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How can South Africa, a resource rich and labour-abundant economy, employ upstream and downstream mineral beneficiation as a way of developing its economy further? A critical focus on the chromium mineral value chain as a case study

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How can South Africa, a resource rich and labour-abundant economy, employ upstream and downstream mineral beneficiation as a way of developing its economy further?
A critical focus on the chromium mineral value chain as a case study.

BY

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In partial fulfilment of the Master of Commerce, Development Theory & Policy, at the University of the Witwatersrand, Johannesburg.

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DECLARATION

I declare that this thesis is my own unaided work. It is submitted for the degree of Master of Commerce: Development Theory & Policy at the School of Economics and Business Sciences, Faculty of Commerce, Law and Management, University of the Witwatersrand, Johannesburg. This research paper has not been submitted before for any other degree or to any other university.



NOMBUSO BHENGU

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Lastly I wish to dedicate this research to my beautiful and gracious son, Zwelakhe Mbuso Nzama. I know that mommy has not been around much of the time, but I certainly appreciate your support, patience, and understanding as I pursued my Masters' degree. This one is for you! I hope that I have paved the way for you to one day attain academic excellence in your own life. Mommy loves you VERY much!

ABSTRACT

South Africa has been referred to as a country of "geological superlatives" because of its rich and diverse mineral resource base. Despite its unique endowment of precious metals and mineral resources, the country has fallen short of translating these resources into the required economic linkages that will lead to sustainable employment creation and economic emancipation for the majority of its people. Whilst the country has established, successful critical upstream industries based on its natural resource advantage, it has not managed to develop successful downstream value additions in most of its strategic value chains, most notably the chromium mineral value chain.

This paper explores the significance of the chromium mineral value chain in the context of South Africa's economic development trajectory, the dynamics between the mining and manufacturing sectors, the ongoing structural constraints, and the implications all these have on stainless steel fabrication.

South Africa is a dominant player in chrome, consuming approximately 80% of the world's chromite ore reserves and is undeniably one of the major producers of ferrochromium globally, with production accounting for approximately 34% of total world production. Despite a mature ferrochromium industry that boasts world-class ferrochromium manufacturing facilities and contributes massively to the domestic and global economies, a declining market share to China threatens the sector. The availability (or lack thereof) of power supply, high energy costs, uncompetitive domestic prices amongst other structural issues are contributing to this decline.

The challenge remains in government, the mining industry, labour and all other affected stakeholders to engage robustly in order to preserve a value chain that possesses enough potential to enhance the development of the country, both socially and economically.

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A Political and Economic Review of Chromium Mineral Value Beneficiation in South Africa and its role in the country's development path

SECTION 1: INTRODUCTION

1.1 Background

South Africa has been referred to as a country of "geological superlatives"[1] because of its rich and diverse minerals resource base[2]. These minerals consist of the platinum group metals (PGMs), gold, chromite, manganese, coal, iron ore, vanadium, copper, nickel, titanium, uranium, to mention but a few.

An independent study of the country's non-energy known mineral resources estimated it to be at USD 6.2 trillion (Baaitjies and Govender, 2012), and its mining sector the fifth largest in the world in terms of GDP. The mining sector alone accounts for approximately 18% of GDP (COM, 2012c, p.1) and over 50% in foreign exchange earnings. According to KPMG (2013), the sector brings in an annual income of more than R330 billion.

The country is home to about 80% of the world's chromite ore (or chromium ore – metal content of the ore) reserves and it is one of the major producers of ferrochromium, with production accounting for approximately 34% of total world production (Pan, 2013). Chromium is an important raw material used for the production of ferrochromium alloys used in special steels (stainless steel). More than 90% of the mined chromite ore is converted into different grades of ferrochromium by the metallurgical industry for use in stainless steel production.

The chromium mineral value chain (CMVC) is identified as a critical contributor to the economic development path of South Africa. The country's comparative advantage in chromite ore resources enables it to establish resource processing industries (beneficiation) that could then provide the feedstocks for manufacturing and industrialisation, as well as the immediate market for inputs into these processes (extraction, smelting, refining, forming, fabrication (Jourdan, 2014, p.7).

Despite these positives, the domestic ferrochromium industry is under threat with a rapidly declining market share to China, based on declining ferrochrome production in South Africa. The government recognises that the country's factor endowments have enabled it to partake in the global industry, and has provided the impetus for the development of key manufacturing and service sectors. However, inadequacies in physical infrastructure investment – more notably power supply constraints, high energy and labour costs, continuing labour disruptions as well as the widespread practice of monopoly pricing (IPP) of intermediate products (such as stainless steel) are negatively affecting the competitiveness of the ferrochromium value chain - thus inhibiting the growth potential of the domestic economy and consequently decreasing the economy's productive capacity (Kularatne, 2006, p.65).

[1] ANC State Intervention in the Minerals Sector (SIMS) Report, 2012, pp. 4.

[2] South Africa can no longer be considered a resource-based economy. Stevens (2003) and Nankani (1979) define a mineral-based economy as one whose share of net visible exports is anywhere between 20 and 40% (cited in Ville and Wicken, 2012).

Despite this huge resource endowment, the level of mineral beneficiation domestically has remained low, with the mining sector undertaking activities dominated by primary production whilst largely exporting raw or semi-processed minerals. Although this was not always the case, of late, the power supply constraints have been identified amongst the biggest causes behind this misfortune

In addition, the beneficiation activities have tended to be more concentrated in the capital and energy-intensive sectors of the chromium mineral value (Balchin and Soko, 2012, p.9). Global competitiveness is fast becoming a key differentiator that separates the winners from the losers. Given the country's history, South Africa has had to rethink its development strategy in order to remain competitive. If the intention is to go beyond its comparative advantage in mineral resources, the manner in which beneficiation is implemented (and the policy environment accompanying this strategy) will determine the success of the country's growth. The alternative is that the country will fail to maximise on these depleting resources.

In 2011, the SA Cabinet officially adopted beneficiation as the official strategy that seeks to translate the country's sheer comparative advantage inherited from mineral resources endowment to a national competitive advantage. The strategy has since been criticised for not putting sufficient focus on downstream value addition. Dr. Iraj Abedian contends that beneficiation should include both upstream and downstream linkages otherwise this could *"restrict the potential to derive the maximum economic benefits from the country's key mining sector."*

The challenge therefore, is to enforce a development strategy that will launch the domestic economy beyond a net exporter of raw minerals. This requires the participation and support of all market players, including government, business and labour.

The Mineral and Petroleum Resources Development Act (MPRDA) of 2002 came into effect as an attempt to legislate the vision of the Minerals Policy. One particular objective of the Act was to entrench the State's role as owner and custodian of South Africa's mineral wealth by changing the mineral rights system from being privately owned to being exclusively state-owned. The purpose of the Act was to promote economic growth through increased beneficiation of mineral production; to ensure that mining contributes to rural development through employment opportunities and advancement of social and economic welfare; to ensure that holders of rights contribute towards socio-economic programmes through the implementation of proactive social and labour plans (Cawood, 2004, p.58).

According to SIMS (2012), the study further called for a critical analysis of the existing mining sector, including potential and actual upstream and downstream sectors; mineral-related logistics; energy and environmental sustainability challenges and opportunities; to present regulation and legislations – including the licensing regulations and the Mining Charter.

The growth and expansion of the South African economy around the mining sector led to the development of the 'Minerals-Energy Complex' or MEC (Fine and Rustomjee, 1996, p.5)[3]. Rustomjee and Fine (1996) maintain that the MEC not only dominates the economy, but it is by far the largest contributor to South Africa's GDP, exports, capital formation and employment. It is considered critical to the creation of input-output linkages, but also because of its specific ownership structure and its relation to the financial sector and the State (Wild and Schwank, 2008, p. 2).

Until 2007, many mineral value chain investments benefitted from SA's low-cost power advantage, but the State's failure to give Eskom approval to commence new plants in the mid-1990s turned SA's power surplus into a deficit in 2008, eventually leading to tariff increases in the last few years (Jourdan, 2014, p.7).

In 2005, Eskom embarked on a capacity expansion programme to build additional power stations and major power lines to meet the country's rising demand for electricity. The Medupi and Kusile coal-fired power stations are the latest two being built.

According to the Department of Mineral Resources (DMR, 2011), this transition has partly resulted in the construction of a number of large scale resource-based investment projects, including Columbus Stainless Steel, Saldanha Steel, Lion Ferrochrome smelter and others. The government acknowledges that whilst there needs to be a more coordinated and streamlined approach to the beneficiation strategy, such improvements demonstrate the country's state of readiness for value addition, albeit currently in a less orderly manner.

Given that the mining industry has greater economic multipliers than most primary industries, much of the problem lies with the manner in which political interference has beset the industry as a result of the perceived lack of economic benefit derived from it. The dynamics between the industry, the political landscape (given the country's history) and other affected market players such as labour will be explored further to root out the deep-rooted issues.

SECTION 2: OVERVIEW OF THE SOUTH AFRICAN MINING INDUSTRY AND METHODOLOGY

2.1 Setting the Political Landscape

Mining has been the driving force behind South Africa's economy for more than 130 years. Since its existence, the industry has shaped the country's socio-political and economic development (KPMG, 2013).

[3] The MEC formed the core of the domestic economy since the end of the nineteenth century. These economic sub-sectors – consisting of mining and certain sub-sectors of manufacturing which are closely linked to mining and are particularly energy-intensive (i.e. the electricity, transport and storage sectors) - were established by mining conglomerates (SIMS, 2012, p.5)

In 1994, the African National Congress (ANC) was elected as the country's first black-majority led democratic government. The party's key policies included creating a better life for all the people of South Africa.

The Freedom Charter of 1955 inspired the ideology of the ANC stating clearly that *"The national wealth of our country, the heritage of South Africans, shall be restored to the people. The mineral wealth beneath the soil…shall be transferred to the ownership of the people as a whole"* (SIMS, 2012, p.3).

In an effort to accelerate the ideology of the Freedom Charter, the ANC government promulgated the Mineral and Petroleum Resources Development Act (MPRDA) 28 of 2002, which enforced that the State shall be granted exclusive ownership and custodianship of the country's mineral wealth from private ownership. This meant that the State had greater authority in the granting of legal rights on mineral and petroleum properties. The other objectives of the Act were to promote economic growth through increased beneficiation of mineral production; to ensure that mining contributes to rural development through employment opportunities and advancement of social and economic welfare; to ensure that holders of rights contribute towards socio-economic programmes through the implementation of proactive social and labour plans (Cawood, 2004, p.58).

To achieve the above objectives, the government had to commit that any decisions taken in terms of the Act would be conducted within a reasonable time frame and in accordance with the principles of lawfulness, reasonableness and procedural fairness (Cawood, 2004; MPRDA, 2002).

In 2011, the government identified five strategic mineral value chains that are intended to "demonstrate the inherent value for South Africa in embracing beneficiation for all mineral commodities" (DMR, 2011, p.12). The ANC reaffirmed their commitment to economic transformation at the party's 53rd National Conference held in Mangaung in December 2012. This resolution reads as follows: *"South Africa's endowment of mineral resources belongs to the people as a whole through state custodianship, and should be governed by the democratic developmental state in the interests of all South Africans. Exploitation of minerals must optimise their developmental impact, especially job creation, across the economy. Mining must catalyse broader industrialisation through the realisation of all the potential backward and forward linkages, including a much greater degree of beneficiation."*

The political history of the country ensued an economy that is extremely capital- and energy-intensive, driven by resource extraction and the development of interrelated economic activities known as the 'minerals-energy complex' (Fine & Rustomjee, 1996, p.5). This complex comprises of mining, minerals processing, the energy sector and associated industries linked to these sectors.

The state principally supported and exerted investment initiatives in these capital-intensive sectors linked to the MEC where, according to Black (1991), skilled and highly paid white workers would find jobs. Fine and Rustomjee (1996, p.191) reveal that while attempts were made to support manufacturing sectors such as textiles by means of a tariff policy, these

measures were found to be less effective and important than support for the MEC. Nevertheless the two main targets of post-democracy industrial support have been apparel and motor vehicles (MIDP/APDP)[4] with disappointing results, whilst the minerals beneficiation/value addition sector has received almost no support, especially the minerals inputs sector (capital goods) that has, despite the lack, of support, displayed robust export growth over the last decade (see Kaplan D, 2011).

Post the 1994 democratic elections, industrial development was influenced by restrictive macroeconomic framework conditions, witnessed by poor economic growth rates (Wild and Schwank, 2008, p.4). Research conducted by Makgetla (2004b) revealed that mining's share in output declined and job losses increased significantly, mainly due to a shift from gold exports to platinum. In terms of value-added, Makgetla (2004b) - through her own calculations - discloses that MEC sectors grew at an annual rate of 1.92% between the period of 1990 and 2006. Non-MEC manufacturing sectors were calculated to have grown at far less levels, 1.11% per annum.

In an effort to address the macroeconomic problems, social injustices and apartheid-linked infrastructure bottlenecks instituted by the apartheid era, the ANC government went on to employ three successive policy frameworks between 1994 and 2009 – the Reconstruction and Development Programme (RDP), the 1996 Growth, Employment and Redistribution Strategy (GEAR) and the 2006 Accelerated and Shared Growth Initiative of South Africa (AsgiSA) (ANC (1994); DTI (1996); AsgiSA (2006). The GEAR paid more attention to stabilising the macroeconomic environment; i.e. reducing the fiscal deficit and tighten monetary policy as these were thought to be conducive for investment (Weeks, 1999) and privatisation of state assets (see energy, above). Contrary to its objective of growing the employment levels, the reverse transpired. The policy has been criticised as not being an "integrated growth and development strategy" (Altman, 2001, p.694).

In 2010, the government introduced another policy initiative known as the New Growth Path (NGP). The policy sets job creation as a leading priority (Zarenda, 2013) and viewed the mineral sector as a key job-driver (NGP, 2010, p.12). It further proposes the acceleration and "*exploitation of mineral reserves by ensuring an effective review of the minerals rights regime, lowering the cost of critical inputs including logistics and skills in order to stimulate private investment in the mining sector, and setting up a state-owned mining company that would co-exist with a strong private mining sector and that promotes beneficiation, as well as*

[4] The MIDP was initiated in 1995 to help the motor industry adjust to South Africa's reintegration into the global economy. Prior to that time the industry was protected by tariffs in excess of 100 percent and burdensome local content requirements. Unsurprisingly it produced a very wide range of products at low scales of output and at high cost. It was a very inefficient import substitution sector that could not have competed either domestically or internationally in the face of immediate trade liberalization. The Automotive Production and Development Programme (APDP) replaced the Motor Industry Development Programme (MIDP) on January 1st, 2013. The program applies to light vehicles only, and that there are separate regulations to support future heavy vehicle production, which are covered at the end of this article [See NAACAM for more on this]

greater utilisation of the mineral resource base of the country for developmental purposes, including potentially through a sovereign wealth fund[5]."

The main direction of government policy with respect to mineral products is downstream beneficiation. Beneficiation features strongly in the National Industrial Policy Framework (NIPF) as well as in the Industrial Policy Action Plan (IPAP) (AMV Report[6]), which also targets upstream value addition (mineral extraction and processing inputs).

The NGP recommends *"Refocusing the beneficiation strategy to support fabrication (stage 4) (rather than only smelting and refining, which are both capital and energy intensive), including stronger measures to address uncompetitive pricing of intermediate inputs, such as where appropriate, export taxes on selected mineral products linked to clear industrial strategies."* (NGP, 2010, p.12)

The National Development Plan (NDP) came into effect between 2012/2013 as a policy framework for the country's future economic and socio-economic development. Although the NDP has very little on resource-based development (Jourdan (2014), it does indirectly recognise MVC opportunities, citing *"If these pitfalls are consciously avoided, and if the mineral endowments are used to facilitate long-term capabilities, these resources can serve as a springboard for a new wave of industrialisation and services for domestic use and exports* (NGP, 2012) (Jourdan, 2014)*." [See Appendix A for more on the NDP]*.

The government recognises that the country's mineral endowments provide it with a sheer comparative advantage (DMR, 2011). Whether SA is able to use this advantage to generate the required levels of growth, build internationally competitive industries, attract foreign direct investment, create sustainable jobs and skills development and move towards a knowledge-based economy, remains an ongoing debate (CDE, 1998a; Chang, 1998; Altman, 2001; DTI, 2002).

2.2 Problem Statement

This study seeks to analyse how well and to what extent the chromium mineral value chain can be beneficiated in order to sustainably grow South Africa's economy beyond its current levels. The country's resource advantage in chromite ore reserves affords it the opportunity to transform this into a competitive advantage similar to countries like Sweden and Finland. These economies have demonstrated how natural resources can be used to underpin industrialisation and create employment opportunities, expand the local skills and knowledge base, and achieve domestic and global competitiveness through the expansion of economic linkages – a far cry from South Africa's reality (and that of most of Africa's economies). Yet, South Africa – a resource rich and labour-abundant economy – struggles to leverage off its comparative advantage in minerals to achieve maximum benefits from beneficiation. The chromium mineral value chain is one such case in point that upholds this argument.

[5] The New Growth Path (NGP) 2010 "The New Growth Path: The Framework", EDD, Pretoria
[6] AMV Report – ISG Bulletin 2: Optimizing mineral linkages needs a conscious policy approach

2.3 Research Aim and Objectives

The aim of this paper is to explore whether the chromium mineral value chain has the potential to contribute much more meaningfully to South Africa's economic development path in the context of the prevailing political economy. It is argued that chromium is important to the global chrome, ferrochromium and stainless steel value chains.

The paper will seek to address this by engaging the implications of upstream and downstream mineral beneficiation in achieving economic diversification and expansion, whilst creating sustainable employment opportunities.

The paper will also address the key challenges and constraints that have prevented the chromium mineral value chain from achieving maximum developmental gains, whilst tackling the political climate and ensuing dynamics between the mining and manufacturing industries, the government and the labour market.

2.4 Research Question

The over-arching question in this research paper is whether there is merit in beneficiating the chromium mineral value chain so as to develop South Africa's economy beyond its current contribution.

In order to answer the research question, the following sub-questions will be unpacked in the paper:

a) What are the different dimensions (and critiques) of beneficiation and SA's beneficiation strategy?
b) How can SA translate its comparative advantage in chromite ore into a competitive advantage; and what are the spin-offs on the stainless steel value chain?
c) What are the key challenges and constraints impeding the successful development of the chromium mineral value chain and economic linkages?
d) What sort of interventions and policies are thus required in order to realise a successful beneficiation strategy?

2.5 Rationale or Significance of the study

This study presents an important contribution to the lack of available literature on the domestic chromium mineral value chain specifically, and the extensive economic linkage opportunities these ferrous minerals could unlock in order to aid South Africa towards achieving a sustainable social and economic development path.

2.6 Research Methodology

In order to answer the "how" and the extent to which the chromium mineral value chain can be developed further, the research applied a qualitative-analytical approach. This method enabled the author to investigate the 'how and why' in answering the research question.

The research also used semi-structured interviews that were answered by participants from the public and private sector, as well as subject experts (independent consultants) to address the question. The responses from the interview participants, together with the theoretical justifications for chromium beneficiation allowed for in-depth analysis and the opportunity to extract the differing views in order to summate the conclusion.

The participants directly affected by the subject matter were chosen as follows: Government departments (Department of Mineral Resources and Department of Trade and Industry); the private sector (Chamber of Mines and Industrial Developnment Corporation); power utility (Eskom); Trade union (COSATU); and independent experts (proConsult – Dr Oliver Damm; IFAA – Professor Ben Turok and WITS Supervisor – Dr Paul Jourdan). In the end, only four interviews were had – these consisted of COSATU and the three independent consultants. The other interviews were unsuccessful on the basis of work commitments and unforeseen circumstances.

The paper has twelve sections in total. Section 3 explores the claim that mineral resources tend to impact the economic growth of developing countries negatively, as well as various justifications for mineral beneficiation and associated economic linkages. Section 4 contextualises the South African mining industry briefly. This is followed by Section 5 which provides the background to the composition of the domestic energy sector. This is important as it provides a basis for the ferrochromium mineral value chain. Section 6 explores the discourse around the merits in beneficiating the chromium mineral value. Section 7 will expound on this by looking at the implications on the stainless steel value chain. Section 8 will then provide the various challenges and constraints impacting the CMVC and Section 9 will cover the policy views of the various stakeholders directly affected. Section 10 presents provide the overall recommendations and Section 11 will reflect on the discussions already covered. The paper will then close off with a conclusion.

SECTION 3: LITERATURE REVIEW

3.1 A Neoclassical approach to the development of a mineral-based economy: New Structural Economics Theory

In an economy juxtaposed by labour abundance and high unemployment such as South Africa's, Black and Hasson (2012, p.2) make the point that in order to raise the output elasticity of employment, first and foremost, economic activities should become more labour intensive; secondly, there should be a shift in the composition of output to relatively labour-intensive sectors.

From a neoclassical perspective, Lin (2009) cautions against strategies that defy a country's comparative advantage by supporting activities that are too capital or skill intensive. The new structural economics (NSE) theory argues that sustainable income growth is the foundation for poverty reduction and economic development. It further postulates that the best way for an economy to develop is to allow its factor endowments to change over time through

upgrading from a more labour and resource-intensive endowment structure, to one that is capital-intensive (Lin, 2012, p.6). When this is achieved, the economy will be most competitive, the economic surplus will be large, and the capital accumulation and upgrading of its factor endowment structure will be the fastest possible.

The NSE theory has formed the basis for providing direction for the economic development of most first world countries. The theory is firmly rooted in its orthodox assumptions that hold much faith in the mechanism of the market. The NSE further creates the space for industrialisation strategies to occur, such as the global value chain development, vertical specialisation or resource-led industrialisation (Newman and Takala-Greenish, 2014). The role of the state, therefore, should be that of facilitating the economy, in industrial upgrading and solving coordination problems in the market - not necessarily to push its own agenda.

In a resource rich and labour-abundant economy such as South Africa, economic development according to the NSE can be achieved if it follows its comparative advantage in developing resource-intensive industries, including extraction, forestry and agriculture. In addition to this, the NSE recommends that South Africa should develop its labour-intensive manufacturing industries as these industries can provide more jobs for the poor. They would also pave the basis for continuous upgrading to higher value-added industries, which will increase the wage rate (Lin, 2011, p74). Eventually, the development process will upgrade the country from a labour-intensive economy to a more capital-intensive industry as capital becomes more abundant.

However, opponents strongly disagree with the manner in which the NSE supports industrial policy specifically in developing economies. The first limitation is that the NSE theory defines industrial policy to include both broad and specific or targeted aims without interrogating the context or the mechanisms that inform the accumulation and shift from one endowment structure to the next. Secondly, the NSE is said to assume that industrialisation is an automatic process, which relies on the notion that a static view in the micro context can represent the continuous and complex nature in the macro economy. Naude and Szirmai (2013, p.2) argue that industrialisation is not an automatic process, but that different types of industrial policies are necessary in different contexts and times. Thirdly, the NSE assumes that the categorisation of economic activity is possible and in response, an appropriate policy can be identified and implemented accordingly (Newman and Takala-Greenish, 2014).

Altman (2001) made the point that some authors did not agree with the hypothesis that higher value-added higher productivity investments were appropriate in a labour surplus economy, such as South Africa's. Altman argues that the only way for South Africa to form a sustainable industrial strategy is for it to support the development of higher productivity or higher value industries that will yield incomes high enough to support employment multipliers in low productivity, job-creating industries. In order to realise the labour-intensive downstream fabrication, industries need to invest in the capital-intensive precursors (feedstocks, such as steel and polymers).

Thus the market-led approach of the NSE is said to limit policy in identifying ways to upgrade the economy's endowment structure, given the inherent market imperfections in the short run. In the long run, the NSE assumes that market forces and mechanisms are operating efficiently. In summary, the NSE does not take cognisance of cumulative linkages. Neither does it foster the diversity of different economic activities across diversified sectors (Newman and Takala-Greenish, 2014).

In response to the NSE's recommendations and after the RDP, GEAR and AsgiSA programmes failed to achieve their objectives, President Jacob Zuma adopted the New Growth Path (NGP) in 2010 as the official framework to create more inclusive economic growth by encouraging more labour absorptive economic activities. The NGP's objectives are to create five million jobs by 2020 and it identifies six priority sectors – all of which are focused on infrastructures and rebuilding the productive sectors of the economy (DMR, 2011, p.iii). Mineral beneficiation is one of the priority growth nodes for job creation.

3.2 Endogenous Growth Theory

Endogenous growth theory holds that economic growth is driven primarily by endogenous and not external factors. Moreover, it postulates that growth is dependent on technological progress and diffusion, and that investing in capital, in the labour input and in knowledge will significantly contribute to economic growth. The growth theory further emphasizes that the strength of state institutions (and the lack of corruption) and the orientation of economic policy are good determinants of well developing economies (Altman, 2001).

The neoclassical growth theory of Solow (1956) and Swan (1956) assumes that the rate of technological progress is achieved independently of economic forces. Endogenous growth theory challenges this neoclassical view by proposing channels through which economic factors can influence the rate of technological progress, and hence the sustainability of economic growth. It asserts that innovation plays an integral role in inducing technological progress in the form of new products, dynamic processes and markets, many of which are the result of economic activities (Howitt et. al., 1998). Firms and therefore economies become more competitive through learning by doing and repeat-learning. Over time, this makes them more efficient through acquiring production experience. Eventually, a higher pace of economic activity is achieved.

In addition, firms that spend on R&D and countries that formulate economic policies with respect to trade, competition, education, taxes and intellectual property are able to influence the rate of innovation in order to attain sustainable economic progress (Howitt et. al., 1998) The NDP indirectly identifies skills and technology development as being key drivers to MVC development (Jourdan, 2014, p.13; NGP, 2012).

3.3 Global Value Chain Development (GVCD) as a strategy for industrial development

With the recent re-emergence of industrial policy in the current era, GVCD as a strategy for industrial development has taken centre-stage as a promoter of value chains linked to natural resource abundance (Fine and Rustomjee, 1996; Morris et. al. 2012).

GVCD hails directly from the global value chain analysis, which describes the full range of activities that firms and workers perform to bring a product from its conception to end use and beyond (i.e. after-sales market). These activities generally include design, production, marketing, distribution, and support to the final consumer. Similarly, the term "commodity chain" refers to a network of labour and production processes whose end result is a finished product (Hopkins and Wallerstein, 1986, p.159).

The GVC approach therefore analyses the global economy from two contrasting vantage points: top down and bottom up. The former examines how lead firms "govern" their global-scale affiliate and supplier networks) whilst the latter questions how these business decisions affect the trajectory of economic and social "upgrading" or "downgrading" in specific countries and regions) (Gereffi & Fernandez-Stark, 2011, p.4). This "upgrading" has important implications for a country as its economy can either move to higher value activities in GVCs in order to increase the benefits (e.g. security, profits, value-added, capabilities) from participating in global production (Gereffi et. al., 2005, p. 171); alternatively, the converse can occur.

Given the abundance of minerals within Africa, 'resource-based industrialisation' (RBI) is seen as the promoter of high-value added activities in advancing African countries from the chains of the resource curse. The expected continuing demand of Africa's natural resources – specifically from countries like China and others alike - provides opportunities for resource exporting countries to upgrade and diversify vertically along commodity chains that remain untapped or unexploited on the continent.

3.4 The Resource Curse Argument

One of the more influential ideas in recent development discourse and policy is the so-called 'resource curse'. The argument around the resource curse thesis is that mineral abundance, generally found in less developed countries, tends to generate poor growth performance and negative developmental outcomes compared to resource-poor countries that have enjoyed considerable economic success from diversifying their economies (Di John, 2010). The hypothesis observes that mineral exporting countries are the leading victims of this curse. It has been observed that South Africa, like most mineral-rich economies, is a victim of the resource curse theory. Studies by Auty (1990) suggest that economic and political factors have influenced the disappointing growth outcomes of resource abundant economies.

Variants of the Argument

1. According to Presbisch (1950), the origins of the resource curse were based on the structuralist theses of the 1950s, which focused on the decline in the terms of exchange between primary and manufactured products, the price volatility of primary products, as well as the limited linkages between the natural resource sector and the rest of the economy (Hirschman, 1958). Thus the model predicts that de-industrialisation is the expected structural change that occurs following these commodity booms.

Yet, recent development economic thinking identifies positive externalities as coming from the manufacturing sector, not from natural resource sectors. Hirschman (1958), Seers (1964) and Baldwin (1966) promoted the view that beneficial forward and backward linkages from primary exports to the rest of the economy would be small. This is informed by the idea that manufacturing creates more economical and employment multipliers than natural resource sectors (Sachs and Warner, 1997, p.5).

Di John (2010, p.1) puts this forth as possibly owing to a number of reasons, namely that less developed economies tend to generate negative poor economic performance, growth collapses, high levels of corruption, ineffective governance and political instability. These natural resources are thus deemed to be more of a 'curse' than a 'blessing'.

2. The Dutch disease concept refers to potential negative effects natural resource abundance and exchange rate appreciations can have for the rest of the economy (Di John, 2010, p.2). The potential danger of such booms is that it can render certain sectors, i.e. manufacturing, less competitive, thus generating de-industrialisation (and therefore a decline in production and employment). Auty (1993; 1994a; 1994b; 1998) observed that overvalued exchange rates – caused by mineral exports earnings – render low productivity investments uncompetitive. Volatile export prices also constrain growth in the balance of payments, commodity prices as well as relatively lower levels of national income per capita. The result is that the benefits of resource rich economies do not reach the financial objectives.

3. Sachs and Warner (1997, p.3) observed the negative association between resource abundance and growth, particularly when the natural resource has high transport costs associated with it. In such cases, the availability of the mineral resource requires the introduction of new technology. According to Sachs and Warner (1995), the distortion is created by export booms in primary-commodity exporting countries. These distortions are said to linger on even after the boom subsides, thus affecting the structure of production and investment required for future growth.

4. Some economists, including Auty (1995), Davis (1995) and Gylfason (1999) have argued that minerals are a "wasting asset" and cannot meaningfully contribute to a country's development. However, Wright (2001) maintains that there are a number of developed countries, including the United States, Canada, the Nordic states and of late Australia, that have demonstrated that a further processing and conversion of these acquired natural resources into finished goods of higher export sales value can bring economic success through economic diversification.

   These countries' resource sectors evolved from having poor technologies based on low-cost labour in sectors characterised by highly-skilled, knowledge intensive and export-oriented activities. This diversification of the economy encourages the development of key industrial and service sectors directly linked to the resources

base, thus ensuring continuation and economic progress long after these resources have depleted (Porter, 1990) (Vuori & Yla-Anttila, 1992) (Pajarinen et al, 1998) (Karppi, 2001) (Wright, 2001). This strategy was the catalyst in generating upstream and downstream value addition in these, now, developed economies, which eventually gave rise to related and support industries and the creation of employment. Heeks (1998) makes the point that the resource-based operations provide the impetus for the taxation of associated profits to generate excess revenue for the state. In turn, the state should then invest in physical infrastructures, namely roads, rail, port facilities, power, and water supplies; in social infrastructure including schools, hospitals, and prisons as well as in productive infrastructure, namely factories. Consequently, the above would lead to employment and linkage creation within the resource sector and in support industries, effectively leading to economic diversification.

3.5 The Rentier State – the 'staples thesis' and Rent-seeking behaviour

In contrast to this negative view of mineral abundant economies, earlier ideas on the subject adopted a more positive association of this resource abundance and industrial growth, specifically in developed economies. The 'staple thesis' supported this thinking, which demonstrated that growth was originally stimulated by the export of primary products which subsequently attracted capital and labour, and further induced a more diversified production structure (Innis, 1930; Watkins, 1963).

Rentier state models attempt to explain why state decision makers in natural resource abundant countries create and uphold growth-restricting policies by supporting rent-seeking behaviour (see Mahdavy, 1970; Karl, 1997; Auty, (2007). The proposition is that higher levels of mineral rents encourage rent-seeking and therefore corruption, as compared to those countries with lower mineral abundance.

Proponents of the rentier state model suggest that reducing the state's 'unearned income' from mineral rents will foster a peaceful existence between government and the mining companies (Center for Global Development, 2004, p.56-57). Those who oppose the rentier state theory argue that natural resource rents – only to the extent that the state appropriates them – should be identified as encouraging savings, foreign exchange, and relaxing fiscal constraints (Gelb & Associates, 1998, p.17-18).

Another key structural problem identified by Black and Kahn (1998); and Klasen and Woolard (2000) is that the misallocation of mineral resource rents has left South Africa's middle income status highly distorted. Whilst the country's cost structure and market-oriented production sectors reflect this status, other key indicators, namely the human development index, skills and knowledge base and export profile reflect a less developed economy.

In South Africa, the state captures a very small share of resource rents. Based on observations made by Torvik (2002), Robinson et al. (2006) and Sandbu, (2006), this is largely because natural resources attract a large number of Pseudo-entrepreneurs with intentions to make profits rather than entrepreneurs whose priority is to run productive firms. Torvik (2002)

argues that such behaviours lead to an overall reduction in income (or lower welfare), rather than an increase.

Altman (2001) argues that mineral rents enabled the government to by-pass the development of labour-absorbing industries in favour of highly capital-intensive energy and chemical industries. The consequences of this have been a distorted cost structure that has isolated a mass creation of jobs specifically in labour-intensive, low productivity exports.

3.6 Economic linkages – the basis for beneficiation?

Research by Wild and Schwank (2008) maintains that linkages form an integral part in the sectoral growth process of an economy. It is said that they provide economic and employment opportunities for upstream and downstream producers, thus shaping the development path of any economy.

The Africa Mining Vision[7] defines linkages in two ways: 1) quantitatively as inputs and outputs into mining operations, and 2) qualitatively, in terms of the relationships between sectors in the supply chain.

According to the AMV Report, linkages force a country to consider how each participant in the market can interact with the other, and how value can be achieved by each participant at each stage of the value chain. It is observed that each stage of the mining process may have upstream, downstream, side stream and lateral linkages. The problem, according to the ISG Report, is that such linkages in most developing economies are not well developed, which partly elucidates the why a country like South Africa extracts and exports the bulk of its natural resources to international markets, thus forming stronger industry integration with these markets and not its own domestic markets.

The ensuing linkages created between the different sectors, most notably the combined impact of the mining sector and the manufacturing sector have sparked debate in the theoretical approaches to economic growth (Wild and Schwank, 2008, p.2). German economist List (1950) stresses how the development process is important for building up productive capabilities, and how certain industrial activities initiate production and further stimulate productivity in other sectors of the economy. List (1950) singles out manufacturing as a favourable economic approach over agricultural production mainly because manufacturing activities lead to increases in productivity in all other sectors. Manufacturing is enlisted as the key that ensures institutional, infrastructural and political progress (ibid., p. 230).

It is also argued that in order to harness linkage opportunities, certain fundamental constraints need to be adequately addressed. These include deficiencies in knowledge intensive areas, particularly, human skill development and infrastructure bottlenecks.

[7] Africa Mining Vision, Optimizing mineral linkages needs a conscious policy approach, ISG Bulletin 2

In an effort to promote diversification in resource rich countries, Hirschman (1981) sees resource rents as the ideal tool to build linkages between the commodities sector and the industrial sector. Four types of linkages are distinguished below:

a) **Fiscal linkages:** these consist of taxes, (including resource rent tax, corporate tax or indirect tax such as royalties, export tax etc.) which can possibly be used to promote industrial development in other sectors (UNECA & AU, 2011).

b) **Consumption linkages:** this refers to the demand for the output of other sectors raised by incomes in the commodities sector.

c) **Production linkages:** these include forward (value addition through processing and refining) and backward (supplying goods and services for the commodities sector). These are dependent on the "magnitude and technological intensity of production" (Hirschman, 1981).

d) **Horizontal linkages:** developing capabilities in the resource's sector that can help build other industrial sectors or services (UNECA, 2011). This can occur by reinvesting tax revenues in infrastructure development.

The point Hirschman (1981) was making is that the development of these linkages, specifically production linkages, offers industrial diversification. But perhaps of greater importance, is that for the beneficiation to be successful, linkages across these pillars require coordination, integration and collaboration between the public (state) and private sectors. These sectors therefore need mutually beneficial relationships, a common vision and "joined-up strategies" (Morris, Kaplinsky & Kaplan, 2012) that will ultimately benefit even the ordinary people of South Africa.

With that said, Diestsche (2014) makes the point that industrial policies therefore need to be strategically designed such that they are supportive of this collaborative effort between the above-mentioned sectors. The key principle around the success of economic linkages is to adopt economic policies that are development oriented and that would harness the strengthening of these linkages.

3.7 South Africa's industrial structure

According to Fine Rustomjee (1996) and Black & Roberts (2009), South Africa's industrial structure characterises an economy dominated by a "minerals energy complex" (MEC). These MEC sectors consist of various mining activities and further processing into semi-manufactured commodities so closely linked that the latter are understood to be more closely linked to mining than to manufacturing.

The domestic industrial structure has historically been biased towards upstream, minerals-related heavy industries. Accordingly, the policy orientation towards the industry was heavily influenced by the requirements of the apartheid regime – steel being an important example. Consequently, the development of key inputs for industries such as arms, meant that basic iron and steel production was developed through state-owned Iscor (Fine and Rustomjee, 1996).

Although South Africa's manufacturing sector is considered underdeveloped, there are cases whereby the Standard Industrial Classification (SIC) system has classified beneficiation under mining if it happens at the mine and under manufacturing if it was undertaken at a different site (ISP, 1993). The SIC system therefore fails to separate manufacturing activities from mining activities. By reclassifying production and separating "true" manufacturing activities from mining, refining and processing, it then becomes clear that the minerals-energy related commodities represents a mere 30% of South Africa's GDP and 80% of its exports (Fine Rustomjee, 1996).

Altman (2001) affirms the above discussion by adding that the slower growth in secondary and tertiary sectors can be attributed to a minerals-led economy largely influenced by apartheid diaspora, which effectively sanctioned the South African economy from participating alongside the rest of the world; it permitted only a few entrants and competitors in a small domestic market; it restricted the need for inclusive job seeking, "affordable cost of job search, and circulation of market information. These conditions were all created by the presence of import substitution industrialisation (ISI), international sanctions, legal restrictions on ownership of assets and businesses by the black population, and controls over the labour market and access to education." In summary, the apartheid government intentionally undermined all the factors that underpinned a growing economy. This included the "efficient coordination of factor and product markets."

Jourdan (1994, p.6) also observed that part of the problem to employment creation lies in the fact that South Africa's economy or industrial structure has not adequately exploited the employment intensive sectors within the minerals processing value chain. The value chain has five discrete phases, namely:

- Raw material extraction
- Beneficiation of raw materials (processing, smelting, refining) to intermediate products
- Component manufacture
- Sub-assembly
- Original Equipment Manufacturers (OEM)

Presently, the domestic agriculture and mining sectors are the only two known sectors that provide for their high employment intensity. The second phase, the resource processing stage, provides for low employment intensity due to the complex nature of the work as well an extremely high capital cost of employment (Jourdan, 1994, p.7). Although the third phase, known as component manufacture, is also characterised by a high level of employment intensity, this stage has only had limited success due to import parity pricing. This suggests that South Africa is stuck at the low employment-creation end of the processing spectrum.

SECTION 4: CONTEXTUALISING SOUTH AFRICA'S MINING HISTORY

4.1 The birth of South Africa's mining industry and the current state of the economy

The transformation of South Africa's economy from a predominantly agricultural economy to one of the most industrialised nations in Africa began in the late nineteenth century in an undeveloped interior known as the Witwatersrand Basin. The discovery of world-class diamonds and gold deposits laid the foundation for the birth of a mining industry that has essentially become an important contributor to South Africa's economy (GCIS, 2012, p.21).

The discovery of these precious minerals, together with challenges of accessing them, provided the initial impetus for industrialisation. Heavy equipment, power supplies and large forces of organised labour were therefore needed in order to extract and process underground ore deposits, triggering a series of spin-off activities in other sectors such as transport (railway system), power generation (coal mining), manufacturing, and commercial farming (Abedian & Standish, 1992) (Davis, 1994) (Fine & Rustomjee, 1996) (Mainhardi, 1997).

Despite these opportunities, Davis, 1994; Fine and Rustomjee, 1996; and Chang, 1998 argue that rapid growth and economic development in the country were held back by the prevailing economic structure of the time, including direct state involvement in the economy as well as the dominance of import substitution policies (and import parity pricing) between early 1920s and early 1990s.

In current South Africa, the mining industry is one of the most developed industrial clusters with extensive science and technology research, expertise in geosciences (Baxter, 2012).

4.2 The South African Energy sector

4.2.1 Overview

The South African energy sector has been and continues to play a critical role in the country's development path (Davidson and Winkler, 2003). South Africa has the highest energy consumption on the continent, accounting for approximately 30% of total primary energy consumption in 2012. Eskom - the country's primary energy utility - supplies roughly 95% of South Africa's electricity and the remainder come from independent power producers (IPPs) and imports.

Whilst the economy is energy-intensive by international standards, the intensity however, is not equally distributed in the economy – it is only concentrated in specific sectors of the economy – manufacturing and transport.

Hughes et al. (2002) contend that the reasons for the high energy intensity is due to the extraordinary use of coal in electricity, and the large number of energy-intensive enterprises, which are linked to the low prices of coal and electricity that have consistently been around 40% of US average prices for the last four decades. Hughes maintains that while this has provided South Africa with a competitive advantage in minerals processing, it has also deterred investment in alternative energy supply, and more importantly, energy efficiency.

Compared to other countries, South Africa's energy efficiency is on average significantly lower.

Unfortunately, the security of supply remains a contentious issue. In the 1970s, Eskom's 35,408MW of coal plants were designed to run at 75% capacity factors; yet the IRP envisages these 30 year old plants to run at 85% capacity factors for the foreseeable future (AEY, 2013). Analysts strongly oppose this view, citing the need for an introduction of new power sources to enter the market.

Winkler and Marquand (2009) note that the development of the South African energy system can be divided into two related aspects: a) the development of an energy-industry complex, designed to drive the domestic industrialisation during the 20th century. The development of a 'minerals-energy complex' structured this; and b) the development of 'civil energy', i.e. the provision of household, commerce and services. The latter is said to be largely influenced by, and subject to, the former, as well as to the economic and social policies of the apartheid regime.

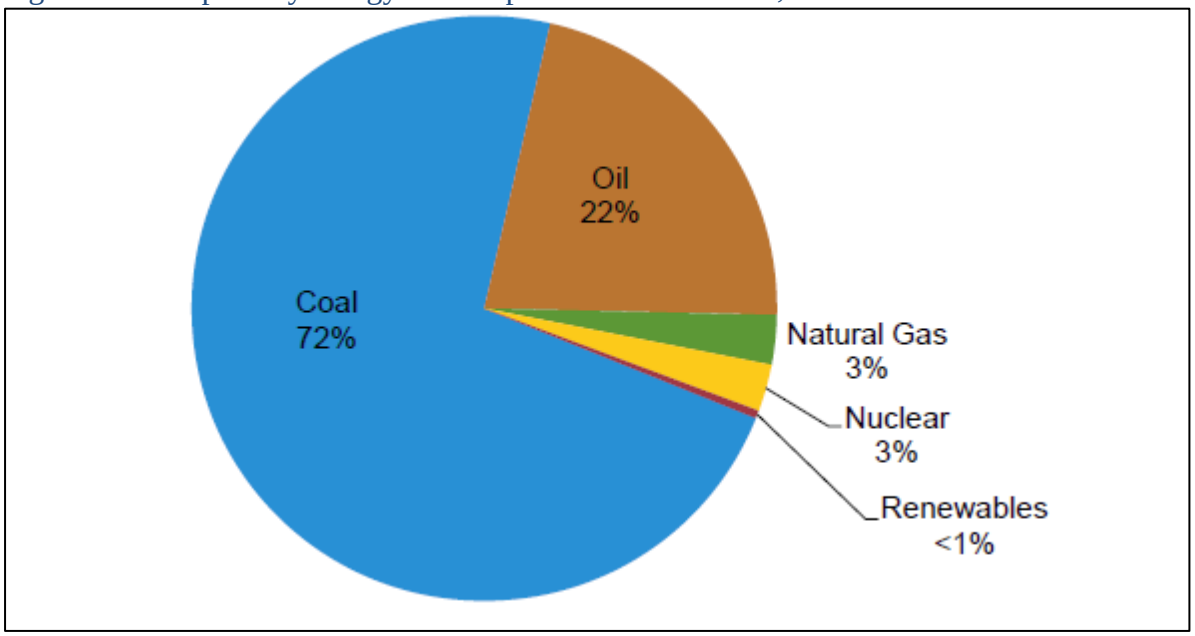
The current energy system is powered primarily by coal; however, South Africa plans to diversify its electricity generation mix. According to the DME (2004), coal comprises about 70% of the country's primary energy; crude oil comprises around 23%, natural gas around 3%, nuclear energy[8] around 3%. As for electricity generation, around 92% came from coal-fired power stations (NER, 2004a). South Africa's renewable energy-industry (comprising about 1%) is significantly small, but the country plans to expand renewable electricity capacity to 18,200 MW by 2030. To date, a total of 64 projects have been awarded to the private sector with investment totalling US$14 billion. The first projects are already on line. These projects are expected to generate 3,922 MW of renewable power (Eberhard, 2014, p.1).

South Africa has one nuclear power plant, Koeberg, with installed capacity of 1,940 MW. The country plans to build six new nuclear power plants by 2030 which will generate 9,600 MW of electricity (PWC, 2012). This nuclear build programme is already underway, as confirmed by Energy Minister Tina Joemat-Pettersson in Parliament on 19 May 2015[9].

[8] See DTI: IPAP 2014/2015-2016/2017 for more on Nuclear Energy, the key opportunities and constraints, pp. 125

[9] South Africa to build 6 new nuclear power plants, 19 May 2015, www.mybroadband.co.za

Figure 1: Total primary energy consumption in South Africa, 2012



Source: BP Statistical Review of World Energy 2013; PWC, 2012

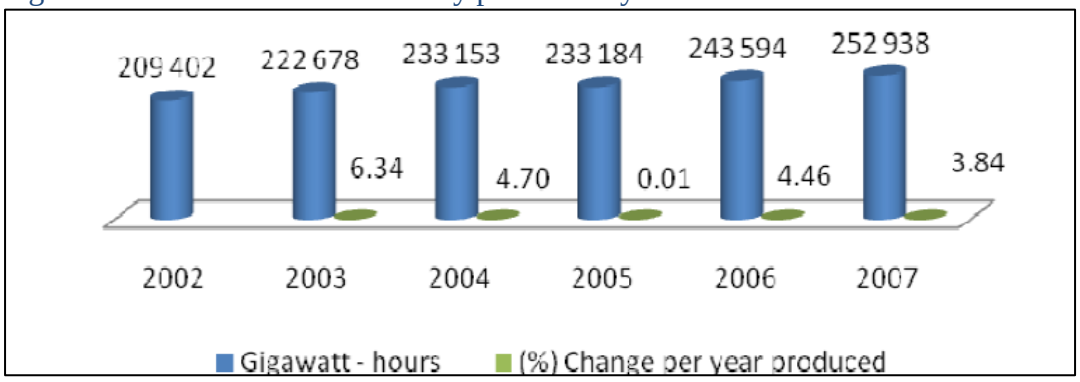
4.2.2 Demand and Supply issues

Eberhard (2003) argues that the construction of new power plants was put on hold and eventually cancelled during the apartheid era because the ruling government of the time was more concerned with energy security, overestimates of continued growth in demand and long lead times that led to large excess supply in the 1980s and 1990s.

As can be seen on Figure 2 below, the demand for electricity has subsequently grown in response to the rapidly growing domestic economy. Yet as shown in Figure 3, South Africa continued to export the already deficient electricity.

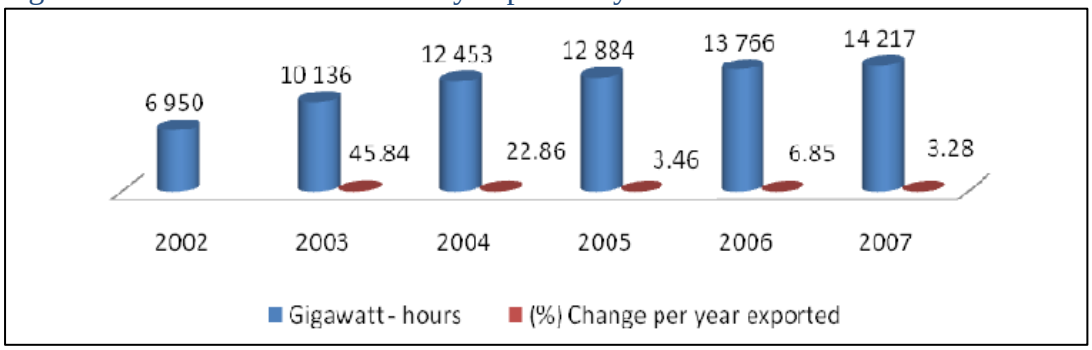
In the latter months of 2007, South Africa – a country which always had an excess electricity supply - started experiencing widespread rolling blackouts as demand exceeded supply, threatening to destabilise the national grid.

Figure 2: Total volume of electricity produced by Eskom



Source: StatsSA , Dec 2007-2002, Doc – P4141; Solidarity

Figure 3: Total volume of electricity exported by Eskom



Source: StatsSA , Dec 2002-2007, Doc – P4141; Solidarity

4.2.3 Addressing the power crisis: Unpacking the reasons

Since its establishment in 1923, Eskom has undergone a number of periods of almost complete autonomy (i.e. not subject to any form of parliamentary oversight, state auditing and financial controls); to greater regulation; oversupplying electricity, continuing blackouts, to electricity price increases (Koen, 2012, p.3).

Eskom's mandate at the time was to produce and supply electricity neither for profit or loss, while producing and distributing capacity at the lowest cost possible to meet the demands of mining and industrial companies.

Real causes of the crisis[10]

a) The attempted privatisation of Eskom in the 1990s saw the appointment of the Electricity Council to govern Eskom's corporate body, which was made up from stakeholders from business and the municipalities (Koen, 2012, p.7). Consequently, the restructuring of the power utility resulted in an unmonitored electricity pricing policy[11].
b) One of the real causes behind the electricity crisis was due to the government's decision in 2001 to prevent Eskom from building any new power stations despite several attempts government's own official 1998 energy policy acknowledging the power shortage.
c) Government's failure to accept and act on the responsibilities of ownership: as an owner of the state utility, government's incompetence (as cited in CDE Round Table no.10) have been exposed since it failed to replace worn out machinery and capital assets swiftly, as well as respond effectively to investing in newer power plants timeously to meet the growing demand. Moreover, government's indecisiveness on creating more capacity early enough cost the South African economy from the possibility of attracting private generation. Consequently, the power supply shortage

[10] Michael Koen, The Eskom Factor: Power Politics and the Electricity Sector in South Africa. Based on the Research Report: The Electricity Governance Complex. Report 2012.
[11] The drafters of the new Act, who included members of Eskom's legal department, managed to insert a clause that exempted Eskom from the requirement to have a license issued by the ECB (Electricity Control Board) and thus from having its prices regulated.

in South Africa has led to an increase in the cost of electricity that has more than doubled since 2008. A plan has been tabled to increase the electricity price by 16% every year from 2013 to 2018 (Pan, 2013, p.106).

d) Eskom's poor response to the difficult situation it was placed in by the government: Eskom was as equally responsible for the state of its affairs as it was unable to convince the government to permit it to build new power stations. Instead, the power utility placed much greater value on socio-political issues (i.e. racial transformation and affirmative action) than in finding solutions to the skills deficiency it needed to keep operations going. Moreover, Eskom failed to extend the favourable long-term contracts with major coal suppliers that had provided it with some of the cheapest coal in the world.
e) Poor leadership by the Eskom board: in accordance with the views of some senior and experienced executives, Eskom's board failed to provide the right skills, independent leadership, and long-term strategic direction to the management of the utility. Its governance structure has been criticised for being old-fashioned.

With approximately 80% of world chrome ore reserves and being one of the major producers of ferrochrome, South Africa and all local ferrochrome producers are looking for alternatives that can use less electricity.

Since ferrochrome production is energy-intensive, during the first quarter of 2012, Eskom offered to pay energy-intensive ferrochrome smelters in exchange for them temporarily shutting down their furnaces in order to save energy (ICDA, 2013). Several companies signed this buyback deal. Xstrata-Merafe Chrome Venture closed five furnaces including International Ferro Metals (IFM), Assmang and Mogale Alloys. Hernic Ferrochrome Ltd. and Ruukki SA signed the deal in May. At the end of 2012, Tata Steel KZN agreed to the buyback program. The power constraints clearly and absolutely limit the first step of the chromium mineral value chain (MVC) – that of electricity intensive ferrochrome production, and consequently the whole value chain.

Increasing electricity tariffs has prompted greater electricity efficiency in smelting – e.g. Glencore's Lion project (Primus technology from old CMI pre-reduction technology). As Slatter (1995) put it, the electric submerged arc furnace has dominated the smelting of chromite ores and it has become engrained as the recognised production unit for ferrochromium alloys. The submerged arc smelting of ferrochromium has become a mature or aging technology and the smelting costs are becoming increasingly difficult to manage. In order to preserve the future sustainability of the industry, ferrochromium producers are introducing new technologies to be more cost effective and to produce better products.

SECTION 5: THE CASE FOR MINERAL BENEFICIATION

5.1 Defining Beneficiation

The DMR (2011) narrowly defines beneficiation (value addition) as the transformation of a primary material (produced by mining and extraction processes) to a more finished product of

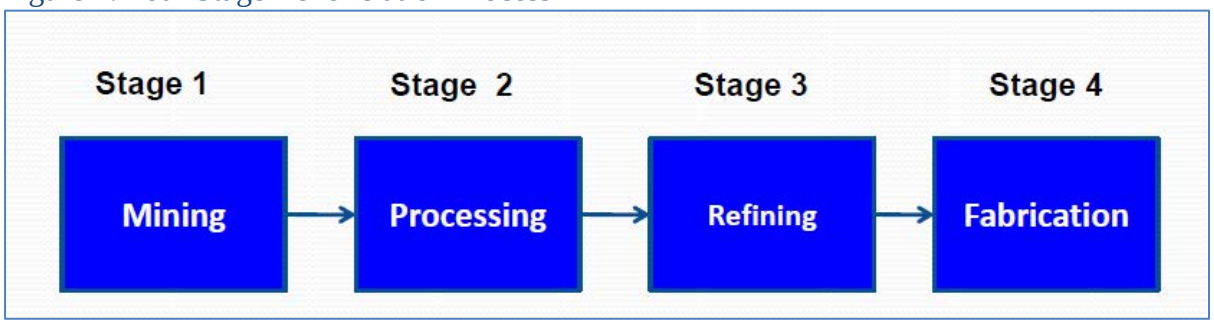
a higher export sales value. The original definition of beneficiation, according to April (2009) referred only to smelting ore or extracting metal. The definition has since been broadened to include the five stages of manufacturing metal. Each successive level of processing permits the product to be sold at a higher price than the previous intermediate product or original raw material and adds value at each stage. Thus the 'narrow' definition excludes upstream value addition (i.e. local content in mining/smelting, reducing value addition (imports) at each stage).

The broader definition of beneficiation is the sum of local value addition (excluding all imported inputs) and it encompasses the inclusion of all five mineral linkages, i.e. backward linkages into capital goods, services and consumables; forward linkages into manufacturing, logistics etc., spatial linkages (infrastructure), fiscal linkages (resource rent capture and deployment and knowledge linkages (R&D, HRD: skills formation etc. (Jourdan, 2013)[12].

The Beneficiation Strategy is supported by a number provisions within existing national policy and legislation, such as the Minerals and Mining Policy for South Africa (1998), Minerals and Petroleum Resources Development Act, the Broad-Based Socio Economic Empowerment Charter, the Precious Metals Act, the Diamonds Amendment Act, the energy security plan as well as compliance with environmental protocols (DMR, 2011, p. 1).

There are generally four stages involved in mineral beneficiation (DTI, IPAP 2014/2015 – 2015/2016, p. 82) – see Figure 4 below:

Figure 4: Four Stage Beneficiation Process



Source: Eco Partners, 2011

- **Stage 1** involves the primary stage of mining and extracting an ore or concentrate (minerals are not beneficiated)
- **Stage 2** converts the ore or concentrate into an intermediate product such as a metal or alloy. The production of intermediate products usually takes place in capital- and energy-intensive smelters and refineries (DTI, 2005, p.15). (Involves limited beneficiation)
- **Stage 3** transforms an intermediate good into a refined, semi-fabricated product suitable for use by both small and sophisticated enterprises. Employment levels are

[12] Mineral Value Chains (MVCs) Resource-based Industrialisation, Minister's IPAP Update Briefing, Paul Jourdan, DTI, Tshwane, April 2013

generally high and the degree of value-added increases substantially due to the inclusion of other resources and inputs such as skills and technology (DTI, 2005, p.15)

- **Stage 4** transforms the processed metal further into finished products of a large variety. The range of employment opportunities is significantly larger at this stage (represents maximum possible value addition) (DTI – IPAP 2014/2015 – 2016/2017, p.82)

There is common agreement that there is currently little value-addition taking place in South Africa, specifically in the chromium mineral value chain as a result of the country largely exporting unbeneficiated or semi-processed chromite ore, thus limiting employment creating opportunities. The Chamber of Mines (2000) on the other hand, is of the belief that the amount of downstream beneficiation already taking place in the country is grossly underestimated.

Table 1: Stages of beneficiation and levels achieved

Table 1.2 Stages of Beneficiation and Levels Achieved				
Commodity	**Stage 1 Ores / Concentrates (%)**	**Stage 2 Processed / Refined Ore (%)**	**Stage 3 Primary Manufacture (%)**	**Stage 4 Finished Manufacture (%)**
Gold	100	100	5	2
PGM (Platinum Gp of Mts)	100	100	n.a.	6
Iron ore to steel	100	30	30	15
Chrome to stainless steel	100	85	9	3
Aluminium	0	100	30	11
Zinc	100	100	90	60
Manganese	100	50	25	22
Titanium	100	15	4	Small
Copper	100	100	65	50

Source: DTI, 2005:16

As evidenced by Table 1 above, there are very low levels of beneficiation taking place, especially in Stage 4 (fabrication stage) of the in the Chromium MVC. The DTI (2005, p.16) believes that this can be attributed to weak economic linkages and the problem of import parity pricing by upstream metals producers at Stages 2 and 3. It also believes that the shortage of knowledge and skills, as well as the low levels of investment is what are generally affecting the competitiveness of downstream firms at Stage 4.

5.2 The Beneficiation Strategy and its Objectives

In 2011, the SA Cabinet adopted the "Beneficiation Strategy for the Minerals Industry of South Africa."[13] The Strategy is a framework aimed at promoting and facilitating beneficiation. It identifies ten strategic mineral commodities, amongst them, the chromium mineral value chain, which forms part of the Iron and Steel Value Chain.

[13] Department of Minerals Resources (DMR), 2011: A Beneficiation Strategy For The Minerals Industry Of South Africa

Although the concept is not new in the country, beneficiation has not been successful in addressing government's key priorities of reducing poverty and unemployment through the contribution of the mining sector.

The Department of Trade and Industry (DTI) desires that all four stages of manufacturing be developed domestically with the support of mining companies offering assistance to local communities. Yet there are countries – for example China – that are interested in acquiring South Africa's minerals and metals for the development of their own economies. China prefers beneficiation to take place in China, though there are some Chinese companies who have shown a willingness to support local beneficiation (DTI, 2014).

Yet South Africa faces a number of challenges for ferroalloy beneficiation with Eskom power shortages arguably an absolute constraint. The other challenge is the country's impending laws against climate change (carbon tax) that aim to limit greenhouse gas emissions. Additionally, there seems to be no collaborative effort between government and the private sector – notably the financial sector and to some degree the mining sector – which would rather support the exports of unbeneficiated ore.

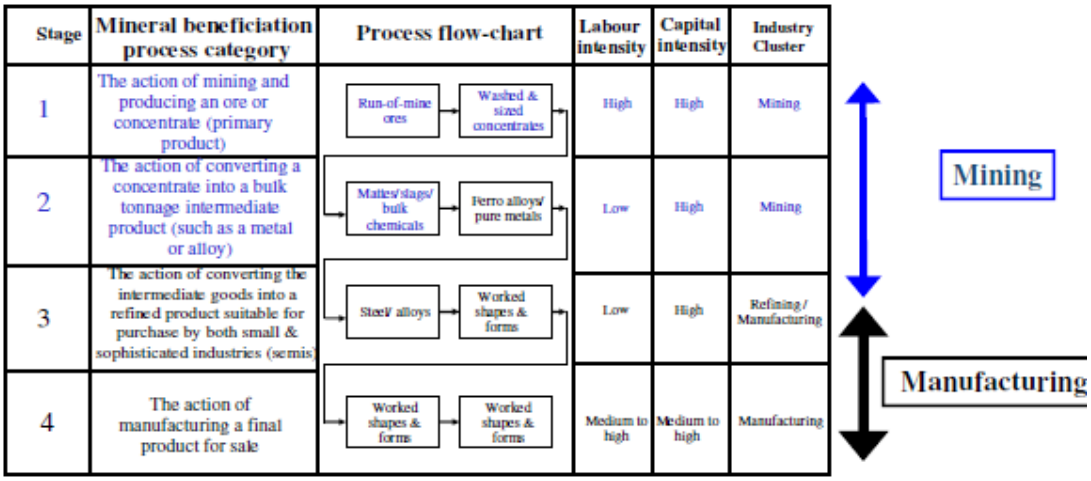
The SIMS report of 2012 (cited in Jourdan, 2012) believes that there are two broad approaches to downstream value addition. The *supply-driven approach* starts with the mineral endowment and then develops value addition strategies for those minerals with major domestic resources (DMR, 2011). The second, known as the *demand-driven approach*, identifies which mineral inputs the economy needs for rapid job creation and then develops strategies for the cost effective supply of these inputs in the required beneficiated form (Jourdan, 2012).

Given the cross-cutting nature of the issues that are necessary to promote beneficiation, the Chamber of Mines (2000) supports the view that there needs to be a coordinated strategic approach and a concerted effort by all stakeholders (i.e. labour, business and government) to facilitate greater beneficiation. This means that the Beneficiation Strategy needs to work with the existing policy frameworks of the National Development Plan (NDP), the NGP, IPAP5 and the Integrated Resource Plan (IRP2010) as all these talk to beneficiation. These policies shall be explored later in the paper.

5.3 A Critique of the Beneficiation Strategy

The beneficiation process categories are divided up between mining and manufacturing, as demonstrated below:

Figure 5: The Role of Mining and Manufacturing in the Beneficiation Process



Source: Chamber of Mines, 2012

According to Baxter (2013), mining and manufacturing have very distinct competencies and/or skills that the former does not have. The Chamber of Mines is of the view that mining has competencies in certain parts of the concentrating and/or smelting areas (hence its role is limited to Stages 1and 2 in Figure 5); whereas manufacturing companies have the core skills and competencies from refining to the fabrication of a final consumer product (hence its role is focused on Stage 3 and 4).

The Chamber of Mines makes the point that manufacturing beneficiation should not be driven by the availability of raw materials, but rather it should be driven by competitive advantage issues such as cost competition production, skills and craftsmanship.

The other critique on the Beneficiation Strategy is that whilst it is meant to be part of a broader policy and legislative framework *"that leverages more value from the mining sector beyond taxes and royalties"* (DMR/PCTI; 2014, p.31), it is restricted to downstream beneficiation (adding further value to the primary minerals generated by mining), or forward linkages. Unlike most developed countries such as Canada and Australia where upstream, and side-stream beneficiation industries have been given appropriate recognition and supported by their governments, it is argued that the South African government needs to pay more attention to supporting side-stream beneficiation.

Economist Dr Iraj Abedian has argued for a broader definition of beneficiation, to include both upstream and downstream linkages around the mining industry, as well as the "spin-offs in related industries, such as water, power, transport, chemicals and telecommunications" (side-stream) because in his view, *"the prevailing "downstream conception" of beneficiation could restrict the potential to derive the maximum economic benefits from the country's key mining sector."*

Professor Turok argues that the beneficiation strategy *"would be very different to the nationalisation approach, which says 'let's grab the commodity and then government*

manipulate it in some way'. It will break down the mining and manufacturing process and see what capability exists in the value chain and where government should intervene.[14]"

Lastly, while the beneficiation strategy identifies several constraints to downstream beneficiation, namely trade barriers, shortage of power supply, access to mineral feedstocks at developmental prices, etc., it fails to propose detailed strategies that can be implemented successfully, and it does not appear to challenge the existing policies and legislation by proposing amendments in order to enhance beneficiation. Jourdan (2012) makes the case that as *"minerals are a state asset that are concessioned (leased) for a mining company to extract, the conditions of the lease (license) are clearly the strongest instrument available to ensure greater value addition".*

SECTION 6: BENEFICIATING THE CHROMIUM MINERAL VALUE CHAIN (CMVC) – IS THERE MERIT IN THIS?

6.1 Overview of the Ferrochromium Industry

South Africa is a dominant player in the ferrochrome industry. Not only is it the largest producer in the world, it also boasts the largest smelting capacity in the world, at just over 4.1 million tons per annum. Unfortunately, the industry is in a transition phase since it has lost its competitive edge at producing ferrochrome cost effectively. Recent electricity hikes and electricity blackouts have significantly impacted domestic ferrochrome producers (IDC, 2012, p.9).

The South African ferrochromium industry was established in 1964 by Rand Mines, the largest holder of chromium ore reserves. Rand Mines researched the conversion of chromium ore to ferrochromium and formed RMB Alloys. This was shortly followed by the construction of the Southern Cross Stainless Steel Company, built in Middelburg (Jourdan, 2013, p.70) and the construction of a stainless steel plant in 1966. Due to the domestic market being too small to support the factory as a profitable venture, RMB Alloys merged with Palmiet Chrome to form Middleburg Steel & Alloys (MS&A) in 1969. In the early 1970s, small disintegrated chromite mines were consolidated and recapitalised leading to the development of the ferrochromium industry.

The Bushveld Igneous Complex located in South Africa holds approximately 80% of world chromite ore reserves (Pan, 2013), and it dominates global chromite ore production. This region covers large parts of the Northwest, Gauteng, Mpumalanga and Limpopo provinces.

The chromium mineral value chain (which falls under the Iron and Steel Value Chain) has been identified by the South African government as an important sector that offers the country a competitive advantage. In the words of Deon Dreyer, MD, Xstrata:

[14] Carol Paton, Africa's lack of beneficiation probed, 13 August 2012

"We must choose to maintain whatever advantage we have that enables us to retain our industrial capacity, keep people employed and produce skilled workers. Our ferrochromium industry has a hi-tech beneficiation capacity of 5 million tons a year and employs 200,000 people directly and indirectly, contributes about R2.5bn in taxes a year and contributes R42 billion to GDP. It is therefore a logical beneficiating mineral value chain to sustain and build upon."

The industry is by volume one of the most important feeders into manufacturing and job creation (Jourdan, 2013, p.7). It is therefore a logical beneficiating mineral value chain to sustain and build upon.

It is argued that this current size of contribution is unlikely to continue for much longer. Despite the clear potential within the chromium mineral value chain, SA's mining companies have been energetically exporting unprocessed chromite ore to China, dropping smelting capacity utilisation from 90% in 2004 to 74% or less now, due to power constraints. An increasing portion of this ore is supplied by local platinum producers (UG2), for whom this would otherwise be waste material. Regrettably, this action has devastating long-term effects for the domestic ferrochromium industry.

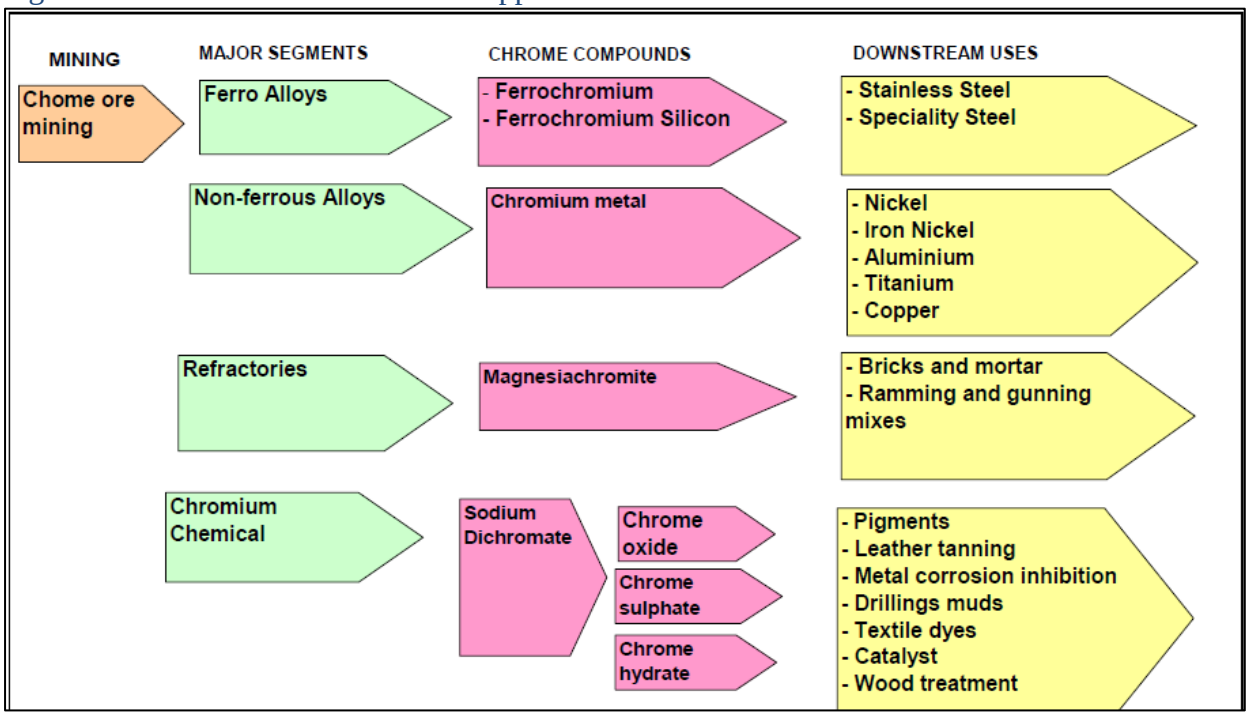
Hinting at South Africa's power supply constraint that was directly to blame for the challenges experienced by the sector, Dreyer (2012) affirmed that the country currently has *"no policy to manage this trend, which is facilitating the de-industrialisation of a mature sector."*

6.2 Key Sectors Driving the Chromium Mineral Value Chain

a) The Stainless Steel Market

The chromium sector is mainly driven by the stainless steel market, the largest consumer. The biggest driving force behind the demand for ferrochromium in the stainless steel value chain is that there is no other known substitute for it in the stainless steel production chain (Ideas1stResearch, 2010, p.4). Stainless steel is considered the most important end use market for chromite ore, as shown in Figure 6 below; however, more shall be discussed in the next chapter.

Figure 6: Chrome value chain and its applications



Source: European Chemicals Bureau; IDC, 2007

Chromium induces hardness, toughness, corrosion and chemical resistance in steel. It is identified as an important alloying element and is vital to the production of high-quality stainless steel, high technology weaponry, super alloys for jet engines and other modern kitchenware appliances including food processors. When combined with iron and nickel, the alloy produced is known as nichrome, which is resistant to high temperatures and used to make heating units, ovens and other appliances (Jourdan, 2014).

Of more importance perhaps, is that chromium has no substitute in stainless steel – the leading end use – or in super alloys, the major strategic end use.

Chromite (the raw material) in conjunction with magnesia is utilised in the manufacture of heat-resisting (refractory) bricks used for the construction and maintenance of industrial furnaces, mainly in the steel industry. It is the sole source of chromium, which when beneficiated, can be used in metallurgy, refractories, foundries and chemical applications.

Figure 7 below illustrates the three broad categories of chromium usage, namely:

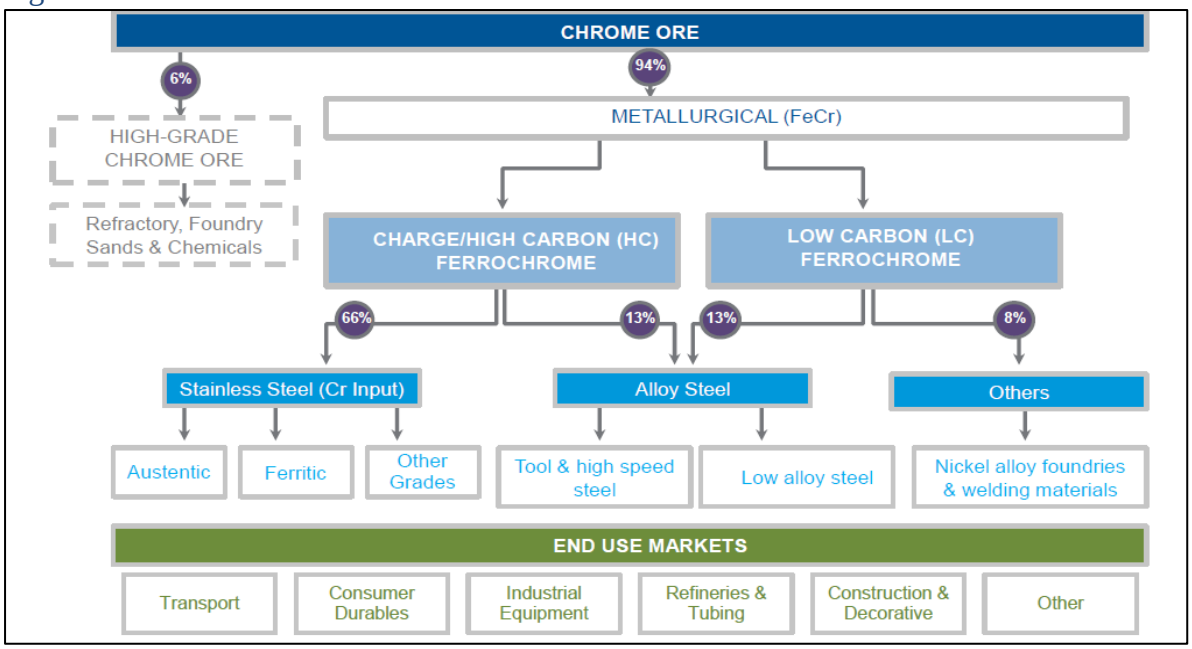
- Metallurgical (ferrochromium) (94%)
- Refractory and Foundry Sands (chromite) (4%)
- Chemicals (2%)

i. *Metallurgical Industry*

As demonstrated below, demand for chromium is primarily driven by the metallurgical industry that converts over 90% of the chromite ore into different grades of ferrochromium.

The stainless steel industry in turn consumes over 80% of the ferrochromium produced (mainly high carbon/charge grade[15]) (Murthy, Tripathy & Kumar, 2011, p.375).

Figure 7: Uses of Chromite Ore



Source: Heinz Pariser, Cliffs Analysis

The addition of chromium in low alloy steels improves the hardness and toughness in engineering steels. Alloy cast irons for example, are a particular portion of the cast product use for chromium. They are applied in pumps, valves, pipes, rolls and wear plates (IDC, 2007, p.9).

ii. *Refractory and Foundry Sands*

The high heat resistance of chromium ore is applied in various refractory bricks, castables and ramming mixes, while chromite foundry molding sands are used on account of their increased heat conductivity, which allows chilling of castings to improve their integrity (IDC, 2007, p.11).

iii. *Chemicals*

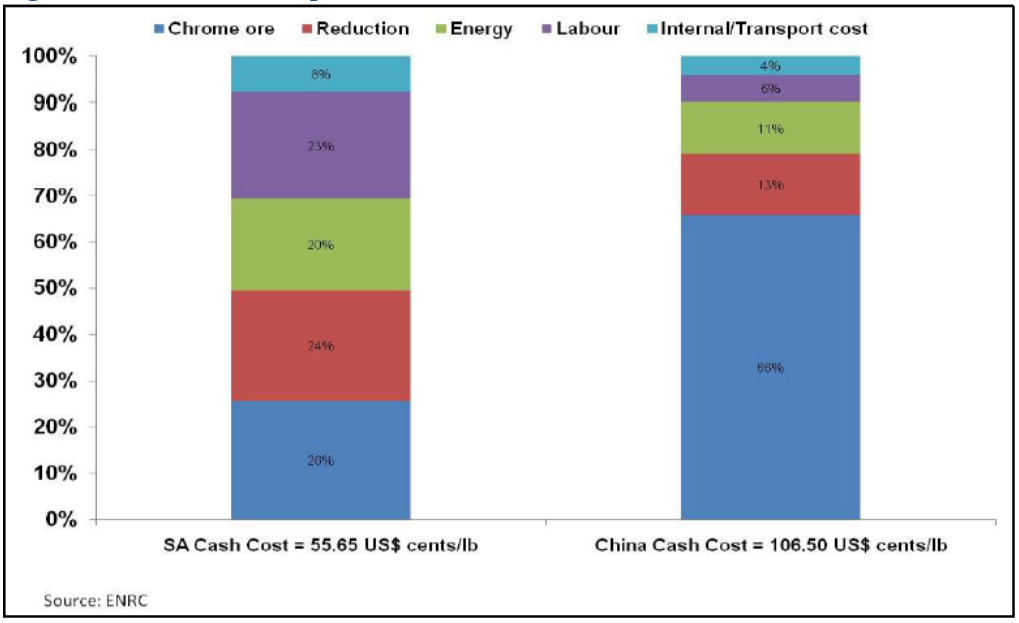
Chromium chemicals offer permanence and colour stability. Natural materials such as leather, wood and timber are stabilised for durability.

[15] Charge chrome contains between 48-55% chrome and 6-8% carbon and is mainly used in the production of stainless steel. South African producers are major suppliers in this segment.
High Carbon Ferrochrome contains over 60% chrome and 7-8% carbon and is mainly used in the production of alloy steel, other than stainless steel. Kazakhstan is the leading producer in this segment.

b) Integrated nature of domestic producers

South African ferrochrome producers have an integrated network which allows them huge cost advantages over key rivals, including China, as seen in Figure 8 below. Since the country has the advantage of chromite ore abundance, producers do not need to source it in the spot market. In a country like China, chromite ore makes up 66% of China's total production costs, whereas in South Africa, it only represents 26%.

Figure 8: Cash cost comparison between South Africa and China, 2008

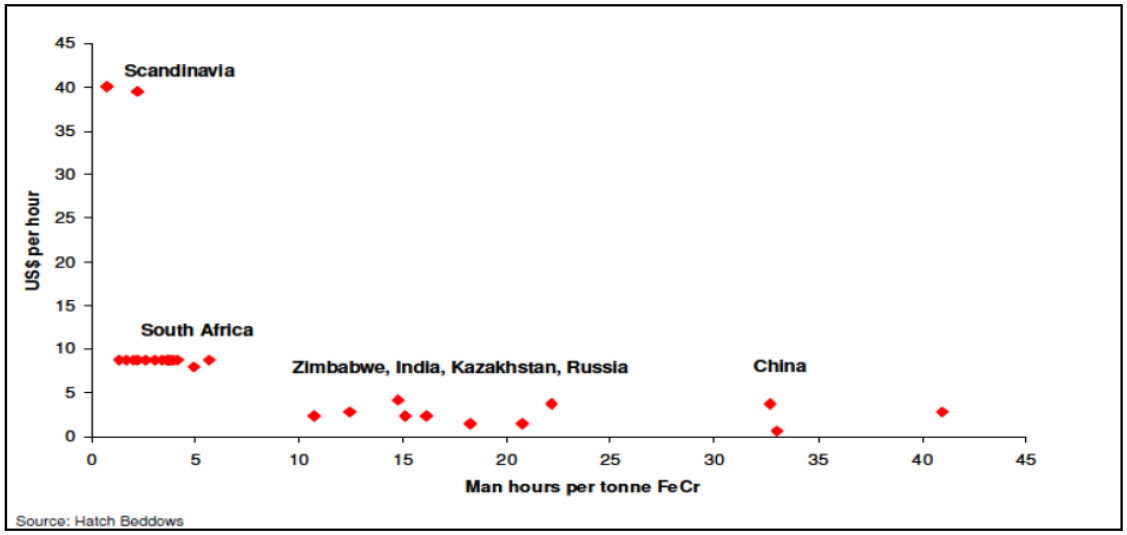


Source: IDC, 2012

c) South Africa is an efficient producer of ferrochrome

According to a report by Hatch, South Africa continues to be the most efficient producer of ferrochrome (see Figure 9). The country is considered to have optimal balance between wage and productivity cost. It must be made clear in this case that South Africa does not necessarily have the lowest wage cost when compared to countries like China, India, Kazakhstan and Zimbabwe, but it is the most productive/efficient producer of ferrochrome. In this case, South Africa compares well to a country like Scandinavia, except that wages there are four times higher than in South Africa (IDC, 2012, p.11).

Figure 9: Wage costs vs. productivity levels in ferrochrome producing countries, 2009



Source: IDC, 2012

d) Supply and Demand Pressures

South Africa has a huge surplus in ferrochrome production, hence the bulk of the country' ferrochrome production is exported (IDC, 2012, p.15).

Table 2 and 3 below illustrate the world ferrochrome production from 2005 to 2012. In 2012, South Africa was the world's largest chromite ore producer and exporter, accounting for 43.7% of total world output and 47.1% respectively; followed by Kazakhstan and India at 14.1% and 12.9%, respectively.

Table 2: World chromite 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	4.0	6	0	0	-
Brazil	17	0.2	7	677	3.5	7	115	2.7	6
Finland	120	1.6	4	571	3.0	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	

Table 3: World chromite ore reserves, Production and Exports: 2012

	RESERVES			PRODUCTION			EXPORTS		
COUNTRY	Mt	%	Rank	Kt	%	Rank	kt	%	Rank
South Africa	6 751	74.1	1	11 310	43.7	1	5 546	47.1	1
Kazakhstan	387	4.2	3	3 663	14.1	2	861	7.3	3
India	54	0.6	6	3 353	12.9	3	329	2.8	8
Turkey	220	2.4	4	2 378	9.2	4	2 183	18.5	2
Russia	-	-	-	660	2.5	5	0	0.0	12
Oman	-	-	-	591	2.3	6	538	4.6	4
Brazil	18	0.2	7	588	2.3	7	29	0.2	10
Pakistan	-	-	-	572	2.2	8	480	4.1	6
Finland	120	1.3	5	499	1.9	9	15	0.1	11
Zimbabwe	930	10.2	2	468	1.8	10	0	0.0	12
Australia	-	-	-	461	1.8	11	501	4.3	5
Iran	-	-	-	448	1.7	12	448	3.8	7
Albania	-	-	-	310	1.2	13	309	2.6	9
Other	626	6.9		602	2.3		536	4.6	
TOTAL 2012	9 106	100		25 903	100		11 775	100	
2011	9 106			25 071			11 473		

Source: Heinz H. Panser (2013)
International Chromium Development Association, 2013
Mineral Economics, 2013

From the tables, global chromite ore exports have more than doubled from 15% in 2005 to 47% in 2012, suggesting that the government has chosen to increase ore exports instead of beneficiating the ore further. In response to this, ferrochromium producers have appealed to the government to introduce chromite ore export tax or quotas. As can be seen in Figure 8 (add on pg 15), South Africa has much to gain from exporting ferrochrome relative to the chromite ore sales. The concern however, is that the growth trend in the export values of unbeneficiated chrome ore has been increasing more than that of ferrochromium.

e) Employment

According to available statistics from the Department of Mineral Resources, employment in the chrome mining and ferrochrome processing sectors grew by an average rate of 12% per annum. In nominal terms, employment grew from 5 026 in 2001 to 16 088 in 2011. This is largely due to the growth in export volumes and the entry of new players in the industry (IDC, 2012, p.21).

SECTION 7: IMPLICATIONS ON THE STAINLESS STEEL VALUE CHAIN

7.1 Introduction

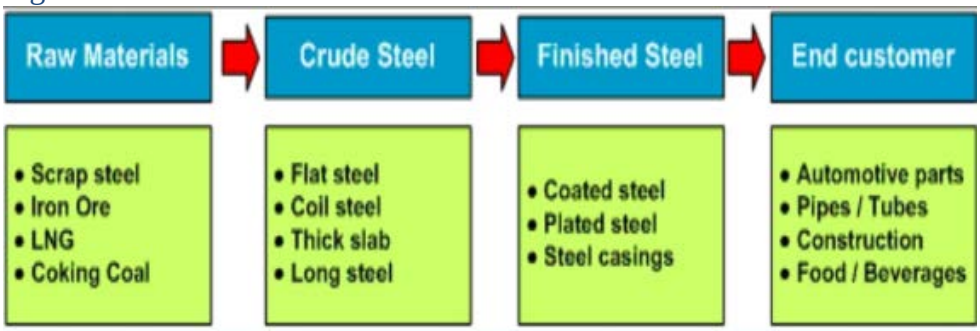
The above sections showed the significance of chromium to the metallurgical industry and how chromite ore is essential for the use in stainless steel production.

Stainless steel is basically a low-carbon steel, which contains a minimum of 10.5% chromium. The metal contains non-corrosive properties largely because of the addition of chromium and the addition of other elements, namely molybdenum, nickel and/or nitrogen. It is also vital to note that it is chromium and not nickel that contributes the greatest towards corrosion resistance in stainless steel and furthermore, it is chromium that is used in stainless steel irrespective of what grade or series of stainless steel is manufactured (Ideas1stResearch, 2010, p.12). Nickel increases strength, impact strength and toughness, while also improving resistance to oxidation and corrosion[16].

Stainless steel is considered a versatile commodity that takes on many applications throughout the economic value chain (see Figure 10 below), specifically in the consumer goods and construction sectors. Over the last decade, domestic consumption more than doubled. The biggest sectoral sector is the automotive industry (IDC, 2014). Stainless steel (that includes chromium) is used widely in various components of the exhaust system, particularly in catalytic converters (Ideas1stResearch, 2010, p.16). Other sectors that benefit from this metal include the cutlery and kitchenware (hollow-ware) industries; chemical, processing and oil & gas industries; power generation industry; food production and storage industry; architecture, building and construction; medical applications.

Whilst there are broad opportunities to utilise stainless steel, imports dominate the downstream industries. At present, no less than 75% of stainless steel consumer goods are imported.

Figure 10: Stainless steel value chain



Jourdan, 2014

7.2 The South African Stainless Steel Industry

Perhaps the single largest constraint acting against the domestic steel and stainless steel industry is the worldwide practice of import parity pricing (IPP). IPP is simply defined as "the price that a purchaser pays or can expect to pay for imported goods; which includes international transport costs and tariffs" (Wikipedia, UN World Food Program definition). Jourdan (1994, p.8) reveals two reasons for the existence of IPP in SA. Firstly, the absence of real competition drives IPP between upstream suppliers due to a relatively small domestic

[16] The Effect of Alloying Agents on Steel Properties. How do alloying agents benefit steel, Terrence Bell

market and high economies of scale for several intermediate feedstocks (e.g. steel and petrochemicals). The second reason is driven by the absence of rivalry between upstream suppliers.

Jourdan (1994) further makes the point that South Africa has no real regional rivalry within the Southern African Development Community (SADC) since the latter are devoid of any real level of industrial development for the production of intermediate mineral-based feedstocks.

Columbus Steel is the dominant producer of stainless steel. At least 90% of the ferrochromium production is consumed in the production of stainless steel. Ferrochrome only represents between ca. 3-4% of the value in finished 300 series stainless steel product, depending on the stainless scrap ratio (Xstrata, 2010, p.1). It is further noted that whilst both nickel and stainless scrap are major materials in the production of 300 series stainless steel, South Africa is still reliant on the import of these metals, making it further disadvantaged by the absence of end use stainless steel markets.

The austenitic 300 series dominate global stainless steel production, which contains around 8% nickel and 18% chromium. However, due to the high price of nickel, it constitutes around two-thirds or 60% of the raw material costs in making this alloy.

A further disadvantage of the Columbus Stainless Steel plant[17] is its inland location (Middleburg) resulting in high logistic costs for the export of its products as well as the import of inputs (i.e. nickel, ferronickel and stainless scrap) (Jourdan, 2013, p. 92). However, nickel is also a minimal cost driver in the low-Ni stainless steels (200 and 400 series) which have lower raw material costs than the 300 series. Thus, SA could have a comparative advantage in the production of low-nickel grades (200 series and 400 series) of stainless steel. These constitute over 40% of global consumption. Consideration should be made to build future plants producing these low-nickel grades closer to the coast (Jourdan, 2013, p. 89-90).

7.2.1 Stainless steel world production

According to IDC (2012, p.3) research, the global stainless steel industry consumes about 66% of the global ferrochrome production. China – the world's largest producer of stainless steel – produces 14.2 million tons.

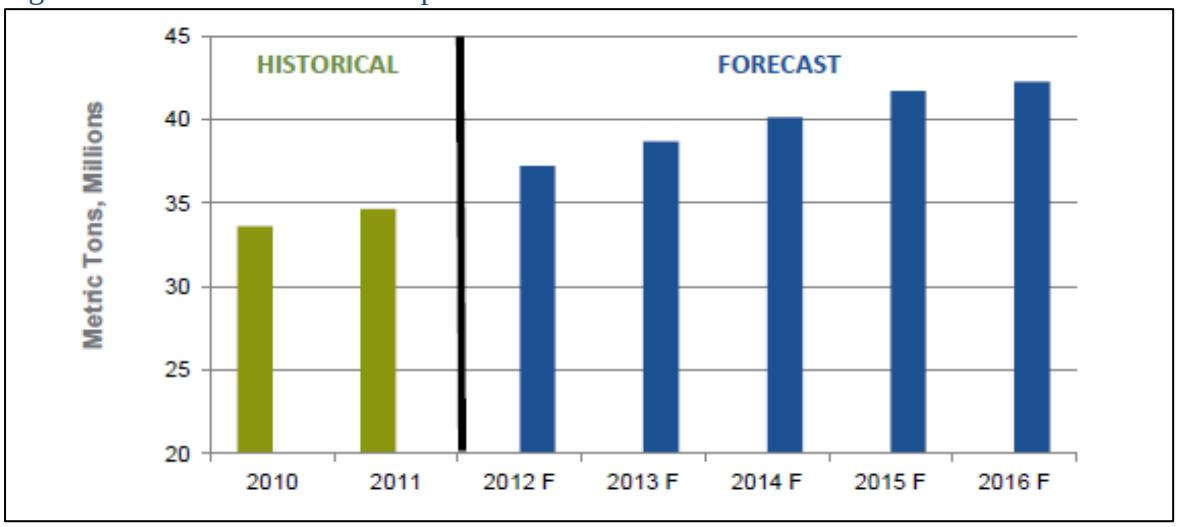
South Africa is a net exporter of stainless steel due to two main reasons:

1) Increasing global production that is expected to rise through to 2016 to 42.2 million tons from 33.6 million tons in 2010 (refer to Figure 11). This is primarily driven by rising incomes and booming construction in BRICS countries; and
2) Weak domestic demand. The 2008/2009 financial crisis drastically affected markets across the globe, especially the EU countries, Japan and the US[18]. Commodity prices collapsed and demand waned, affecting most construction industries. As a result, global demand for

[17] Columbus Stainless - South Africa's and Africa's only producer of stainless steel flat products
[18] Ideas 1st Research, Ferrochrome, March 2010.

stainless steel dropped significantly during the slowdown, and so did the market for ferrochromium

Figure 11: Global stainless steel production



Source: Ideas1st Research

7.2.2 China – a potential threat

As stated earlier, China is the biggest importer of the chromite ore firstly because it lacks this commodity and secondly because it requires this commodity for stainless steel production. The table below demonstrates how Chinese imports have increased since 2005 and how South Africa has been its biggest supporter.

COSATU spokesperson Patrick Craven (2014) agreed that South Africa had an opportunity to promote beneficiation if local cooperatives took over the manufacturing of the smallest components of high-value stainless steel goods (e.g. spoons, tools etc.) currently produced in China.

SECTION 8: CHALLENGES AND CONSTRAINTS TO UPSTREAM AND DOWNSTREAM BENEFICIATION

8.1 Power: The cost and availability of electricity

According to Steve Phiri, CEO of Merafe: *"No major ferrochromium expansion is expected in South Africa for the next three years mainly due to power shortage"* – ibid (n.d.).

Power is a critical component in the production and conversion of chromite ore into ferrochromium. Unfortunately, ferrochromium production is a costly process as it is energy-intensive by nature, consuming between 3,300 – 3,800kWh per ton of metal produced. It uses electric power that supplies the energy required to carry out the heating, melting and reduction reactions (Pan, 2013, p.106). The cost of electricity accounts for 35-40% of total production cost.

Today, South Africa faces serious energy constraints instigated primarily by power shortages and escalating tariffs. These constraints have serious negative consequences on both the domestic and global ferrochrome industries.

Since 2008, the cost of electricity has more than doubled and the National Energy Regulator South Africa (NERSA) together with Eskom have explicitly stated that electricity prices are expected to increase by an average of 16% for the next five years.

Plans to tackle ongoing power shortages from Eskom amidst high energy costs are underway. This is very important since South Africa supplies between 40% and 45% of the world's ferrochromium. With electricity prices expected to increase by 75% over the next decade before stabilising in 2020, ferrochromium producers are looking for alternatives that can use up less electricity (Ideas1stResearch, 2010, p.15).

The 2003 White Paper on Renewable Energy[19] (DME, 2003b) set a target of 10,000 GWh of final energy demand to be produced from renewable resources by 2010. The Energy Efficiency Strategy further set a target for national improvement in energy efficiency of 12% by 2015 (DME, 2005), yet there has been little has been done to implement these two mitigation strategies.

In response to the electricity shortage, Eskom is building two power stations, namely Medupi and Kusile. Medupi will comprise 6 units totalling at 4788 MW of installed capacity. The first unit was scheduled to go online in 2012 and the last one is scheduled for commissioning by 2015. Kusile will comprise 6 units totalling 4800 MW of installed capacity. According to Eskom, the first unit is scheduled for commissioning in 2014 and the last one is scheduled for 2018 (Ideas1stResearch, 2010, p.15).

According to the IDC (2012, p.23), retrofitting cogeneration plants (i.e. electricity that is generated from waste heat and/or from waste combustible gases) at ferrochrome smelters offers a good alternative to improve their energy efficiency and to reduce their environmental impact. Mining companies like International Ferro metals Limited (IFM), Hernic and ArcelorMittal SA have already installed cogeneration plants at their respective sites, and there are still many more of these facilities being developed in the country, with at least five in ferrochrome smelters.

The growing uptake of cogeneration plants is a good alternative of widening the energy mix, whilst at the same time, easing the current pressure on the electricity grid.

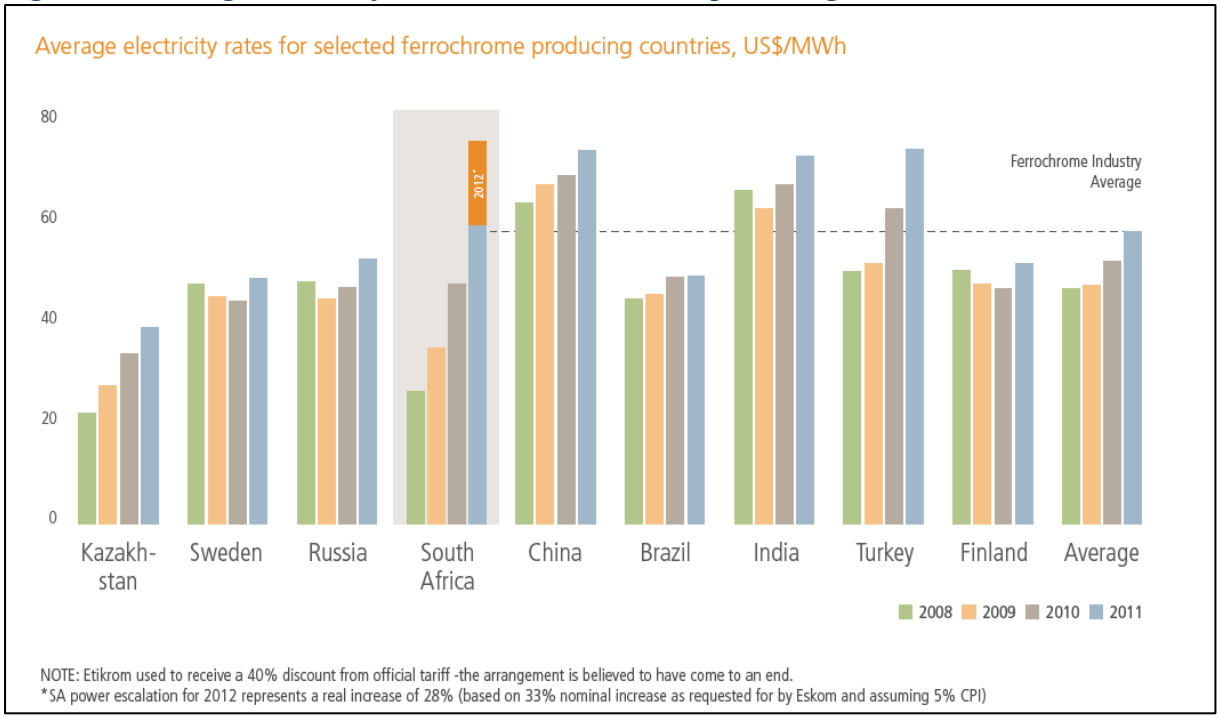
The DTI (2005, p.52) notes that the varying use of electricity and the price agreements across the value chain differ significantly. For example, Stages 2 and 3 are highly energy-intensive, yet it is Stages 1 and 2 that are said to be the main beneficiaries of electricity. Whilst the primary and secondary producers get their supply directly from Eskom at pre-negotiated rates, the downstream producers have to pay higher municipal rates. There is also no

[19] See DTI: IPAP 2014/2015-2016/2017 for more on Renewable Energy and government's plans around it as well as challenges regarding the future roll out, pp. 112

information available to indicate how much more downstream producers pay for electricity. The clear price disadvantage for downstream producers inhibits growth of the higher value added chromium sector.

Figure 12 below benchmarks electricity costs for ferrochromium producers globally, illustrating that South African electricity prices are already high in an already constrained power supply environment.

Figure 12: Average electricity rates for ferrochromium producing countries, US$/MWh



Source: CRU, Xstrata, 2010

8.2 Limited access to raw material for local beneficiation

This constraint ensues from the current structural agreement of the mining industry geared towards the export orientation of raw (primary) materials, with the majority of current producers locked in long-term contracts with their international clients. Uncompetitive pricing structures used by some of these raw material producers hamper beneficiation to the final stages of the value chain, such as is the case in the local steel industry (DMR, 2011, p.5).

8.3 Minerals Energy Complex (MEC) argument

South Africa's economic structure favours upstream concentration through investments in capital and energy-intensive upstream mineral exploitation and beneficiation (i.e. stage 1, 2 and 3 beneficiation), to the detriment of expanding downstream labour-intensive industries and increasing economic diversification (i.e. stage 4 beneficiation). This dilemma needs to be corrected should the country wants to grow its economy (IDC, 2014).

8.4 Anti-competitive pricing of inputs

The prevailing pricing mechanisms used by some raw and intermediate producers - most evident in the steel industry - hinder beneficiation of the chromium mineral value chain from being fully realised. The use of IPP (i.e. applying international prices on domestic raw and intermediate materials) renders the downstream value addition uncompetitive as the pricing mechanism does not consider proximity to production (IDC, 2014, p.21).

Since the local stainless steel industry only has one producer, Columbus Stainless, it may exert market power over the prices of inputs such as nickel and stainless scrap into downstream production as well as due to its locational disadvantage to the coast.

8.5 Infrastructure Bottlenecks

Infrastructure investment has been at the helm of public policy debate in SA since the discovery of most precious metals in the nineteenth century. Jimenez (1995, p.2774) made the point that economic infrastructure existed primarily to support economic activities. The government's renewed interest in infrastructure investment follows a long period of decline and stagnation (1976 – 2002) (Perkins, Fedderke &Luiz, 2005, p.212), which gave rise to numerous concerns in the private sector regarding unreliable and/or expensive infrastructure services.

South Africa faces a shortage of railways, highways, and carrying capacity transportation that are negatively affecting the current beneficiation initiatives, especially when transporting ferrochrome from smelting plants to ports (DMR, 2011).

Like Eskom, Transnet - the transportation parastatal - has been criticised for inefficiency. The Transnet Rail Freight recently announced that as much as R300 billion would be spent expanding the country's rail infrastructure and rolling stock. By addressing these bottlenecks, it is expected that this will unlock the country's growth potential and further develop linkages in other areas of the economy through the reduction of costs related to the production and exportation of beneficiated chrome.

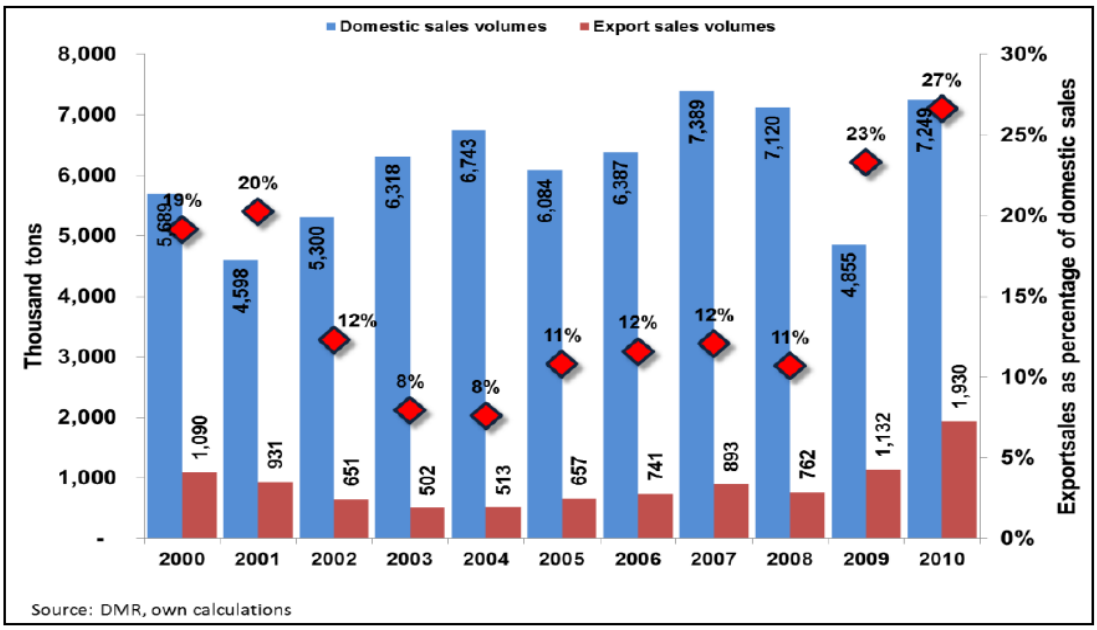
An important point addressed by April (2009, p.472) and Smith et al. (2008) is that infrastructure extends far beyond than just a physical frame. It also comprises the operating procedures, management practices, and developmental policies that facilitate the effective utilisation and development of the infrastructure in response to societal demand. South Africa still needs to get this right.

8.6 The threat of raw chrome exports

As emphasized throughout the paper, domestic ferrochrome producers are calling for government to halt the exportation of unbeneficiated chromite from the country, or impose high export taxes. The principle behind this action is that the exporting of chromite ore undermines the domestic beneficiation of chrome; consequently, putting the ferrochrome industry at risk. It is believed that not only will this lead to the loss of ferrochrome production capacity domestically, but it will lead to the de-industrustialisation of an already mature industry which has a lot of potential.

As per the IDC's research, these arguments are not without merit. Figure 13 shows that chrome ore export volumes have risen considerably since 2002, reaching 1.93 million tons in 2010. This alone represents 27% of domestic sales (IDC, 2012).

Figure 13: Export sales vs. domestic sales of chrome ore, 2000 to 2010



Source: IDC, 2012

8.7 High relative cost structures

The Industrial Development Corporation believes that South Africa's relative cost structures for labour-intensive production are higher than those of its competitor countries. These costs include labour costs (such as wages and salaries), energy costs, as well as transportation and logistics costs. High cost structures undermine the country's competitiveness and are further intensified by sustained currency appreciation and excessive volatility (IDC, 2014, p.21).

8.8 Mineral Rights (Resource rent tax to fund knowledge linkages)

There have been many reasons put forward for state participation in the mining sector, specifically the mineral energy complex in South Africa. Some of these reasons, according to the ANC SIMS (2012) report, include capturing a greater share of the rents (taxes, profits and dividends), regulating the private sector, building capacity in the public sector and addressing developmental goals outside, but directly linked to the mining sector (Ibid). These goals include investing in long-term knowledge and physical infrastructures; create labour-absorbing employment.

The government further understands that to do this requires greater policy coordination between the public and private sectors. The former needs to employ various (policy) instruments that will facilitate the development of the mineral sector in order to capture an equitable share of the rents generated, while the latter needs to be more transparent, supportive and forthcoming with respect to their participation (SIMS, 2012, p.28).

8.9 Skills & Research Development

Altman (2001) credits the real wealth of a country to the technical skills and knowledge of its people rather than in its natural resources. Jourdan (2014, p.2) concedes that knowledge linkages are prerequisites for developing the crucial backward and forward beneficiation linkages.

The Industrial Development Corporation (IDC, 2014) argues that the government needs to invest in and subsidise more academic and research and development (R&D) institutions. Such innovations require advanced technical skills that can be found in engineers and scientists (IDC, 2014). Presenting at the Parliamentary Colloquium on Beneficiation last year, the IDC identified that the strengthening research institutions, investing and investing in the material sciences and engineering and improve educational outcomes are pivotal to the country if it wants to ensure consistent breakthrough technology and innovative development programs that will create new products for beneficiation.

8.10 Access to international markets for beneficiated products

Earlier it was discussed that foreign markets (specifically developed countries) tend to impose higher tariffs for beneficiated goods and almost low or no tariffs for imported raw materials. This makes it challenging for developing economies to compete fairly with the rest of these advanced economies.

SECTION 9: CONFLICTING POLICIES, VIEWS AND ANALYSES FROM THE STAKEHOLDERS (MINING INDUSTRY, GOVERNMENT, LABOUR UNIONS AND INDEPENDENT CONSULTANTS)

9.1 The Mining sector (Represented by the Chamber of Mines)

According to the Chamber of Mines, mining companies have expressed various concerns in the treatment of the mining industry as a political tactic. Baxter (COM, 2012) contends that post 1994, political interference has negatively affected the South African mining industry and the supply of strategic minerals. Since then, mining has fallen from 16 percent of GDP in 1994 to about 6 percent, while countries like China and India, for example; continue to experience successful growth rates in their industrial sectors.

The new mining rights order, issued in 1994, gave economic power to only a few blacks, especially ANC elites. The move has gone in a complete opposite direction from what the Freedom Charter of 1955 envisaged for the whole of South Africa's citizens. Secondly, the DMR has made it difficult for mining companies to obtain mining licenses. Peter Leon - a mining expert - stated at a mining congress that regulatory issues played only a secondary role to geology when it came to the mining industry and that imposing and prioritising such issues was more harmful than good.

The impasse between the government and mining companies is exacerbating the pricing structure set by government on mining companies. According to Turok (2014), administrative costs, plus uncertainties of supply are heavily influencing the pricing. This explains why mining companies are able to charge international prices of mined raw materials to local

customers, inevitably raising their profit margins. This is negatively affecting activities in downstream manufacturing.

Although the COM claims to support beneficiation and seeks collaboration with other sectors of the economy, it insists on differentiating between 'mining beneficiation' and 'manufacturing beneficiation' (Turok, 2014, p.5). The COM believes that mining companies' primary objective is to focus on upstream activity; downstream beneficiation is but a secondary focus.

The first reason to justify this is that the COM already believes the sector is "struggling" (COM, 2009), citing a fall in the sector's real GDP figures since 1994, continuous labour unrest amidst high labour costs, loss-making in some deep level mines and uncertainty around the MPRDA. Secondly, the COM believes that South Africa is not yet at the point where it can compete globally with other countries at internationally determined prices; thirdly, the country is still operating at high (cash) costs as it lacks the required infrastructure and advanced machinery/technology to ensure consistent efficiency.

The COM asserts that mining and manufacturing are two separate businesses, and the responsibility lies primarily with the government to assist the manufacturing sector, not the mining industry.

9.2 The Government

9.2.1 The MPRDA

The African National Congress calls for the amendment of the MPRDA Act (2002) to maximise the developmental impacts. According to SIMS (2012), the objectives of the MPRDA do not currently include the maximisation of these impacts, mainly through job creation and the expansion of linkages to the rest of the economy. By revising these objectives, it is anticipated that the state would be permitted the right to impose the necessary conditions (i.e. backward, forward and knowledge and lateral linkage milestones every five years of the concession) on all prospecting or mining licenses.

The ANC also calls for the amendment of the MPRDA and regulations to make provision for "strategic minerals"[20] so that it would allow concessions or licenses to have *"sales/pricing and other conditionality; and for unexploited deposits, give first option for developing them (prospecting license) to the state (SMC[21])"* (SIMS, 2012, p.35).

9.2.2 Department of Mineral Resources (DMR)

The ensuing tensions between government and the mining industry are ongoing. In October 2002, the DMR adopted the Mining Charter (amended 2010) that was based on the provision of Section 100(2) of the MPRDA. The Charter called for the then minister of mineral resources Susan Shabangu to develop a broad-based socio-economic empowerment charter,

[20] PGMs – Platinum Group Metals (platinum, palladium, rhodium, ruthenium, iridium and osmium)
[21] State Minerals Company

which specified social responsible minimums, which the mining industry has to adhere to. In 2011, the DMR adopted the Beneficiation Strategy for Minerals.

Whilst it was challenging to secure a one-on-one interview with the Deputy Director-General of the DMR, Mosa Mabuza, the MPRDA Amendment Bill (Bill 15B, 2013) describes the government's determination to ensure that the mining industry adheres to the "mine-gate price." This is the price (excluding VAT and transportation costs) that will be charged to local beneficiators. The Amendment Act thus deliberately forces mining companies to levy competitive local prices to local customers, instead of the prevailing international prices.

However, the DMR seems to have abandoned "developmental" pricing in their earlier version of the MPRDA Bill. This comes on the back of the Bill's return to Parliament for reconsideration over what mining policy should be. Minister of Resources Ngoako Ramatlhodi said various industry participants were contesting the mine-gate price setting and he was examining the possibilities of testing some of the provisions and legalities of MPRDA Amendment Bill with the Constitutional Court to avoid negative repercussions later.[22]

The Amendment Bill also calls for the Minister of Mineral Resources to regulate the mining industry with the objective of prioritising the country's development concerns; to promote and secure the supply of minerals for beneficiation purposes; amongst others.

Opponents against the Bill argue that it seeks to impose price controls and that it overlooks important obstacles crucial for ensuring successful and sustainable beneficiation, namely the power shortages, insufficient skills formation, infrastructural backlogs and high labour and input costs. The Bill is said to empower the Minister to introduce export controls on whichever minerals are considered "strategic". This contradicts the view of the NDP that warns that these actions could render the mining operations unviable and financially constrained, thus leading to mine closures and significant job losses. A further argument is that the Bill further imposes restrictions on future investments by mining companies since the minerals they may seek to mine may be subject to state controls[23].

9.2.3 Department of Trade and Industry (DTI)

The DTI has always been in support of beneficiation, specifically the further industrialisation of the country. One of its publications, the Industrial Policy Action Plan (IPAP) in 2013/14 – 2015/16 emphasized mineral beneficiation and argued for greater downstream beneficiation as well as the deepening of upstream value chains (Turok, 2014).

Whilst the DTI has put in a lot of work in identifying strategic mineral value chains – including the iron ore/steel value chain - as well as in identifying industrial infrastructure constraints that the government needs to prioritise, it remains frustrated by the lack of intra-governmental coordination (especially with the DMR) and progress by the government and

[22] Mining Weekly- Opposition Calls on President to Back Minister on Developmental Pricing Issue, Martin Creamer, 16 February 2015

[23] Draft Minerals Bill will discourage investment in SA - South African Institute of Race Relations, 11 September 2013

the country's restrictive fiscal and monetary policies. To date, the financial obligations pledged by the government have not been forthcoming at the expected rate (Turok, 2014, p.8).

The DTI has also expressed dissatisfaction over major steel, plastic and polymer producers who charge international prices to local manufacturers. At Parliament's recent colloquium on beneficiation held late 2014, Trade and Industry Minister Rob Davies argued that since mineral resources were a depleting asset, the government together with private companies, will offer these resources at discount prices to ensure competitiveness in downstream industries. Minister Davies also called for scrap metal to be made available at discount prices to local users and he argued that some steel products that are currently being imported could be manufactured locally.

Although he acknowledged that moving the country towards a fully-fledged beneficiating economy has its challenges, he added that *"if we fail to decisively pursue beneficiation, we will relegate the SA economy to a place at the bottom end of the globalisation of labour, with serious consequences for our ability to generate income and employment*" (SAGNA, 2014).

He further conceded that "*we do not have the luxury of debating whether to beneficiate our mineral wealth. We must harness the collective industrial capabilities of SA firms to map how to beneficiate and what enabling policies or support measures are required to ensure this happens successfully and for the benefit of all South Africans"* (SAGNA, 2014).

9.3 Industrial Development Corporation (IDC)

The IDC fully supports the concept of mineral beneficiation.

IDC Research Head Jorge Maia confirmed this belief in an interview with Engineering News[24], stating that *"the demand has been typically for South African commodities or relatively unbeneficiated products, which is not the kind of export basket that we would like to be reliant on going forward."*

Nevertheless, it is of the view that government together with the private sector should collaborate in terms of prioritising which value chains the country should fully develop as not everything can be manufactured.

The IDC (2014) believes that the chromium mineral value chain is an important value chain that should be pursued and fully supported given the fact that the country already has the comparative advantage in chromite ore reserves and it boasts world-class technological capabilities to support beneficiation.

[24] Martin Creamer: Raw export rise flies in face of beneficiation calls, Engineering News, 08 December 2010

9.4 The Democratic Alliance (DA)

James Lorimer, the DA Shadow Minister of Mineral Resources, is of the view that the MPRDA Bill will "*severely damage the mining and energy industries in our country.*"[25]

The MPRDA is termed a "*crony enrichment bill*" by the DA. The party is of the view that the Bill and South Africa's current mining law do not provide adequate protection and certainty for mining companies and foreign investors. The uncertainty lies in the premise that the MPRDA Bill is a regulation and not legislation. This implies that it can easily be amended, be influenced by political interests (corruption) and often times, it is opaque, leaving investors in doubt about the safety of their long-term investments.

The DA is also of the view that the MPRDA gives government the *"power to nationalise at fire sale prices. In the words of the Bill: "'free carried interest' means a share in the net profits derived from the exercise of an exploration right or production right issued in terms of this Act as acquired by the State in terms of section 80(7) or section 84(6) as the case may be, despite the State not contributing to the capital expenditure"* (MPRDA Amendment Bill, 2013, p.4).

In addition to this, the DA believes that the government is artificially coercing the mining industry to subsidise the manufacturing industry by providing the latter with lower priced inputs.

SECTION 10: RECOMMENDATIONS

10.1 Price stabilisation

According to Xstrata (2012) South Africa needs to consider two important issues if it wants to maximise its resource endowment in chromite ore and enhance the beneficiation strategy. Firstly, it needs to create a competitive environment for beneficiation. This can be achieved by maximising the capacity utilisation of existing ferrochromium and then expand ferrochromium capacity. Secondly, the government needs to extend the life of the country's mineral reserves through good resource management. To do this, the government needs to ensure a sustained balance between supply and demand in the market in order to improve the stability of prices.

In an interview with Jourdan (2015), he recommended that the country's biggest ferrochromium producers – Samancor Chrome, Hernic Ferrochrome, International Ferro Metals (IFM), Asa Metals and Tata Steel consolidate and potentially set up a 'single channel export system' (similar to OPEC), in which they would actively manage ferrochromium production by setting up production targets. In doing this, the supply of and demand for ferrochromium would be administered accordingly in relation to the economic environment.

[25] MPRDA Bill: Crony Enrichment Bill will result in job losses, 2013, James Lorimer – Democratic Alliance Shadow Minister of Mineral Resources

10.2 Export ore tariffs

Ferrochromium producers have appealed to the government to implement an export tariff of approximately 100USD/tonne of chromite ore in order to encourage local beneficiation in line with the country's beneficiation strategy, especially in the face of a power crisis. This is believed to increase ferrochromium production and yield greater domestic economic benefits. However, Pan-African Capital CEO, Dr Iraj Abedian argues that the export tariff is an unsustainable solution to the crisis that would cause a *"short-term, knee-jerk reaction to specific developments in the market place"* (Business Day, 2012).

The export tariff constraints are stipulated in the World Trade Organisation (WTO) GATT export restrictions. The motivation against export tariffs is that they have the potential to suppress job creation and economic growth, especially in developing economies that are contending with severe (infra) structural problems – namely South Africa. Thus, whilst SA may not directly impose export tariffs on chromite ore, it can possibly regulate the production capacity of ferrochromium, and indirectly regulate the supply of chromite ore.

10.3 Technology Innovations in the Smelting of Chromite Ore

10.3.1 Smelting efficiency

Ferrochrome smelting is known to be energy-intensive and a costly process. The Premus process - Xstrata's CMI Premus technology in use at the Lion Ferrochrome plant in South Africa - has been found to be the lowest-cost and most energy-efficient ferrochrome smelting technology since it reduces electricity consumption by over 30% (Ugwuegbu, 2012).

Jourdan's (2014:41) recommendation to the power supply problem is for the government and Eskom to assess the efficacy of capital expenditure (capex) incentives, such as the old 37e (immediate tax write-offs)) and other instruments, in order to facilitate the migration of current technologies to more efficient configurations, including cogeneration.

10.3.2 Smelter energy imports

Government should facilitate the direct import of electricity by smelters from neighbouring countries. Not only is risk of supply is adequately managed, but the country will benefit from lower tariffs through underwriting "take or pay" contracts (Jourdan, 2014, p. 48).

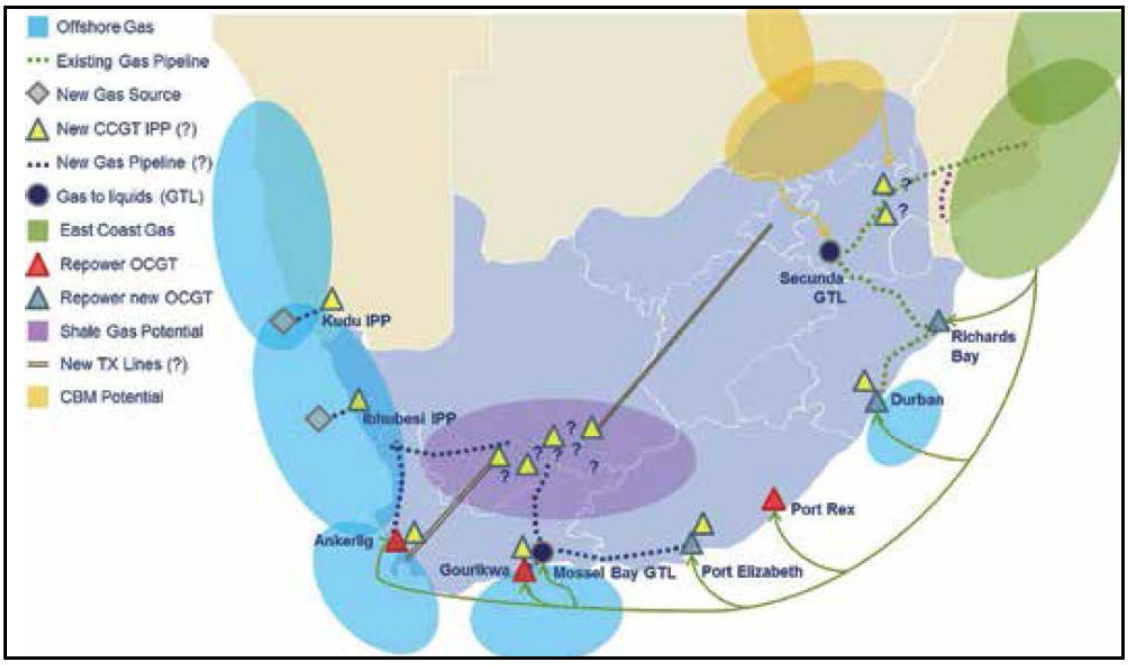
10.4 Substitutes for energy

10.4.1 Shale gas

The South African government hopes that shale gas will provide the country with a reliable alternative fuel to coal. A recent study undertaken by the U.S. Energy Information Administration (EIA, 2013) estimated that South Africa holds approximately 390 trillion cubic feet (Tcf) of technically recoverable shale gas resources, which needs to be significantly reduced for economically recoverable amounts (refer to Figure 14).

According to Jourdan (2014), shale gas has the potential to offer an alternative feedstock to compete with Sasol in the upstream.

Figure 14: SA Shale gas and renewable energy options



Source: PASA; AEY- Standard Bank

These shale gas resources are located in the Karoo basin in the Whitehill (211 Tcf), Prince Albert (96 Tcf), and Collingham (82 Tcf) formations. The Whitehill Shale's recovery rate and resource estimate were also reduced because of the geologic complexity, according to the EIA (2013) report.

However, it was noted that only 1 Tcf of natural gas is needed to fuel 1,000MW of Combined Cycle Gas Turbines (''CCGT'') for 25 years.

10.4.2 Natural Gas

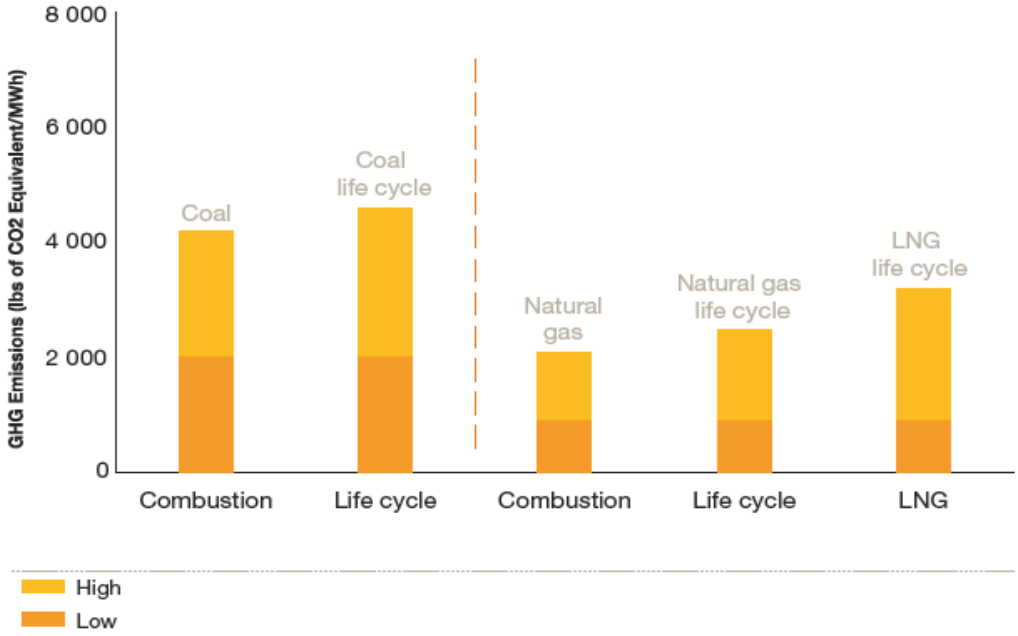
Natural gas makes up only 3% of the total primary energy mix in South Africa; however, the government has shown its support in growing the share of natural gas to around 10% over the next decade (Peters, 2010) largely because it burns more cleanly than any other fossil fuel, emitting 50-70% less carbon dioxide (CO_2) than coal in electricity generation. A modern gas-fired power plant is also 40% more efficient than a coal-fired plant[26].

The International Energy Agency (IEA) estimates that enough natural gas exists to meet global demand for the next 250 years at today's production rates (Shell n.d.). The Anadarko and Eni-led consortia recently discovered the Rovuma Basin in Mozambique, which contains gas of around 100 Tcf (Anadarko, 2012), while Eni recorded gas in place of 75 Tcf (ENI, 2013).

[26] Shell: Natural gas: building a cleaner energy future, https://www.shell.com/zaf/future-energy/natural-gas.html

As stated in a report by PWC (2012), natural gas is more preferred to coal as a substitute simply because of the efficiency in capital cost, construction lead times, fuel costs, total cost per kWh and energy diversification as shown in Figure 15 below. Natural gas is also the preferred fuel for combined cycle heat and power plants. In these plants the heat produced from generating electricity is used for industrial or domestic heating, raising overall efficiency (PWC, 2012).

Figure 15: Life cycle analysis: coal vs. natural gas



Source: Jaramillo et al, 2007; PWC, 2012

10.5 The Carbon Tax option

The electricity sector, the metals industry, and the transport sector produce the vast majority of South Africa's CO2 emissions (about 80%). The electricity sector's reliance on low-cost fossil fuels-based electricity generation is one of the main reasons for the carbon-intensive nature of our economy. These already high levels of GHG emissions were expected to increase as the economy grows.

Government is of the view that South Africa needs to reduce GHG emissions by 34% by 2020 and 42% by 2025 while working to ensure economic growth, increase employment, and reduce poverty and inequality (National Treasury, 2010).

It is suggested that taxes should be applied directly on the emissions of CO2; however, since this may be an administrative complex and impractical exercise, two options are proposed:

1. an upstream tax at the point where fuels enter the economy, according to their carbon content; or
2. a downstream tax on emitters at the point where fuels are combusted. The administrative costs and complexity of an upstream tax are significantly lower.

Jourdan (2014, p.40) argues that imposing carbon tax could have dire consequences on economic growth, exports and fiscal revenues. Rather than penalties, well-crafted incentives should be introduced.

10.6 Fiscal linkages

The state argues that under the current fiscal regime, South Africa is not getting an equitable share of the resource rents generated from the country's mineral resource. The SIMS (2012, p. 38) report makes the point that the mining industry (made up mostly of foreign ownership) benefitted significantly from the returns made by the country's natural resources. Jourdan (2014) recommends that a resource rent tax (RRT) of 50% must be imposed on all mining. This RRT will trigger only after a normal return on investments has been achieved, therefore not impacting on marginal or low grade deposits. This 'normal return' is the RRT threshold that should be defined as the Treasury Long Bond Rate plus 7% (currently estimated to be 15%). It is noted that a RRT of 50% would yield about R40 billion per annum at current prices. The SIMS (2012) Report further recommends that the RRT proceeds be kept in an offshore Sovereign Wealth Fund to improve the strengthening of the Rand during commodity booms.

Once a local value addition is achieved, the recommendation is that the RRT 50% rate be reduced in order to encourage miners to facilitate downstream beneficiation (Jourdan, 2014, p.33).

10.7 Stainless steel fabrication

Steel products are vital inputs into labour-intensive manufacturing processes. However, the industry is rigged with excessive anti-competitive pricing practices (IPP) that are severely constraining the growth of the manufacturing industries. The DMR (2011) calls for an increase of competition in the local steel industry as one of the interventions to curb this behaviour.

Jourdan (2014) recommends that the State facilitate the construction of a new stainless steel export plant through the reservation of ore resources, including chromite ore and iron, particularly for the low-Ni 200 and 400 series.

10.8 Chromium Mineral Value Chain

It is argued that chromium value addition can be increased through the establishment of a chromium value chain cluster in the metallurgical, chemical and refractory industries, and likewise establish a value chain cluster of miners, smelters, HRD, R&D institutions in order to develop chromium value-added projects and tackle the obstacles, bottlenecks and constraints felt by the entire value chain. The intended consequences of this type of value addition are expected to yield sustainable job creation (Jourdan, 2014, p.48).

Jourdan (2014) further recommends that developing local technology through RDI funding can strengthen the chromium value chain. This is intended to develop competitive solutions to technological challenges at all steps of the chromium mineral value chain as well as to develop new chromium-based products that play to the country's resource strength.

10.9 Addressing the Chromite ore export ban

The challenge currently is imposing a ban when South Africa has not adequately addressed the lingering power constraint. Independent subject expert Jourdan (2014) is of the view that government should only consider imposing a ban on chromite ore exports once power is adequately available, or else the country will lose out whatever revenue it can potentially attain from the sale of this unbeneficiated ore.

However, consideration needs to be applied in imposing export tariffs that many states widely use (e.g. China, Russia, Indonesia, Mexico, Venezuela, Mongolia, Canada and, historically, most OECD states) to encourage downstream beneficiation on the assumption that the raw mineral producer will be encouraged to transform the product into a higher value-added product.

SIMS (2012) and Jourdan (2014) propose that trade tariffs be treated as an industrial strategy instrument, rather than a fiscal revenue instrument and consequently should be administered by the DTI and not the Treasury.

In this regard, consideration should be given to the introduction of reasonable export tariffs on selected crude minerals or mineral-based feedstocks to facilitate the local beneficiation and concurrently renegotiate or terminate bilateral trade agreements that constrain the introduction of reasonable and judicious export tariffs on crude mineral commodities. However, the domestic power crisis still needs to be acknowledged and resolved urgently.

SECTION 11: REFLECTIONS

Is there merit in beneficiating the chromium mineral value chain? The paper sought to address this question by reflecting on the local mining industry against the political environment and the prevailing infrastructural constraints.

The answer to this question remains two-sided given the many structural challenges and constraints with which the country is contending. However, one thing remains clear and that is that South Africa has the potential to grow and develop its economy beyond the current levels.

By strengthening the country's social and political institutional framework, by taking stock of the structural challenges and constraints, and bringing alignment between government, business and labour, then the country stands a chance to work towards one ideological goal on beneficiating materials.

At current levels, the country cannot be said to be sufficiently competitive compared to a country such as China.

CONCLUSION

This paper has confirmed the claim that a resource abundant economy does not necessarily imply a wealthy economy. Similarly, the case was made that good growth performance in

resource abundant economies is achievable as long as a country is disciplined enough to strengthen its institutional and policy framework in order to increase socio-economic standards. Good governance is therefore a prerequisite to the promotion of growth and a reduction in poverty.

South Africa's comparative advantage in chromite ore will continue to yield less than satisfactory economic benefits unless maximum beneficiation of ferrochrome is encouraged. Supporting this strategy will reinforce the economic linkages across various sectors of the economy. Eventually the country will move beyond being just a resource extraction economy to a knowledge-based economy specializing in higher-value added activities. In order for this to happen, overall transformation is needed across all sectors of the economy – from business, government, financial, labour, research and development, and infrastructure expansion.

Although electricity has been highlighted as a key constraint to the chromium mineral value chain, it is not the only primary concern. In other words, even if the power issue was rectified, the challenges and constraints listed in the discussion are still critical factors which may limit the extent to which the chromium value chain is developed.

Furthermore, if the government's objective is to direct the country towards reindustrialisation, both minerals upstream and downstream beneficiation need to be prioritised so as to ensure that more value addition to chromite ore (or any mineral resource) takes place domestically before it is exported. Doing this ensures greater economic value, participation and employment creation.

The Minerals Energy Complex (MEC) needs to be transformed from its current form of driving profits and into a driver of growth and development through maximising all the MEC linkages (fiscal, backward, forward, knowledge and spatial). South Africa is not doing well on this basis, and more needs to be done through good governance (SIMS, 2012, p.55).

The lack of policy integration and coordination within government departments, the mining and manufacturing sectors and labour is a clear developmental challenge. Unless resolved, this will continue to impede the creation of mineral linkages across the economy and thus exacerbate unemployment and the income disparity between the rich and the poor.

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Appendix A: The NDP

NDP

The National Development Plan has very little on resource-based development and MVC opportunities, other than a recognition of the well-known negative impacts of a minerals endowment:

"Resource curse: Mineral-exporting economies tend to have difficulty diversifying their industrial base, and also experience slower than average growth and high inequality. An exchange rate linked to commodity prices, rather than the sophistication of a nation's exports, is a major challenge. In addition to volatility, the exchange rate can become overvalued in periods where commodity prices rise, putting a brake on non-commodity exports. Activities that are not traded benefit, such as retail, banking, telephony and housing construction. Difficulties arise when the boom is over and goods producers are left weakened. Some firms have adapted to this cycle by producing for local or export markets depending on domestic market conditions and the exchange rate. This enables survival, but is not conducive to long-term planning and expansion.

Higher commodity prices buffer the economy and create the appearance of growth, leading governments and companies to become complacent and under-invest in people and productivity growth."[1]

However, NDP does indirectly recognise MVC opportunities: "If these pitfalls are consciously avoided, and if the mineral endowments are used to facilitate long-term capabilities, these resources can serve as a springboard for a new wave of industrialisation and services for domestic use and exports."[1]

It also indirectly identifies skills and technology development as being key to MVC development through recognising that "Many economies that have achieved middle-income status, struggle to shift further upwards. However, many have experienced substantial, albeit relatively slow, growth over the past decade. The differentiator is how much the country invests in human capital, product development and technology."[1]

However, the NDP also explicitly acknowledges the opportunities inherent in backward linkages development:

'Substantially more attention will be devoted to stimulating backward linkages or supplier industries (such as capital equipment, chemicals, engineering services), especially as demand is certain, there is an opportunity for specialised product development, and the product complement is diverse. They are also more labour absorbing than typical downstream projects. Such products have the potential for servicing mining projects globally, an advantage should the commodity boom persist.' (NDP, 2011, p. 125).

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Appendix B: The Vision of the National Industrial Policy Framework (NIPF)

The NIPF holds the following vision for the domestic economy:

- To facilitate diversification beyond the country's reliance on traditional commodities and non-tradable services. This requires the promotion of increased value addition per capita characterised particularly by movement into tradable goods and services that compete in export markets as well as against imports
- To intensify South Africa's industrialisation process and move towards a knowledge-based economy
- To promote a more labour-absorbing industrialisation path to focus on tradable labour-absorbing goods and services and economic linkages that accelerate employment creation
- To promote a broader-based industrialisation path that supports and drives the inclusion of historically disadvantaged people and marginalised regions into the mainstream industrial economy
- To build the country's productive capabilities in order to contribute to the African continent

Source: Department: Trade and Industry, A National Industrial Policy Framework, pp. 2