REPORT R60 /2007

THE IMPACT OF CHROME ORE EXPORTS ON THE LOCAL FERROCHROME INDUSTRY 2007

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

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THE IMPACT OF CHROME ORE EXPORTS ON THE LOCAL FERROCHROME INDUSTRY

2007

DIRECTORATE: MINERAL ECONOMICS

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INTRODUCTION

Historically, South Africa was a source of raw material and a market for goods manufactured outside the country from its raw material. The Mineral and Petroleum Resources Development Act (MPRDA 2002) which regulates the optimal exploration, exploitation, processing and utilisation of mineral resources, seeks to ensure maximum benefit for South Africans from their treasured mineral resources. The act has as one of its key objectives, local beneficiation of ores.

In this report, the behaviour of chrome ore export and ferrochrome production are investigated to establish the effect of chrome ore exports on the ferrochrome production industry. Other factors incorporated are ferrochrome demand, unit prices, Rand-Dollar exchange rates, revenues and employment.

This investigation follows a surge in chrome ore exports in 2005, which may have been instigated by the decreased local ferrochrome capacity utilisation due to the weaker market conditions that was influenced by the ferrochrome oversupply. Consequently, some local chrome ore producers exported in order to sustain chrome ore mining business under these difficult market conditions.

Questions asked are: - Does an increase in chrome ore exports pose a threat to the growth of the local ferrochrome industry? Could increased chrome ore exports result in reduced smelting capacity utilisation? What impact could such a situation have on the revenues generated by the industry and therefore on the local economy? What are the consequences of such behaviour on employment and competitive advantage?

Chrome industry is completely subservient to the fortunes of the stainless steel manufacturing in which over 90 percent of chrome ore produced is consumed while ferrochrome contribution per ton of stainless steel is 25 percent.

1. OVERVIEW OF THE CHROME INDUSTRY

CHROMIUM USAGE

Chromium was first isolated as a metal in 1798, but it was not until 1818 that it was put to regular use in pigments for the manufacturing of wallpaper. With the development of the world steel industry during the 20th century, chromium has assumed a considerable importance as an alloying element. Chromium usage may be divided into three broad, widely diverse areas of application:

- Metallurgical (91%)
- Chemical (5.5%)
- Refractory and Foundry Sand (3.5%)

The metal's greatest benefit to the metallurgical industry lies in its ability to impart such properties as corrosion resistance, hardness, strength and bright attractive furnish. For this reason, metallurgical grade ores are used for the production of ferrochrome used by the steel making industry in the production of corrosion and heat resistant steel and stainless steel. Chromium has no substitute in stainless steel, the leading end use, or in super alloys, the major strategic end use. Chromium-bearing scrap can substitute for ferrochrome in other metallurgical applications.

The chemical application of chromium embraces all aspects that involve dissolving ore into aqueous solution by chemical means. Chromium is converted into dichromate for the manufacturing of colouring agents, timber preservatives, and for leather tanning and chromium plating.

Most important to the manufacturing of refractory bricks used in furnace lining are low silica content and the consistency of ore which is the characteristic of the South African chrome ore concentrate.

Chrome foundry sand is a specialised, well graded product used extensively in the production of steels casting and other foundry practices.

WORLD CHROME ORE RESERVES

The World's largest chrome ore reserve base (6403 Mt) is located in Southern African region and is associated with the Bushveld Complex and the Great Dyke of Zimbabwe (Figure1).

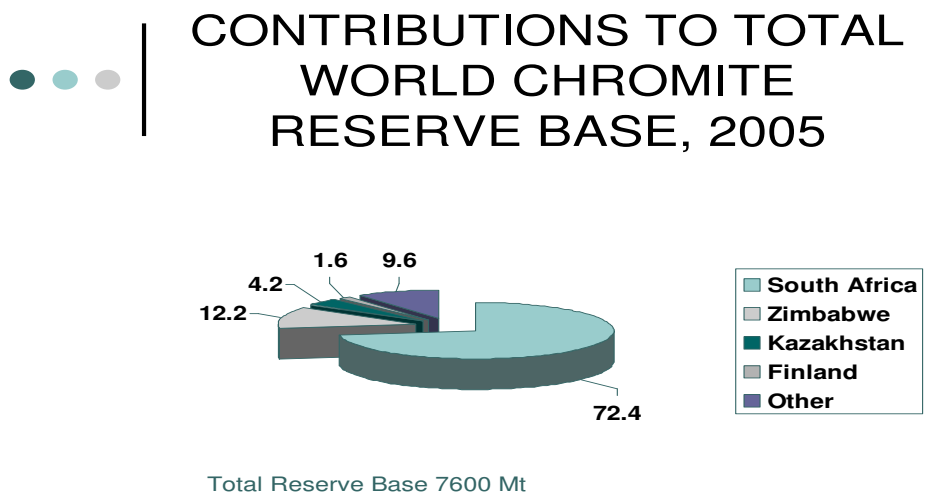

Figure 1: World Chrome Ore Reserves
Sami 2005/2006

At 5 550 Mt, South Africa is home to 72.4 percent of the world's chrome ore resources although it only supplies 38.3 percent of world chrome ore output and accounts for 15.4 percent of global ore exports (Table1). Exports are lower because the country concentrates on adding value to the ore, exporting predominantly beneficiated products such as ferrochrome. A bulk of chrome ore production is consumed locally, where 90 percent was consumed by the domestic market in 2005, hence South Africa was ranked number 4 on chrome ore exports.

Table 1: World Chrome Ore Reserves, Production and Sales: 2005

	RESERVES			PRODUCTION			EXPORTS		
COUNTRY	Mt	%	Rank	kt	%	Rank	kt	%	Rank
South Africa	5 500	72.4	1	7 494	38.3	1	657	15.4	4
Kazakhstan	320	4.2	3	3 581	18.5	2	920	21.6	2
India	67	0.9	5	3 255	16.5	3	1 031	24.2	1
Turkey	20	0.3	6	859	4.5	4	720	16.9	3
Zimbabwe	930	12.2	2	820	4.3	5	0	0	-
Russia	w	w	-	772	4	6	0	0	-
Brazil	17	0.2	7	677	3.5	7	115	2.7	6
Finland	120	1.6	4	571	3	8	0	0	-
Australia	w	w	-	242	1.3	9	204	4.8	5
Iran	w	w	-	224	1.2	10	224	5.3	4
Other	626	8.2	-	816	4.4		390	9.1	-
TOTAL	7 600	100,0		19 311	100,0		4 261	100,0	

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SOUTH AFRICAN CHROME ORE RESERVES

Substantial resources of chrome ore, mined for the production of chromium and its alloys, are found in the Bushveld Complex which covers large tracts of the Northwest, Gauteng, Mpumalanga and Limpopo provinces. This oval-shaped layered complex, which consists of layers of strata of igneous rock, extends over 300km east to west and 100km north to south and the layers dip gently towards the centre of the complex. The Bushveld complex consists of five belts or limbs and chrome ore is currently being mined from the eastern and the western limbs of the complex. Stratiform chrome ore reefs occur within layers of mafic to ultramafic rocks which formed as a result of differential crystallisation during the cooling of magma. The remarkable aspects of the chrome ore reefs, is their consistency in grade and thickness over a distance of 200km along strike and down to a depth of over 1km. Two types of Chrome ore are mined in South Africa, these types are classified according to their chromium content, namely; less than 44 percent and 44-48 percent chromium. South African chrome ores are generally of lower grade than those mined in other countries.

- **PROCESSING**

Chrome ore is converted to ferrochrome through intense metallurgical processing which includes smelting with carbon or silicon, utilising about 3 - 4 MWh per ton of ferrochrome. About 90 percent of Chrome ore is locally processed to ferrochrome for metallurgical applications, while over 90 percent of ferrochrome is consumed by the stainless steel making industry. Over 80 percent of ferrochrome is exported to Asia, Europe and the USA among other markets.

- **THE CHROME VALUE CHAIN**

a) ORE PRODUCERS

As already stated, ore is produced for different applications; each application requires a specific grade of ore. The following are ore specification which may differ from one producer to another (Table 2).

Table 2: Ore Specification for Different Applications

Application	Grade (Cr_2O_3)
Metallurgical	40% – 46%
Chemical	>46%
Foundry Sands	>46%
Refractory	60%

M Bonga SA Ferro Alloy Hand Book 2006

b) ALLOYERS

Some 80 percent of ferrochrome is produced by integrated smelters that source ore from their captive operations.Ferrochrome is classified into 3 types, namely: High Carbon, Medium Carbon and Low Carbon. High carbon ferrochrome (3 to 8 percent carbon), also referred to as charge chrome, is used to produce steel in which both chromium and carbon are present. It is made by reducing chrome ore with coke in a submerged arc furnace with the charge being introduced from an

open top. The latest trend in charge chrome production entails the adoption of plasma furnace technology, which involves the injection of pulverized chrome ore into a shaft furnace containing generators that produce high temperature ionized gases. Plasma furnaces allow friable chrome ore fines to be used as the raw material, which results in lower material loss thereby increasing the ferroalloy recovery rate.

Ferrochrome containing less than 3 percent carbon: medium carbon ferrochrome is produced by adding chrome ore, lime, silicon and fluorspar to molten high carbon ferrochrome in a two-stage process.

Ferrochrome with an even lower content of carbon (maximum of 0,1 percent) is produced by heating high carbon ferrochrome with ground quartzite in a high vacuum with the removal of carbon as carbon monoxide. Low carbon ferrochrome is used for producing chromium steels in which the presence of carbon is detrimental.

c) CHROME END-USE MARKETS

Ninety percent (90%) of ferrochrome is utilised in the stainless steel industry (Figure 2).

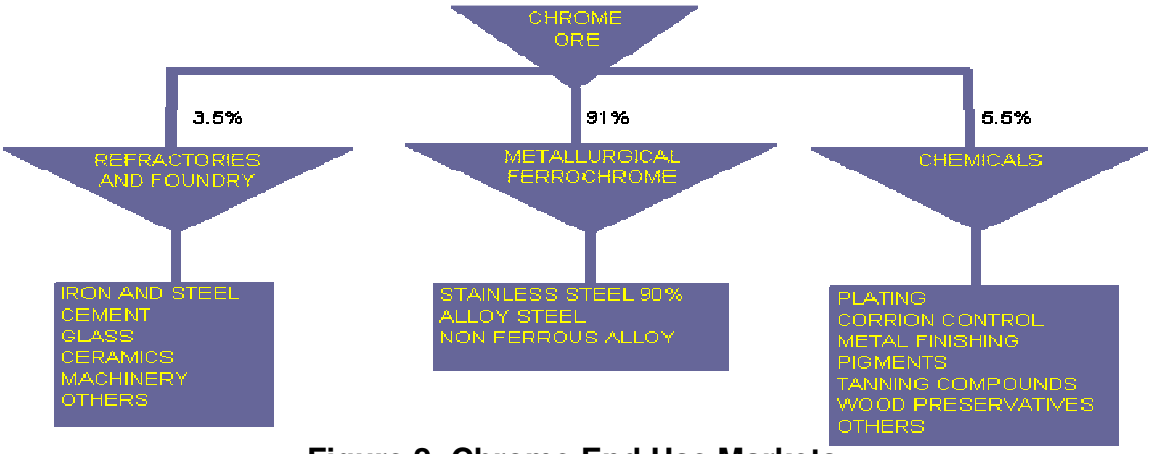

Figure 2: Chrome End Use Markets
M Bonga SA Ferro Alloy Hand Book 2005

- **VALUE CHAIN STRUCTURE**

Figure 3: Value Chain
Source Xstrata Alloys

In order to produce one ton of ferrochrome, 2.5 tons of chrome ore is consumed, while one ton of ferrochrome is needed to produce 4 tons of stainless steel (Figure 3).

2. RECENT MARKET DYNAMICS

China is the major consumer of chrome ore produced worldwide, receiving most of the feedstock from South Africa, Kazakhstan and India. [1] Its dependence on chrome ore trade is about to diminish as the Chinese government intends to reduce high polluting and power consuming industries in the country. Consequently, only a few operations will remain, which could limit the chrome ore import into China. Furthermore, a reduction of ferrochrome import duties from 2 percent to 1 percent by China (the fastest growing stainless steel producing country) earlier this year could provide an opportunity for increased ferrochrome exports to that country. India, the world's number one ore exporter, has also made China's access to its ore more difficult by imposing a 45 percent tax on chrome ore exports.

[1] Helnz H. Parlser

3. SOUTH AFRICAN CHROME ORE INDUSTRY

Since stainless steel is the major end-use for chrome ore, world stainless steel production or anticipated production plays a major role in determining chromium demand and is, therefore, a major influence on chrome ore production and prices. When demand exceeds supply, prices tend to increase (the reverse is also true), such a deficit is likely to lead over-supply/production in an attempt to bring the market back to the state of equilibrium. The general behaviour of the chrome ore and ferrochrome market has been influenced by five major events in the past 20 years (Figure 4). They are:-

a) The dissolution of the former Soviet Union (FSU) [now known as the CIS] in 1991, which resulted in decreased demand for chromium from those markets.
b) The birth of democracy in South Africa which attracted more international investment into the country's mining industry from the mid 1990's.
c) The Asian crisis in 1997, which resulted in a lower world demand for stainless steel, exerting further downward pressure on ferrochrome demand and chromium production.
d) The US recession in 2000 had the same effect as the Asian crisis of 1997.
e) Strong Chinese demand for chrome ore and ferrochrome from 2001 onwards, due to rapidly rising stainless steel production in China.

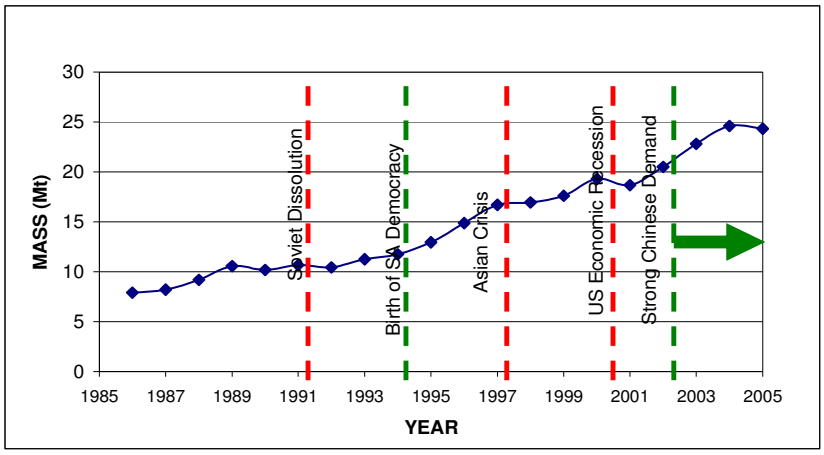

Figure 4: World Stainless Steel Production 1986 - 2005
Data by World Metal Statistics 1986 – 2005

SA CHROME ORE PRODUCERS

There are 7 major chrome ore producers in South Africa namely: Xstrata, Samancor, Hernic, Merafe, Assmang, ASA Metals and International Ferro Metals (IFM). Xstrata is the largest producer with a total ferrochrome output of 1.6 million tons followed by Samancor. All these mining operations produce primarily metallurgical ore accounting for about 85 percent of the total ore output, while the remaining 15 percent is utilised in the production of chromium chemicals, refractory grade products and foundry sands concentrate. Vereeniging Refractories is the only operation that produces ore for refractory purposes. The company sources ore through the Maricco Chrome Corporation which is based in Nietverdiend in the Northwest Province. National Manganese mine which is also located in the Northwest province, near Mooinooi (east of Rusternburg), producing ore for conversion into chemicals and foundry sands concentrate.

SA CHROME ORE PRODUCTION

South African chrome ore production has grown at an average rate of 3.82 percent per annum from 3 904 kt in 1986 to 7 494 kt in 2005 (Figure 5), with the strongest growth being experienced in the second half of the 20 year period.

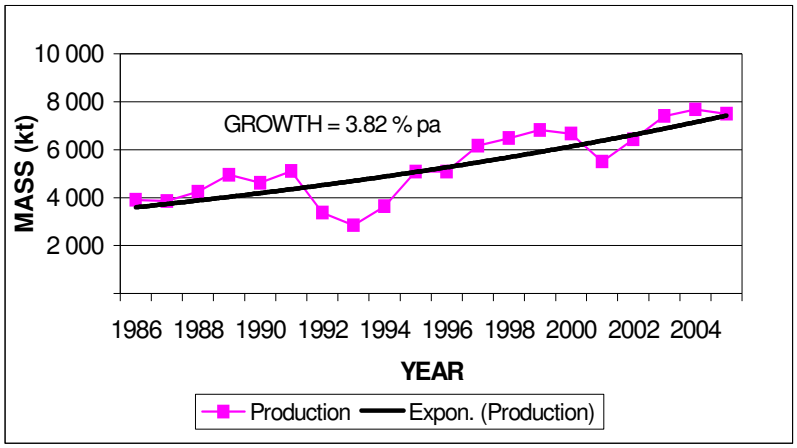

Figure 5: South African Chrome Ore Production 1986 - 2005
DME Mineral Economics

Strong demand for chromium from the international stainless steel market resulted in generally increasing production from 1987 through to 1989. However, significant falls in chrome ore output between 1991 and 1992, and 2000 and 2001 reflect a period of reduced stainless steel production on global markets.

CHROME ORE SALES

➢ DOMESTIC SALES

Domestic sales volumes show a positive growth trend during a 20 year period, with an annual growth rate of 5.96 percent per annum from 2 401 kt in 1986 to 6 071 kt in 2005 (Figure 6).

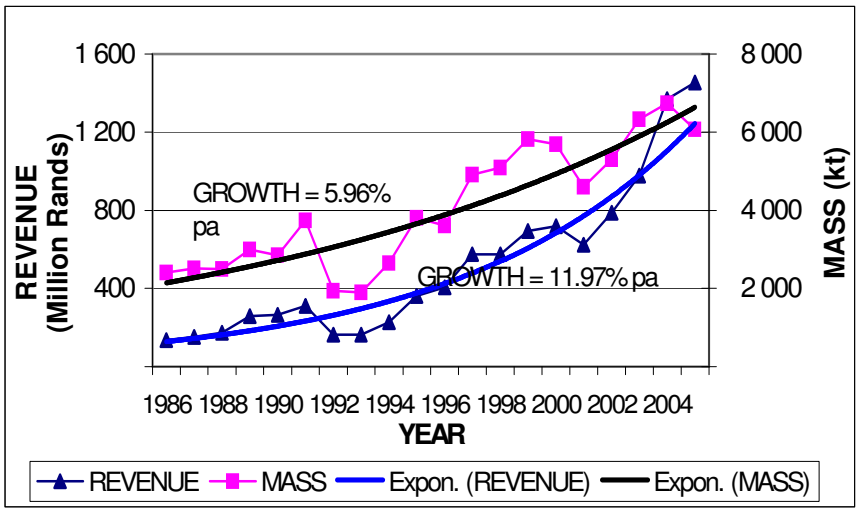

Figure 6: South African Chrome Ore Domestic Sales 1986 - 2005
DME Mineral Economics

Corresponding revenues from domestic sales increased from R135 million to R1.4 billion with an average growth rate of 11.97 percent per annum (Figure 6), The accelerated increase in revenue was mainly driven by high unit value, increasing at an average rate of 5.99 percent per annum from R56 per ton in 1986 to R239 per ton in 2005 (Figure 10).

- **EXPORT SALES**

In contrast with domestic sales, chrome ore export sales tonnages declined at a rate of 14.31 per annum, from 1 134 kt in 1986 to 657 kt in 2005 (Figure 7). This decline is partly due to the growing local investment in an expanding ferrochrome industry which saw less chrome ore being exported and more being retained for domestic consumption.

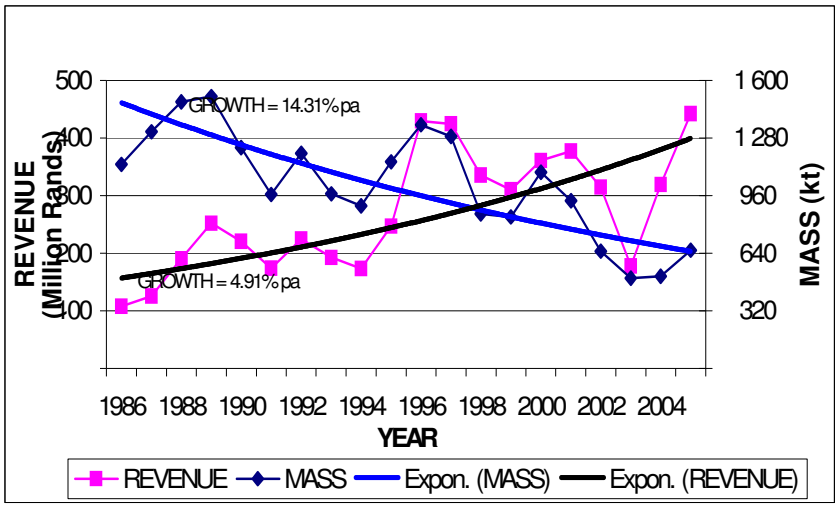

Figure 7: South African Chrome Ore Exports 1986 - 2005
DME Mineral Economics

The lowest level of exports was achieved in 2003 when 502 kt were exported, but ore exports increased by 2 percent in 2004 and a further massive increase of 28 percent was seen in 2005.

The associate revenue generated, increased by an average rate of 4.91 percent per annum from R108 million in 1986 to R442 million in 2005 on the back of higher unit values, which increased at the healthy rate of 19.21 percent per annum from R95 to R673 per ton over a 20 year period (Figure 10). Sixty five percent (65%) of total revenue was generated in the second half of the 20 year period.

✓ **SA EXPORTS BY DESTINATION**

The USA is the largest consumer of South African chrome ore, having accounted for 50 percent of chrome ore exported from South Africa in 2004 (Figure 8). Imports of chrome ore into USA are primarily for the foundry and chemical industries consumption. The second largest consumer in 2004 was Argentina with 11 percent, followed by Japan and Netherlands jointly occupying the third place at 9 percent.

China, the world's largest stainless steel producing country, became the second largest consumer of South African chrome ore in 2005, significantly increasing ore imports and doubling the country's market share to 16 percent from 8 percent in 2004.

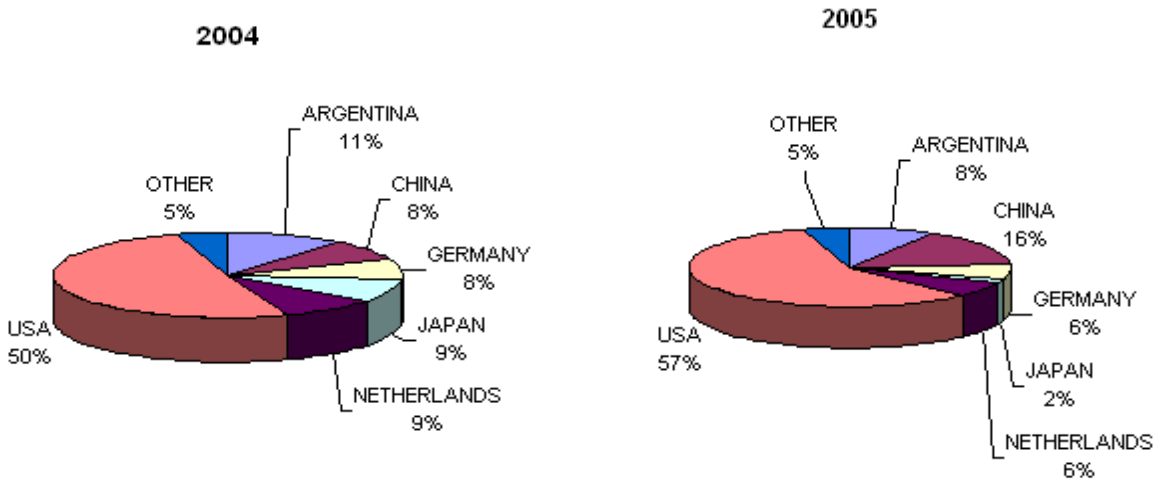

Figure 8: South African Chrome Ore Exports by Destination 2004 - 2005
DME Mineral Economics: Statistics

China possesses insignificant resources of chrome ore and so the large increase in ferrochrome production in China could only have occurred through the importation of chrome ore from a number of countries such as India (number 1 supplier to China) and South Africa (number 2 supplier to China). There is a danger that South Africa could loose the international competitive advantage in chromium alloy production it currently enjoys, if it continues to supply China with

the ever increasing tonnages of raw material for ferrochrome production.

- ✓ **THE RATIO OF EXPORTS TO TOTAL SALES**

The ratio of export mass to total sales mass of ferrochrome averaged 23 percent from 1986 – 2005 (Fig 9), declining at the rate of 8.22 percent per annum from 32 percent in 1986 to 10 percent in 2005, with the lowest ratio of 7 percent reached between 2003 and 2004.

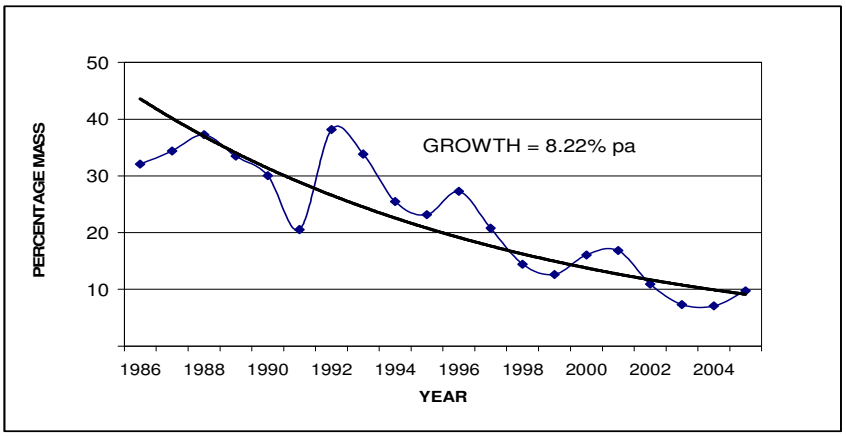

Figure 9: Ratio of Chrome Ore Exports to Total Mass 1986 - 2005
DME Mineral Economics

The general decrease in ratio is due to increasing developments in the local beneficiation of chrome ore. However, the ratio went up by 3 percent in 2005 due to increased ore exports.

- ✓ **CHROME ORE UNIT VALUES**

Local sales unit values, which at the beginning of a 20 year period were R56 per ton, increased significantly at the rate of 5.99 percent per annum, to R239 per ton in 2005 (Figure 10). The unit value is total sales value divided by total sales mass. It can serve as a proxy for the average aggregated price in Rand per ton, received by the industry as a whole. The impressive growth in values was largely due to the progressive weakening of the rand and strong stainless steel demand over the period.

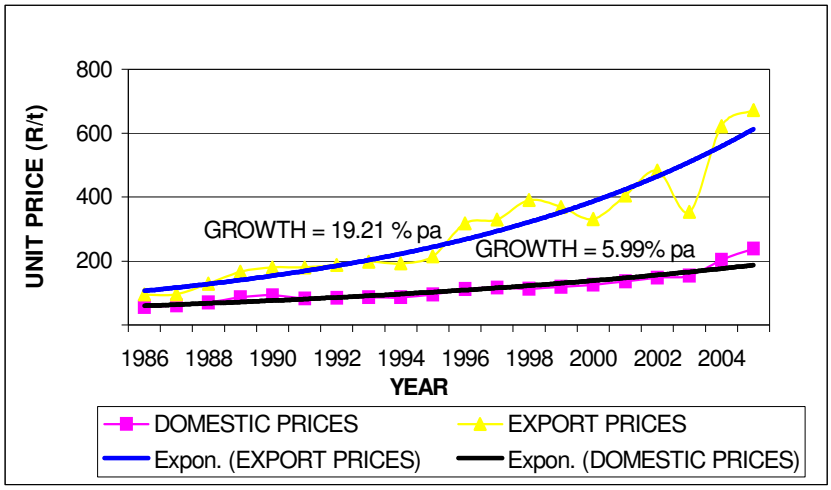

Figure 10: Chrome Ore Unit Values 1986 - 2005
DME Mineral Economics

Export values had a strong growth of 19.21 percent per annum from R95 per ton to R673 per ton. The increase in unit value seems to have been due to the progressive weakening of the rand (Figure 11) and strong stainless steel demand over a 20 year period.

- ✓ **RAND-DOLLAR EXCHANGE**

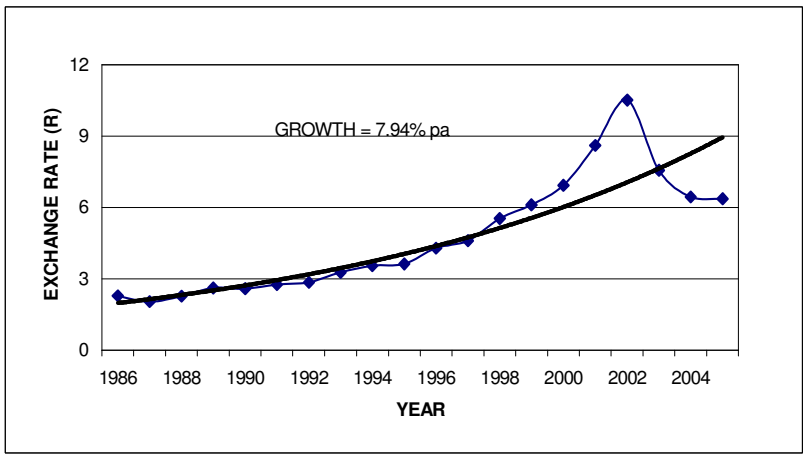

Figure 11: Rand – Dollar Exchange Rates 1986 -2005
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It appears that the rand systematically weakened at an average rate of 7.94 percent per annum from 1986 to 2005 (Figure 11). This situation helped drive the revenues generated by local producers.

4. WORLD FERROCHROME INDUSTRY

PRODUCTION CAPACITY

During the first decade (1986 – 1995), Asia had the highest ferrochrome production capacity, followed by Africa, with Europe and America at the third and fourth place respectively (Figure 12). The second decade (1996 – 2005) shows a sharp increase in African ferrochrome production capacity, influenced mainly by the growth in the number of smelting operations in South Africa, which accounted for an average of 85 percent during a 20 year period.

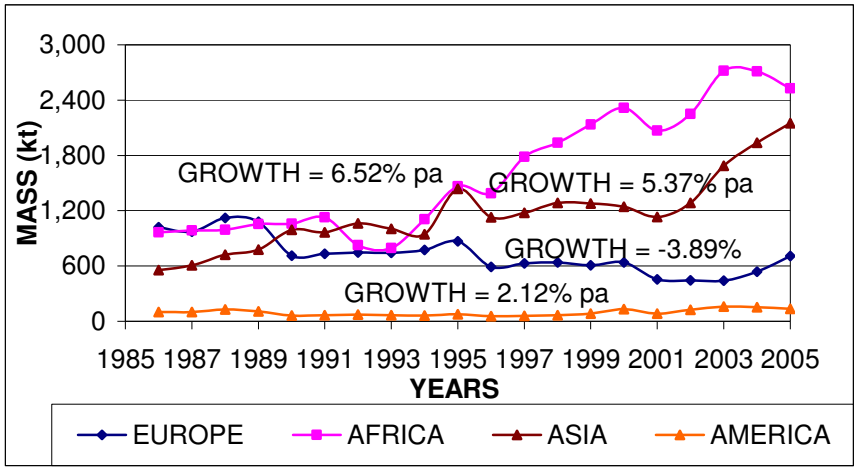

Figure 12: Ferrochrome Capacity 1986 - 2005
Data Courtesy of Xstrata Alloys

Consequently, this put Africa at the top, with Asia holding the second position, while Europe's capacity declined marginally in the second decade, and America's remained constant throughout the 20 year period. Although Asia has very little ore reserves (less than 5 percent) as compared to Africa (85 percent); it remains competitive due to the import of raw material from India, Turkey and Africa.

WORLD FERROCHROME PRODUCTION

South Africa's production of ferrochrome declined to 2 812 kt in 2005 from 3 032 kt in 2004, this amounts to a loss of 5.4% in a ferrochrome market share (Figure 13), riding on increases chrome ore exports. Kazakhstan improved by 9 percent from 969 kt in 2004 to 1 064 kt in 2005. China produced 697 kt in 2004, which improved to 920 kt in 2005, a 24 percent increase. While India, Russia, and Zimbabwe (countries with least ferrochrome production) improved by 13, 40, and 16 percent in their order.

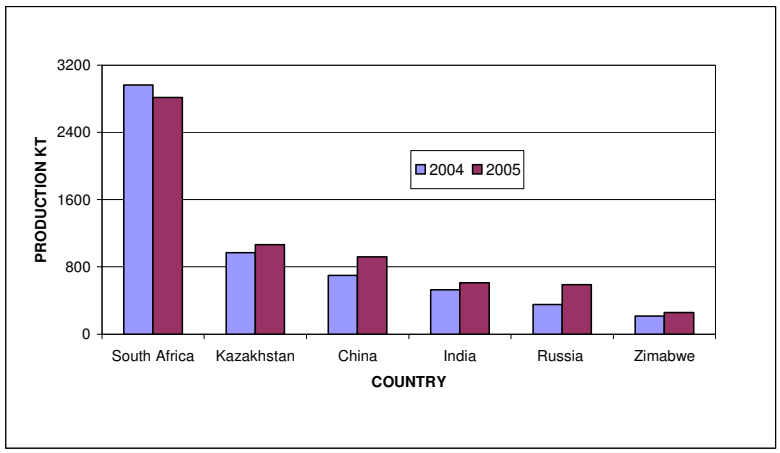

Figure 13: World Ferrochrome Production 2004 - 2005
DME Mineral Economics: Statistics

WORLD CAPACITY UTILISATION

During the first 10 years of the 20 year period; Europe's capacity utilisation was highest at 75 percent, followed by Africa at 74 percent while Asia and America utilised 50 and 34 percent capacity respectively (Figure 14).Similar to ferrochrome capacity, Africa's capacity utilisation was higher than Europe's in the second decade, recording 68 percent while Europe dropped to 66 percent. Asia and America had the greatest improvement in the second decade; achieving 66 and 67 respectively.

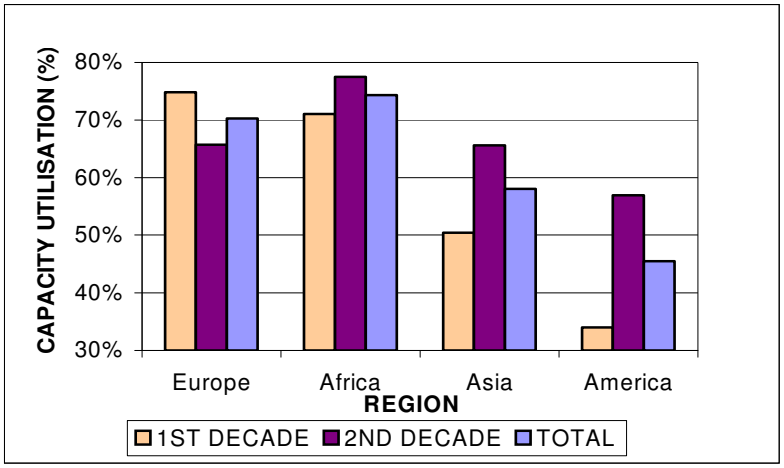

Figure 14: World Capacity Utilisation 1986 - 2005
Data Courtesy of Xstrata Alloys

5. SOUTH AFRICAN FERROCHROME INDUSTRY

FERROCHROME PRODUCTION

Growth in South African ferrochrome production has been robust, increasing at the rate of 7.01 percent per annum, from 925 kt in 1986 to 2 812 kt in 2005 (Figure 15). The increase in ferrochrome output was consistent with global stainless steel production growth which increased by an average 6.10 percent per annum during the same period. Production reached a peak of 3 032 kt in 2004.

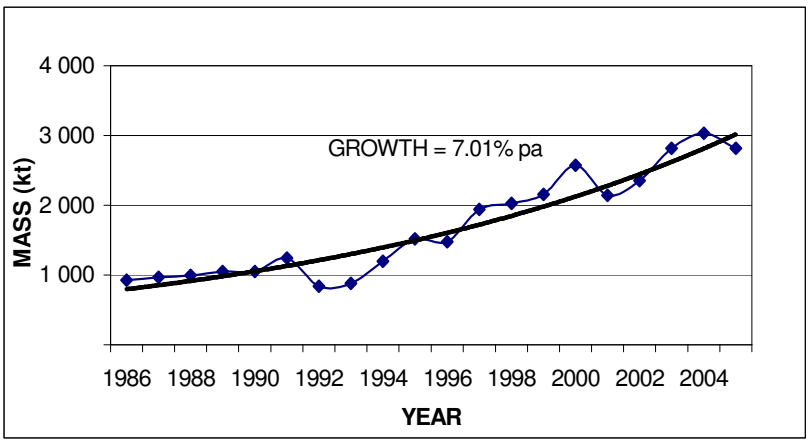

Figure 15: South African Ferrochrome Production 1986 - 2005
DME Mineral Economics: Statistics

The surge in 2000 could have been the result of an attempt to re-establish a market balance. However, a combination of low stainless steel prices and oversupply of ferrochrome led to significant cutbacks in output between 2000 and 2001, as ferrochrome plants shut down in response to the prevailing weak market conditions, responding to the US recession. Production recovered in 2002 and maintained an upward trend up to 2004 as a result of increased demand from stainless steel producers. However, production plunged by 7 percent in 2005, which could be the result of increased ore exports by the local ferrochrome producers.

FERROCHROME SALES

➢ DOMESTIC SALES

Domestic ferrochrome sales mass rose strongly at an average rate of 13.36 percent per annum from 21.0 kt in 1986 to 357.4 kt in 2005, despite an abrupt fall in ferrochrome output between 2004 and 2005 (Figure 16) .Higher consumption by Columbus Stainless Steel, based in the Middleburg and the largest stainless steel producer in Africa was responsible for the sharp mass increase in 2004, while mass dropped sharply in 2005 due to oversupply of ferrochrome.

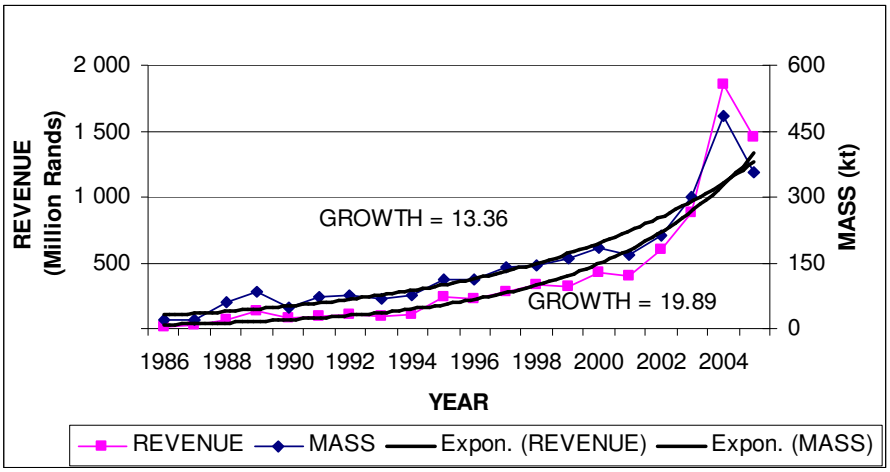

Figure 16: South African Ferrochrome Domestic Sales 1986 - 2005
DME Mineral Economics: Statistics

Likewise domestic sales revenue increased from R19 Million in 1986 to R1 billion in 2005 growing at the rate of 19.89 percent per annum. However, revenues declined by 22 percent from R1.8 billion to R1.4 billion between 2004 and 2005, on the back of the sharp fall in ferrochrome production.

- **EXPORT SALES**

Ferrochrome export sales followed a similar trend, although not as impressive as that of domestic sales, climbing at the rate of 6.88 percent per annum from 879 kt to in 1986 to 2 460 kt in 2005(Figure 9). However, the two percent decrease recorded in 2005 may have been due to overproduction of the alloy in China, taking advantage of increasing ore exports from major ore producers, particularly South Africa. Corresponding revenues grew by an average rate of 13.51 percent per annum from R815 million to R9 911 billion.

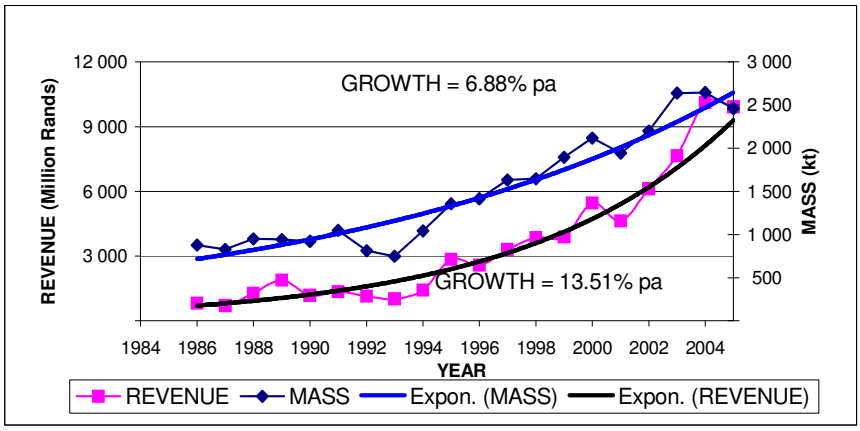

Figure 17: South African Ferrochrome Exports 1986 - 2005
DME Mineral Economics: Statistics

In keeping with the ongoing growth in domestic sales, the ratio of export sales mass to total sales mass of ferrochrome has dropped from 98 percent in 1986 to 87 percent in 2005, decreasing only marginally at the rate of 0.44 percent per annum. The lowest ratio of 85 percent was recorded in 2004 (Fig 18).

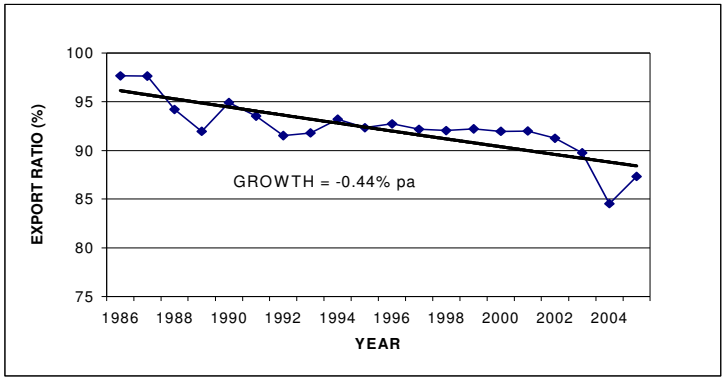

Figure 18: The Ratio of Ferrochrome Exports to Total Mass 1986 - 2005
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- **FERROCHROME UNIT VALUES**

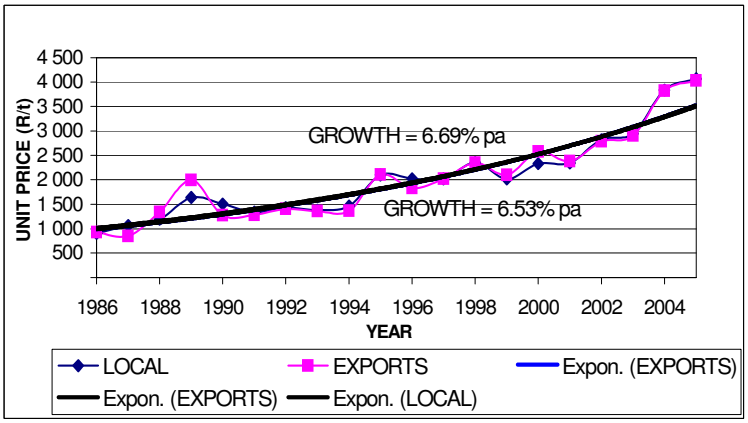

Figure 19: Ferrochrome Prices 1986 - 2005
DME Mineral Economics: Statistics

A combination of high demand and sharp rises in the costs of freight, energy and exploitation of chromium raw materials exerted an upward pressure on the aggregated ferrochrome unit value achieved by the chrome industry, which were at their highest levels in 2005 at R4 000 per ton (Figure 19). This represents a successful recovery from late 1980's when unit values were at their lowest levels (between R800 – R1 500 per ton), and was largely influenced by extraordinary growth in stainless steel production, which, led by Asia, is forecast to maintain strong growth well into the future.

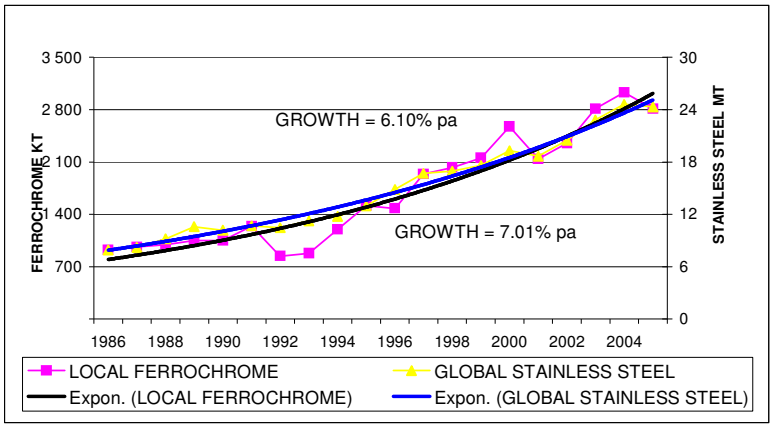

Figure 20: The Relationship between Ferrochrome Production and Stainless Steel Production 1986 - 2005

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Figure 20 shows that a rise in stainless steel production leads to a rise in ferrochrome demand and therefore influence ferrochrome production.

CAPACITY EXPANSIONS

Available information on South African planned production capacity reveals an expected ferrochrome capacity increase of 930 kt by the end of 2007 (table1), representing an increase of 33 percent ferrochrome output obtained in 2005. The additional production of ferrochrome at full capacity will require an increase in chrome ore production by 2 325 kt per annum. At the current annual domestic consumption level of 6 072 kt chrome ore, an additional 1 700 kt chrome ore would be required to meet the new demand (provided that 625 kt exported will be locally consumed).

Table 3: Planned Capacity Expansion For 2007

Company	Capacity (kt)
ASA	110
IFM	180
SAMANCOR	280
XSTRATA	360
TOTAL FERROCHROME	**930**
REQUIRED ORE	**2 325**

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6. THE IMPACT OF ORE EXPORTS ON LOCAL FERROCHROME PRODUCTION

According to Figure 21, ferrochrome production grows as the ore exports decrease and vice-versa. The sharp increase in ferrochrome output in the second half of a 20 year period was influenced by the growth in local beneficiation processes.

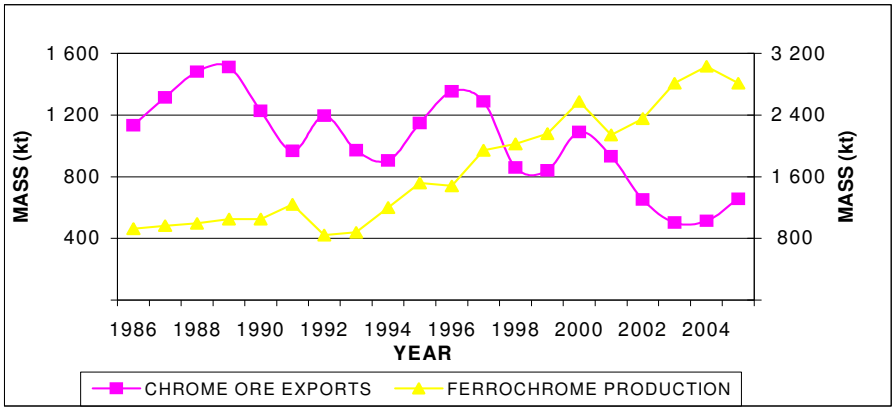

Figure 21: South African Ore Exports vs. Ferrochrome Production 1986 -2005

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7. THE IMPACT OF ORE EXPORTS ON REVENUES

On average, R270 million is generated from 1 027kt chrome ore exported yearly at the unit value of R113 per ton. This amount of chrome ore would yield 411 kt of ferrochrome when smelted, generating R767 million at an average price of R2 036 per ton on the international market. This increase represents 184 percent of revenue generated by chrome ore exports, which amounts to half a billion rand in loss of potential revenue per annum.

8. THE IMPACT OF ORE EXPORTS ON EMPLOYMENT

The ferrochrome industry employs on average between [2]500 - 700 people per ton. From 1986 to 2005 employment levels on the chrome mining industry have remained remarkably flat decreasing only marginally at the rate of 0.22 percent per annum. The number of employees on an annual basis, has on average ranged between 5 500 and 7 000 only occasionally dipping bellow 5 500 (Fig 22).

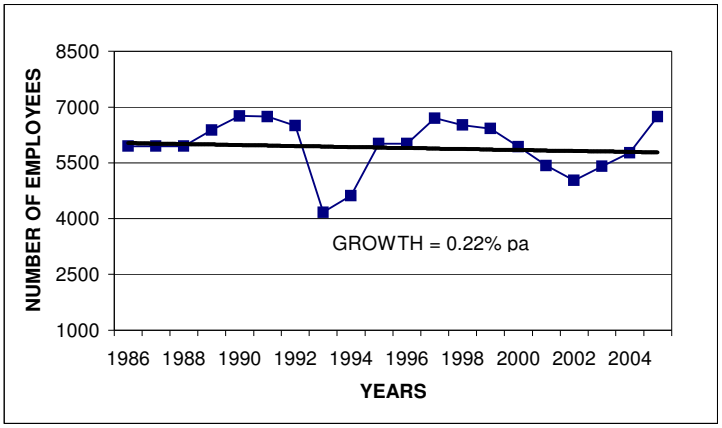

Figure 22: South African Chrome Industry Labour 1986 - 2005
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The improved efficiencies have been achieved through elimination of excess manpower and inflexible employment practices of the past, as well as the introduction of new technologies and the greater scale of production. Considering an average capacity per worker of 700 tonnes, 410 kt of ferrochrome would create 587 employment opportunities per annum.

[2] Andrew Jones

9. CONCLUSION

Increased ore exports compromise South Africa's competitive advantage. Furthermore, exporting chrome ore is likely to perpetuate a colonial paradigm, where Africa was seen only as the source of raw material, such a paradigm promotes minimal value extraction for South Africa while it benefits the competition.

In a period of 20 years, around 600 potential employment opportunities where lost per year due to ore export of about 1 000 kt per year that would have been used to produce ferrochrome locally. The amount of tax that could have been derived from this number of employees cannot be overstated. A total of 2 400 individuals would have benefited from local beneficiation of chrome ore per annum. Increased value addition is likely to create more employment opportunities for the country, which would contribute to the general economy through taxations.

The study revealed that an average of R767 million that could have been generated by beneficiation of exported ore, is lost per annum. The total revenue generated by ferrochrome production could have been 4.7 billion per annum, a 19 percent increase from 3.9 billion generated per annum. The increase represents 184 percent of R270 million generated through the chrome ore export sales. The actual loss amounts R0.5 billion per annum, which would have contributed towards foreign exchange earnings.

However, when the market is oversupplied, it results in a downward pressure on prices which may lead to production cut backs as producers attempt to bring the markets back to a state of the equilibrium.

10. RECOMMENDATIONS

A combination of factors like chrome ore export levy by host country, as well as REACH legislation by EU, could reduce the international trade on chrome ore. If such a situation were to materialise, it could lead to increased value addition by the host country and the benefits emanating from such a situation cannot be overstated. Alternatively, ferrochrome should be made the minimum level of beneficiation for chrome mineral exports.

Solutions suggested by industry experts are:-

The State could use its management of licensing processes, through the Mineral and Petroleum Resources Development Act, as a lever to encourage chrome ore miners to beneficiate ferrochrome before export. Furthermore a mineral royalty regime, based on the degree of local beneficiation, could be considered where the unbeneficiated form would attract a higher royalty. Consideration could be given to a system where freight rates could be increased for lower value bulk mineral exports rather than higher value beneficiated exports. Another option to be explored is the effectiveness of compensatory tariffs against beneficiated Chinese imports within World Trade Organisation rules.

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