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RESEARCH REPORT

The role of mineral beneficiation in the iron and steel industry: Exploiting the linkages in the iron and steel value chain for sustainable development

By: Tshegofatso Radinku

Student number: 752312

Protocol number: CECON/1092

Supervisor: Dr Paul Jourdan

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Abstract

The research aims to contribute to the existing debate on whether there is merits in South Africa using abundant mineral resources to industrialise. South Africa has abundant mineral resources and a comparative advantage in the supply and production of mining products such as gold, platinum, coal and iron ore. Despite the comparative advantage in mineral resources, South Africa is characterised by high unemployment rate and a declining manufacturing sector. The research argues that mineral wealth is a blessing and if well managed, mineral resources can spur industrialisation and employment creation. This can be achieved through appropriate policies and strategies that support downstream beneficiation.

The research focuses on downstream beneficiation in the iron and steel value chain. The iron and steel value chain is the most important value chain for industrialisation and job creation. The iron and steel products are the most important feedstocks or inputs into the manufacturing sector. The research finds that despite the economic benefits associated with downstream beneficiation, there is currently little value addition taking place in the iron and steel value chain. South Africa exports mainly un-beneficiated or semi-processed iron ore, thus limiting employment creating opportunities. Challenges and constrains to beneficiating the South African iron and steel include: limited access to raw material for local downstream beneficiation, infrastructure bottlenecks, high costs of doing business, shortage of skills and anti-competitive pricing by producers of raw materials and minerals.

Policy measures proposed in the research to overcome the challenges and constraints to downstream beneficiation include: better coordination between government departments responsible for industrial policy and mineral beneficiation, greater spending and investment in skill development, upgrading physical infrastructures, reducing the logistics costs and regulating the price of raw materials and minerals.

Declaration

I declare that this research report titled “The role of mineral beneficiation in the iron and steel industry: Exploiting the linkages in the iron and steel value chain for sustainable development” is my own work. All the sources I have used or quoted have been indicated or acknowledged by means of completed references. This research report has not, either in whole or in part, been submitted before for any degree or examination at this, or any other institution.

Tshegofatso Radinku: _____

Date: _____

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Kea leboga University of the Witwatersrand *le ka moso*.

List of acronyms

AMSA	ArcelorMittal South Africa
ANC	African National Congress
BPP	Beneficiation Promotion Programme
COM	Chamber of Mines of South Africa
DoE	Department of Energy
DMR	Department of Mineral Resources
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EDD	Economic Development Department
EU	European Union
GDP	Gross Domestic Products
GEAR	Growth Employment and Redistribution
GVCD	Global Value Chain Development
IDC	Industrial Development Corporation
IPAP	Industrial Policy Action Plan
IPP	Import Parity Pricing
Iscor	Iron and Steel Corporation
LPI	Logistics Performance Index
NES	New Structural Economics
NGP	New Growth Path
PIC	Public Investment Corporation
PRSA	Ports Regulator of South Africa
RBI	Resource based industrialisation
R&D	Research and Development
RDP	Reconstruction Development Program
RMB	Raw Material Basket
SADC	Southern African Development Community
SAISI	South African Iron and Steel Institute
SASSDA Association	Southern Africa Stainless Steel Development

SIMS	State Intervention in Mining Sector
SOEs	State Owned Enterprises
US	United States

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CHAPTER 1

MINERAL BENEFICIATION AND DOWNSTREAM LINKAGES IN THE IRON AND STEEL

1.1. Introduction

Mining activities have underpinned the South African economy since the discovery of natural resources, such as diamonds and gold in 1867 and 1886, respectively (Mohr and Fourie, 2004:84). The mining sector is a significant contributor to the country's employment, exports, Gross Domestic Products (GDP) and capital formation. The Chamber of Mines of South Africa (COM) estimates that the mining sector directly constitutes approximately 7.3% (R304 billion in value) of GDP and 18% of private fixed investment (COM, 2016). Furthermore, the mining sector employs 7.9% of all private sector labour and 6% of all people employed in South Africa (COM, 2016).[1] The report published by Department of Mineral Resources (DMR) finds that South Africa is "among resource-rich economies in the world, holding the largest reserves of strategic industrial resources such as chrome, vanadium, gold, manganese, and the platinum-group metals" (DMR, 2011:8).

South Africa's abundant mineral resources has enabled it to establish a comparative advantage in the supply and production of mining products such as platinum, coal and iron ore (Ashman, Fine and Newman, 2012). However, South Africa has not fully exploited its comparative advantage in mineral resources. Turok (2014) argues that "South Africa has failed to develop a matching manufacturing industry of significant scope and scale to produce more beneficiated products down the mineral value chain". South Africa has emerged as a major exporter of un-beneficiated mineral products and an importer of beneficiated manufactured products (Economic Commission for Africa, 2004). Moreover, unemployment rate in South Africa is high and increasing (in excess of 25% in terms of the narrow definition) whilst the manufacturing sector is declining. The Industrial Development Corporation (IDC) states that the manufacturing sector's contribution towards South Africa's GDP has declined considerably from 21% in 1994 to 12% in 2013 (IDC, 2014). Therefore, the need to transform the economy and develop the manufacturing sector has become more apparent to policymakers.

According to Jourdan (2016), part of the solution to South Africa's national priority of tackling high and rising unemployment rate may be for the country to focus on exploiting labour-

[1] The mining sector's contribution towards GDP, employment and private fixed investment has significantly declined since the recession and financial crisis of 2008.

intensive niches within the mineral processing value chain. The comparative advantage in mineral resources provide South Africa with a unique opportunity to diversify production away from basic natural resource activities to downstream beneficiation activities linked with value addition manufacturing. Comparative studies from countries such as Finland and Sweden indicate that mineral beneficiation is a state-led policy initiative that can grow the economy and address unemployment challenges. Moreover, Jourdan (2012a) and Walker (2004) find that industrialisation in these countries was driven by the ability of the state to beneficiate or add value to abundant natural resources.

The DMR (2011:4) defines beneficiation as "the transformation of a mineral (or a combination of minerals) to a higher value product which can either be consumed locally or exported". The South African government adopted the New Growth Path (NGP) policy framework in 2010. NGP is built around the Industrial Policy Action Plan (IPAP). NGP and IPAP identify mineral beneficiation as a vital strategy to help build South Africa's industrial base and value-added manufacturing. Furthermore, NGP and IPAP identify beneficiation along the mineral value chain as one of the main job drivers. The main objective in the NGP is to create five million new jobs by the year 2020 and mineral beneficiation is recognised as one of the job drivers to achieve this objective. In 2011, the DMR published a report titled "A Beneficiation Strategy for the Mineral Industry of South Africa" that identifies five strategic mineral value chains for beneficiation. These strategic mineral value chains include, pigment and titanium metal, uranium and thorium, coal, iron and steel. Beneficiation along these strategic mineral value chains is expected to optimise the country's developmental trajectory, especially industrialisation and job creation.

Jourdan (2017) identifies the iron and steel value chain as the most important value chain for industrialisation and job creation in Africa. According to Jourdan (2017), the iron and steel products are the most important feedstocks or inputs into the manufacturing sector. The research focusses on mineral beneficiation in the iron and steel value chain. The aim is to critically assess the role of mineral beneficiation in the iron and steel value chain. The research also identifies ways in which the downstream linkages in the iron and steel value chain can be exploited to support the country's developmental objectives. Linkages can be upstream and downstream process but the research focuses on downstream linkages since it is concerned with how natural resources can be utilised to support the manufacturing sector. Accordingly, beneficiation in the research entails the interface between mining and manufacturing whereby the production activities include mineral extraction and value addition stages to minerals through various manufacturing processes.

The iron and steel value chain is identified as a critical contributor to the economic development path of South Africa. The country's comparative advantage in iron ore resources enables it to establish resource processing industries (beneficiation through steel) that could then provide the feedstocks for manufacturing and industrialisation (Jourdan, 2014). Iron ore is the main input in the production of steel. Steel produced from iron ore mineral also provides feedstocks (key intermediate inputs) for manufacturing thus linking the mineral and the manufacturing sector.

The role of mineral beneficiation in the iron and steel sector is to ensure that country's abundant minerals are utilised in a manner that supports downstream manufacturing. Mineral beneficiation and its linkages can assist manufacturers to become cost effective and competitive. Mr Saul Levin argues that beneficiation is much broader than supplying abundant minerals to the local downstream industry at a cheaper or developmental price. Mr Saul Levin states that "the price of minerals is an important factor in beneficiating…however, you also need industrialisation effort to create jobs. This implies that in addition to mineral prices, you need to get other inputs or services right. These include: financing, skills, technology, infrastructure and electricity in order to beneficiate" (Interview: Saul Levin, 2018).

exploiting linkages in the iron and steel to support downstream manufacturing activities depends on numerous factors including, *inter alia*: pricing strategy of iron ore and steel producers for the local market i.e. access to feedstock at a competitive price; availability of the required quantity and quality of iron ore and steel for the local market i.e. supply patterns in terms of the local versus export market; proximity to suppliers of feedstock; efficiencies of State Owned Enterprises (SOEs) – lower logistics and electricity cost; skill development and product innovation. Regarding pricing, downstream beneficiation implies that steel manufacturers should obtain the required quantity of iron ore at a developmental price. In turn, steel producers should also sell to downstream manufacturers the required quantity of steel at a developmental competitive price. In other words, beneficiating along the iron and steel value chain include suppliers of iron ore (and ultimately steel producers), providing critical inputs and feedstocks for the local market at competitive, cost-plus prices, rather than seeking rents (Jourdan, 2014).

The research finds that despite the economic benefits associated with downstream beneficiation, there is currently little value addition taking place in the iron and steel value chain. South Africa largely exports un-beneficiated or semi-processed iron ore, thus limiting employment creating opportunities. Challenges and constrains to beneficiating the South African iron and steel include: limited access to raw material for local beneficiation, infrastructure bottlenecks, high costs of doing business, shortage of skills, technology and

innovation and anti-competitive pricing or the use of Import Parity Pricing (IPP) by producers of raw materials.

The mining industry is export-orientated. The mining companies prioritise the interest of their international clients at the expense of the local South African industries. The use of IPP (applying international prices on domestic raw and intermediate materials) renders the downstream value addition uncompetitive. The pricing mechanism of IPP does not consider proximity to production (IDC, 2014). IPP negatively affects the affordability of raw and intermediate inputs as it obligates local value adding industries to pay a premium for the products that are locally produced. IPP is not strictly cost-related and forces local industries to pay the same price for the products as if they were importing. The price of the raw and intermediate inputs for the local industries will include artificially assumed costs, such as harbour charges, imports duties, freight and insurance.

The research also provides recommendations to overcome the challenges and constraint to downstream beneficiation. Key policy measures proposed in this research include: better coordination between government departments responsible for industrial policy and mineral beneficiation, greater spending and investment in skills, education (R&D) and physical infrastructures and regulating the private sector.

1.2. Aims and objectives

The aim of this research is to critically assess the role of the mineral beneficiation in the steel industry. The study focusses on the role of mineral beneficiation because having mineral resource in abundance does not automatically translate into beneficiation or the development of the manufacturing sector. Rather, to fully exploit the abundant mineral resources for growth and employment creation requires dedicated government intervention to identify strategic minerals for beneficiation and address possible constraints impeding successful beneficiation.

Beneficiating along the iron and steel value chain is important for industrialisation and job creation. However, the iron and steel value chain is characterised by low and limited levels of beneficiation. Jourdan (2012b) argues that the mineral beneficiation strategy has a key role to play in assisting the steel industry to become competitive and supportive of manufacturing since iron ore is one of the main inputs (or cost drivers) in steel production. Thus, it is important to critically assess the appropriate role of the mineral beneficiation in the context of the iron and steel value chain.

The research also aims to identify ways in which the downstream linkages in the iron and steel value chain can be exploited. The downstream linkages provide South African industries with

the opportunity to be competitive in the downstream value addition stages. Importantly, these downstream linkages allow a country to acquire a competitive position further down the value chain towards the production and exports of finished products. The research also aims to identify factors impeding the exploitation of these linkages and provide possible solutions or recommendations to policy makers on how these challenges can be overcome.

1.3. Research question

This research has two broad questions namely:

- What is the role of mineral beneficiation in the iron and steel industry?
- How can the downstream linkages in the iron and steel value chain be exploited for sustainable development of the economy?

In answering these broad research questions, this study seeks to analyse how well and to what extent the iron and steel 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 iron 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, create employment opportunities, expand the local skills and knowledge base, achieve domestic and global competitiveness through the expansion of economic linkages.

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

- What are the economic benefits and criticisms (adverse effects) of mineral beneficiation?
- What is South Africa's policy position on beneficiation?
- How can South Africa translate its comparative advantage in iron ore into a competitive advantage along the iron and steel value chain?
- To what extent can mineral beneficiation along the iron and steel value chain allow South Africa to industrialise and create jobs?
- What are the key challenges and constraints impeding the successful beneficiation along iron and steel mineral value chain and exploitation of downstream linkages?
- What sort of interventions and policies are required to realise a successful iron ore beneficiation strategy?

1.4. Problem statement

The research intends to explain the role that mineral beneficiation can play in the development of the South African economy and how challenges to beneficiation can be overcome. As indicated above, South Africa, a natural resource rich country, struggles to leverage off its comparative advantage in minerals to achieve maximum benefits from beneficiation. The iron and steel mineral value chain is one such case in point that upholds this argument. For instance, the country's comparative advantage in iron ore resources provides it with a unique opportunity to establish resource processing industries (beneficiation via steel) that could in turn provides key inputs for manufacturing and industrialisation (Jourdan, 2014).

Despite the potential economic benefits associated with beneficiation, there is currently little value addition taking place in the iron and steel value especially along the employment intensive industries of the value chain. The research aims to identify ways in which South Africa can leverage off its comparative advantage in minerals. Constraints that impedes beneficiation will be unpacked. At the same time, ways to overcome these challenges and constraints will be presented in the research.

1.5. Significance of the study

This research aims to contribute to the existing debate on whether there is merits in South Africa using its mineral endowment to industrialise. Currently, there is divergent views from stakeholders on mineral beneficiation. Moreover, there is limited literature on mineral beneficiation in South Africa since most studies focus on the success stories of countries like Sweden and Finland with limited focus on South Africa or African countries with mineral endowment.

The research does not only focuses on mineral beneficiation broadly but rather it is sector or industry specific in that it identifies and focuses on mineral beneficiation in a sector or industry that has the potential to create jobs and grow the economy. Therefore, the study will also contribute to the limited literature that exist on mineral beneficiation along the iron ore and steel industries. In 2011, the government identified five strategic mineral value chains that are critical for the development of the South African economy. The iron and steel value chain is one of the identified strategic minerals. Despite this, very limited literature exist on beneficiation along the iron and steel value chain and potential economic benefits that can be realised by beneficiating along this value chain. Therefore, the research aim to contribute to this body of literature by considering the views of various stakeholders in the iron and steel value chain as well as the economic argument for and against beneficiation in the iron and steel sector.

1.6. Research outline

Chapter 1 presents a brief background on mineral beneficiation and linkages in the iron and steel. Chapter 2 discusses literature review on mineral wealth. It discusses competing theories that support and rebut mineral wealth and beneficiation. Chapter 3 presents the research methods used to gather data. Chapter 4 assesses different viewpoints on whether South Africa should beneficiate. Chapter 5 discusses whether there is merits in beneficiating along the iron and steel value chain. Chapter 6 examines the challenges and constrains to beneficiating the South African iron and steel value chain. Chapter 7 and 8 provide conclusion and recommendations to overcome the challenges and constraint to downstream beneficiation.

CHAPTER 2

LITERATURE REVIEW: RESOURCE (MINERAL) WEALTH AND BENEFICIATION

There are competing theories in development literature on the potential for mineral wealth to contribute to the government's macroeconomic policy objectives, namely: economic growth (in this instance through industrialisation) and employment creation. Mineral wealth is considered a 'double-edged sword' to mineral rich countries since it can either be a blessing or curse to the economy.

The possession of mineral resource is generally believed to aid development. ECA (2004) and Heeks (1998) find that exports of mineral resources in developing countries provide the government with much-needed foreign exchange that is used to purchase imported capital goods. Moreover, profits from mineral resource generate revenue for the fiscus since they are taxed. In turn, the revenue allows the government to create a vibrant environment for business activities by investing in rail, road, ports, power generation, pipelines, technology and other infrastructure related activities (Jourdan, 2012a).

However, studies have shown that mineral wealth can be perceived to be a 'curse' and present developmental problems to mineral-rich economies often referred to as 'Dutch Disease' and 'Resource Curse' (ECA, 2001; Gylfason, 2001 and Wright, 2001). Advocates of Resource Curse theory argue that booming mineral sector has adverse effects on manufacturing. Booming mineral sector is associated with the loss in manufacturing sector competitiveness with the end result being economic stagnation. The literature review will present various debates concerning mineral wealth and beneficiation. The literature review will be structured as follows:

- Economic arguments that support mineral wealth and beneficiation;
- Economic arguments that rebut mineral wealth and beneficiation; and
- Comparative studies on mineral wealth and beneficiation.

Beneficiation is directly linked to theories of mineral wealth. Beneficiation is premised on the use of the country's abundant mineral resources to increase domestic production and create employment through various mineral value addition stages. The theory of downstream beneficiation perceives mineral wealth as critical to industrialisation and employment creation.

2.1. Economic arguments supporting mineral wealth and beneficiation

This section presents arguments that support mineral wealth and beneficiation. These arguments view mineral resource endowment as a blessing to the economy, if well-managed. The section provides an assessment on how mineral resources can be utilised to contribute meaningfully to the government's developmental objectives.

2.1.1. New structural economics

According to Newman and Takala-Greenish (2014), New Structural Economics (NSE) defines industrial structure through factor endowments. The theory builds on the notions of comparative advantage, defined by static factor endowments, by allowing for factor endowments to change over time through upgrading from more labour and resource-intensive endowment structure to one characterised by abundant capital.

NSE encourages the government in developing counties to facilitate the development of industries according to the country's comparative advantage. NSE advocates for targeted government support of specific industries 'picking winners' in line with the country's comparative advantages (Gelb, 2012). The NEC theory postulates that natural resource-rich countries should focus on developing labour intensive non-resource sectors that are linked to abundant strategic minerals. NSE offers a different strategy for managing natural resource wealth. In resource abundant countries, "NSE recommends that an appropriate share of revenues from commodities be used to invest in human capital, infrastructure, social capital, and compensation for first movers in new non- resource sectors so as to facilitate the structural transformation" (Lin 2012).

Lin (2015) urges the government in natural resource-rich countries to use a significant portion of revenue generated from natural resources to finance industrial projects that facilitate economic development and structural change. According to Lin (2015) the government should use revenue from natural resource to finance projects that "stimulate the development of new manufacturing industries, diversify the economy, provide jobs, and offer the potential of continuous upgrading". Lin also discourages the idea of keeping natural resource revenues in sovereign funds and investing in foreign equity markets. In a resource rich-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 and developing its labour-intensive manufacturing industries (Bhengu, 2015). Newman and Takala-Greenish (2014) argue that the NSE creates the space for industrialisation strategies to occur through, amongst others, Global Value Chain Development, Vertical Specialisation and Resource-led Industrialisation.

2.1.2. Resourced-based industrialisation

Resource-Based Industrialisation (RBI) refers to the promotion of higher value added products, associated with natural resources. According to Jourdan (2008), RBI stresses the need for mining to be integrated into the rest of the economy through the development of important mineral linkage sectors. RBI also emphasises the importance of downstream linkages in the mineral value chain. RBI argues that downstream linkages in the mineral value chain can be exploited to support downstream manufacturing activities. For instance, iron ore and coal are critical inputs in steel and polymers products. Steel and polymers products are used as inputs in various manufacturing industries. Therefore, RBI encourages the following:

- Beneficiation of strategic minerals to occur locally.
- Unabated access of strategic minerals by local industries.
- Competitive pricing for strategic minerals.
- Proximity to strategic mineral for value adding manufacturers.

State Intervention in the Minerals Sector (SIMS) report prepared by the African National Congress (ANC) encourages RBI and emphasises the importance of utilising the comparative advantage in mineral resources to support and grow the manufacturing sector (ANC, 2012). The growing manufacturing sector is expected to grow the economy and generate employment. Kaldor (1966) recognises the manufacturing sector as the engine of economic growth. According to the DTI (2013) the “manufacturing sector has substantial direct employment-creation potential and is the engine of rising per capita income and employment through its stimulation of the rest of the economy”. Tregenna (2008) identifies manufacturing as a significant driver of innovation and productivity growth.

2.1.3. Global value chain development

African Economic Outlook (2014) defines Global Value Chain Development (GVCD) as the “full range of activities that firms undertake to bring a product or a service from its conception to its end use by final consumers”. The most important aspect regarding this definition is that at each step or stage in the chain, certain form of value addition process accrues. Each step or stage of value addition in the chain presents: unique opportunities for new local activities and industries, increased business profits and employment creation, new skill sets and technology and innovation.

GVCD has emerged as a strategy for industrial development since it promotes activities and chains linked to abundant natural resource. Gereffi and Fernandez-Stark, (2011) state that the activities in GVCD include goods and services from conception, development and design,

manufacture or production, sales and marketing, distribution through various channels and networks and support or aftersales service to the end-consumer. By successfully integrating various activities into a value chain, a country is allowed to seize a bigger share of those benefits and accelerate its industrialisation process (African Economic Outlook, 2014).

2.2. Economic arguments against mineral wealth and beneficiation

This section presents arguments that against mineral wealth. These arguments view mineral resource endowment as a 'curse' to the economy that is negatively correlated to growth and development. The section provides an assessment on how mineral resources adversely affect economic growth, lead to misallocation of resources and corruption.

2.2.1. Natural resource-curse theory

Morris *et al.* (2011) argue that resource endowed countries fail to fully exploit the economic benefits of industrial development due to the 'Resource Curse' and the 'Dutch Disease'. Resource-rich countries suffer a 'curse' as a result of the significant inflow of revenue generated from the extraction and sales of natural resource. According to natural resource theory, resource-rich countries exporting minerals are doomed to fail and stagnation in the long run. Stevens (2015) points out to the experience of the Netherlands in the 1970s, after the discovery of the Groningen gas field. This discovery had adverse effects on the economy of Netherlands. After the discovery of gas field, the economy of Netherland started to depend heavily on gas field activities and its associated export revenue. At the same time, non-natural resource sectors, such as manufacturing started to decline and diminish. The Netherlands experience suggests that abundant mineral resources result in the loss of the local manufacturing industry and de-industrialisation.

The Resource Curse theory argues that resource-rich countries, produce lower economic growth rates than non-mineral-rich countries (Auty, 2001). Stevens (2015) notes that Resource Curse theory is based on the premise that several resource-rich countries appear to have fared worse in terms of economic progress and poverty reduction than countries without such apparent resource benefits. Sachs and Warner (1995 & 1997) investigated the relationship between natural resource-based exports and economic growth for the period 1970 to 1990. Their results found an inverse or negative relationship between natural resource resource-based exports[2] and economic growth rates. Based on their empirical evidence, Sachs and Warner concluded in both the 1995 and 1997 studies that "the resource-abundant

[2] The natural resource-based exports included: agriculture, minerals, and fuels

countries have stagnated in economic growth since the early 1970s, inspiring the term curse of natural resources. Empirical studies have shown that this curse is a reasonably solid fact".

2.2.2. Increased role of government and its 'failure in the market'

Scholars writing on Resource Curse indicate that in most legal jurisdictions, minerals are the property of the government or communities and this inevitably results in government intervention in the mining sector. According to Ascher (1999) and Auty (1998) the Resource Curse can be explained mainly by assessing the role of the government in the mining sector and the economy. Mikesell (1997) investigated the performance of Venezuela's economy during the export boom of the 1970s and 1980s and found that it was the involvement of the government and its intervention in the mining sector that caused the challenges in the economy rather than direct distortions from the export booms in mineral resources.

Auty (1993) suggests that economic and political factors (increased government role) have influenced the disappointing growth outcomes of resource abundant economies and made it impossible for RBI to succeed. Resource-rich countries cannot industrialise or develop their manufacturing sector due to government failures being worse than market failures. Advocates of Resource Curse argue that increased role of government results in increased corruption, rent-seeking and misallocation of resources:

a) **Corruption and rent-seeking:** mineral wealth is linked with political patronage in the distribution of economic rents. Stevens (2015) finds that rent-seeking and corruption is more prevalent in resource-rich countries (especially developing countries) with weak state capacity and independent institutions tasked with eliminating corruption. Government intervention in the market economy may create distortions that lead to income and wealth transfer to private individuals and interest groups in the form of rent-seeking. The concept of economic rent is usually defined as that part of the reward accruing to the resource owners over and above the payment that the resource would receive in any alternative employment – in a way similar to monopoly profit in that individuals or groups extract more than what they deserve to the detriment of the society. Corruption refers to the looting of taxpayers' money and states assets (including natural resources) by the executives of the state or individuals with direct link or ties to the state. Government becomes corrupt because of the potential individual benefits derived from mineral resource wealth by the government officials. As a result, the assets (including the resources) move away from the promotion of the greater good and end up benefiting few government elite and firms involved in mineral extraction.

b) **Misallocation of resource:** according to Gelb (1986) large revenues generated from mineral resource exports or taxation, appear to change the way in which governments and their officials behave, causing damage to the developmental prospects of the country. Government intervention leads to market failure and misallocation of critical resources required for the economic growth and development of the economy. The argument is that in most jurisdictions, the government owns the minerals resources underneath the soil. Therefore, by implication the government has an increasing direct role in the management of minerals resources. A study by Oxfam America titled "Extractive Sectors and the Poor" (cited by Ross, 2001) state that "resource rich countries tend to suffer from unusually high rates of corruption; authoritarian government; government ineffectiveness; military spending [and] civil war".

2.3. Comparative studies on mineral wealth and beneficiation

Luciani (2011) states that several resource-rich countries have learned how to utilise resource wealth to generate economic growth and employment whilst managing price volatility associated with mineral resources. Wright and Czelusta (2002) argue that the notion that mineral wealth harm growth is misleading since some of the mineral curse evidence is based on selection bias of regression's cross-country analysis. Wright and Czelusta (2002) further suggest that the United States (US) is an example of a resource-rich country that avoided the 'curse'. Resource abundance was a significant factor in shaping the US path to becoming a world leader in manufacturing. According to Wright and Czelusta (2004), between 1890 and 1910 the US was the world's leading mineral economy and utilised its mineral resources to become the world leader in manufacturing, during the same period.

Jourdan (2010 & 2016) argues that countries, such as Australia, Finland, New Zealand and Canada used their natural resources to industrialise and growth the economy. RBI in these countries eventually engendered related industries. Walker (2000) states that these countries' resource sectors evolved from poor technologies, low skilled and low-cost labour into sectors characterised by knowledge intensive, highly-skilled and export-orientated activities. This diversification of the economy, encourages the development of key industrial and service sectors directly linked to the resources base. Therefore, it ensures the continuation and economic progress of the country long after resources have been depleted (Vuori and Yla-Anttila, 1992).

2.4. Conclusion

Mineral wealth can either be a blessing or curse to the economy. It is apparent that if well-managed, mineral resources can spur industrialisation and employment creation. This can be

achieved through appropriate policies and strategies that supports downstream beneficiation. It is also evident that resource-based economies have performed poorly not because of abundant minerals but rather, their inability to develop mineral value adding industries. The government and individuals (linked with the government) have also failed the resource-rich countries. They have engaged in rent seeking and corrupt activities whilst failing to finance or establish non-resource based industries.

CHAPTER 3

RESEARCH METHODS

The research uses qualitative techniques as a methodology. The research relied on a combination of primary and secondary data. The research utilised semi-structured interviews to collect primary data. Semi-structured interviews are better placed for answering questions that have implications on the economic policy and South Africa's development trajectory.

3.1. Primary data sources

The research considered the sources of knowledge or information appropriate to answer the specific research questions. From the research questions, it is apparent that various stakeholders have to be interviewed. This include stakeholders at different levels of the iron and steel value chain with knowledge of the following:

- The iron ore and steel industry.
- Mineral beneficiation and its importance.
- Challenges to beneficiation.
- Appropriate policies for beneficiation.

Four interviews were conducted with various individuals listed in table 1. These stakeholders shared their personal experience and knowledge of mineral beneficiation along the iron and steel value chain.

Table 1: Sources of primary data or information for research methodology

Interviewee name	Area of expertise or focus	Relevance to the research
Mr Dean Subramanian	Chief Financial Officer at AMSA and Member of the Steel Committee established under ITA Act. Area of expertise include: Understanding of the key cost drivers in steel, iron ore value addition into steel, price of iron ore (pricing methodology), steel pricing methodology, ways in which steel manufactures can support the manufacturing sector. Ways in which the comparative advantage in iron ore can assist/benefit steel industry. The challenges in the steel industry and how government can intervene or support the steel industry.	Steel producer: Steel manufacturers form a key component in the iron and steel value chain. They link mining and manufacturing sectors. AMSA is part of the Steel Committee that is tasked with ensuring that the steel sector remain efficient and competitive. AMSA is also affected by government policy or strategy decisions in the iron and steel sector.

Processor Ben Turok	Expert in mineral beneficiation and policy making. Area of expertise include: Mineral beneficiation: the role of mineral beneficiation, linkages in the mineral beneficiation and how they can be exploited, economic benefits and criticism of mineral beneficiation, challenges and constraint to beneficiation, translating the comparative advantage in minerals into manufacturing, how can mineral beneficiation allow SA to industrialise.	Processor Ben Turok has written extensively on mineral beneficiation and advised the South African policy makers on the merits and critics of beneficiation. The interview helped to understand various aspects of mineral beneficiation from policy perspective such as its role, economic rationale, economic linkages, challenges and constraints, recommendations to policy makers.
Mr Saul Levin	Executive Director at Trade & Industrial Policy Strategies (TIPS) a research Institution. Also worked as a Chief Director at ADD. Area of expertise: Mineral beneficiation: the role of mineral beneficiation, linkages in the mineral beneficiation and how they can be exploited, impact of imports on iron and steel and development. Challenges and constraint to beneficiation and industrialisation. Policy measures or recommendation for government to implement if wants to industrialise and beneficiate minerals.	TIPS**:** has conducted research on the iron and steel industry and the potential employment the industry can generate. It has also conducted research on how the pricing of Iron ore and steel impact on downstream manufacturing. Moreover Mr Saul Levin background of working for the EDD is crucial in understanding beneficiation from government perspective and how state institutions are aligned or co-ordinated in achieving policy objectives.
Mr Gerrit Kruyswijk	Industry champion at IDC with extensive knowledge of the South African downstream and manufacturing industries. He was also part of the steel task team that included members of DTI, EDD and beneficiation experts. Area of expertise: History and formation of industries such as steel from state owned to privatisation. Key costs drivers in steel and how iron ore fits into the steel industry. The financial implications of financing capital intensive industries such as steel and manufacturing. How the government can intervene and assist industries such as steel and downstream steel users. Challenges in the local and global steel sector and how they can be addressed.	IDC: Is a financial institution known for supporting various industries such as steel and manufacturing. It is important to establish the kind of support they can offer steel and manufacturing in the process of beneficiation. Moreover, Mr Gerrit Kruyswijk involvement in the steel task team is also crucial as the team analysed the steel value chain and how state can support the industry and downstream firms that are involved in the process of beneficiation.

The above interviewees were able to answer key questions on the following themes:

- The role of mineral beneficiation: its importance and place in the economic policy landscape.
- Mineral beneficiation in the context of iron and steel: the best possible ways to fully beneficiate the iron and steel.
- Challenges to beneficiation and interventions required.

3.2. Secondary data sources

The research also relied on secondary data collected from various reports, published academic journals, published statistics and public and industry association pages, internet pages of government agencies. The published integrated annual and financial reports for Kumba Iron Ore and ArcelorMittal South Africa (AMSA) were also useful. These reports assisted in understanding the business environment, activities, models and strategies of iron ore and steel companies in South Africa. The DTI reports and presentations of the steel task team and committee were also crucial in understanding the government's role and perspective on mineral beneficiation.

3.3. Data limitations

The main challenge to collecting primary data was the unavailability of other stakeholders involved in the iron and steel value chain. The interview requests and proposals were distributed amongst a large pool of potential respondents or interviewees. However, the interviews with numerous respondents were unsuccessful due to, *inter alia*, interviewee's work commitments. The main limitation or shortcoming to the interviews was that it was impossible to schedule interviews with the DMR, DTI and iron ore mines (although attempts were made to contact all). Concerning the collection of secondary data, the only limitation is that the data available for AMSA and its steel production activities is limited to the year December 2015 while for Kumba Iron Ore the data is limited to the end on the year 2016.

3.4. South African mineral beneficiation strategy

Mineral beneficiation is not a standalone policy framework but rather a component of the industrial policy forming part of the IPAP. In 2011 the South African government officially adopted the mineral beneficiation as a strategy. The strategy identified the iron ore mineral as a strategic mineral for downstream beneficiation. According to the strategy, the EDD and DTI must coordinate and form, amongst others, the steel task team to ensure that iron ore mineral is used for beneficiation to support the iron and steel industry. The research intends to use the experiences, challenges and lessons learned by the EDD and DTI steel task team since 2011

in implementing measures to beneficiate the iron and steel industry. These lessons and experiences will assist the research to formulate ideas around the role of mineral beneficiation in the iron and steel and how best can the linkages in the iron and steel value chain be exploited.

CHAPTER 4

A CASE FOR MINERAL BENEFICIATION IN SOUTH AFRICA

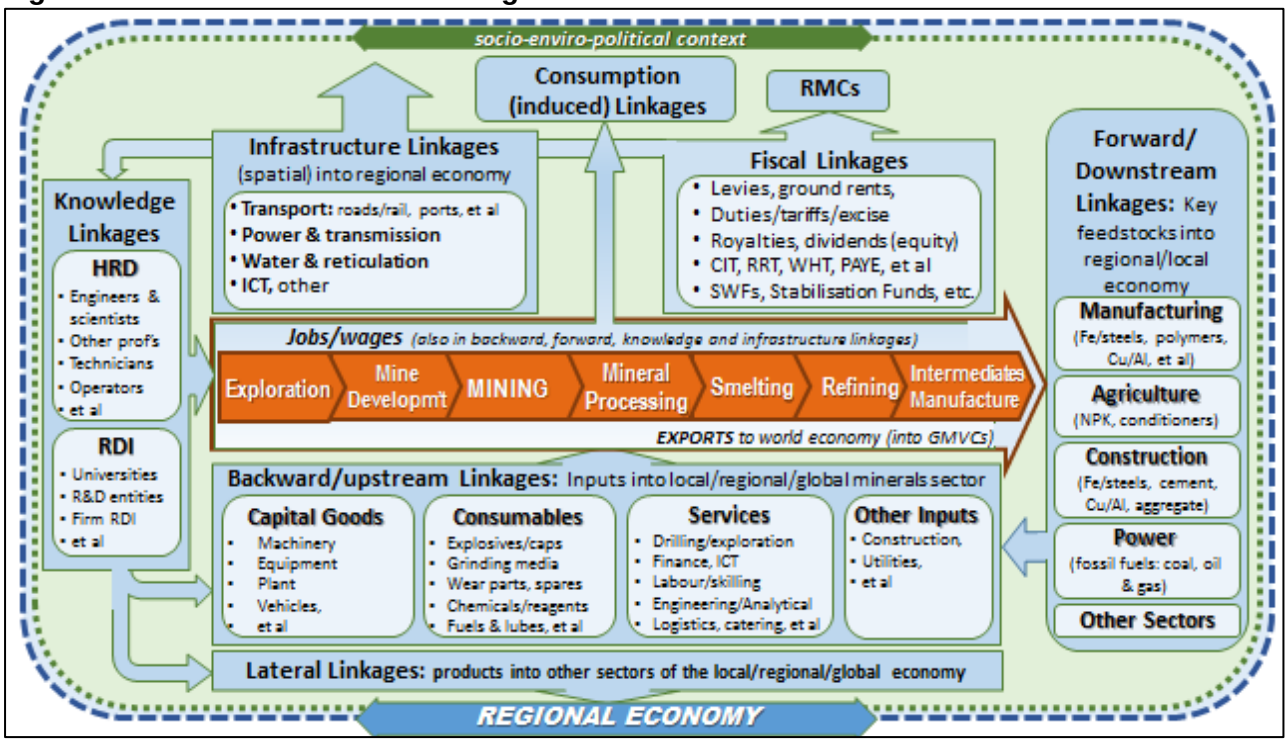
There are debates in South Africa from various stakeholders on whether the country should use its mineral endowment to spur industrialisation (through downstream beneficiation). This section provides different viewpoints on whether South Africa should beneficiate. The section is divided into four sub-sections namely: definition of key concepts on beneficiation; economic benefits and rationale for mineral beneficiation; critique of mineral beneficiation; and South Africa's policy position on mineral beneficiation.

4.1. Definition of key concepts in mineral beneficiation

The DMR (2011:4) defines beneficiation "as the transformation of a mineral (or a combination of minerals) to a higher value product which can either be consumed locally or exported". The broader definition of beneficiation is the sum of local value addition (excluding all imported inputs) and it encompasses five mineral linkages, namely:

- Backward linkages into capital goods, services and consumables.
- Forward linkages into manufacturing, logistics etc.
- Spatial linkages (infrastructure).
- Fiscal linkages (redeployment and resource rent capture).
- Knowledge linkages (R&D, HRD, skills formation etc.)

Figure 1: Mineral beneficiation linkages



Source: Jourdan (2017:27) - developing a regional mining vision for the Southern African Development Community (SADC)

Beneficiation is divided into four stages with the commodity gaining value as it moves from one stage to the next. According to the IPAP 2014/2015 these stages are:

- First stage: the primary stage that involves the mining and extraction of raw ore (minerals not beneficiated).
- Second stage: the production of intermediate products. Cleaning, washing and polishing of raw ore. This stage is capital and energy intensive (involves limited beneficiation).
- Third stage: the transformation stage where inputs, such as skills and technology are critical. Intermediate goods are transformed into a refined and semi-fabricated product for use by small and sophisticated businesses. Employment levels and degree of value-added are generally high at this stage.
- Last stage: this stage is labour-intensive, representing the maximum possible value addition. It transforms the processed metal further into a large variety of finished products. Finished products at this stage can be used by end-users in various sectors of the economy such as construction and infrastructure, machinery, plant and equipment.

Each stage of value addition has inputs of capital goods, consumables, services and RDI (except for the merchants), which offer a potential backward linkages market and opportunities for the RMC concerned. Similarly, each step requires capital (Capex & Opex) and financial services, as well as logistics and marketing (except from crude steel to casting/rolling/forming/coating: usually the same plant). To fully beneficiate, each stage must reduce the consumption of imported inputs such as capital goods: machinery, equipment, vehicle and plant. If each stage of beneficiation is utilising imported machinery and equipment, it reduces the extent of beneficiation or value addition using local capabilities or content. Each stage must exploit upstream linkages by using local capital goods, consumables and other services. This implies that beneficiating fully, requires a country to develop, over a period of time, local competencies and skills to manufacture and supply the local market with capital goods, consumable and services required at each stage of beneficiation.

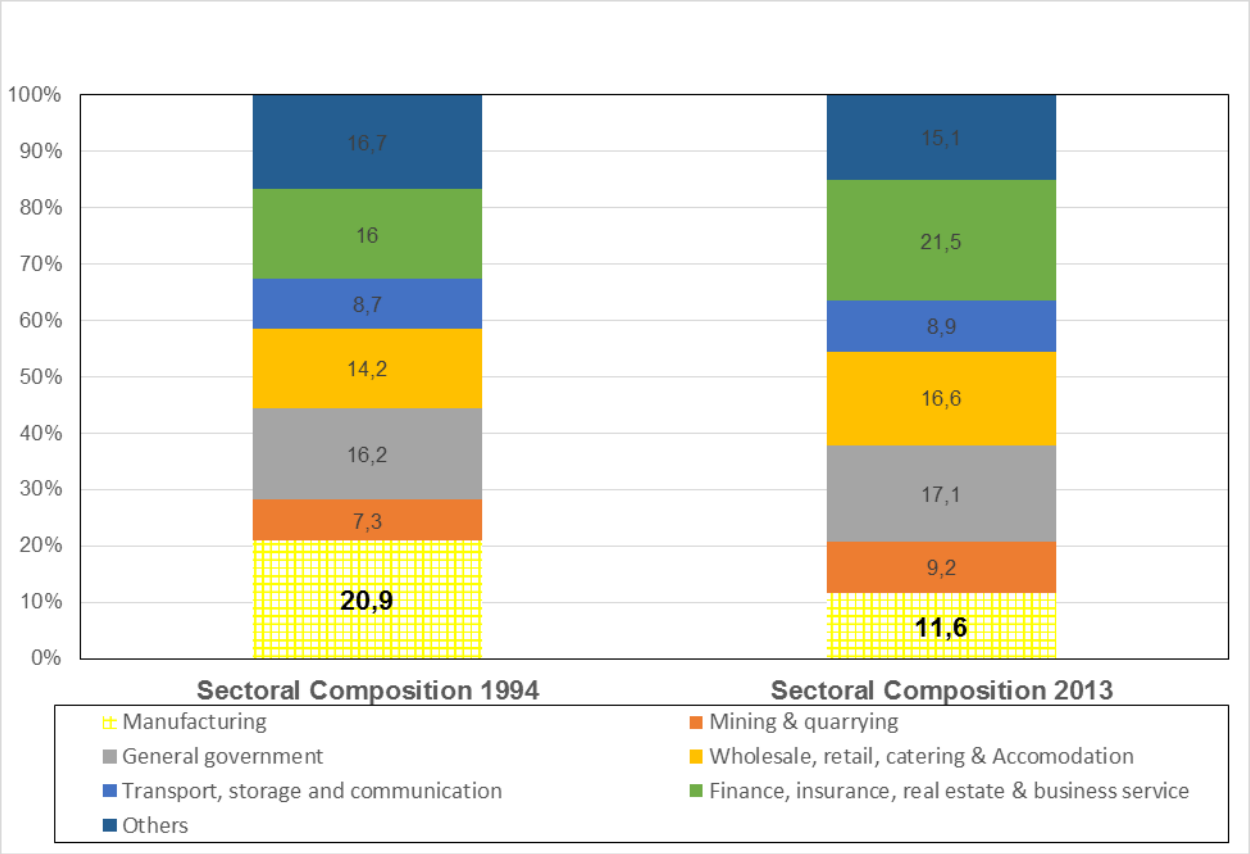
The DTI (2014) identifies two approaches to beneficiation namely the supply-side and demand-side. In the supply-side approach, the first step is to determine the national mineral endowment and then develop strategies for their beneficiation around abundant minerals in the country. In contrast, the demand-side approach identifies critical mineral inputs into the economy needed for job creation, thereafter strategies are developed for the cost-effective supply of those mineral feedstocks into critical industries such as manufacturing. The research utilised the demand-side approach and identified the iron and steel sector as critical for the economy, particularly, job creation.

4.2. Economic benefits and rationale for mineral beneficiation

4.2.1. South Africa's developmental challenges

South African faces developmental challenges of high unemployment rate and sluggish economic growth. Unemployment rates in South Africa are high (25% on a narrow definition). Moreover, manufacturing is declining its share of contribution towards GDP becoming insignificant. The performance of the manufacturing sector is a concern given that it plays a critical and indispensable role in innovation, employment and productivity growth (Tregenna, 2008). Moreover, unemployment is a main determinants of poverty and can be used as a measure of economic development (Morgan 2013). A high and rising unemployment rate is associated with an increasing poverty rate.

Figure 2: Sectoral composition of the South African economy in 1994 and 2013



*Source: IDC (2014) *Note - figure shows IDC calculations of the sector share according to GDP at base price (current prices)*

According to IDC (2014) the manufacturing sector's contribution to South Africa's GDP declined sharply from 21% in 1994 to 12% by 2013. Challenges facing the manufacturing sector include:

- Access to key inputs at a competitive price.
- Access to market.
- Access finance.
- High logistics costs.

Therefore, policy programmes (e.g. industrial policy) that aim to support the manufacturing sector are critical to South Africa's economy.

4.2.2. Is mineral beneficiation the answer to South Africa's developmental challenges?

Beneficiation can play a significant role in assisting the government to tackle the challenges of declining manufacturing sector and raising unemployment rate. However, mineral beneficiation alone is not the solution to South Africa's developmental challenges. Turok (2013

& 2014) and Jourdan (2010 & 2012)[3] advocate for RBI which is the promotion of higher value-added products associated with natural resources. Turok and Jourdan maintain that mining companies should support beneficiation availing strategic mineral resources to the local market at a cheaper developmental price. Professor Ben Turok maintains that the benefits of beneficiation are immense. According to Professor Ben Turok when a country beneficiates and add value to any commodity there is "skill training and development, job creation and some innovation involved" (Interview: professor Turok, 2018).

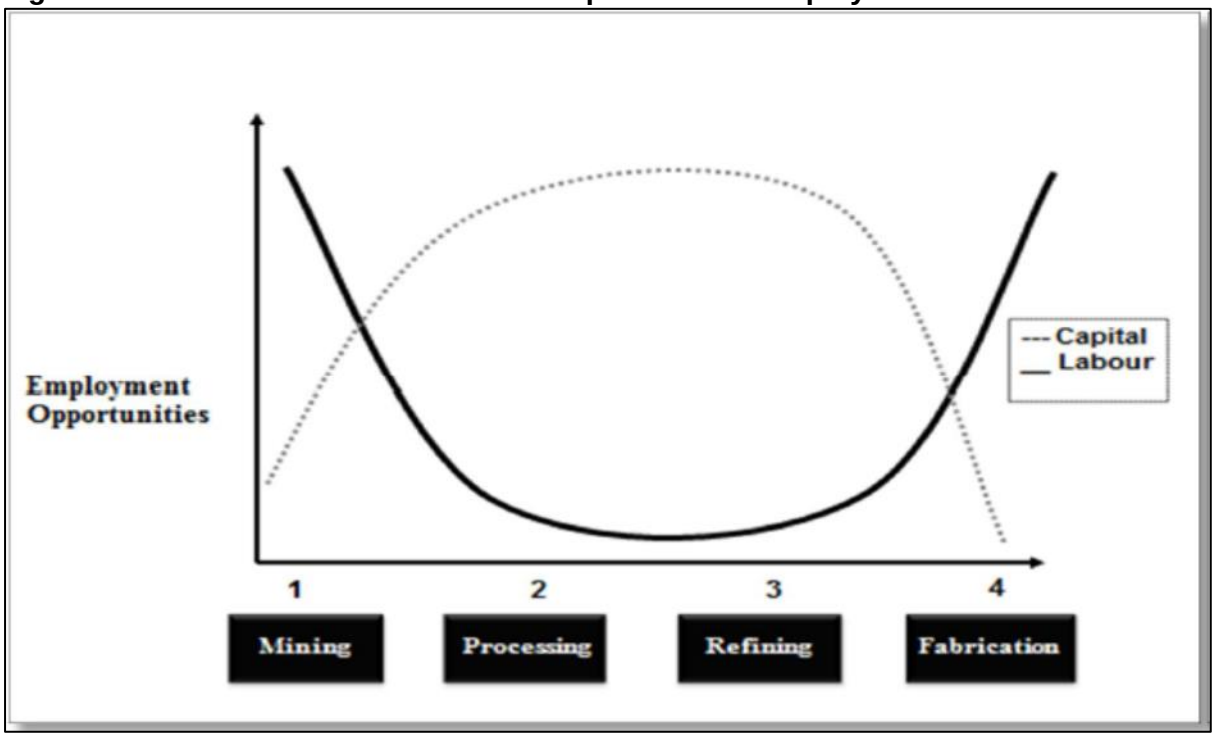
Jourdan (2014) relies on the experience of international countries such as Finland and Sweden to identify three positive economic effects of RBI strategy:

- Acceleration of economic growth and development of manufacturing.
- Less-reliance on exporting of raw and refined mineral products. The prices of these raw minerals are cyclical and volatile in nature and ultimately exposes the country to external shocks.
- Creation of jobs through manufacturing and skill development. South Africa is constrained by high rates of unemployment and low skill levels. RBI strategy aims to address these challenges.

In essence, beneficiation ensures that strategic mineral resources are used to support the government's macroeconomic policy objectives of economic growth (via industrialisation) and employment. Baartjes (2011) illustrates that the potential for employment creation is far greater at the downstream end of the metals beneficiation pipeline. Baarjes illustration emphasises the importance of focusing on downstream beneficiation which is less-capital intensive but labour-intensive.

[3] These authors are experts in the field of mineral economics

Figure 3: The Mineral value chain and the potential for employment creation



Source: Baartjes (2011)

Robinson and Van Below (1990) find that the final stage of the mineral value chain is labour-intensive. Advocates of mineral beneficiation argues that for the government to create employment, it should introduce initiatives and incentives that supports value addition activities at the last stage of the mineral value chain.

4.3. Critique of mineral beneficiation

Kumba Iron Ore, a major mining company, argues that the rationale for mineral beneficiation policy should be carefully assessed given that the price and supply of mineral products such as iron ore are determined by the global market forces (Kumba Iron Ore, 2011). Kumba Iron Ore further argues that iron ore contribution to the costs of manufactured end products is insignificant and typically contribute less than 1% of the final product. This implies that mineral beneficiation is an inappropriate policy option for South Africa and will not assist in establishing any competitive advantage in manufacturing. Kumba Iron Ore (2011) also states that the prices of mineral resources (determined at the global level) are not a constraint to beneficiation in South Africa. Key constraints to downstream beneficiation are identified as shortage of power supply, high logistics costs (rail and ports), access to the international market and inefficiencies of manufacturers.

Walsh (2013) finds that South Africa is geographically distant from major end-user markets and shipping routes. This results in higher transportation costs which ultimately affects

manufacturers' ability to compete in the international market. Therefore, critics of mineral beneficiation argue that the focus should be on reducing the costs of manufacturing (e.g. transportation or logistics costs) and skills development. According to Rossouw and Baxter (2011) mining and manufacturing poses distinct competencies and skills that the former does not comprise. Therefore, manufacturing beneficiation should not be driven by the availability of mineral resource raw materials, but rather be determined by competitive advantage factors such as cost of production, skills and craftsmanship.

Dobreva and Schoer (2007) assert that beneficiation and state-led interventionist policies lead to market failure and imperfections. Haussmann, in association with Rodrik and Sabel (2007: 17) conclude that mineral beneficiation is not a sensible programme. The revenue and benefits that accrue from mining activities should be exploited in different ways beyond simplistic value addition or downstream manufacturing.

4.4. Review of South Africa's policy position on mineral beneficiation

The part examines the role of mineral beneficiation policy and South African policy evolution concerning mineral beneficiation.

4.4.1. What is the role of mineral beneficiation in the iron and steel?

Policy documents such as the NGP and IPAP identify mineral beneficiation as a vital strategy to assist South Africa to build its industrial base and value-added manufacturing. IPAP (2014/2015 and 2016/17) states that "SA faces the challenge of diversifying away from mining and resource extraction towards a manufacturing, value-adding and job-creating economy. Minerals downstream beneficiation and minerals upstream (inputs) have been identified as a key 'pillar' of SA's reindustrialisation push".

Professor Ben Turok states that the role of mineral beneficiation in the iron and steel is to ensure that the costs of establishing value addition downstream industries that rely on steel products are minimised. This will allow industries to be competitive locally and internationally. Beneficiation is a state-led initiative with private sector participation and it is the responsibility of the state to create a vibrant environment for these industries to flourish in the market (Interview: Professor Turok, 2018 and Interview: Levin, 2018). However, Mr Saul Levin warns that not all the minerals in South Africa can be beneficiated. The government should identify strategic minerals to be beneficiated as part of the industrial policy programme (Interview: Mr Levin, 2018).

Mineral beneficiation's role in the iron and steel sector is to also ensure that the country's abundant iron ore minerals are utilised in a manner that supports downstream manufacturing. In case of the steel industry, mineral beneficiation refers to the iron ore being made available

to the steel industry at the cost-plus price (developmental price) and the steel industry passing down the costs advantages by charging customers of steel in downstream industries cheaper steel prices (Interview: Professor Ben Turok, 2018). Mr Saul Levin argues that the role of beneficiation is much broader than supplying abundant minerals to the local downstream industry at a cheaper or developmental price. Mr Saul Levin states that "the price of mineral is a key factor in beneficiating…you also need industrialisation effort to create jobs. This implies that over and above mineral prices you need to get other inputs or services right. This include: financing, skills, technology, infrastructure and electricity in order to beneficiate" (Interview: Saul Levin, 2018).

Mr Saul Levin's (2018) articulation of mineral beneficiation is consistent with IPAP five (2013/14 to 2015/16) which highlights the need for the government to undertake the following steps to beneficiate:

- Research in innovation and technology: this is to be performed through the cooperation between the DMR and the Department of Science and Technology (DST).
- Different ways of lowering energy costs for energy-intensive industries.
- Research on Transnet's National Ports Authority and Transnet Rail and how they can lower their tariffs to facilitate beneficiation of final products.

It is apparent from policy documents, particularly, IPAP that the role of mineral beneficiation in the iron and steel include using various state levers to lower input costs and allow for the beneficiation or value addition of iron ore minerals along the four stages of beneficiation (from iron ore extraction, steel production to final product). The government has identified the iron ore minerals as strategic for downstream beneficiation. For beneficiation to succeed, it requires a great degree of state coordination and alignment between various government departments and SOEs such as the EDD, DTI, DMR, IDC, DST, Transnet and Eskom.

4.4.2. Evolution of the policy position on mineral beneficiation

The roots of mineral beneficiation as an integral policy framework for the African National Congress (ANC) efforts to restructure and develop the economy can be traced back to the ANC's 1992 Ready to Govern document which asserts that "policies will be developed to integrate the mining industry with other sectors of the economy by encouraging mineral beneficiation and the creation of a world class mining and mineral processing capital goods industry" (ANC 1992). The Reconstruction and Development Programme (RDP) introduced in 1994 as a socio-economic policy framework reaffirmed the ANC led government's intent to beneficiate in order to, *inter alia*, develop and incentivise the manufacturing sector and create jobs (Government Gazette, 1994).

However, the transition to the Thabo Mbeki presidency resulted in the new policy direction in a form of Growth Employment and Redistribution (GEAR) in 1996.[4] Fourie (2010) describes GEAR as a policy document that closely resembles Washington Consensus' policy programme dominated by the likes of International Monetary fund and World Bank. GEAR is a macroeconomic stabilisation policy aimed at setting the scene for higher economic and employment growth rate. A key component is tight fiscal policy, the reduction of budget deficit and development of an economic climate as investor friendly as possible (Department of Finance, 1996). Accordingly, mineral beneficiation was no longer a priority or integral part for the government's effort to grow the economy and create jobs.

The introduction of GEAR contributed to the destruction of South Africa's cheap electricity which ultimately had negative effects on beneficiation. For instance, Jourdan (2014) notes that until 2007, mineral value chain investments in South Africa benefitted from low-cost power advantage. However, the government's pursuit of tight fiscal policy resulted in the failure to provide Eskom with approval to commence new plants in the mid-1990s. This consequently, turned "South Africa's power surplus into a deficit in 2008, eventually leading to tariff increases in the last few years" (Bengu, 2015).

Beneficiation was brought forward to the debate table by the Jacob Zuma led ANC through the adoption of 2007 Polokwane Resolutions that argued the need for the government to develop an "active beneficiation strategy" that will "deepen the linkages of the mineral sector to the national economy through beneficiation of these resources and creating supplier and service industries around the minerals sector" (ANC, 2007). Moreover, in 2010, the government introduced another policy initiative the NGP which viewed mineral beneficiation particularly beneficiating along the downstream manufacturing as a key job-driver. NGP never really gained traction and was superseded by National Development Plan (NDP) which also recognises the need for South Africa to beneficiate. However, despite the policy framework that support beneficiation, the South Africa has failed to beneficiate along its mineral value chains. The levels of beneficiation have remained low.

4.5. Conclusion

This section has considered the debates in South Africa from various stakeholders on whether the country should use its mineral endowment to spur industrialisation through downstream beneficiation. Mineral beneficiation has received contrasting reaction from various

[4] In 1996 Thabo Mbeki was the deputy president of South Africa and played a pivotal role in the introduction of GEAR. Even though Thabo Mbeki was the deputy president in 1996, he was in control of the economic policy framework of the country and played an influential role in determining which economic policy to be adopted. In 1999, Thabo Mbeki became the president of South Africa and continued with GEAR as an economic policy framework.

stakeholders. On the one hand, mineral beneficiation is viewed as vital towards industrialisation. Conversely, the economic rationale for mineral beneficiation has been criticised on the basis that the prices and supply for minerals are determined by global market forces and there are other more pressing key factors that affects beneficiation. These factors include infrastructural development, energy costs, logistics costs (rail and ports) and proximity to the target market. From the policy framework perspective, South African government, at least in theory, supports beneficiation.

CHAPTER 5

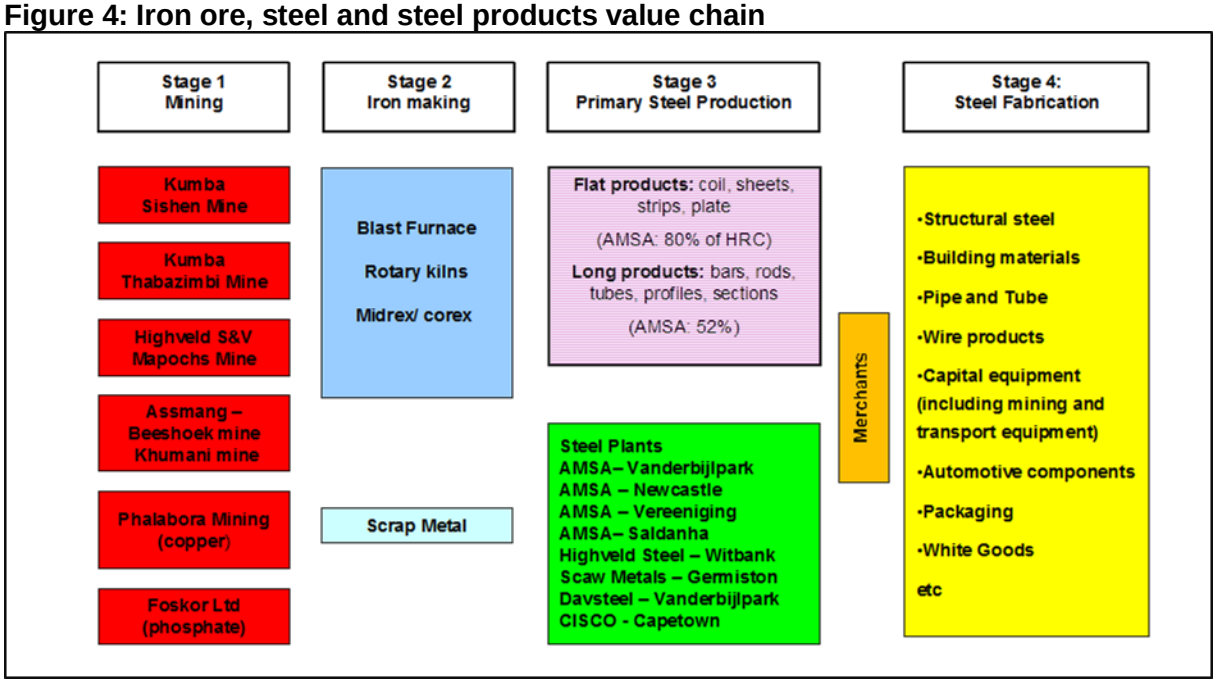
BENEFICIATING AND EXPLOITING LINKAGES IN THE IRON AND STEEL VALUE CHAIN – IS THERE MERITS IN THIS?

This section provides an assessment of whether there is merits in beneficiating along the iron and steel value chain. The section provides an overview of the iron and steel value chain; stakeholders in the value chain; and the importance of beneficiating the iron and steel.

5.1. The iron and steel industry value chain

According to DTI (2010) the iron ore and steel value chain comprises of four stages, namely, mining, iron making, primary steel production and steel fabrication.

Figure 4: Iron ore, steel and steel products value chain



Source: DTI (2010) – Response to the iron ore, steel and steel products value chain matters

A detailed description of the four stages in the iron and steel is listed below:

- Stage 1: involves extracting iron ore (through drilling, blasting, loading and hauling techniques). The iron ore extracted is used to produce steel. Participants involved in this industry include: Kumba Iron Ore, Assmang and Evraz Highveld Steel / Vanadium.
- Stage 2 and 3: refers to activities performed by the steel manufacturing industry. Kumba Iron Ore (2011) states that stage 2 and 3 of the value chain involves smelting to converting iron ore into pig-iron primarily through the blast furnace route and then refining (e.g. using a basic oxygen furnace) and shaping it in rolling mills into steel products (e.g. HRC - hot rolled coil). Stage 2 and 3 comprises of the steel manufacturing companies or mills that process the iron ore to produce flat and long steel products. AcellorMittal South Africa (AMSA) dominates the South African market.

- Stage 4: is the fabrication, manufacturing and end user industries of steel products. Steel fabricators take steel from stage 2 and 3 and customise it for a specific purpose. There are several players in this industry varying in market size from large scale fabricators to medium and small scale companies. Stage 4 also include manufacturers or end-users that buy steel from either steel producers or fabricators, depending on their needs and application. These include packaging industry, motor industry, locomotive assemblers, components manufacturers, welding rod manufacturers, construction companies and other steel end-users.

For mineral beneficiation to succeed, it must be supported by companies that participate in stage 1, 2 and 3 of the value chain, namely, iron ore and steel producers. The behaviour of these companies on the following factors is crucial in determining whether South Africa is able to beneficiate along the iron and steel value chain:

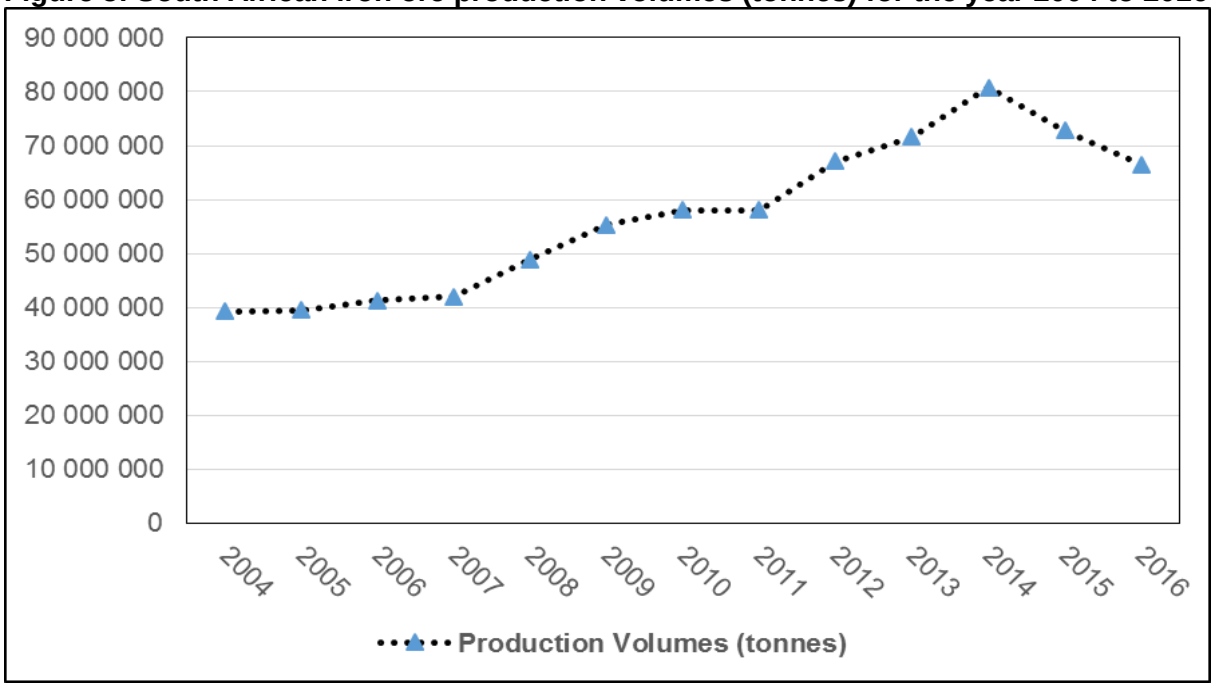
- Pricing for the local market.
- Supplying conditions for the local market.
- Shareholder interest for companies.

The success of manufacturers and end-users of steel depends on their ability to procure steel at the competitive price whilst AMSA's competitiveness is dependent on the availability and price of iron ore. The premise taken in this research is that for downstream beneficiation to occur it has to be driven by a collaboration between government, iron ore and steel companies.

5.2. Review of the South African iron ore industry

The South African iron ore mining industry produced approximately 39 million tonnes of iron ore in 2016 (COM, 2017). The South African mining industry supplies the domestic market's full demand for iron ore. The remaining volumes are exported. The players in the market for the mining and supply of iron ore include: Kumba Iron Ore, Assmang and Evraz Highveld Steel and Vanadium. The industry also comprises of smaller players such as junior BEE companies.

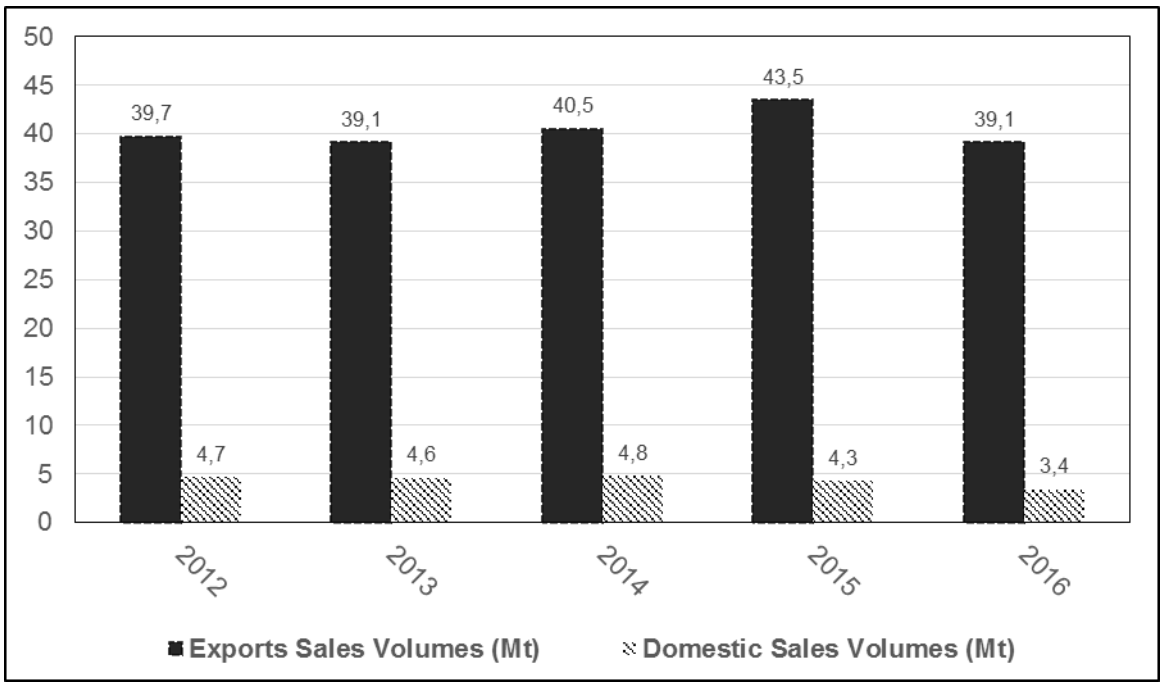
Figure 5: South African iron ore production volumes (tonnes) for the year 2004 to 2016



Source: Chamber of Mines of South Africa (2017: 30): - compiled from facts and figures report

Kumba Iron Ore is the largest iron ore mining company in South Africa. According to the DTI (2013) Kumba Iron Ore accounts for 80% of domestic production and is a world leading supplier of lump ore. Kumba Iron Ore's majority shareholders are foreign investors. The government holds shares indirectly through the Public Investment Corporation (PIC) and the IDC. Kumba Iron Ore generates over 90% of its sales volume from the export market. Less than 10% of Kumba Iron Ore is locally sold and beneficiated.

Figure 6: Kumba Iron Ore Sales volume (Mt) for the financial year 2012 to 2016



Source: Kumba Iron Ore (2017:108) – compiled from annual report for the year ended 2016

Kumba Iron Ore customers are located in South Africa, China, India, Japan, South Korea, Europe and the Middle East. Export sales to China accounts for 64% of company's production while in South Africa AMSA is its major customer (Kumba Iron Ore, 2017).

Kumba Iron Ore asserts that the global market forces determine the price of iron ore. TIPS (2016) argues that during boom periods in iron ore mineral, Kumba Iron Ore increases exports and raises its domestic prices to match global trends which results in decline in local processing. When iron ore prices fall Kumba Iron Ore views local market customers such as AMSA as a captive market that could compensate, at least in part, for lower prices in the rest of the world and charges AMSA even more than the export cost. This suggests that Kumba Iron Ore does not support mineral beneficiation along the iron and steel value chain.

5.3. What is the link between iron ore and steel industry?

Jourdan (2017) states that global steelmaking demand determines the iron ore prices. Most iron ore go into iron and steel, but in mature economies scrap is an increasing feedstock as recycling systems become more efficient. According to Kumba Iron Ore (2016) annual report, the main customers for iron ore in the export market is China (64%), Japan and Korea (17%), Europe and America (14%) and India and other Asia (5%). Globally Chinese imports for iron ore increased from 326Mt in 2006 to 951Mt in 2015 (+192%). Mr Dean Subramanian estimates China's steel capacity to be approximately 1 billion tonnes and the local steel consumption 600 million tonnes (Interview: Subramanian, 2018). Mr Gerrit Kruyswijk also states that the

Chinese are the chief buyer of iron ore globally. To a certain extent, China is the price marker of iron ore in the market (Interview: Kruyswijk, 2018).

5.4. Review of the South African steel industry

5.4.1. History of the steel industry

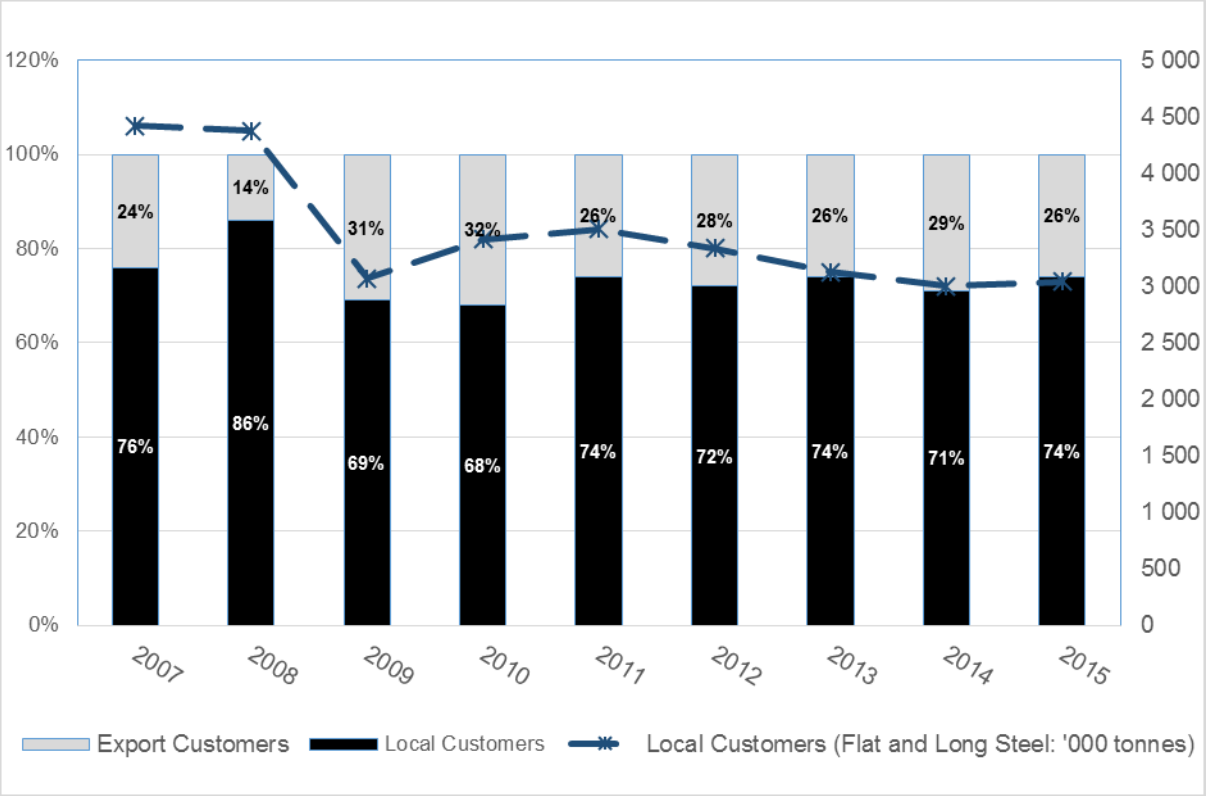
In 1927, the Apartheid government established a state-run steel company called the South African Iron and Steel Corporation (Iscor). According to Roberts and Rustomjee (2010: 51) Iscor as a state run company was "guided by the government objectives of the Apartheid state and not strict profit making imperatives". Iscor was protected from foreign competition with the government imposing relatively high import tariffs for steel. Importantly, Iscor supplied steel to the local market on a cost-plus basis (Fine and Rustomjee, 1996; Roberts and Rustomjee, 2010).

In 1989, Iscor was privatised and listed with significant government shareholding through IDC. After the privatisation of Iscor, the government also committed to the trade liberalisation programme to reduce trade barriers and allow import competition (Black and Roberts, 2009). In 2004 Iscor became AMSA following the acquisition of the majority shareholding by Mittal (Kumba Iron Ore, 2011). This resulted in a change of ownership structure and the strategic / operational running of Iscor from state-led to foreign leadership. Iscor/Mittal was unbundled in 2001 into iron ore mining (Kumba Iron Ore) and steel making (Iscor). The vertical integration was preserved until March 2010 with Kumba obliged to supply Iscor with iron ore on a cost plus 3% basis. Before March 2010 Iscor/Mittal derived a cost advantage under cost plus 3% supply arrangement for iron ore (DTI, 2010 & 2013).

5.4.2. Importance of steel industry

According to Mr Dean Subramanian, the steel industry is the backbone of any industrialised and developed economy. South Africa is a developing economy and if a developing economy like South Africa does not have the steel industry it will not be able to beneficiate the natural resources such as coal and iron ore (Interview: Subramanian, 2018). The steel industry is a key strategic industry in South Africa. A report by Who Owns Whom (2015) finds that the steel industry contributes approximately 1.5% to the country's GDP. Furthermore, steel is a significant input in many sectors of the South African economy and is particularly crucial to the automotive, cable, mining and construction sectors which combined contributes approximately 15% GDP and employs about 8 million people, directly and indirectly (DTI, 2016). Figure 7 shows that AMSA sells most of its steel products to the domestic customers.

Figure 7: AMSA's local versus export customers and volumes sold to local customers

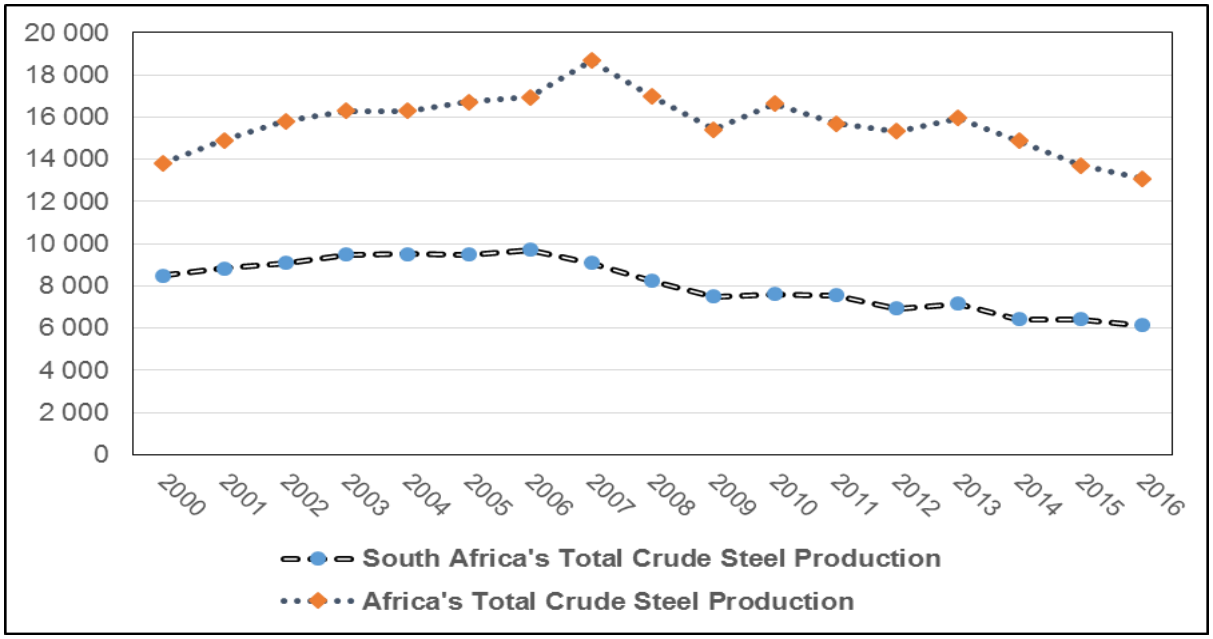


Source: AMSA (2017:34) and AMSA (2013: 5) - compiled from AMSA's annual reports for the year ended 2012 and 2016

Figure 7 shows that the local market is the major consumer of AMSA's steel products consuming approximately 74% of its total production of flat and long steel. AMSA's split of domestic sales by sector for the year 2015 is: construction 60%, metal products 20%, automotive and assembly 11% and mining and agriculture 9% (AMSA, 2016). However, the consumption of AMSA's steel products by local consumers has declined significantly from 4.4 million tonnes in 2007 to 3 million tonnes in 2015.

Data published by World Steel Association shows that South Africa is the largest steel producer in Africa, producing almost half of the total crude steel on the African continent and contributing significantly to foreign exchange earnings through its exports to other African countries.

Figure 8: South Africa & Africa's total crude steel production (1000Mt) for 2000 to 2016



Source: World Steel Association, statistical yearbooks

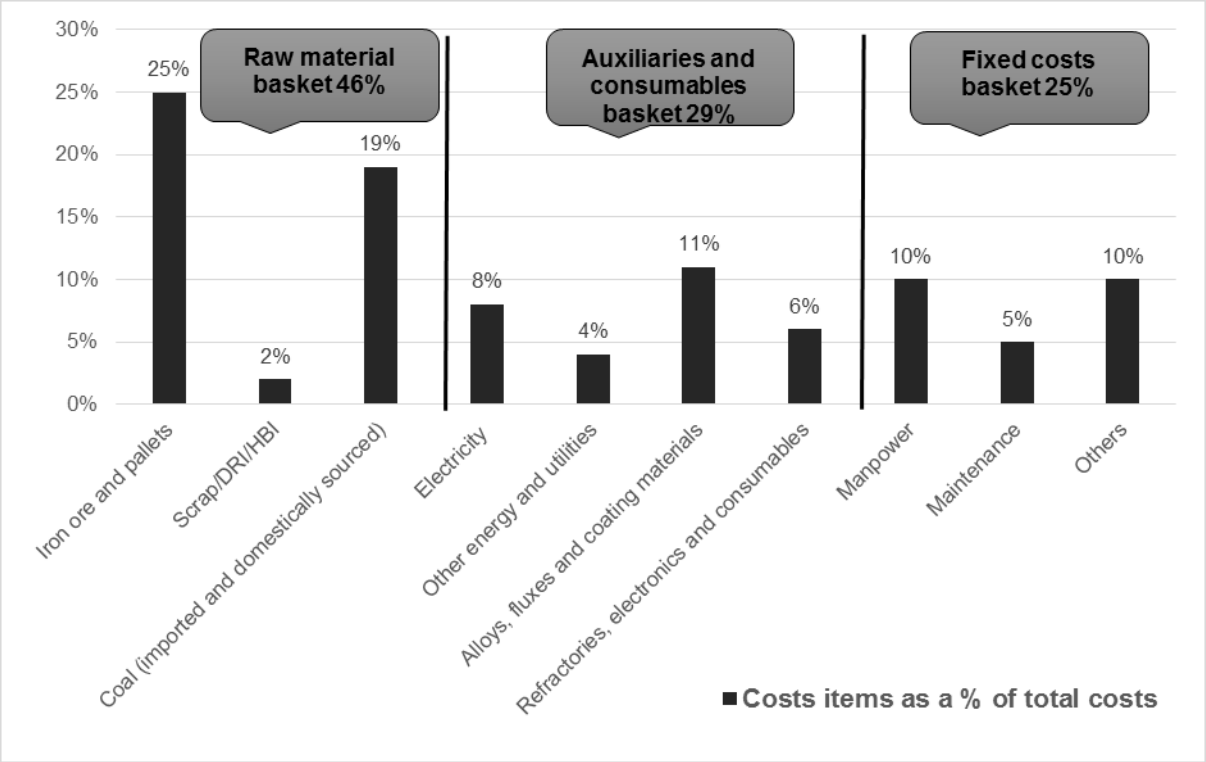
The DTI states that AMSA holds approximately 80% and 52% market share in the production of flat steel and long steel.. AMSA's 2011 annual report also states that "AMSA is the leading steel producer in South Africa, with over 62% of the total market share". High market shares results in AMSA having substantial market power and the ability to control local market prices. AMSA has enjoyed market dominance and their pricing strategy in the local market for many years was not constrained or disciplined by any form of competition both locally and internationally.

Mr Gerrit Kruyswijk states that the steel industry requires large capital investments. Most steel industries were developed under state ownership in industrialised and developing countries (Interview: Kruyswijk, 2018). Factors such as scale economies and high capital requirement to establish a steel mill implies that absent government intervention it is inevitable that the local steel market will be dominated by few businesses with high market share.

5.4.3. Costs drivers in the steel industry

According to Mr Dean Subramanian the main cost driver in the steel industry is the Raw Material Basket (RMB) which is made up of iron ore, coal and scrap. Mr Dean Subramanian states that RMB constitutes approximately 50% of the cost of producing steel. Other important cost drivers include: electricity, other energy and labour (Interview: Subramanian, 2018).

Figure 9: Steel costs drivers (R/t liquid steel) for AMSA in 2015



Source: AMSA (2017:33) – compiled from AMSA's annual report for the year ended 2016

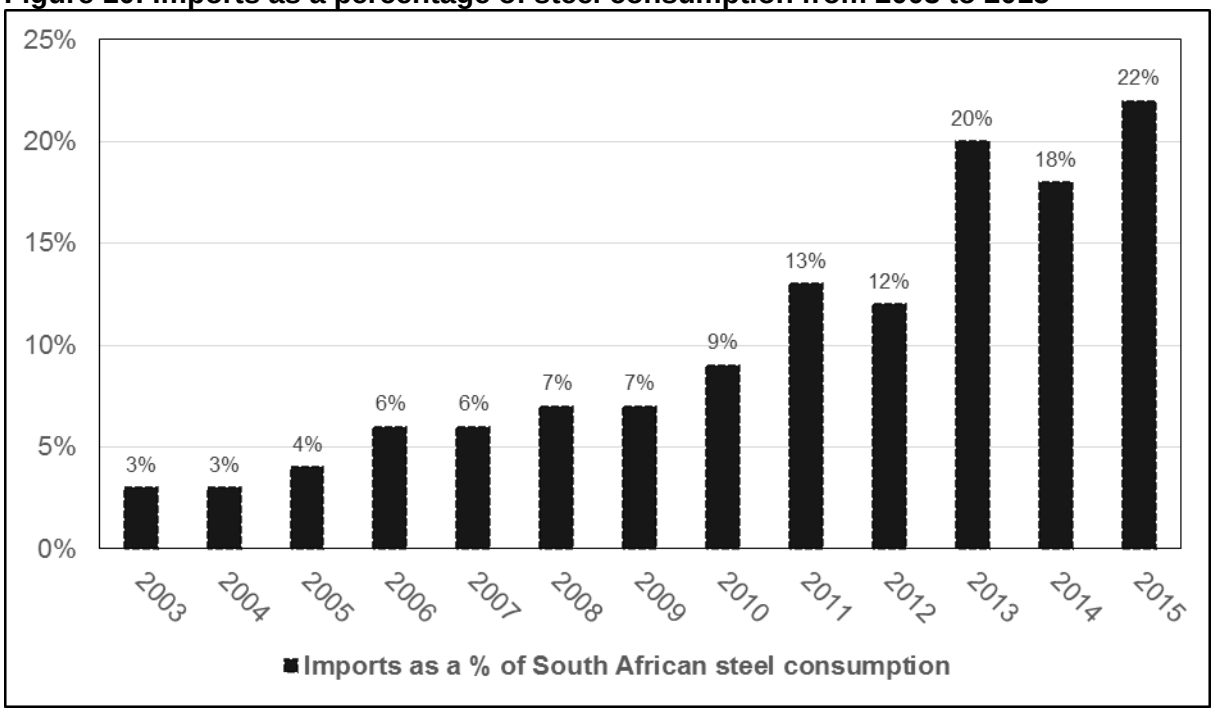
** Others refer to general expenses outside the services, expert fees, IS/IT and Insurance premiums*

The main cost drivers for primary steelmaking (blast furnace route) are iron ore and pallets (25%), coal/coke (19%), Alloys, fluxes and coating materials (11%), manpower (10%) and electricity (8%). It is evident that iron ore is a key input and the main cost driver in the production of steel. This implies that the price of iron ore has a significant impact on the cost of production for steel manufacturers and their competitiveness level in the market.

5.4.4. The declining South African steel industry

The domestic steel industry is under threat with a rapidly declining market share to China. The DTI (2016:8) notes that around 2015 it initiated Inter-Departmental Task Team on iron and steel to "support and save the industry from the immediate threats and closure and the subsequent loss of capacity". The share of imports in total steel demand for the local market has climbed from 3% in 2003 to 22% in 2015. These imports are rapidly displacing local production. Local steel production has declined from 9 million tonnes in 2003 to 6 million tonnes in 2015 (TIPS, 2016).

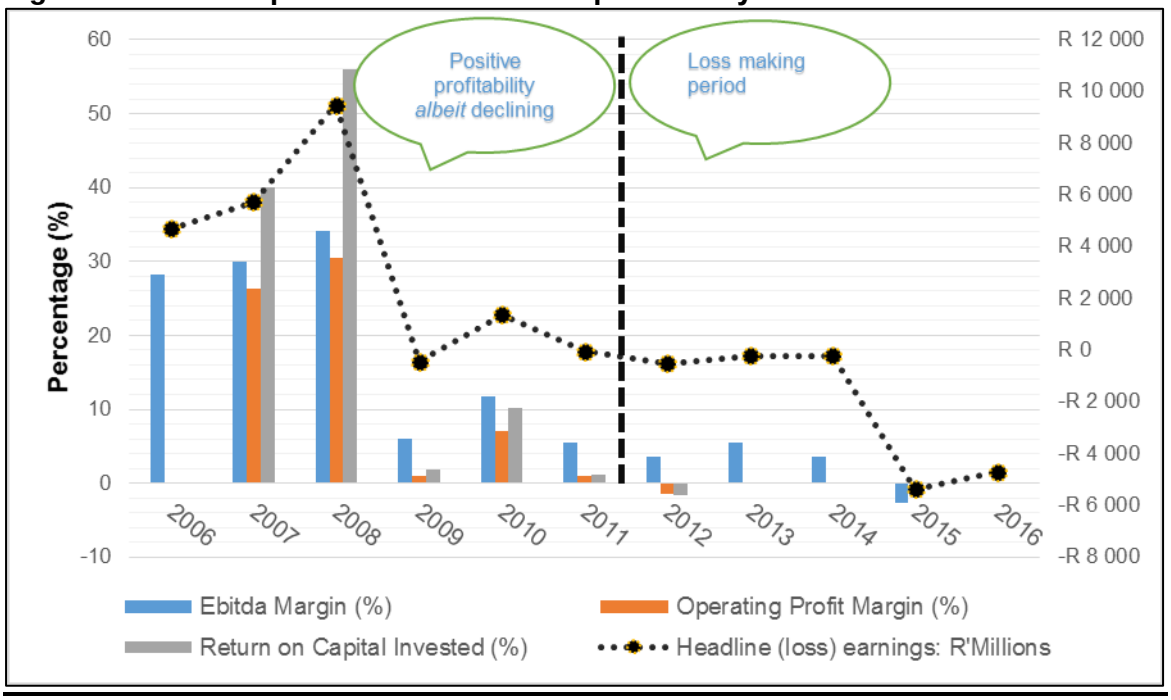
Figure 10: Imports as a percentage of steel consumption from 2003 to 2015



TIPS (2016: 4) – compiled from TIPS report titled a strategic response to the crisis in the steel industry

Mr Dean Subramanian explains that the cheapest price for steel is from China. China's steel capacity is approximately 1 billion tonnes while local steel consumption in China is about 600 million tonnes. Therefore, China has 400 million tonnes of excess steel capacity. China's excess steel of 400 million tonnes is exported at significantly lower prices to countries globally, including South Africa (Interview: Subramanian, 2018). Mr Gerrit Kruyswijk contends that the China has changed the dynamics of the global steel industry. China is in a position to produce 50% of the global steel and control the market prices (Interview: Kruyswijk, 2018). The rest of the world has commenced imposing duties on China (including South Africa) which imposed normal duties or tariff of 10% and also put safeguards measures in place.

Figure 11: AMSA's performance based on profitability indicators from 2006 to 2016



Source: AMSA (2017:35&36) and AMSA (2013: 4&5) - compiled from AMSA's annual reports for the year ended 2012 and 2016

The above table shows AMSA's published financial indicators such as Ebitda and operating profit margins, headline earning and return on capital invested. From 2012 onwards, AMSA did not publish operating profit margin and return on capital invested percentages. It is clear from figure 11 that AMSA's business performance is declining. AMSA moved from being a business that generates operating profit margins of 30% with a return on capital invested of more than 50% to a loss making business.

5.4.5. Market distortions in the global steel industry

Jourdan (2010 & 2016) identifies practices that create market distortions in the global steel industry. These market distortions have created uneven playing field and are slowly crippling the steel industry in some developing countries such as South Africa. Jourdan (2010) finds that steel producers in Europe receive subsidies estimated to be approximately $80 billion in tariff barrier for products where value is added. An article published by the US Financial Times (2016) states that China's steel producers receive subsidies ranging from $57.8 million to $225.4 million. These subsidies include cash grants, raw materials price controls, capital infusions, subsidies for utility, land use subsidies, tax benefits and preferential loans. According to Southern Africa Stainless Steel Development Association (SASSDA) the government subsidies from China grants steel producers an unfair advantage in the global market. These subsidies promotes Chines exports, possible dumping of steel products, loss of efficiency and weaker profitability for the global steel industry (SASSDA, 2016).

Jourdan (2016) finds that in addition to tariffs, developed countries such as EU and US impose anti-dumping laws, standards covering health, environment and labour laws to prevent market access for beneficiated goods such as steel. These developed countries have imposed tariffs and duties to protect local steel producers against unfair competition from China. Article published by SASSDA states that the South African government is shying away from imposing anti-dumping duties or significant tariffs on steel imports from China because of the potential trade conflict with China. South Africa considers China a strategic trade partner and does not want to risk future investment nor the trade account with China (SASSDA, 2016).

Ultimately, the unfair trade practices in China and EU prevents developing countries from entering into higher value added downstream manufacturing activities and exports of beneficiated products. The steel industry today is in crisis and characterised by over-capacity, widespread protection measures in favour of domestic firms, local content requirements, bail outs (state aid), public procurement requirements and other trade distortions.

5.5. Is there merits in beneficiating along the iron and steel industry value chain?

As already indicated, South Africa is facing developmental challenges of high unemployment rates and a declining manufacturing sector. The level of mineral beneficiation domestically has remained low with the mining sector preferring to export largely raw and semi processed minerals.

The iron and steel value chain is identified as a critical contributor to the economic development path in South Africa. The country's comparative advantage in iron ore resources enables it to establish resource processing industries (beneficiation through steel) that could then provide the feedstocks for manufacturing and industrialisation (Jourdan, 2014). Moreover, Jourdan (2016a & 2016b) identifies the iron and steel value chain as the most important value chain for industrialisation and job creation in Africa. According to Jourdan, the iron and steel value chain is by far the most important feedstock into manufacturing. Table 2: Principal local mineral-based feedstocks for rapid job creation summarises mineral based feedstock that are critical for growth and development in various sectors of the economy.

Table 2: Principal local mineral-based feedstocks for rapid job creation

Sector	Mineral-based feedstock
Manufacturing:	**Steel**, polymers (coal, HCs), base metals (Cu, Al, et al)
Infrastructure:	Construction: **Steel**, copper, cement (limestone, gypsum, coal) Energy-Electricity: Fossil fuels: Coal, oil, natural gas (CBM, shale gas)

Agriculture:	Nitrogen (from coal, gas), phosphate, potassium, conditioners (limestone, dolomite, sulphides), **Steel** into agro-machinery & equipment

Source: Jourdan (2016b:11) - Mining and Mineral Beneficiation: Mineral Value Chain Opportunities

It is evident from Table 2 that steel is used for various applications, such as manufacturing, infrastructure or construction and agriculture. The value addition (beneficiation) of iron ore mineral is critical in the steel making process. The benefits of increasing value at each stage of the value chain include more revenue and employment every time value is added.

Table 3: Economic benefits of iron ore value addition

Description	Selling price per ton of steel (US$)	Employment per 1000 ton / annum steel	Investment Rm per job	Type of Beneficiation (Stage)
Iron Ore	180	0.17	R8.5	1
Iron	500	0.8	R7.3	2
Hot Rolled Coil	585			3
Cold Rolled Coil	685			3
Pipe and Tube	960	20	R1.5	3
Structural Steel (ave. of heavy and light)	3000	30	R0.5	4
Yellow Metals (ADT)	13700	150	R0.6	4

Source: DTI (2010:3) – Response to Iron Ore, Steel and Steel Products Value Chain Matters

Table 3 confirms that the first two stages of beneficiation along the iron and steel value chain are capital intensive, whilst the last two stages have the potential to generate employment. It is also apparent that beneficiation along the iron and steel value chain holds the potential to enhance the performance of the manufacturing sector and consequently address unemployment challenges. Thus, the efficiency and competitiveness of the downstream industries are directly correlated to the competitiveness (and efficiency) of the steel industry. Accordingly, the behaviour of mining and steel industry directly impacts on South Africa's efforts to industrialise. Lundall *et al.* (2008) confirms that the first two stages of beneficiation are capital intensive whilst the last two stages (particularly stage 4) are much more labour intensive.

5.6. Downstream linkages in the iron and steel industry value chain

The main rationale underpinning downstream mineral beneficiation is that South Africa initially through government support, developed to some extent, industries that can provide important feedstock at competitive prices to the manufacturing sector. Thus, the key question is "what are the main factors that determine successful downstream mineral beneficiation?" To answer the question it must be appreciated that the role of mineral beneficiation in the iron and steel

sector is to ensure that country's abundant iron ore minerals and subsequently steel products are utilised or supplied to the local market in a manner that supports downstream manufacturing industries.

Mr Saul Levin and Professor Ben Turok assert that beneficiation is much broader than making iron ore and steel available to the local market at the developmental or cost-plus price. They argue that over and above iron ore and steel prices, the government and SOEs have to provide other inputs in an efficient and effective manner. These other inputs include: technology and skill development, financial incentives or funds, infrastructure – electricity, water, rail and road. (Interview: Levin, 2018 and Professor Turok, 2018).

Some of the important factors driving downstream beneficiation and its linkages are as follows:

- Pricing strategy of iron ore and steel producers for the local market (i.e. access to feedstock at a competitive price).
- Availability of the required quantity and quality of iron ore and steel for the local market (i.e. supply patterns – local vs export market).
- Proximity to suppliers of feedstock to lower transport and logistics cost.
- The costs of supplying electricity, rail and port (SOEs linked) for local industries.
- Innovation, technology and skill development programmes in place for the value addition and manufacturing industries.
- Financial incentives and funds available to the downstream value addition industries.

5.7. Conclusion

This section has assessed whether there are merits in beneficiating along the iron and steel value chain. The iron and steel value chain is the most important value chain for industrialisation and job creation. The iron ore and steel industry is characterised by high barriers to entry with few players in the market. These include dominant and large players such as Kumba Iron Ore and AMSA who account for more than 70% market shares in their respective industries. These players can determine unilaterally whether to: reinvest their profits into the domestic industries, supply the domestic market and the price to charge the domestic market. The success of downstream beneficiation is dependent on the cooperation between the government and private firms such as Kumba Iron Ore and AMSA.

CHAPTER 6

CHALLENGES AND CONSTRAINTS TO DOWNSTREAM BENEFICIATION

This chapter examines the challenges and constrains in beneficiating the South African iron and steel value chain. The chapter furnishes evidence asserting that the country has failed to beneficiate along the iron and steel. Thereafter, challenges and constraints to downstream beneficiation are fully discussed.

6.1. Un-beneficiated iron ore for the export market

South Africa is a natural resource-rich country with comparative advantage in minerals such as iron ore, gold and platinum. According to Professor Ben Turok, South Africa's mineral industry does limited beneficiation that relates to the early stage of mineral cleaning, washing and polishing. Thereafter, the mining industry exports the minerals and does not beneficiate any further (Interview: Professor Turok: 2018). Lundall *et al.* (2008) and Turok (2014) state that South Africa has failed to leverage off its comparative advantage in minerals by establishing industries along the mineral value chain. Despite the potential economic benefits associated with beneficiation along the steel value chain, there is currently little value addition taking place.

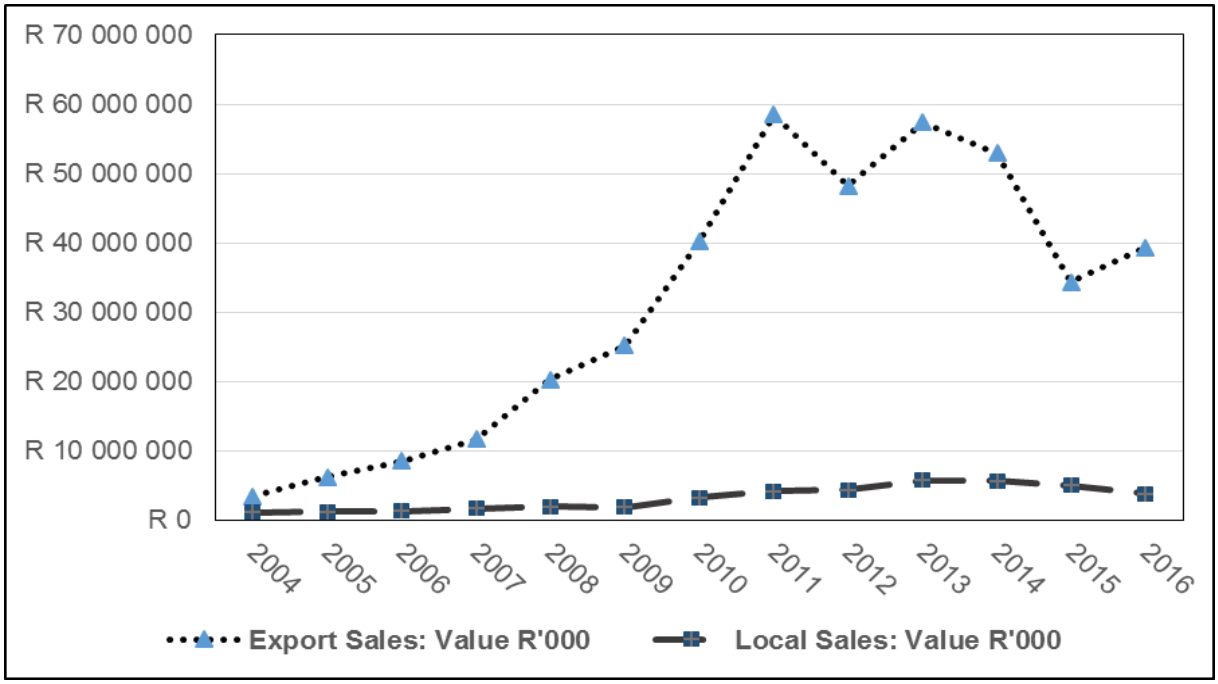
Table 4: Stages of beneficiation and level of beneficiation achieved in South Africa

Material	Stage 1 - % Raw	Stage 2 – % Processed	Stage 3 - % Fabricated	Stage 4 - % Finished
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

Lundall et al, 2008 - Industrial structures and skills in the metal beneficiation sector of South Africa

Table 4 shows that only a small percentage of iron ore is benefited locally and the rest is exported. It is evident from table 2 that while 100% of iron ore is extracted locally only 15% reaches the final stage of beneficiation. The South African iron ore mining industry is exports oriented and the majority of producers have entered into long-term supply agreements with international clients. This suggests that the local market that requires iron ore for beneficiation is not prioritised by the mining companies.

Figure 12: South African iron ore sales for the local and export market from 2004 to 2016



Source: COM (2017:32) – compiled from facts and figures report

Figure 12 shows that iron ore companies derive the most of sales revenue from the export market. According to the COM (2017:4) South African iron ore mines generates over 90% of its sales volume from the export market.

6.2. Dominance and market power of iron ore and steel firms

High market shares result in substantial market power and the ability to control local market's pricing and supplying conditions absent credible competition. Section 7 of the Competition Act, 89 of 1998, as amended (the Act) states that a firm with at least 45% market share is considered to be dominant and poses market power. The Act defines market power as "the power of a firm to control prices, or to exclude competition or to behave to an appreciable extent independently of its competitors, customers or suppliers". AMSA has enjoyed market dominance and their pricing strategy for many years was not constrained or disciplined by any form of competition in the local market. Kumba Iron Ore is the largest iron ore mining company in South Africa. The lack of competition in the domestic market is arguably a significant factor that allow dominant firms like AMSA and Kumba Iron Ore to exert unilateral market power in setting prices and setting out the terms of supply arrangements. The two main challenges and constraint to beneficiation relating to the dominance and market power of AMSA and Kumba Iron Ore are as follows:

a) **<u>Limited access to raw (mineral) materials</u>:** the DMR (2011) identifies limited access to mineral raw materials as a crucial constraint for local downstream beneficiation. The structure of the mining industry remains internationalised in nature. The DMR (2011) further states that limited access to raw material is a direct result of the current structural arrangement in the mining industry that prioritises the exporting of raw materials to international beneficiators. These international clients or beneficiators have also entered into long-term supply contracts with local mining companies to secure unabated supply of mineral resources. Kraemer and Tulder (2009) explains that long-term supply contracts grant overseas beneficiators exclusivity and access rights over local resources at the expense of local manufacturing industries. Moreover, this allows the international clients to be price setters of local minerals thus allowing them to have a strategic position and control over the pricing and allocation of national resource key reserves.

b) **<u>Anti-competitive pricing of key inputs (iron ore and steel)</u>:** Professor Ben Turok argues that the mining industry should make the mineral available to the local market at a lower price e.g. developmental price. However, Processor Ben Turok explains that "the mining industry plays the world market. What they do with the iron ore, platinum and other minerals is they look at the world market and sell the mineral at the best possible price" (Interview: Professor Turok, 2018). The mining industry cannot influence prices in the global markets. However, in the domestic market, mining companies have the power to control local domestic price instead they choose to raise profit margins by selling to local customers at international prices.

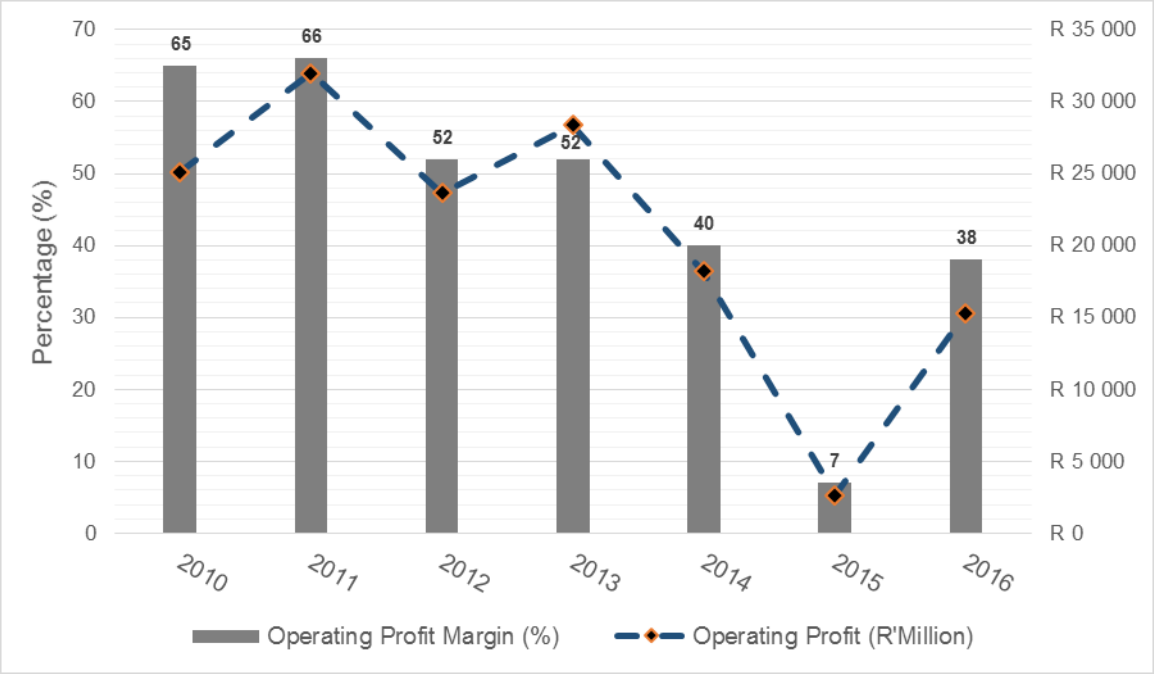
Steel manufacturers also do not support beneficiation and downstream manufacturers as they have been accused of uncompetitive pricing structures (i.e., charging Import Parity Pricing that renders downstream beneficiation uncompetitive) (Roberts and Rustomjee 2009; Jourdan, 2014; DMR, 2011). The use of IPP renders the downstream value addition uncompetitive as the pricing mechanism does not consider proximity to production (IDC, 2014:21). IPP negatively affects the affordability of raw and intermediate inputs as it obligates local value adding industries to pay a premium for the products that are locally produced. IPP is not strictly cost-related and forces local industries to pay the same price for the products as if they were importing. The price of the raw and intermediate inputs for the local industries will include artificially assumed costs such as harbour charges, imports duties, freight and insurance.

6.3. Foreign listing, unbundling and profit maximisation

There are two main events that occurred in the late 1980s and early 2000s that had directly implication on South African's efforts to support downstream beneficiation. These events are: the privatisation and listing of Iscor in 1989 and the unbundling of iron ore and steel firms in 2001 into iron ore mining (Kumba Iron Ore) and steel making (Iscor). According to Professor Ben Turok, the government should "never have privatised Iscor nor unbundled the iron ore and steel operations of Iscor" (Interview: Professor Turok, 2018). Similarly, Mr Gerrit Kruyswijk regards the unbundling of Iscor's iron ore and steel operations as a "mistake" (Interview: Kruyswijk, 2018). The decision to unbundle and privatise Iscor was not in the best interest of South Africa's policy objective of job creation and growing the economy through beneficiation. The privatisation of monopoly industries lead to profit maximisation, price increases and extraction of monopoly rents by private firms.

The above events played a significant part in South African iron ore and steel industries having private foreign shareholdings. Kumba Iron Ore (2016: 14) states that Anglo American plc is the ultimate holding and controlling company (Anglo American interest in the Kumba is held through a 69.71% holding by Anglo South Africa Capital Pty Ltd) of Kumba Iron Ore. Anglo American plc has primary listing in London Stock Exchange. The implications of majority foreign listings and ownership in iron ore mineral to the South African economy is that, South Africa has stuck to exporting natural resources rather than attempting to develop manufacturing industries through industrial policy (Fine and Ashman, 2012: 3). In the case of South Africa the interest of foreign majority shareholders appears to be to maximise profits rather than assisting the government to achieve its industrial policy objectives such as supporting beneficiation.

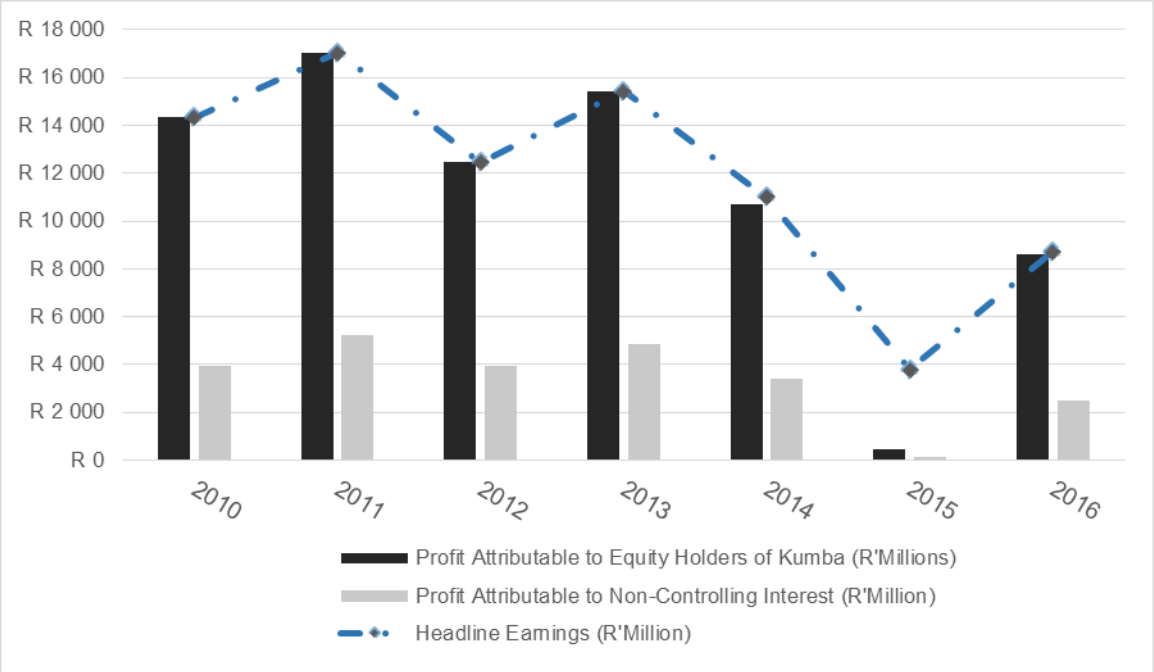
Figure 13: Kumba Iron Ore's operating profit margins from 2010 to 2016



Kumba Iron Ore (2017:108) – compiled from annual report for the financial year ended December 2016

Figure 13 illustrates that the iron ore mining industry is profitable with operating profit margin ranging from 65% to 38% in 2010 and 2016, respectively. Figure 14 below shows that the profit generated by Kumba Iron Ore is attributable to its shareholders with Anglo American plc receiving most of the profits as a majority shareholder.

Figure 14: Profit attributable to shareholders of Kumba Iron Ore and headline earnings from 2010 to 2016



Kumba Iron Ore (2017:108) – compiled from annual report for the financial year ended December 2016

The important aspect of beneficiation is that it argues that profit from mining activity and its related activities should remain in the country to benefit local industries and communities. More importantly, the profits from mining activities should contribute to the industrialisation and employment creation objectives.

A crucial aspect concerning private foreign shareholders is that the high profit margins generated in figure 13 above are not reinvested in the economy and thus do not benefit the South African economy. Todaro and Smith (2004) argue that business leaders and large firms seek safe havens abroad for their savings in what is known as capital flight. Such savings and investments do not add to the nation's productive resources. This view are also echoed by Morh *et al.* (2006) who argue that foreign owned companies are often reluctant to reinvest their profits in the developing countries such as South Africa.

AMSA (2016: 86) states that AMSA is controlled by ArcelorMittal Holdings AG, which effectively owns 69% of shares. ArcelorMittal Holdings AG headquarters is based Germany with listing in, amongst other, Luxembourg Stock Exchange. AMSA has also been accused by the government for not supporting downstream local industries. AMSA has over the years maintained artificially high prices and after privatisation it made sizeable profits on the back of "making monopolistic or oligopolistic rents from downstream firms, primarily in the form of the practice of import parity pricing (IPP)" (Roberts and Zalk, 2004).

6.4. Institutional constraint and misalignment between state institutions

Mr Saul Levin states that the biggest challenge facing beneficiation is that state institutions are not aligned. These institutions include the DTI, EDD, DMR, Eskom, Transnet and DST. For instance, the DTI is pursuing an industrial policy and wants to industrialise. Industrialisation is energy intensive and requires rail / ports infrastructure to be offered at a cheaper prices. However, SOEs such as Eskom and Transnet have been increasing tariffs and not supporting the country's effort to industrialise (Interview with Levin, 2018).

Similarly, Jourdan (2012b) points out that the DTI which is responsible for industrial and economic development is not aligned and co-ordinated with other key institutions like DMR. Jourdan argues that lack of strategy to alignment state institutions like DMR and DTI is the main reason for the lack of progress in realising beneficiation and job creation. Darwar (2013) finds that the state lacks sufficient policy coherence to develop more labour-intensive and value-adding upstream manufacturing sector to become competitive and successfully industrialise.

6.5. Unfavourable economic environment for downstream beneficiation: financial incentive, energy, infrastructure and the role of SOEs

The Black Industrialists Indaba (March 2015) highlights access to finance and markets as the major stumbling blocks to the sustainable development of entities in the manufacturing sector (DTI, 2016b). Accordingly, the government must focus on developing financial packages to assist manufacturing entities that want to add value to the strategic minerals such as iron ore. Concerning, access to finance, the government need to develop and implement funding packages that include, *inter alia*, a cost-sharing finance for the procurement of new capital equipment, working capital support and funding feasibility studies (DTI, 2016b). Professor Ben Turok and Mr Saul Levin state that the government has not done enough in designing financial packages that would incentivise emerging industrialist to establish industries that specialise in production of manufactured goods or in value addition of strategic minerals (Interview: Professor Turok, 2018 and Levin, 2018).

6.5.1. Infrastructure bottleneck and inefficiencies

The main concern with infrastructure bottleneck is the inadequacy of the rail and port infrastructure and its inability to freight beneficiated products. Morris *et al.* (2011: 10) argue that the infrastructural facilities in South Africa namely: water, ports, power and rail facilities were developed specifically to facilitate the extraction of raw mineral products and transport to the coast and shipping to the export market. ANC SIMS (2012:24) identify the infrastructural constraints to be transport (rail and ports) and energy infrastructure capacity. According to

ANC SIMS rail and energy have been unable to expand to meet local demand especially for beneficiated products.

Mr Gerrit Kruyswijk states that Transnet port and rail divisions have been accused of offering unacceptable services to break-bulk cargo customers like AMSA. In some instances, AMSA has been forced to transport steel by road as Transnet was unable to provide additional capacity for beneficiated steel products (Interview: Kruyswijk, 2018). A further challenge to downstream beneficiation is the costs of electricity (Morris *et al*, 2011). Beneficiation is an energy-intensive processes and the rising power costs is negatively affecting industries that want to beneficiate. Jourdan (2014) notes that until 2007, industries like steel in South Africa benefitted from low-cost power advantage. However, the government's pursuit of tight fiscal policy resulted in the failure to provide Eskom with approval to investment in new infrastructure in a form of new plants in the mid-1990s.

6.5.2. High costs of doing business

The infrastructure related challenges are compounded further by the costs of transporting beneficiated products. Professor Ben Turok explains that "the other fundamental issue is you have rail, ports and energy. These are fundamental inputs into industries and in countries like China they are subsidised to support local downstream industries. The producer end-up having cheap inputs and lower costs. Thus, becomes competitive locally and internationally. In South Africa, this is not the case – the electricity prices are enormously high, rail and ports charges are expensive and ridiculous. The manufacturer who you want to set up an industry that will depend on these inputs will not want to enter the market because inputs into manufacturing are very high" (Interview: Professor Turok, 2018).

Mr Dean Subramanian agrees that the energy costs in South Africa are expensive. Mr Dean Subramanian states that "the way Eskom has increased electricity price has impacted on the costs of steel. If you look at Eskom price increase, energy price over the last five years have increased by more than 100%. This has negative impact on the cost of producing steel and ultimately steel prices … the electricity costs in South Africa run up to 15% of your costs in the production process" (Interview: Subramanian, 2017). DTI (2016a:5) estimates that electricity prices have increased by more than 300% since 2007 while rail tariffs have increased by more than 100% during the same period.

Table 5: Average Eskom prices by customer category in cents per kilowatt per hour (2006-2016)

Period	Local-Authorities	Residential	Commer-cial	Industrial	Mining	Agricul-ture	Traction	Interna-tional	Average Prices
2006/07	16.88	41.74	23.50	16.01	16.90	33.69	21.05	11.15	18.06
2007/08	18.21	44.56	24.85	17.28	17.99	35.91	23.31	14.16	19.60
2008/09	23.29	53.43	31.61	21.69	23.12	45.78	29.78	18.45	24.97
2009/10	30.84	63.98	40.97	27.03	30.25	58.96	38.23	22.47	31.95
2010/11	39.53	66.45	52.63	34.34	39.78	72.72	48.55	31.04	42.20
2011/12	48.03	77.50	63.92	40.12	48.10	87.22	56.24	36.73	50.27
2012/13	54.59	87.05	73.24	45.56	55.74	99.75	68.66	42.72	58.49
2013/14	60.67	92.41	82.67	51.79	64.66	108.75	77.34	47.56	62.81
2014/15	65.92	98.06	89.16	56.81	69.52	115.66	83.63	52.55	67.63
2015/16	74.11	108.11	100.07	62.64	78.01	128.19	96.60	59.82	75.38

Source: Department of Energy (DOE, 2016:25) – South African energy price report

Table 5 shows that the average electricity prices have sharply increased over the past 10 years. These increases have been applied across all sectors of the economy. Electricity prices have increased by approximately 285% in the industrial sector since 2006/07 period (i.e. increase from 16.01 to 62.64). DOE (2016:25) asserts that although the costs of electricity have significantly increased, the price of electricity in South Africa especially in the industrial sector is still amongst the lowest when benchmarked against international countries. A report published by the Ports Regulator of South Africa (PRSA) shows ports un-beneficiated minerals such as coal and iron ore are charged lower rates than the global average sample whilst automotives and containers (export and import) are subject to port costs which are significantly higher than the global average.

Table 6: South African total ports costs across commodities (as deviation from the sample global averages)

	2012/13	2013/14	2014/15	2015/16
Automotive	256%	198%	204%	195%
Containers	360%	212%	190%	116%
Coal	-43%	-53%	-57%	-54%
Iron Ore	-32%	-49%	-52%	-53%

Ports Regulator of South Africa (2015:25) - Global Pricing Comparator Study (GPCS)

The above findings suggest that the logistic costs of exporting raw minerals are low while it is expensive to exports commodities that are critical to industrialisation (e.g. automotive). DTI

(2016a:5) raises concerns about the high costs of ports tariffs for break bulk or value added commodities like steel and stainless steel. In the same report, the DTI states that the ports tariffs are uncompetitive while ports services for beneficiated products are inefficient.

Ports, rail and energy prices are increasing the costs of doing business in South Africa. The electricity and logistics service costs are high although they are under the control of the state. SOEs should consider incentivising downstream industries by making rail, ports, water and electricity inputs cheaper. This requires engagements and coordination between SOEs and government, departments such as the DTI.

6.6. Shortage of skills, technology and innovation (Research and Development)

ANC SIMS (2012: 22) talks about knowledge linkages as part of beneficiation process. ANC SIMS states that "no country has managed to attain a high level of economic and social development without appropriate investments in good quality schooling and post-school education- no resource-based industrialisation has succeeded without developing technical skills and technology". Similarly, Altman (2001) finds that the wealth of a country is created by citizens with technical skills and knowledge rather than the country's natural resources. The IDC 2014 urges the government to invest and subsidise more Research and Development (R&D) institutions. IDC views these institutions as drivers of innovations and technical training skills required to gear South Africa towards industrialisation path. The study conducted by Lundall *et al.* (2008: 36) confirms that there is a shortage of skilled technical workers. Moreover, South Africa has not trained much engineers. Vocational training is very poor in South Africa.

CHAPTER 7

RECOMMENDATIONS

This chapter provides recommendations to overcome the challenges and constraints to downstream beneficiation. The ANC (2012:27) SIMS report provides a detailed analysis of the policy measures required for successful downstream beneficiation. Some of the main policy measures proposed in the SIMS report include:

- Improved coordination between government departments responsible for industrial policy and mineral beneficiation.
- Greater spending and investment in long-term knowledge
- Greater spending in physical infrastructures.
- Regulating the private sector.

A detailed analysis of policy measures required for successful beneficiation is provided below.

7.1. Price stabilisation for strategic inputs

The pricing of strategic minerals (iron ore) and feedstocks (steel) has been a major challenge and constraint to downstream beneficiation. For downstream beneficiation to flourish, strategic minerals and feedstocks must be supplied at competitive or developmental prices for domestic industries. Currently, the price of iron ore and steel are not regulated in South Africa but are subject to competition law enforcement. The pricing mechanisms of iron ore and steel are determined by the market and negotiation between buyers and sellers.

This research has considered three options that the government should consider to achieve a competitive or developmental prices for iron ore and steel:

a) **Introducing a price regulator:** the government should consider introducing a price regulator for strategic minerals such as iron ore and feedstock like steel for the local market. The regulators' mandate should be to ensure that the iron ore and steel products are supplied to the local market at cost-plus reasonable margin. Mr Gerrit Kruyswijk suggests that if the government wants to regulate prices of strategic minerals like iron ore, it must ensure that local steel producers pass-down the price to downstream industries otherwise steel producers can absorb the costs advantage and make additional profits (Interview: Kruyswijk, 2018).
b) **Amendment of the Competition Act:** the current competition laws hinder the prosecution of firms that charge customers' excessive prices. Moreover, it takes time to investigate and prosecute firms for contravening competition law provisions.

Decisions of competition law authorities are also susceptible to appeal by higher courts and longer litigation periods by private firms with financial power. The Competition Act must be amended to include appropriate methodology to determine excessive pricing, especially for monopoly industries. The sanctions for excessive pricing of key strategic inputs should be harsher to deter firms from contemplating charging high and excessive prices.

7.2. Creating a vibrant economic environment for downstream beneficiation: the use of SOEs to support beneficiation

Infrastructure development contributes positively to economic growth and reduces production costs (Kessides, 1993). The government must ensure that all inputs and services required for downstream beneficiation are available and offered at the discounted or subsidised price. ANC SIMS (2012) states that coal should be utilised to fully support the needs of Eskom before it can be exported. It also recommends that Eskom should expand capacity of electricity supply. The government should also consider other alternatives energy mixes such as gas-based power generation and nuclear. The DTI (2014:82) IPAP report states that government and business recognise the role of developed infrastructure as a driver of economic growth. IPAP calls for the cost of doing business to be reduced to enhance the competitiveness of the country's goods and services.

Eskom and Transnet are expected to introduce and implement the Beneficiation Promotion Programme (BPP) to incorporate the government's industrial policy into the determination of their tariff determination process. This will ensure that industries are incentivised to beneficiate rather than exporting raw minerals. Industries that beneficiate until the last stage will be offered significant discount to encourage more entry into the market. For instance, IPAP suggests a lower tariffs of 60 to 80% discount for stage 4 value addition industries that wish to export value-added products as opposed to un-beneficiated minerals.

7.3. Knowledge and development linkages

There is a strong correlation between knowledge and economic performance. The government should investment in technical skills at various grades during the schooling years. The government should encourage both quantitative and qualitative educational training. Jourdan (2014) recommends that developing local technology through RDI funding can strengthen the iron and steel value chain. This is intended to develop competitive solutions to technological challenges at all stages of the value chain. Jourdan emphasises that no country has successfully built a mature economy from its mineral resource base without significant and sustained investment in technical knowledge and R&D. Equally, Turok (2004) finds that

South Africa needs to substantially expand R&D spending, create design studios and generate capabilities by learning through doing.

7.4. Vertical integration: Iron ore and steel operations

If an iron ore mine is integrated downstream into steel production then the ore would be transferred at cost and profit taken from steel sales (the resource rents would thus be transferred downstream and be realised in steel profits). Previously in the days of ISCOR, AMSA was vertically integrated and had access to cheap iron ore and coal.

According to Mr Dean Subramanian it would be beneficial for a steel producer to be vertically integrated by owning iron ore and coal mines. Mr Dean Subramanian cautions that vertical integration comes at huge cost such as acquiring mines, capital equipment and the volatility of iron ore prices. Concluding on the topic of vertical integration Mr Dean Subramanian affirms that “the benefits of backwards vertical integration into iron ore are significant for a steel plant. A steel plant has to be both backward and forward integrated. Backwards into iron ore mine and forward integration into supply chain that can sell steel into end-users. If you look at the model in Brazil, most steel plants own iron ore mines and distribution outlets. Therefore, it is essential to integrate backwards and forward but it comes with costs” (Interview: Subramanian, 2018).

Mr Gerrit Kruyswijk also views vertical integration of steel plant into iron ore as crucial. Mr Gerrit Kruyswijk advices that “one must not look at iron ore in isolation as the key to beneficiation… you must carefully look at other costs drivers or components. If you look at Mittal you will see that their RMB is the main costs component for steel and cooking coal forms part of that basket” (Interview: Kruyswijk, 2017). Ideally a steel firm should backward integrate into iron ore and cooking coal to be costs effective.

7.5. Export tariffs for iron ore

ANC (2012) SIMS report and Jourdan (2014) propose that trade tariffs be treated as industrial strategy instruments, rather than a fiscal revenue instruments. Consequently, trade tariffs should be administered by the DTI and not by the Treasury. Consideration should be given to the introduction of reasonable export tariffs on selected strategic minerals or mineral-based feedstocks to facilitate the local beneficiation. The government should also consider renegotiating or terminating bilateral trade agreements that constrain the introduction of reasonable and judicious export tariffs on strategic mineral commodities. However, the domestic power crisis still needs to be acknowledged and resolved to ensure that minerals are locally beneficiated.

The challenge is imposing export tariff for iron ore when South Africa has not adequately addressed the lingering power constraint and the rail and ports tariffs. Government should only consider imposing tariff on iron ore exports once power and logistics constraints are adequately addressed. In other words, once these inputs or services are subsidised to industries that beneficiate. Export tariff for iron ore should be imposed to encourage downstream beneficiation on the assumption that (i) raw mineral producer will be encouraged to transform the product into a higher value-added product internally or (ii) raw mineral producer will sell to local industries that are willing to add value to the mineral and subsequently sell the higher value product to the local and export market.

Mr Dean Subramanian argues that the government cannot simply impose iron ore export tariff without a detailed policy on iron ore tariff and beneficiation. Mr Dean Subramanian states that the government "needs a policy measure to indicate that for iron ore the government want X% to be beneficiated locally…the government also need a policy measure with coal to say that it wants X% to be beneficiated locally" (Interview: Subramanian, 2018). Currently, it is much more beneficial for mineral producing companies to export minerals rather than beneficiating locally.

Mr Saul Levin states that export tariff can only be imposed on strategic minerals not all minerals. The government must identify strategic minerals for beneficiation and establish a support policy framework. Mr Saul Levin states that "if the government put in unbearable conditions on firms, local or foreign, to invest in mining they will not invest… if you put in export tax to strategic minerals that is great for local industries that want the input but the environment must be supportive of beneficiation… the government must put a notice to the industry like in 5 years' time the government will impose export tax and there is going to be an incentive to invest in beneficiation along these minerals… in this way the government manages expectations and allow the mining industry to prepare for export tariffs or tax period or to consider acquiring the skills, capital and technology to beneficiate" (Interview: Levin, 2018).

7.6. State levers to support the declining steel industry

To protect the primary steel industry, the government need to impose safeguards and duty measures for the primary, secondary and finished steel products. Mr Dean Subramanian argues that China no longer import as much of primary steel as they used to, instead China has started importing significant volumes of secondary and finished steel products. Therefore, the government should consider protecting and supporting the secondary and finished products industry (Interview: Subramanian, 2018).

Mr Gerrit Kruyswijk suggests that the declining South African steel industry can be supported from a procurement perspective. According to Mr Gerrit Kruyswijk the government must create growth for domestic steel market. Mr Gerrit Kruyswijk suggests that the government creates growth in the domestic steel market through procurement especially state procurement. For example Transnet, Eskom, water infrastructure all have to procure steel locally and it must be compulsory for these government institutions to procure steel locally" (Interview: Kruyswijk, 2018).

There must a written agreement between state institutions that when SOEs or company such as IDC become a shareholder in the project that require steel, only locally produced steel must be used in the project. This implies that the steel industry can be supported firstly by creating a demand and right investment climate in the country. Once the demand is created, the steel is designated. In other words, a condition is formulated and implemented that clearly state that all SOEs must procure steel locally. The government must also put regulatory mechanism (e.g. pricing) in place to ensure that local steel producers do not abuse state support or limited competition for SOEs projects.

7.7. Financial incentive for downstream industries

Mr Saul Levin explains that the private sectors objective is to make profit. Therefore, government should introduce an incentive and support programme that will enable private industries especially in manufacturing and mineral value addition to make profit (Interview: Saul, 2018). This incentive can include: government assisting (through co-sharing finance) industries to finance their (i) machinery and equipment (ii) working capital and (iii) feasibility studies. The government must clearly indicate which minerals it want to beneficiate and make industrial finance available and assist in creating a market for the downstream products. Mr Gerrit Kruyswijk states that the government should also use the funds they obtain from duties related to steel to stimulate the downstream industry.

Moreover, given that import duties increase the price of steel, the government can also consider rebates duties for local industries that are likely to be negatively affected. According to Mr Gerrit Kruyswijk there is a steel fund created for downstream industries where the government (IDC & DTI) are subsidising the downstream steel users. The government must utilise this steel fund in a manner that allow companies that use steel to obtain low interest loan from IDC if they wish to expand their production capacity or purchase new machinery equipment or technology (Interview: Kruyswijk, 2017).

7.8. New steel investments: state-led steel company

The government should consider establishing a new state owned steel firm. The mandate of this steel firm will be to support downstream beneficiation rather than profit maximization. The new steel firm will enhance competition in the steel industry. The benefits of increased competition in the steel industry include, *inter alia*: lower steel prices and increased product range of flat and long steel products for downstream users of steel. Moreover, competition leads to efficiencies and innovation in the market between competing firms. The DTI (2013) states that IDC has been conducting a pre-feasibility study on establishing a new steel firm. However, the steel industry is characterised by numerous factors that impedes new entry into the market. These barriers include: high capital and investment costs of establishing a steel plant, access to local and international market, technological innovation in steel production and competing with China's low steel prices.

Mr Gerrit Kruyswijk argues that conducting a detailed pre-feasibility study is critical before deciding whether to establish a steel plant or not. The government has to ask key questions and consider the market dynamics in the global steel industry. In Mr Gerrit Kruyswijk's view the feasibility study should consider, amongst others, how the new steel plant will compete with China's excess surplus of steel, state supports and subsidies and modern blast furnace technology (Interview: Kruyswijk, 2018). According to Mr Saul Levin it will not be a good idea for the government to establish a new steel plant. The South African market is not sufficient to consume all the steel produced locally. Therefore, the demand for steel in the global market is critical. The Chinese have already filled the gap for global steel demand and production (Interview: Levin, 2018).

The government should conduct a detailed pre-feasibility study on the possibility of opening a new steel plant. The study should consider:

- Whether there are national or international investors with expertise in steel production that willing to enter into a joint venture with the government. The partnership should be based on conditions such as the steel plant will charge local customer developmental prices and different grade of steel that are critical for the local market will be made available at all times; and
- How to minimise the costs structure of the steel plant. This include the minimising the costs of the RMB and partnering with SOEs (rail, ports, power and technology) to reduce the costs of doing business and improving R&D.

CHAPTER 8

CONCLUDING REMARKS

This research focussed on mineral beneficiation in the iron and steel value chain. The aim was to critically assess the role of mineral beneficiation in the iron and steel and identify ways in which the downstream linkages can be exploited to support the country's developmental objectives. The research finds that iron and steel value chain is a critical contributor to the economic development path of South Africa. The role of mineral beneficiation in the iron and steel sector is to ensure that the country's abundant minerals are utilised in a manner that supports downstream manufacturing. Mineral beneficiation and its linkages can assist manufacturers to become cost effective and competitive.

However, the research finds that despite the economic benefits associated with downstream beneficiation, there is currently little value addition taking place in the iron and steel value. South Africa largely exports un-beneficiated or semi-processed ore, thus limiting employment creating opportunities. South Africa has failed to exploit downstream linkages due number of reasons that include: limited access to raw material for local beneficiation and anti-competitive pricing or the use of Import Parity Pricing (IPP) by producers of raw materials. The research has formulated recommendations that can assist the government to fully beneficiate the iron and steel value chain. Some of the recommendations include better coordination between government departments (EDD, DTI and DMR) responsible for industrial policy and mineral beneficiation, greater spending and investment in long-term knowledge and physical infrastructures and regulating the private sector.

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INTERVIEW LIST

Telephone interview with Mr Gerrit Kruyswijk dated 21 February 2018

Telephone interview with Mr Saul Levin dated 1 March 2018.

Telephone interview with Professor Ben Turok dated 7 March 2018.

Personal Interview with Mr Dean Subramanian dated 20 March 2018.