded waste from Vanchem (Vanadium producer owned by the Duferco Group) to produce 0.8 mtpa of pig iron. and the potential of using Palabora magnetite dumps to establish a 2-3 mtpa steel manufacturing facility.

To enable the research and development of nascent steel technologies, Government and the private sector will need to collaborate on developmental financing and skills development.

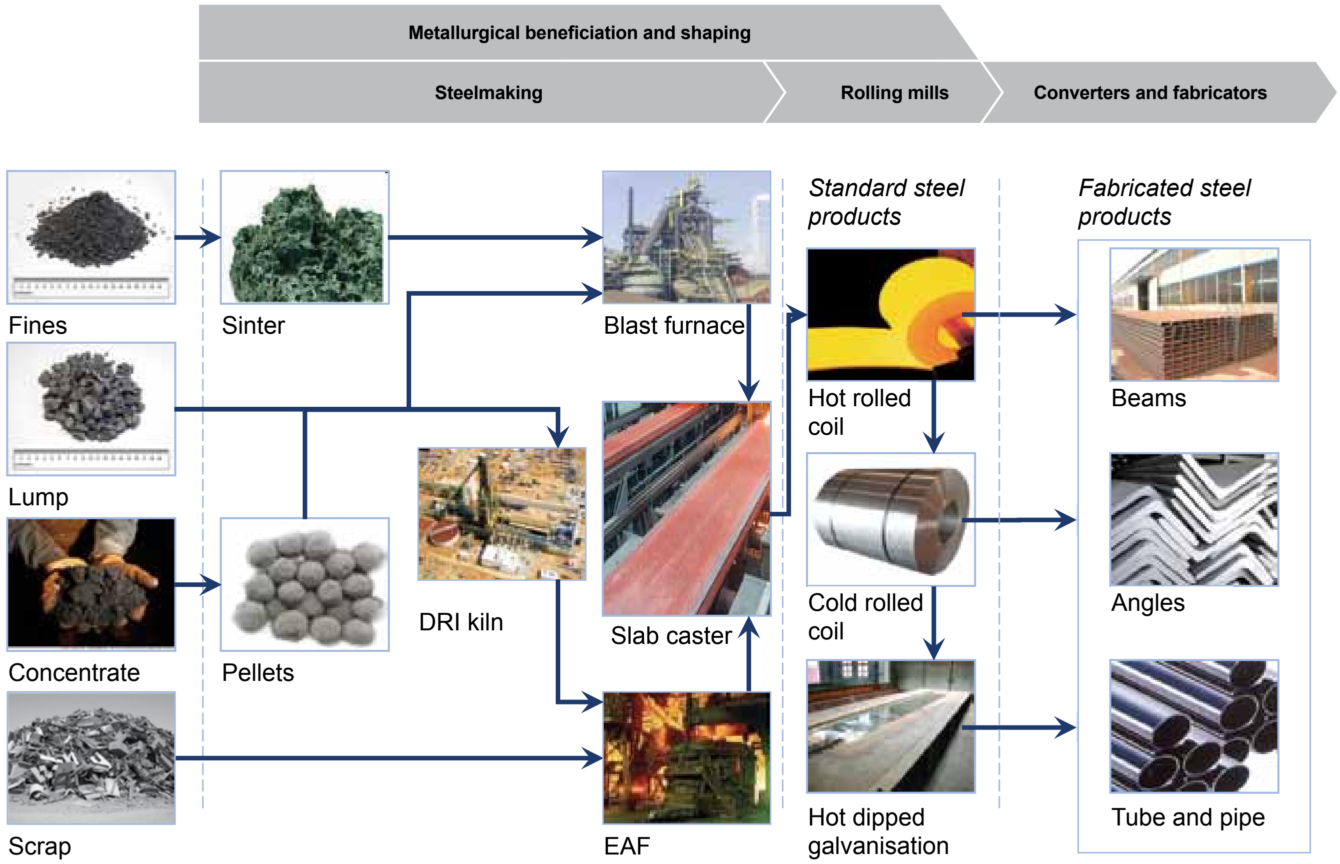
- **Skills development:** Research and development requires advanced technical skills, in particular MSc and PhD graduates and engineers. Government and the private sector should support academic and research institutions and promote development of advanced engineering related skills. Before researching the Finex technology, South Korea founded the Pohang University of Science and Technology in 1986 and the Research Institute of Industrial Science and Technology in 1987. Developing Finex required a full time research and development team of about 600 people from 1992 onwards.

- **Developmental financing:** Commercial development of new technologies will require focused investment in research. For example, prior to South Korea's construction of the first commercial Finex plant (1.5 mtpa) in 2007, Posco invested US$600 m in pilot plants and in training over a period of 15 years.

Investing in an export slab plant

Any new conventional steelmaking capacity in South Africa would need to be export orientated owing to the fact that existing steel production capacity significantly exceeds domestic demand. In this regard, it should be noted that any new steel producer in South Africa is unlikely to be able to justify the investment in South Africa to develop an export facility of the scale, which would match the size of global steel producers. Therefore, building a new intermediate product (slab) steel mill at a coastal location such as Saldanha, Maputo, Richards Bay or Coega/Ngqura would be the only potentially viable growth opportunity using existing, commercially proven technology. Exports of slab products (*see Exhibit 2.15*) would cater predominantly for Asian (Chinese, South Korean and Japanese) steel mills with surplus rolling capacity, and a shortage of iron ore.

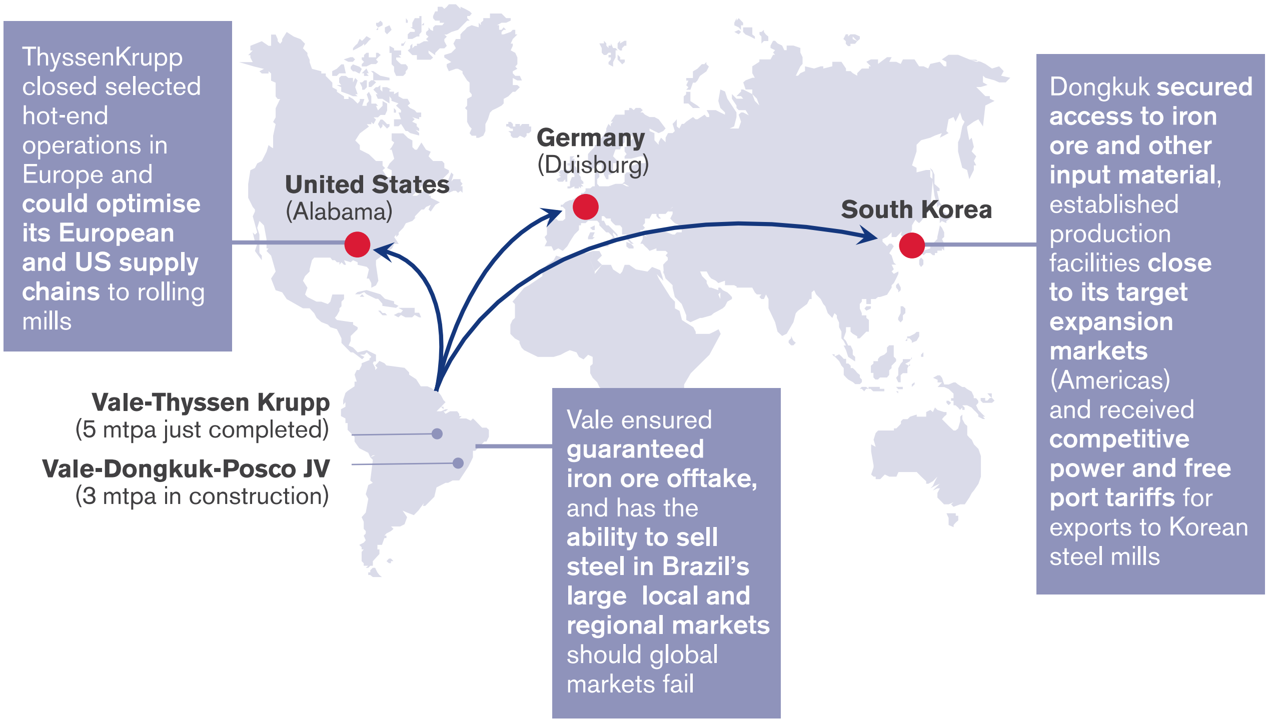
EXHIBIT 2.15: STEEL SLABS ARE INTERMEDIATE PRODUCTS IN THE METALLURGICAL BENEFICIATION AND SHAPING STEP (FLAT PRODUCTS)



SOURCE: Kumba

EXHIBIT 2.16: FOREIGN ROLLING MILLS' NEED FOR IRON ORE AND HIGH QUALITY SLAB ALLOWED BRAZIL TO EXPAND STEEL PRODUCTION

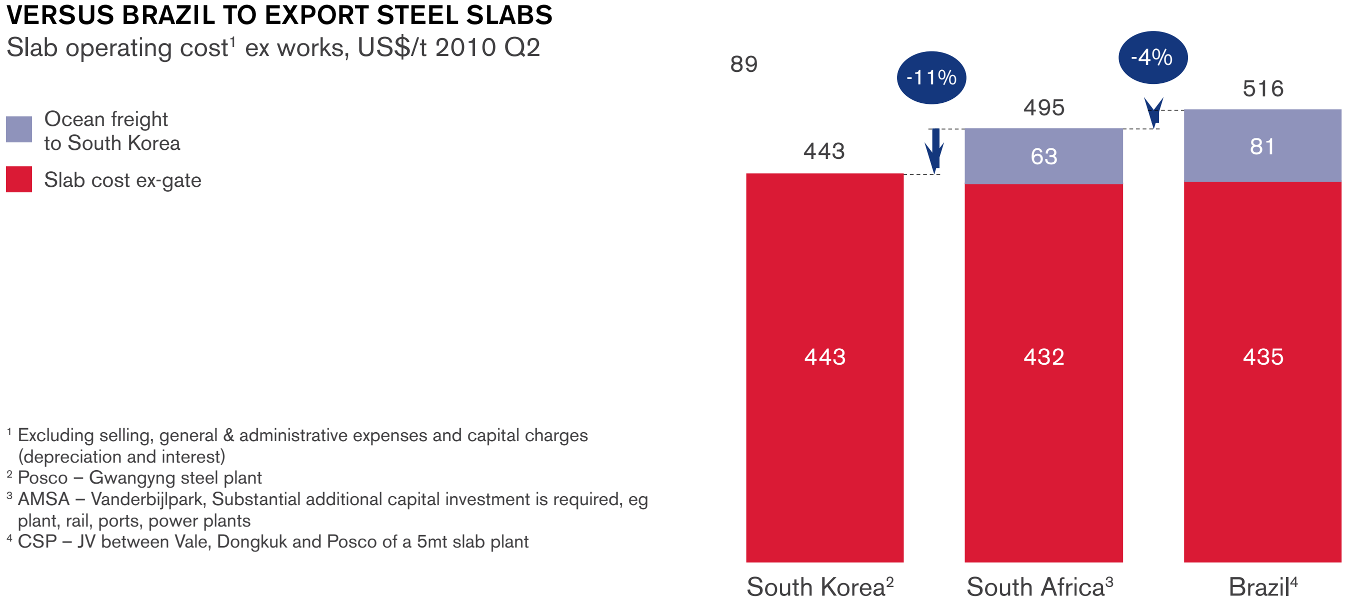
2007-Present



SOURCE: ThyssenKrupp, Dongkuk, Press search, Kumba

EXHIBIT 2.17: GIVEN INTEREST FROM ASIAN STEEL ROLLING MILLS, SOUTH AFRICA IS WELL POSITIONED VERSUS BRAZIL TO EXPORT STEEL SLABS

Slab operating cost[1] ex works, US$/t 2010 Q2



[1] Excluding selling, general & administrative expenses and capital charges (depreciation and interest)
[2] Posco – Gwangyng steel plant
[3] AMSA – Vanderbijlpark, Substantial additional capital investment is required, eg plant, rail, ports, power plants
[4] CSP – JV between Vale, Dongkuk and Posco of a 5mt slab plant

SOURCE: Steel Statistical Yearbook 2009, Plant facts 2009, Kumba

These steel mills require guaranteed volumes of iron ore at market prices to produce flat products. For example, Vale, in partnership with key customers, is already constructing slab mills in Brazil in order to export slab to Asian countries such as South Korea. This means that Brazil will be able to increase domestic Brazilian steel production capacity and beneficiation, while its partners Dongkuk and ThyssenKrupp secure iron ore, coke and electricity supply and/or the chance of optimising their supply chains (*see Exhibit 2.16*). South Africa might be able to provide the Far East with slab products at a similar landed cost to the slab which is produced in Brazil, because of the fact that South Africa is approximately 8 000km closer to the Far East (*see Exhibit 2.17*).

A new slab plant would require approximately three years to build, and would create about 3 000 direct jobs. A slab plant would also provide South Africa with an option to forward integrate, by building downstream rolling mills, when there is sufficient local demand for final products. However, the development of a new slab production facility would require the following:

- **State support for the project:** The business case for a slab plant is not currently economically viable, with a projected IRR of 5-12% (*see Exhibit 2.18*). The core assumptions of this business case can be summarised as follows:

  – Capital costs of US$1 200-1 400/t capacity (US$6-7 bn for a 5 mtpa plant), with the low end capital investment scenario assuming the leverage of Chinese or Indian expertise to decrease capital costs;

  – Operating costs of US$450-600/t of slab (in 2012). This assumes a similar cost structure to that of AMSA's operation in Vanderbijlpark, adjusted for differences in logistics costs, raw material costs (assumed to be at market price) and the cost advantages of newer equipment with higher capacity utilisation; and

  – Independent long term market forecasts for input (coke and iron ore) and output (slab) prices.

Under these assumptions, with a typical cost of capital of 14-15% (nominal), this investment (excluding the cost of required infrastructure investments) in the best possible case would destroy about R5.6 bn of value, and in the worst case destroy R24.5 bn. Therefore, no private sector entity would be able to justify investing in such a project without access to some form of preferential project financing that would ensure an artificially lower cost of capital in the range of 9% (at the South African risk-free interest rate plus 100 basis points). Given the inherent risk in this project and the cost/benefit trade off, Government would have to consider whether it would be more beneficial to provide this level of assistance to other, more promising growth options (within or outside of the iron and steel value chain).

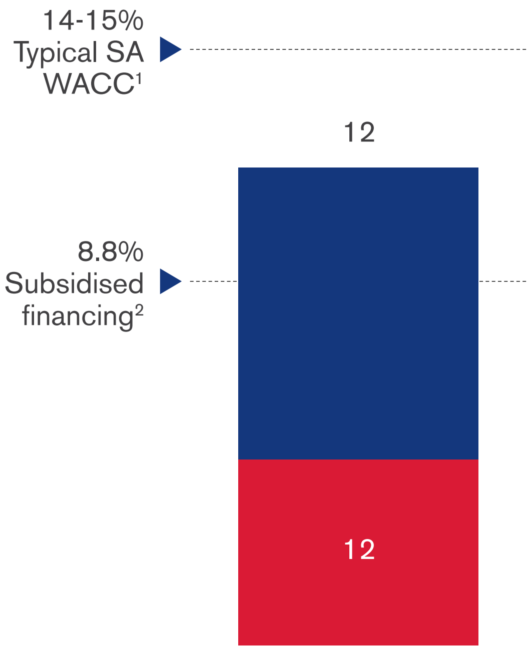
- **Forming a strategic partnership (preferably equity based):** Partnering with a player in the East (eg China, Korea or Japan) for 100% guaranteed slab offtake could make a slab mill viable. Without a partner, slab plants are not viable as the demand for slab is notoriously volatile, and at the bottom of the steel price and demand cycle it is difficult to sell slab. Should global slab markets fail, or the offtake partner default, the plant would need to have a competitive cost position to remain in operation.

  Usiminas, a Brazilian steel group (partly owned by Nippon) did not manage to secure guaranteed offtake agreements with downstream rolling mills, with the result that it was decided that the proposed 5 mtpa greenfield slab plant was commercially unviable and the project was cancelled. Despite benefiting from secured iron ore and world class technology (Nippon), the plant would not have been competitive on an international basis.

- **A plant of about 5 mtpa is needed to benefit from economies of scale.** The proposed slab plant would probably be a blast furnace operation to supply high end flat steel rolling mills, and would need to be constructed at a globally competitive cost of capital. This would probably necessitate using a standardised Chinese or Indian design and contractors to assist with project execution.

EXHIBIT 2.18: LOW CAPITAL COSTS COMBINED WITH SUBSIDISED FINANCING ARE CRUCIAL TO ENSURE THAT AN EXPORT ORIENTATED SLAB PLANT CREATES VALUE

Internal Rate of Return (IRR) scenarios for an export oriented slab plant, %, normal



- **In the high return case the investment would generate 12% IRR**
  – Value creating if subsidised financing provided
  – Scenario assumes:
    - High prices for raw material, eg iron ore and coking coal
    - Low capital costs, eg Chinese capital

- **In the low return case the investment would generate 5% IRR**
  – Not value creating even at subsidised financing
  – Scenario assumes:
    - Low prices for raw material, eg iron ore and coking coal
    - High capital costs, equivalent to SA/EU capital productivity

[1] WACC – Weighted average cost of capital
[2] Risk free discount rate +1%

SOURCE: Kumba

- **Significant infrastructure investment in logistics and utilities.** Owing to the fact that the plant would be export orientated, it should be located at the coast. Saldanha and Ngqura are potential locations for such a plant as they can be supplied with iron ore from Northern Cape, while Richards Bay or Maputo could secure ore from the proposed Limpopo mines (*see Exhibit 2.19*).

  – In each case, Transnet would need to accommodate an additional 8 mtpa of bulk freight, while the ports would need to receive 2 mtpa of coke imports and acquire slab loading equipment. Given the infrastructure investment required, the options for the location of the proposed coastal slab plant would be:

    1) Ngqura and Maputo: These ports can accommodate only Panamax vessels and the capacity of the related railway lines is hampered by rolling stock requirements (due to the distance of the relevant iron ore mines from the port), track bed concerns and insufficient axle weight capacity. Remedying these constraints would require an investment of approximately R3-5 bn.

    2) Saldanha: The existing infrastructure and port provides space for expansions, making Saldanha a suitable location from an infrastructure perspective. The slab plant's capacity requirements would need to be additional to the current rail and port expansion plans. The cost of the further rail and port expansion required for the slab plant is uncertain, but would be in excess of the R4.2 bn required to upgrade the IOEC to 60 mtpa. The primary drawback of this option is that Saldanha is located far from South Africa's local sources of demand, should it ever become feasible to sell beneficiated steel products domestically.

    3) Richards Bay: The port has sufficient capacity, but would need substantial efforts to remove bottlenecks at the Overvaal tunnel in the next expansion of the rail corridor. Excluding rolling stock, the required investment is estimated at R10 bn.

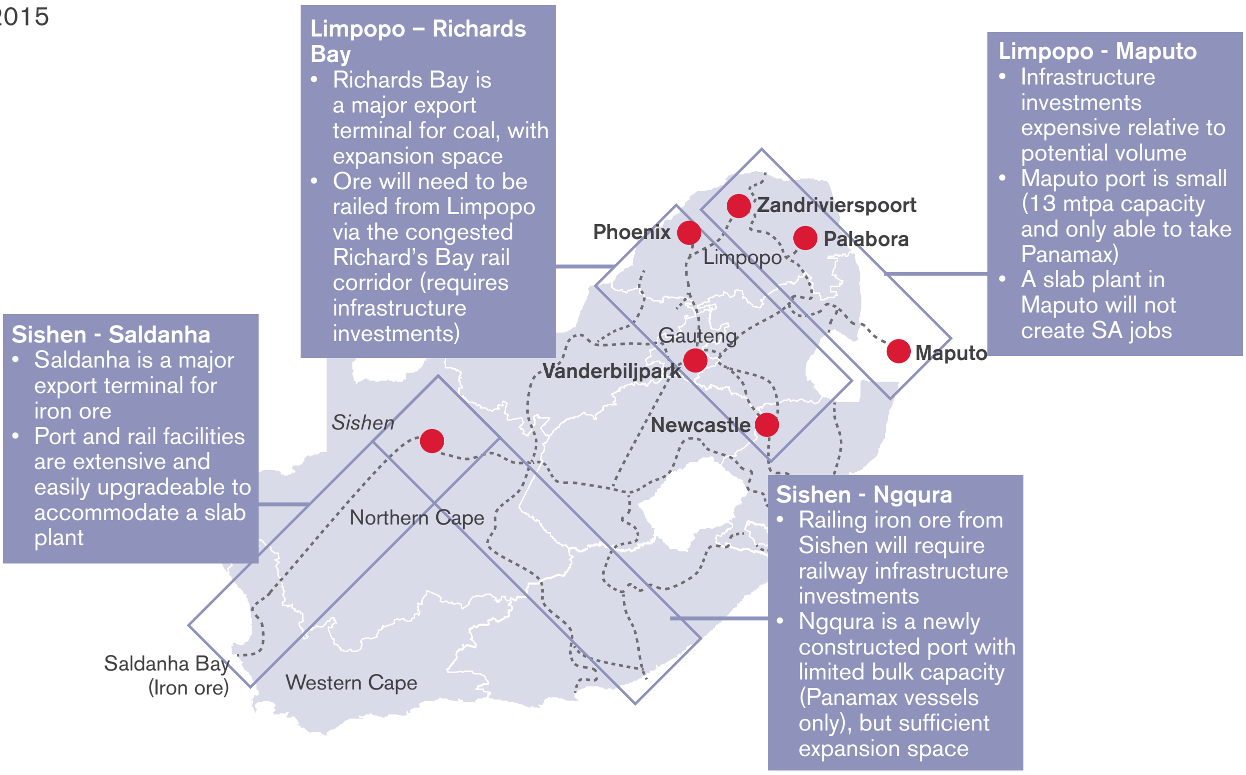
  – The proposed slab plant would also require approximately 15 ML of water a year and 110MW of additional electricity. The electricity could be supplied after Eskom's planned infrastructure expansions in 2016-18, or through a partnership with an independent power producer.

- **Market based pricing:** Given that the anticipated returns on this project are marginal, it would be critical to ensure that there are no artificial distortions to the relevant markets. For instance, all domestic steel producers should be treated equivalently and there should not be any preferential treatment of any specific steel producer (all steel producers should purchase raw materials at market prices). Any intervention to effect the price at which steel is sold in South Africa would also discourage potential entrants from investing in a South African based slab plant on a commercial basis.

Additionally, Government should also consider that each direct job created in steel comes at a cost of approximately R15 million investment, significantly higher than the cost of each direct job created in mining at approximately R6 million investment.

EXHIBIT 2.19: SOUTH AFRICA COULD DEVELOP FOUR DIFFERENT CORRIDORS TO SUPPLY A COASTAL SLAB PLANT

After 2015



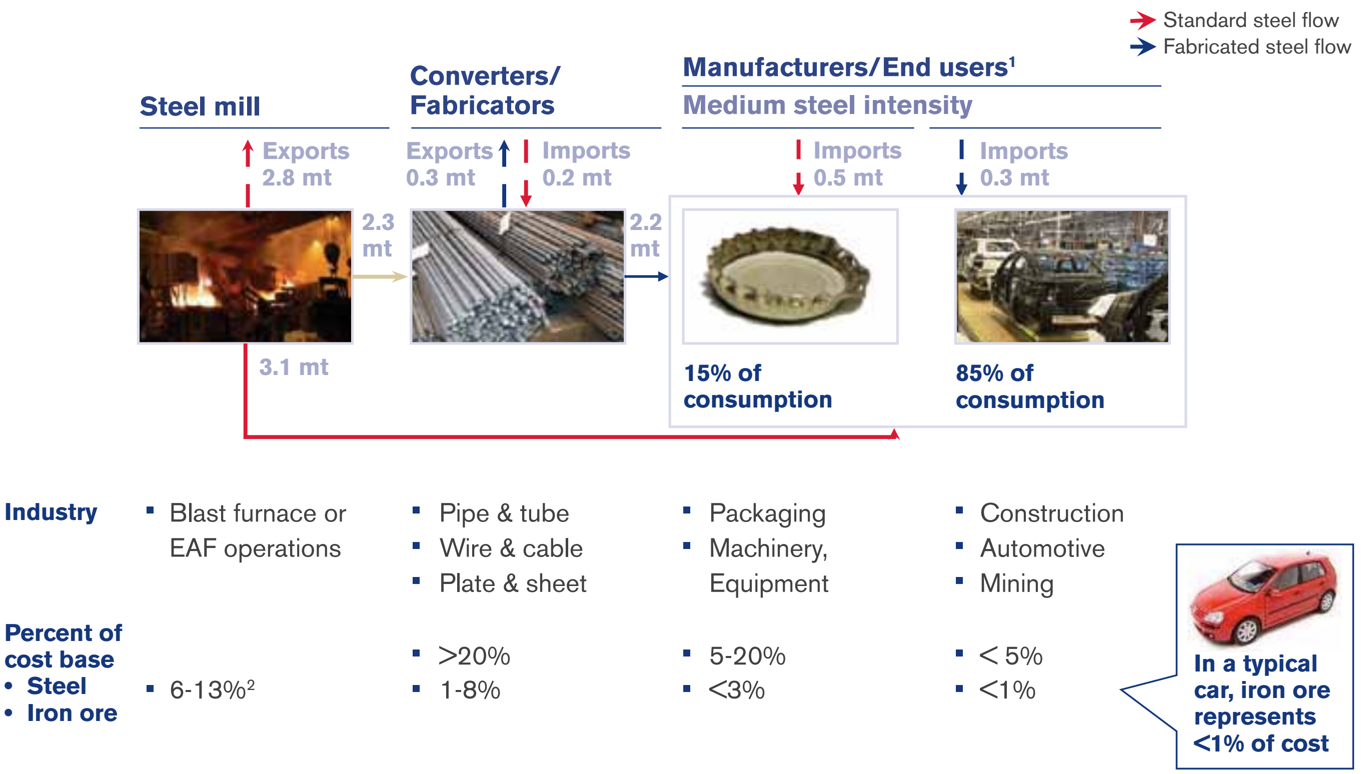
Note: Currently no port in South Africa have capacity to import iron ore lump or fines

SOURCE: Kumba, Hatch, expert interviews

2.3.3 Conversion/fabrication and manufacturing/ end users (downstream industries)

EXHIBIT 2.20: THE IRON ORE PRICE HAS A NEGLIGIBLE IMPACT ON DOWNSTREAM INDUSTRIES

South African steel product flow in 2008



[1] Manufactured goods or end-user product exports 0.4 mt and imports 0.9 mt

[2] At EPP prices for Sishen ore (US$110/t) the share of iron ore will be 20%. For e.g., Posco (buying at IPP ~US$160/t), iron ore is ~35% of costs

SOURCE: SAISI, Stats SA, SA customs data, Wards, University of Maryland, WSD, Kumba

Review of the current situation

South African downstream producers are generally competitive in relation to sales to domestic customers as imported goods have to incur high logistics costs. The corollary of the high logistics costs of importing steel products into South Africa is that most South African downstream industries are not competitive in large scale export destinations. In addition, high labour costs and low labour productivity, as well as the current volatile exchange rate, contribute to the lack of competitiveness of South African exports.

As explained in Section 1, a reduction of steel prices will not compensate for disadvantages in labour and logistics costs in the export markets. Iron ore currently accounts for 6-13% of the cost of the production of steel in South Africa, and steel accounts for less than 5% of the production cost for the vast majority of downstream industries (*see Exhibit 2.20*). Hence, even if iron ore was supplied free to steel producers and gave rise to a concomitant decrease in the price of steel, it would have an impact of less than 0.7% on the vast majority of end products – highlighted by the City Golf example in *Exhibit 2.20*.

In addition, steel price discounts would not have a significant impact on end consumption in downstream industries since:

- **Steel prices would only be effective ex-mill:** The ex-mill price accounts for only 60-70% of the end consumer price. Additional costs for logistics, processing, assembly, inventory costs and margin are incurred by intermediaries in the value chain.

- **Steel demand elasticity is low:** International studies show steel demand elasticity, ie the willingness to increase steel price purchases and consumption if steel prices were lowered, is relatively low at 0.2-0.3 (*see Exhibit 2.21*). If steel price input costs were reduced by 10%, this would create additional steel sales of only 2-3%, as illustrated in *Exhibit 2.22*.

- **Price regulations would be very difficult to implement:** For just one type of steel product – structural sections – AMSA reports >250 SKUs for January 2011. This wide range of products will be almost impossible to regulate.

Investments in modern production facilities have not overcome the structural disadvantages faced by South African producers in export destinations. For example, the converting/fabricating business units of Scaw Metals have invested in new rolling mills, DRI units using local iron ore and, more recently, a mega scrap shredder. Nevertheless, Scaw Metals, along with most other South African mini-mills with rolling facilities, remains marginally profitable and unable to increase export volumes. It should also be noted that Murray & Roberts has recently announced the closure of the CISCO steel mill in Cape Town.

EXHIBIT 2.21: INTERNATIONAL EXPERIENCE SHOWS THAT THE STEEL DEMAND PRICE ELASTICITY IS 0.2–0.3

International research on the elasticity of steel prices

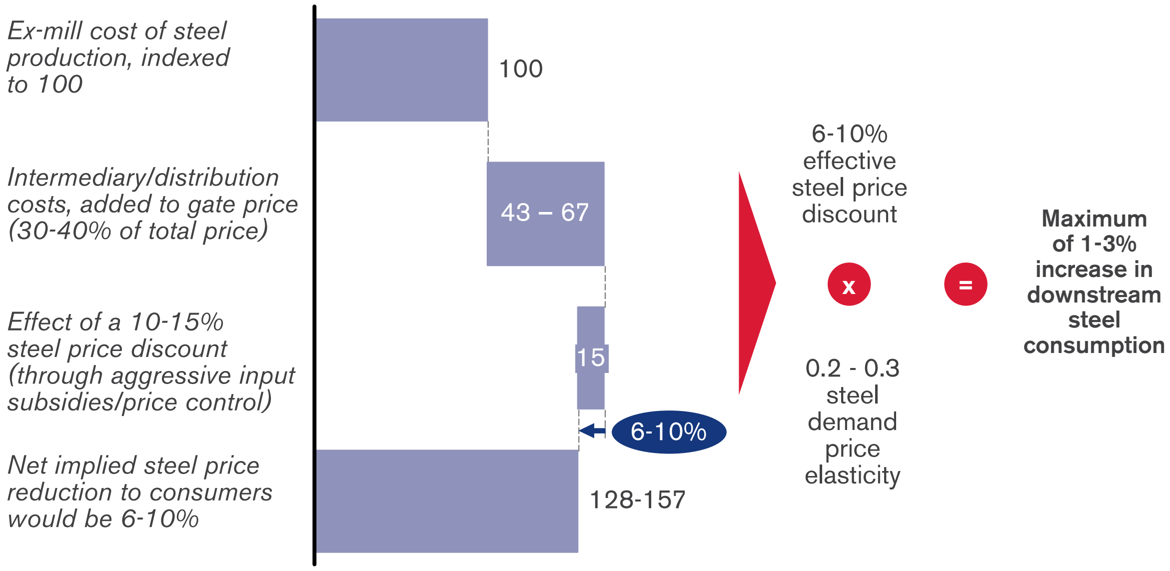
Korea Institute for Industrial Economy & Trade, 2007, South Korea	"The the price elasticity for steel is […] 0.329 for imports"
The American Economic Review, 1940, United States	"The elasticity of demand for steel in not in excess of 0.2 or 0.3"
The Journal of Economic History, 1977, Western Europe	"… the demand elasticity for the industry as a whole of 0.27…"
The Review of Economics and Statistics, 1983, United States	"…aggregate demand elasticity for steel is 0.303"
Centre for International Economics and Shipping, 2002, Europe	"…steel demand elasticity of 0.3 for Europe"

SOURCE: Korea Institute for Industrial Economy & Trade, The American Economic review, Journal of Economic History, Review of Economics and Statistics, Centre of International Economics and Shipping

EXHIBIT 2.22: AGGRESSIVE INPUT COST SUBSIDISATION/STEEL PRICE CONTROL IN SOUTH AFRICA WOULD ONLY CREATE 1-3% OF ADDITIONAL DOWNSTREAM STEEL DEMAND

100 = Current cost of steel production in South Africa

Potential stimulation of South African steel demand



SOURCE: Kumba, Economic price control

Overview of potential growth opportunities for South Africa

The high road for conversion/fabrication and manufacturing/end users is largely that downstream conversion or fabrication will grow in line with the overall value chain. Alternatively, conversion and fabrication could be supported through targeted investment into competitive niche products, eg mining equipment.

The high road scenario in respect of the downstream conversion or fabrication sector would have significant benefits for the overall economy:

- **Employment:** Create new employment opportunities, although the magnitude is difficult to estimate for the wide range of steel consuming downstream industries.
- **Economic growth:** A significant increase in contribution to GDP from R440 bn in 2008 to about R460 bn in 2015 and to the fiscus from R40 bn to R47 bn.

There are two potential opportunities for creating this economic benefit – multiplier effects from expansion of the upstream mining sector and the development of niche export opportunities.

Multiplier effects from expansion of the upstream mining sector

Many industries, such as construction, would benefit from growth in the iron ore sector owing to direct investments in mines and support infrastructure, such as houses built by employees near mines. As many downstream industries are well advanced in terms of BEE participation, these multiplier effects would translate into transformation of the economy.

Chhattisgarh in India is a good example of how an economy has shown positive development as a result of growth in upstream industries (*see Exhibit 2.23*). Until 2001, Chhattisgarh grew by 3% less than India as a whole. After operations began at a coal mine in 2001, Chhattisgarh grew at 1% above the national growth rate.

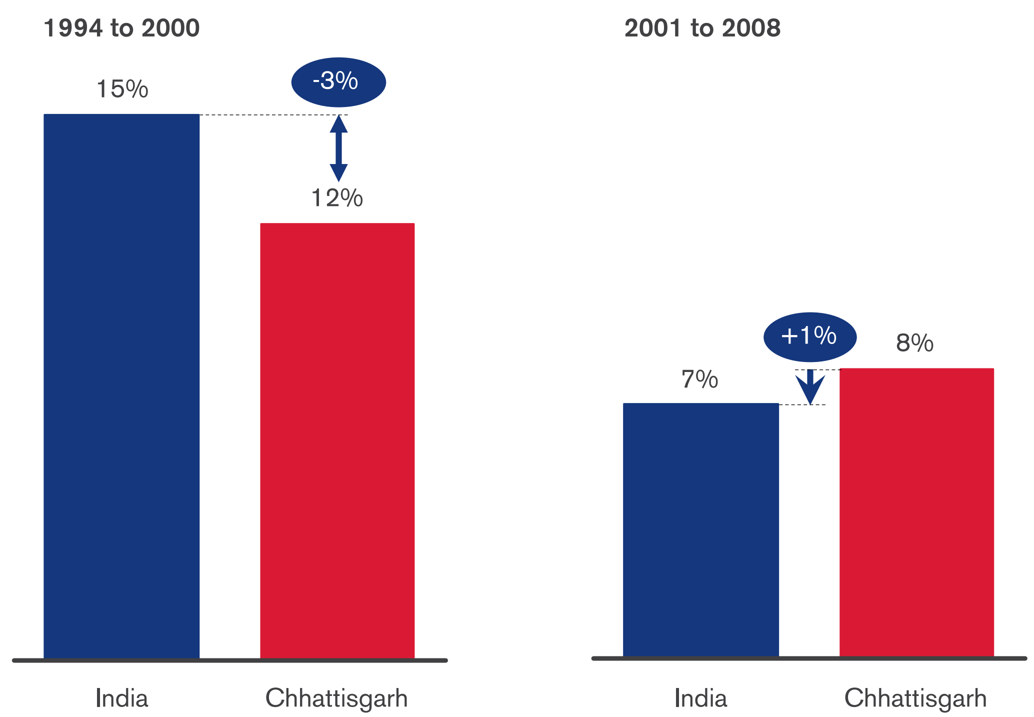
To achieve these multiplier effects in South Africa, it would be necessary to reach the high road scenario described in this document.

Support of niche industry exports

There are certain niche downstream sectors where South Africa has an inherently competitive advantage owing to the fact that there is significant domestic demand for these products. Domestic producers of these products are able to achieve economies of scale, which means that exports are more likely to be competitive and that the industries could further increase exports if given targeted support. One example of a downstream manufacturer which has developed a niche product range which is focused on meeting domestic requirements is Scaw Metals, which

EXHIBIT 2.23: MINE DEVELOPMENTS TURNED CHHATTISGARTH INTO A LEADING GROWTH REGION IN INDIA

GDP growth rate in percent 2001 – Present



SOURCE: India Stat, Central statistical organisation produces grinding media and haulage cable (*see Exhibit 2.24*). Another example of such niche industries in South Africa is the manufacture of long wall continuous mining and drilling equipment. Industries without a current competitive advantage, on the other hand, are unlikely to deliver significant sustainable growth beyond current growth rates, even with Government intervention.

Competitive niche industries would need to be provided with appropriate Government support, such as:

- **Assistance in identifying competitive niche industries** through a thorough approach that evaluates South Africa's current and potential international cost and skill competitiveness on a product by product basis. This is highlighted by the Moroccan example, which shows how the country identified industries with a competitive advantage on a product by product basis. Identified industries were successfully supported through free trade zones, tax incentives, infrastructure (eg ports) and financial assistance.

- **Subsidised skills development and improved ease of doing business through better infrastructure.** The South Korean shipbuilding example (*see Exhibit 2.24*) shows how Korea gained market share from its main competitor, Japan, through lower labour costs combined with higher labour productivity, comparable production technologies and proximity to growth markets.

- **Subsidised finance, which could include direct financial assistance, subsidies and tax incentives.** This could include preferential financing to incentivise investment or favourable tax arrangements which would reduce the weighted average cost of capital and make investments financially more viable. Financing costs in South Africa are high by international standards.

- The South African Development Bank's real interest rate is 6.5%, compared to the 0.7% real interest rate of the Brazilian Development Bank (BNDES). Financing from the BNDES is conditional on investment in defined priority industries, such as electric power (*see Exhibit 2.25*). Apart from enabling economic growth, this initiative also serves as a counter cyclical tool and a way of developing national priority industries. Over the past 7 years, BNDES has been responsible for approximately 60% of investments in the electric power sector, financing projects valued at approximately R$60 bn. South Africa could also benefit from rural development if an attractive financing option was developed.

EXHIBIT 2.24: BY FOCUSING ON AREAS WITH SIGNIFICANT LOCAL DEMAND, SCAW METALS IS A GLOBALLY RECOGNISED SUPPLIER OF MINING EQUIPMENT

Grinding media
- High chromium media
- Forged steel media

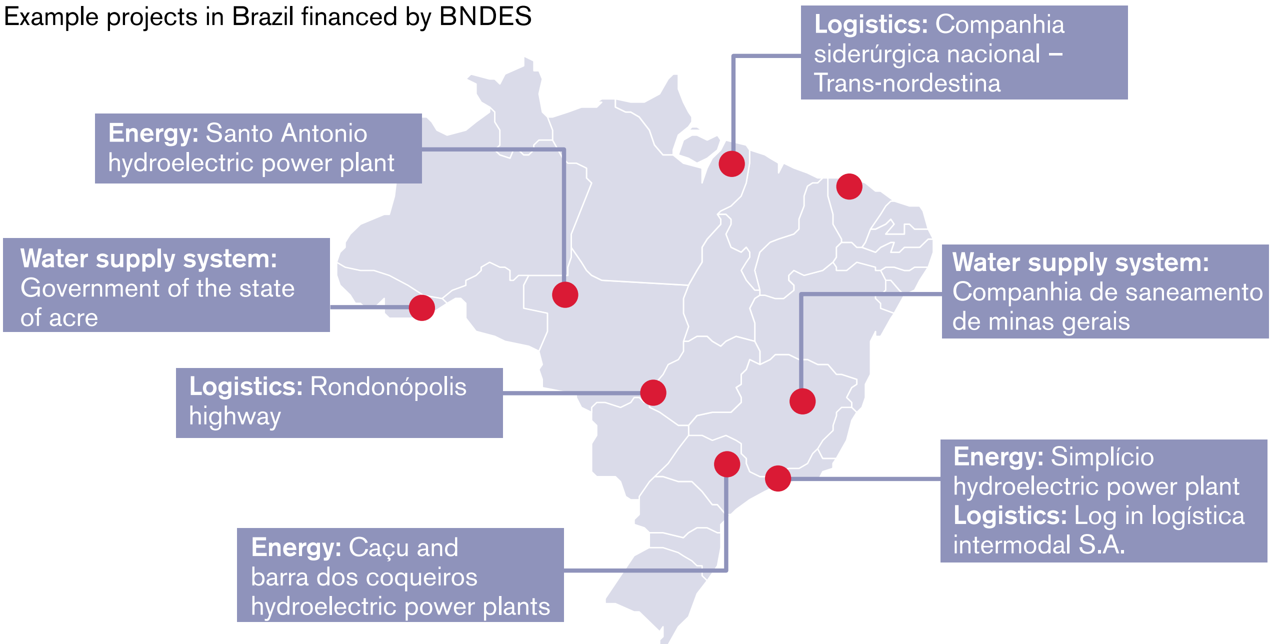
Wire rod products
- Mining commodity ropes
- Mining chains (eg scraper chains, winch-move chain slings)

Cast products
- Mantles, bowl and mill liners
- Dragline parts
- Locomotive/wagon frames
- Slagpots and ladles

SOURCE: Scaw Metals

EXHIBIT 2.25: IN THE LAST 7 YEARS, PRIVATE COMPANIES WITH FINANCING FROM BNDES[1] WERE RESPONSIBLE FOR THE MAJORITY OF INFRASTRUCTURE INVESTMENTS

Example projects in Brazil financed by BNDES



[1] Banco Nacional De Desenvolvimento Econômico E Social – Brazilian Development Bank

SOURCE: BNDES annual reports

2.4 THE LOW ROAD SCENARIO

The high road scenario provides an exciting vision and opportunity for the South African economy. However, the iron and steel value chain could also take the low road if the various challenges referred to in this document are not overcome and/or Government policies adopted are not supportive of attaining the high road objectives.

Should the iron ore and steel sectors follow the low road trajectory, not only will this result in the loss of the significant growth opportunities which have been highlighted in the high road scenario, but it would have a significant negative effect on the value chain and overall economy. Pursuing the low road will conceivably result in lower industrial activity and a reduction in existing jobs (particularly in the steel sector) as well as reduced employment opportunities in the iron ore sector.

The low road scenario, which could arise from a combination of inaction and the unintended consequences of policymaking, could severely affect the value chain and should be avoided at all costs, given the risks it poses for the overall economy.

2.4.1 Iron ore mining and mining beneficiation (iron ore mining)

The expansions in Limpopo and Northern Cape require significant infrastructure capacity growth (primarily rail and port). Should this infrastructure not materialise in time or be built at a cost that results in tariffs well above current levels, these growth projects will not occur.

Similarly, should the price of iron ore from these projects be regulated below market prices, these projects will not be economically viable. This alone will result in South Africa foregoing 14 000 new jobs, related rural development and growth in iron ore mining and beneficiation.

The economy will forgo an estimated GDP contribution of R20.4 bn, contribution to the fiscus of R10.9 bn and contribution to forex of US$3.25 bn by 2015-20.

2.4.2 Metallurgical beneficiation and shaping (steelmaking)

The South African steel industry has historically struggled with overcapacity, and only at the top of the price cycle has domestically produced steel been exported at prices which cover the cost of investment in production plants. Many South African steel players have experienced near-bankruptcies and distressed asset closures. Previous Government interventions designed to grow South Africa's steelmaking capacity, such as investments in Saldanha Steelworks' Midrex-Corex process, have suffered financially.

Government supported the investment with the intention of bringing innovative steelmaking technologies and capacity growth to the South African steel industry through exports. However, since its opening, Saldanha has experienced technological challenges which, in combination with significant exposure to the less-attractive export markets, have led to long term financial difficulties.

Despite these challenges, South Africa boasts one of the most developed steel manufacturing industries (steel volume produced and number of steel producers) relative to comparable global economies (by GDP size and GDP per capita). In the event Government was to regulate (directly or indirectly) the price at which domestic steel producers are able to sell steel in South Africa this would, in all likelihood, discourage steel producers from maintaining their current production capacity. This would compromise the industry's ability to provide South Africa with most of its steel requirements. It would also be likely to discourage potential new capital investment in the South African steel industry and, thereby deter new commercial entrants. Contributors to this low road scenario would include:

- **Steel price regulation:** South African mini-mills (CISCO, DAV Steel, Scaw Metals) are currently running at a loss, with the result that they cannot justify any investment in maintaining or upgrading capacity. Should steel prices be lowered by more than 10% from current market levels, these players would be unable to cover their operating costs. This could lead to their closure and the loss of up to 10 000 jobs. Murray & Roberts recently closed CISCO due to "underperformance". The closure of or reduction in production at anymore of the remaining steel producers would have a negative impact on employment, and would accentuate AMSA's already dominant position in the domestic steel market. It should also be noted that Evraz Highveld reported a significant third quarter loss in 2010.

  Maintaining a well functioning, undistorted system for price regulation of a globally traded commodity is difficult, as illustrated in the case of Iran. The country nationalised its steel industry in 1979 and took control of the value chain from exploration to marketing of steel products. Artificially low prices were set on an annual basis in an attempt to grow downstream industries. However, the system soon became distorted since intermediaries kept market supply low at regulated prices and provided the balance on the black market at market prices. In 2005, a metal exchange was explicitly established to institute a market pricing mechanism.

  South Africa would also face several challenges if it attempted to influence the domestic price of steel as a tool to increase either domestic steel consumption or export sales. It is unlikely that intervention to reduce the domestic price of steel would achieve either of these two objectives. Therefore, it would be more productive to invest in a targeted manner to support developmental objectives.

- **Iron ore price regulation:** AMSA enjoys a dominant position in South Africa, given its significant scale and cost advantages relative to domestic competitors. AMSA has also historically enjoyed a significant benefit over its domestic competitors, partially owing to long term secure iron ore supply on a cost plus basis. AMSA's lower cost of iron ore did not historically produce any downstream benefit and would not have brought any downstream benefit in the future. Any attempt to reduce the price of iron ore in South Africa would simply benefit AMSA and no other domestic steel producers (which principally use scrap and, in the case of Evraz Highveld, captive vanadium-rich iron ore), and would compromise the sustainability of these operations and hamper the competitiveness of an already struggling industry even further.

2.4.3 Converters/fabricators and manufacturers/ end users (downstream industries)

Finally, in the low road scenario, the potential downstream growth and security of steel supply would not be achieved due to the reduced ability in the steelmaking portion of the value chain to invest in adequate steel production and the equipment modernisation needed for the product range required by downstream manufacturing segments. Without domestic access to the required product quality or product range, downstream industries would become increasingly reliant on steel imports.

The low road would significantly hamper economic growth in the iron and steel value chain, with negative consequences for the entire South African economy.

Positioning the South African iron and steel value chain on the exciting high road and supporting Government's intentions to stimulate economic growth in South Africa are important priorities for Kumba.

2.5 SUMMARY

In summary, the following messages have been presented throughout Sections 1 and 2:

- South Africa's iron ore and steel value chain has significant growth potential and could more than double, adding at least 14 000 jobs. Should the required infrastructure not be in place, or market prices not be obtained, either through regulation or taxation, this growth will not happen.

- Contrary to popular belief South Africa has a large steel making industry, relative to its GDP compared to similar global economies. With almost 10.3–11.6 mtpa name plate capacity, and 5 producers, the industry can satisfy almost double South Africa's current steel demand.

- Growth prospects in South African, steelmaking are very limited, given the significant local and global overcapacity. Any incremental capacity would be for the export market where South Africa has a poor landed cost position (30-35% greater cost) in major international markets versus low cost competitors. This is reflected historically by the significant value destroyed by South African steel exports over the steel cycle.

- Aggressive input cost subsidies and/or steel price controls will not create material downstream steel demand growth in South Africa. Given the relatively incompressible cost structure of South African steel producers; the relatively high intermediary costs (storage, distribution and processing); and the relatively low steel demand price elasticity (0.2–0.3) – even an aggressive steel input cost subsidisation/price control would result in only 1-3% additional downstream steel demand growth.

- The economic case for new steelmaking capacity in South Africa is not obvious. However, should Government policy require such investment there are two potential growth opportunities that could be explored – both would need significant government support:

  - Major research and development into new steel making technologies that could re-position South Africa's cost competitiveness by using locally available thermal coal (vs expensive imported coking coal) and low quality iron ore fines.

  - Attempting to follow the emerging Brazilian slab export model, by constructing a large export dedicated slab facility at the coast in conjunction with an Asian partner. Given the large investment required and the at best marginal economics (even with preferential government financing), the question arises as to whether this is the most efficient use of the State's resources for job creation and growth.

- Successful state interventions always focus on supporting industries that have (or could have) a structural competitive advantage. It is important that any such state intervention in the South Africa iron and steel value chain targets those sectors in which South Africa has such advantages and that it avoids many potential, unintended, negative consequences that could damage other parts of the value chain and the broader economy. Given the importance of this sector to South Africa, Kumba is fully committed to work with government, IDC and other stakeholders to ensure the best possible outcome for the entire value chain and for South Africa.

2.6 DETERMINING THE WAY FORWARD

In the two documents presented to date, Kumba has shared its views regarding the structural, economic, commercial and regulatory drivers that inform the viability of the South African iron and steel value chain.

Kumba recognises that achieving a sustainable and growing value chain will require a collaborative effort from all participants in the value chain. Kumba is committed to collaborating with Government and other stakeholders to form a joint view on value chain growth opportunities and the policies required to fulfil the inherent economic growth potential of the sector.

APPENDIX 1 – KUMBA'S ANALYSIS

In certain instances, Kumba's analysis in this document differs from that contained in the DTI's 25 August 2010 presentation to the Portfolio Committee of Trade & Industry (entitled 'DTI response to iron ore, steel and steel products value chain matters'), which was based on 1998 Stats SA Supply and Use tables. This appendix raises a question and an observation regarding the estimates in that 25 August presentation of the importance of iron and steel in selected downstream industries.

Clarification question on how certain figures were calculated

Slide 16 of the DTI's 25 August presentation is a table showing the direct and indirect proportion of steel as an input into metal product and machinery sectors. This table was taken from page 9 of a September 2004 conference paper entitled '*Addressing market power in a small, isolated, resource-based economy: the case of steel in South Africa*' that Nimrod Zalk co-authored with Simon Roberts. The source for this table is described as Stats SA Supply and Use Tables from 1998.

Kumba has attempted to replicate the analysis presented in this table but has not, to date, been successful. Kumba would appreciate guidance on how the calculations underlying the table were made, including details of any adjustments that may have been made to the source data. Taking structural metal products as an example, the way in which Kumba tried to estimate the percentage of direct steel inputs into the sector is as follows:

- Stats SA's 1998 Use table, row P49 (iron and steel products) shows inputs of iron and steel products into the various industries shown in the columns of the Use table.

- The structural metal sector appears in the column labelled I51. Iron and steel products accounted for R2,615 m of inputs to the structural metal sector in 1998, out of total purchases by that sector of R6,236 m. Iron and steel thus appears to have accounted for 42% (=2,615 / 6,236) of inputs into the structural metal sector.

- This figure of 42% differs from the 32% direct inputs figure presented in slide 16 of the DTI's 25 August presentation; Kumba would therefore like to understand how that 32% figure (as well as the 42.7% figure relating to direct and indirect inputs) was obtained.

- Using the method described above, Kumba has obtained higher figures than those in the DTI presentation for some sub-sectors (eg structural metal products) and lower figures in other sub-sectors (eg treated metal products).

Observation on the source data from Stats SA

To better understand the DTI's calculations of the importance of iron and steel products in downstream industries, Kumba has investigated the composition of the 'iron and steel products' category shown in row P49 of the 1998 Use table. It turns out that there are certain complications with respect to the firms included in this category which, depending on the broader purposes of the analysis being conducted, would seem to require making certain adjustments to the Stats SA data.

To explain, we assume that one of the purposes of estimating the importance of iron and steel products in selected downstream industries is to get a sense of the extent to which a given percentage reduction in the domestic steel prices charged by AMSA and the other mills would affect the costs of the downstream industries in South Africa that use steel products. For example, if purchases of steel from steel mills accounted for 35% of the costs of certain downstream industries, then a 20% reduction in the domestic prices charged by the steel mills could be expected to reduce costs in these downstream industries by 7% (= 20% x 35%).

For an analysis of this type, it seems to us that adjustments to the Stats SA data would have to be made to the extent the 'iron and steel products' category (row P49 of the 1998 Use table) included firms other than steel mills. Research we have conducted into the composition of the 'iron and steel products' category suggests that this is in fact a problem, and that the problem is material. (As you know, Stats SA has since published Supply and Use Tables for 2005. The calculations that we describe are with respect to the 1998 tables. The same qualitative points however apply to the 2005 tables.)

While a report describing the composition of the 1998 tables does not appear to be available from Stats SA, the "iron and steel products" category in the 1999 Use table is defined as Standard Industrial Classification (SIC) fifth edition groups 3510 and 3531 (source: Stats SA Report No. 04-04-01 (1999), "Final Supply and Use Tables , 1999", Table N, p.134)[1]. According to Stats SA (http://www.statssa.gov.za/additional_services/siccoder/siccoder.htm), SIC 3510 includes firms whose primary activity is the production of steel (ie the steel mills), but it also includes firms whose primary activity is the production of ferroalloys (ie not steel), as well as firms whose primary activity involves producing intermediate steel products (eg 'angles (iron and steel) manufacturing') used in the downstream industries analysed in Slide 16 of the DTI's 25 August presentation.

[1] In the 2005 supply and use tables, the category "basic iron and steel" corresponds to SIC group 3510 only (source: Stats SA Report No. 04-04-01 (2005), "Final Supply and Use Tables, 2005", Table K, p.103).

The inclusion of firms who do not make or use steel in the "iron and steel products" category (row P49 of the 1998 Use table) seems obviously to be a problem if the goal of the analysis is to estimate the impact on downstream costs of a given percentage reduction in the domestic prices charged by South African steel mills.

The inclusion of firms that make intermediate steel products is also a problem. We assume that Stats SA has made appropriate adjustments to avoid the double counting that could occur with respect to "within category" sales – eg when a steel mill sells to a producer of intermediate steel products, who then sells to downstream beneficiation industries. If the producer of intermediate steel products and the steel mill are both classified within SIC 3510 and thus are both part of the "iron and steel products" row of the 1998 Use table, care must be taken so that sales of steel by the mills to the producers of intermediate steel products are not included in the category total. Otherwise the same ton of steel could be counted twice – once as a sale by the mill to the producer of intermediate products, and then again as an input in the sale of intermediate products to customers in downstream industries that are outside of SIC 351.

However, even if this potential problem of double counting has been avoided, a problem remains with the inclusion of producers of intermediate steel products in the "iron and steel products" row of the Use table. If a goal of the analysis is to estimate the effect on the costs of downstream industries of a given percentage change in the domestic prices charged by South African steel mills, then including the sales of intermediate steel products in the "iron and steel products" row of the Use table will overestimate this effect – because sales of intermediate steel products include the value added by these producers in addition to the cost of the steel that they use.

As mentioned above, our research suggests that both problems are present and that these problems are material. Table 1 below contains a list of all the sub-classifications falling within the SIC categories 3510 and 3531 (Stats SA http://www.statssa.gov.za/additional_services/siccoder/siccoder.htm) The table shows that SIC category 3510 includes activities such as production of ferroalloys (ie not steel), as well as the production of intermediate steel products (eg 'angles (iron and steel) manufacturing').

The materiality of these problems can be illustrated by examining Stats SA's employment figures associated with 'basic iron and steel'. Stats SA figures show that employment in 'basic iron and steel' in 1998 was 49 000. However, Kumba believes that direct employment in steel mills is only approximately 12 000–14 000; steel mill contractors are estimated to add 4 000 to that employment figure. Employment in the ferroalloys sector is estimated to be 7 000 employees plus 2 000 contractors. The balance of employment is therefore in the steel fabrication sector, estimated at 22 000–24 000 employees (out of a total 49 000 employees in 'basic iron and steel'). This corroborates Kumba's view that focusing on the broad 'basic iron and steel' sector as a whole, is likely to overstate significantly the importance of steel products sold by steel mills in the total costs of downstream industries.

Table 1: Sub-sectors falling within 'basic iron and steel'

Sub-sectors of SIC 3510	Sub-sectors of 3531
Alloy or alloyed steel ingots manufacturing	Cast steel chain manufacturing
Alloy steel manufacturing	Casting of iron or steel
Alloyed steel bar manufacturing	Die casting of iron or steel
Alloyed steel strip manufacturing	Die stock manufacturing
Angles (iron and steel) manufacturing	Gunmetal casting
Armour plate manufacturing	Linotype castings manufacturing
Axle rolling or forging	Machined iron or metal castings manufacturing
Band, iron and steel, manufacturing	Malleable iron castings manufacturing
Bars and rods (iron & steel) manufacturing	Metal mould casting
Billets (iron, steel or alloy steel) manufacturing	Primary ferrous metal foundry (casting of finished or semi-processed ferrous metals)
Blast furnace operation	Typecasting of metal
Blooms manufacturing (iron)	
Boiler plate manufacturing	
Bolt, iron or steel, rolling mill manufacturing	
Brad, iron or steel, rolling and drawing	
Cast iron and steel products manufacturing at rolling mill	
Cast iron pipe and fitting manufacturing at rolling mill	
Chrome ferro-alloys manufacturing	
Cold drawn steel pipe or tube manufacturing, cast or forged at rolling mill	

Sub-sectors of SIC 3510	Sub-sectors of 3531
Cold rolled steel strip manufacturing	
Concrete reinforcing wire manufacturing	
Conductor pipe manufacturing	
Conduit tubing of welded steel manufacturing	
Corrugated iron manufacturing	
Drawn iron, steel or alloy steel products manufacturing	
Extruded iron, steel or alloy steel products manufacturing	
Ferro-alloys manufacturing	
Ferrochrome/ferrochromium manufacturing - alloy of iron and chrome	
Ferro-manganese manufacturing	
Ferrous pipe fittings manufacturing	
Ferrous wire drawing	
Ferrovanadium manufacturing - alloy of steel and vanadium used for hardening or making steel lighter	
Flat rolled products iron or steel manufacturing	
Flattened, sheared and weight-reduced sheets and blanks manufacturing	
Forged iron, steel or alloy steel products manufacturing	
Galvanised iron pipe manufacturing by casting or forging at rolling mill	
Galvanised seamless steel pipe or tube manufacturing, cast or forged at rolling mill	
Galvanised steel sheet plate manufacturing	
Galvanised welded steel pipe or tube manufacturing, cast or forged at rolling mill	
High carbon tool steel manufacturing	
High speed steel manufacturing	
Hollow drill bars and rods (iron or steel) manufacturing	
Hollow profiles of iron and steel manufacturing	
Hollow profiles open seam, welded, riveted or similarly closed (iron and steel) manufacturing	
Hot rolled sheet steel manufacturing	
Hot steel rolling	
Iron and steel railway sleeper manufacturing	
Iron bars and rods manufacturing	
Iron coil rerolling	
Iron direct castings manufacturing at rolling mill	
Iron flats manufacturing	
Iron manufacturing	
Iron nut rod manufacturing	
Iron of exceptional purity manufacturing	
Iron or steel chain rod manufacturing	
Iron pipe manufacturing	
Iron plate manufacturing	
Iron powders manufacturing	
Iron refining	
Iron sheet manufacturing	
Iron slab manufacturing	

Sub-sectors of SIC 3510	Sub-sectors of 3531
Iron smelting	
Iron tube drawing	
Iron tube rolling	
Iron tube welding	
Iron wire drawing	
Iron wire rod manufacturing	
Long or short iron or steel terne manufacturing	
Moulded cast iron pipe or tube manufacturing	
Nail wire manufacturing at rolling mill	
Nails manufacturing, in steel works or rolling mill	
Pipe bending manufacturing	
Pipe coil manufacturing	
Plate mill operation	
Primary ferrous metal products in granules, powder form, pigs, blocks, lumps or liquids from ore or scrap manufacturing	
Primary metal (iron and steel) foundry casting from raw materials (ore, etc)	
Primary metal railway sleeper manufacturing	
Puddling iron manufacturing	
Puddling iron product manufacturing	
Rail fastenings manufacturing	
Rail track joint manufacturing	
Rail track switch manufacturing	
Railroad frog manufacturing (grooved iron placed at track crossing)	
Railway and tramway track construction material manufacturing (eg unassembled rails)	
Railway track manufacturing	
Railway track switch manufacturing (made in steelworks or the rolling mill)	
Razor blade strip manufacturing	
Reinforcing steel bar manufacturing (for concrete work)	
Reinforcing steel rods manufacturing	
Reinforcing wire manufacturing	
Rolled iron, steel or alloy steel products manufacturing	
Roof decking steel manufacturing	
Round wire manufacturing	
Seamless, iron and steel, manufacturing	
Shapes, iron and steel, manufacturing	
Sheets, iron and steel, manufacturing	
Skelp steel manufacturing	
Slag, steel furnace byproduct, manufacturing	
Slates, iron, steel or alloy steel, manufacturing	
Spiegeleisen manufacturing (pig-iron containing percentage manganese and carbon)	
Spike rod manufacturing	
Sponge iron manufacturing	
Sponge steel manufacturing	

Sub-sectors of SIC 3510	Sub-sectors of 3531
Spring steel manufacturing	
Stainless steel fabricating	
Stainless steel manufacturing	
Stainless steel seamless pipe or tube manufacturing	
Steel alloys manufacturing	
Steel bands manufacturing	
Steel bar manufacturing	
Steel by pneumatic or hearth processes manufacturing	
Steel coil re-rolling	
Steel direct castings manufacturing	
Steel fabrication	
Steel fibre manufacturing	
Steel flats manufacturing	
Steel ingots manufacturing	
Steel manufacturing	
Steel nut manufacturing (in the rolling mill)	
Steel nut rod manufacturing	
Steel or alloyed strip manufacturing	
Steel pipe manufacturing	
Steel pipe nipple made from purchased pipe	
Steel pipes manufacturing	
Steel plate or strip manufacturing	
Steel powder manufacturing	
Steel rails manufacturing	
Steel refining	
Steel rod manufacturing	
Steel rolling mill	
Steel sections manufacturing	
Steel sheet or slab manufacturing	
Steel smelting	
Steel tilting	
Steel tube drawing	
Steel tube rolling	
Steel tube welding	
Steel tubes mills manufacturing	
Steel welding rod manufacturing	
Steel wire drawing	
Steel wire rod manufacturing	
Strip coils, iron & steel, manufacturing	
Tempering steel bars	
Terneplate manufacturing	
Threaded pipe fitting manufacturing	
Tie plate manufacturing	
Tubes, spun-cast iron manufacturing	
Welding rods manufacturing (made in the rolling mills)	
Wrought iron pipe manufacturing	

SOURCE: **Stats SA** (http://www.statssa.gov.za/additional_services/siccoder/siccoder.htm)