

https://dspace.org/

The implications of mineral resources beneficiation in South Africa

Shandu, Richard Dumisani

2015
http://hdl.handle.net/10539/20013

Downloaded from a DSpace repository. https://dspace.org/

The implications of mineral resources beneficiation in South Africa

Richard Shandu

Supervised by Prof Frederick Ahwireng-Obeng

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

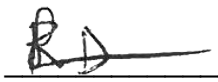
Johannesburg, 2015

ABSTRACT

South Africa is ranked amongst the top five mineral-rich countries in the world. It takes first position when it comes to platinum reserves. Most of the mineral resources are exported in raw form to foreign destinations and they are then imported back into the country as finished goods. Government has come up with a local mineral beneficiation strategy that has in it about ten mineral resources that have been identified as the initial minerals that need to be beneficiated in the country. This study investigated challenges that would be faced by the country when implementing mineral beneficiation. The study was a qualitative study that was done through field interviews that were conducted on industry practitioners and related industries. Fourteen interviews were conducted in this study. The study found that there are challenges that are faced by local industries around pricing of mineral resources. They feel that they are overcharged, yet they are at the doorstep of mining. They feel that overcharging emanates from import parity pricing that is imposed on the raw material making them pay a price that is equivalent to that that is paid by importers of South African raw minerals in foreign destinations. The other challenges that were identified are energy, market, water utilities and government regulations. Energy was identified as the most serious challenge that is facing the country and that will definitely negatively affect implementation of a local mineral beneficiation strategy. Local beneficiation will be good for the country's economic growth, employment, skills development, and many other benefits, but the challenges have to be taken care of first before embarking on implementation of the strategy.

DECLARATION

I, Richard Shandu, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Signed at Johannesburg

On the 31st day of May 2015

DEDICATION

This is dedicated to my whole family, wives and kids. I told them that I was doing this for them when I started. I've always maintained that I'll do the best I can so that they can have a better life. This was one of the milestones I wanted to achieve for their better life.

My brothers, Thulani and Tito, my sisters, Hlengiwe and Muke, and my daddy, I won't forget you too. You are my pillars of strength. You have always been there, as a family, my whole life. You are my extended bigger family in addition to the young family I mentioned above. My brother Thulani - keep being a glue that holds us together as a family. You won't know the impact that you are having on us as a family. I have achieved things that I could not have achieved without your support. It also came through in my studies. I just want to say thank you and let us keep the name of the family high.

ACKNOWLEDGEMENTS

A big thank you to the respondents in this study. Their invaluable contribution has made this study a success. Your invaluable time and allowing me to interview you between your hectic schedules is highly appreciated. Thank you to those referrals as well that you gave me during interviews. They honoured my request to participate in the study.

I want to say thank you to my study supervisor. Thanks for all the support and timeous feedback. That has propelled me to complete this study.

I know it is always difficult to call up everyone that made contribution in supporting one during the study. I would like to apologise in advance to those whose names are not appearing in this acknowledgement. Your support meant a lot to me, and is highly appreciated. At IMS Engineering, my current employer, there are many colleagues that supported me in the study. Every engagement with them and confidence they showed in me gave me the drive to work hard in completing this study. I will mention two names and put everyone else under one umbrella. Mr Johan Snyman, our general manager, and Mr Andrew Welsh, our financial manager, thank you so much. This is not to say other senior management did not give support, but these two are the people that I was engaging with from the time I started thinking about enrolling for MBA and throughout the programme.

My family endured pain of not spending time with me because I was most of the time busy with my MBA studies. They supported me throughout the MBA programme. I just want to thank them all for their support. It kept me going. I really appreciate their being by my side all the way. It is a great pleasure seeing all your support that complemented my hard work culminating in the completion of my study.

I thank you all.

TABLE OF CONTENTS

ABSTRACT ii

DECLARATION iii

DEDICATION iv

ACKNOWLEDGEMENTS v

LIST OF TABLES ix

LIST OF FIGURES x

CHAPTER 1. INTRODUCTION 1

1.1 CONTEXT OF THE STUDY 1

1.2 PROBLEM STATEMENT 6

CHALLENGES ASSOCIATED WITH IMPLEMENTING MINERAL BENEFICIATION IN THE COUNTRY. 6

1.2.1 *MAIN PROBLEM* 6

1.2.2 *SUB-PROBLEM ONE* 6

1.2.3 *SUB-PROBLEM TWO* 6

1.2.4 *SUB-PROBLEM THREE* 7

1.3 PURPOSE OF THE STUDY 7

1.4 SIGNIFICANCE OF THE STUDY 8

1.5 DELIMITATIONS OF THE STUDY 9

1.6 DEFINITION OF TERMS 9

1.7 ASSUMPTIONS 10

1.8 THE REST OF THE REPORT 10

CHAPTER 2. LITERATURE REVIEW 12

2.1 INTRODUCTION 12

2.2 DEFINITION OF TOPIC OR BACKGROUND DISCUSSION 12

2.3 SECURE SUPPLY OF MINERALS 15

2.3.1 MINERALS AVAILABILITY 15

2.3.2 MINERALS REGULATION 17

2.3.3 ACCESS TO INTERNATIONAL MARKETS 19

2.3.4 RESEARCH QUESTION 1 23

2.4 ESTABLISHING A MANUFACTURING SECTOR 23

2.4.1 INFRASTRUCTURE 24

2.4.2 INDUSTRIALISATION 26

2.4.3 LABOUR COST 26

2.4.4 Secure energy supply 27
2.4.5 Research Question 2 29
2.5 Skills 29
2.5.1 Research and development 30
2.5.2 Specialised skills 31
2.5.3 Productivity 31
2.5.4 Research Question 3 32
2.6 Conclusion of Literature Review 32

CHAPTER 3. RESEARCH METHODOLOGY 35

3.1 Research methodology / paradigm 35
3.2 Research Design 36
3.3 Population and sample 37
3.3.1 Population 37
3.3.2 Sample and sampling method 37
3.4 Demographic profile of respondents 38
3.5 The research instrument 39
3.6 Procedure for data collection 40
3.7 Data analysis and interpretation 41
3.8 Limitations of the study 42
3.8.1 Research Sample 42
3.8.2 Other Limitations 43
3.9 Validity and reliability 43
3.9.1 External validity 43
3.9.2 Internal validity 44
3.9.3 Reliability 44
3.10 Conclusion of research methodology 45

CHAPTER 4. PRESENTATION OF RESULTS 46

4.1 Introduction 46
4.2 Demographic profile of respondents 46
4.3 Results pertaining to Research Question 1 50
4.3.1 Diverse respondents' feedback 50
4.3.2 Conclusion 60
4.4 Results pertaining to Research Question 2 60
4.4.1 Diverse respondents' feedback 60
4.4.2 Conclusion 73
4.5 Results pertaining to Research Question 3 73
4.5.1 Diverse respondents' feedback 73
4.5.2 Conclusion 79

CHAPTER 5. DISCUSSION OF THE RESULTS 80

5.1 Introduction 80
5.2 Demographic profile of respondents 80

5.3 DISCUSSION PERTAINING TO RESEARCH QUESTION 1 80
5.3.1 MINERALS AVAILABILITY 81
5.3.2 MINERALS FAIR PRICE 82
5.3.3 POLITICAL WILL 85
5.3.4 GOVERNMENT REGULATIONS 86
5.3.5 MINING LICENCES 87
5.3.6 COHERENT STRATEGY 88
5.3.7 AFRICA AS A SOURCE 88
5.3.8 CONCLUSION 89
5.4 DISCUSSION PERTAINING TO RESEARCH QUESTION 2 89
5.4.1 LABOUR 90
5.4.2 GOVERNMENT REGULATIONS 91
5.4.3 MARKET 92
5.4.4 FAIR PRICE 93
5.4.5 ENERGY 94
5.4.6 JOB CREATION 95
5.4.7 OVERHEADS 95
5.4.8 CONCLUSION 96
5.5 DISCUSSION PERTAINING TO RESEARCH QUESTION 3 97
5.5.1 TECHNOLOGY 97
5.5.2 TRADE SKILLS 98
5.5.3 SKILLS DEVELOPMENT 99
5.5.4 SPECIALIST SKILLS 99
5.6 CONCLUSION 99

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS 101

6.1 INTRODUCTION 101
6.2 CONCLUSIONS OF THE STUDY 101
6.2.1 SECURE SUPPLY OF MINERALS 102
6.2.2 MANUFACTURING IMPROVEMENT 102
6.2.3 SKILLS 102
6.3 RECOMMENDATIONS 103
6.3.1 GOVERNMENT 103
6.3.2 MINING COMPANIES 103
6.3.3 MANUFACTURING SECTOR 104
6.3.4 RESEARCH INSTITUTIONS 104
6.3.5 CONSULTING FIRMS 104
6.3.6 EDUCATION INSTITUTIONS 104
6.4 SUGGESTIONS FOR FURTHER RESEARCH 105

REFERENCES 106

Appendix A 112

INTERVIEW CONSENT FORM 112

Appendix B 113

SEMI-STRUCTURED INTERVIEW QUESTIONS 113

LIST OF TABLES

Table 1: Profile of respondents 38

Table 2: Profile of respondents (planned vs actual) 39

Table 3: Demographic profile of the respondents..... 47

Table 4: Core themes extracted from question 1 interviews..... 51

Table 5: Core themes extracted from question 2 interviews..... 61

Table 6: Core themes extracted from question 3 interviews..... 75

LIST OF FIGURES

Figure 1: Mineral beneficiation stages 3

Figure 2: African mineral resources in top ten world rankings 5

Figure 3: Metallurgical beneficiation and shaping 14

Figure 4: Beneficiation economic linkages 15

Figure 5: Value add through commodity chain 24

Figure 6: Ferro-silicon prices 83

Figure 7: Silicon metal prices 84

Figure 8: Ferro-Manganese prices 85

CHAPTER 1. INTRODUCTION

1.1 Context of the study

South Africa (SA) is one of the richest countries, globally, in mineral wealth (Mohlala, 2010; Republic of South Africa, 2013; Soko & Balchin, 2012). Some of the minerals mined in the country are in the top ten in the world rankings (Republic of South Africa, 2013). For many years the country has been known for mining gold that is found mostly in Witwatersrand area, in Gauteng province. SA is ranked number one in the world in platinum supply and reserves (Republic of South Africa, 2013). The rankings are well and good because the country has a good name about its mineral resources. These minerals are grouped into five value chains:

- Energy commodities (coal, uranium and thorium);
- Iron and steel (iron ore, chromium and manganese);
- Pigment and titanium production (titanium and vanadium);
- Autocatalytic converters and particulate filters (platinum);
- Jewellery fabrication (gold, diamonds and platinum).

For most people in the country, who are looking for employment, they want to see those rankings translated into employment and business opportunities. They want to be economically active but scarcity of job opportunities makes them see no need to celebrate the good news about the country's rankings of its raw mineral wealth. With the current skewed benefit of having mineral resources, it is difficult to see more and more people being employed in the country. Mineral resources are predominantly exported in raw form. They are then imported back into the country in finished manufactured products from countries to which they were exported. They come at a price that is multiples of the cost of raw mineral resources. That value-add of producing finished goods is the missing link in the value chain of SA mineral resources.

It has been advocated for many years that SA should beneficiate its mineral resources. As far back as in the eighties there were suggestions about

beneficiating the country's minerals in order derive more value from the mineral wealth (Jourdan, 2001; Robinson & von Below, 1990). The studies that have been done to suggest to government that mineral beneficiation would be of benefit to the country have not fallen on deaf ears. Government came up with a beneficiation strategy in which it identified ten mineral resources that should be beneficiated in the country (Republic of South Africa, 2011).

Government has seen that in order to face the challenges that it has with promising positive outcomes, it needs to draw from its mineral endowments. It has seen that focusing mainly on the mining activities without extending the value chain, it is exporting jobs to other countries that benefit economies in foreign destinations. In the mineral beneficiation stages shown in Figure 1, SA is mostly involved in the first two that form part of mining. The jobs that could be created in stages 3 and 4 that form part of the manufacturing phase are exported as raw material/minerals to foreign countries. Beneficiating to a level of producing finished goods is where the value lies. Manufacturing has a significant contribution to make in knowledge generation, research and development and technology. Skill sets in manufacturing are so diverse and makes people in that sector versatile. Here is a breeding ground for entrepreneurs. More and more businesses opened means that the fight against unemployment and poverty will eventually bear fruit. With local beneficiation of mineral resources, the aforementioned will be realised in the country. There are good examples in the country where beneficiation is done and the benefits and achievements are making the world see that SA does not only have mineral wealth, but skills and technologies that are high tech. Typical examples are coal beneficiation done by Sasol, and steel done by Arcelor Mittal. There is abundance of coal reserves in SA that will be mined for many decades to come (Jeffrey, 2005b). Sasol is beneficiating the coal and producing a vast product range that it supplies not only to SA market but internationally. Their expertise of mineral beneficiation has made them a power house in energy. They now have operations in international territories. Arcelor Mittal is beneficiating iron ore to make steel. Their steel is consumed by domestic and international markets. Multiples of these two typical examples of beneficiation are required in the country in order for the country to be self-sufficient and get more of its people

economically active. Government wants to see that happening with the implementation of the mineral beneficiation strategy.

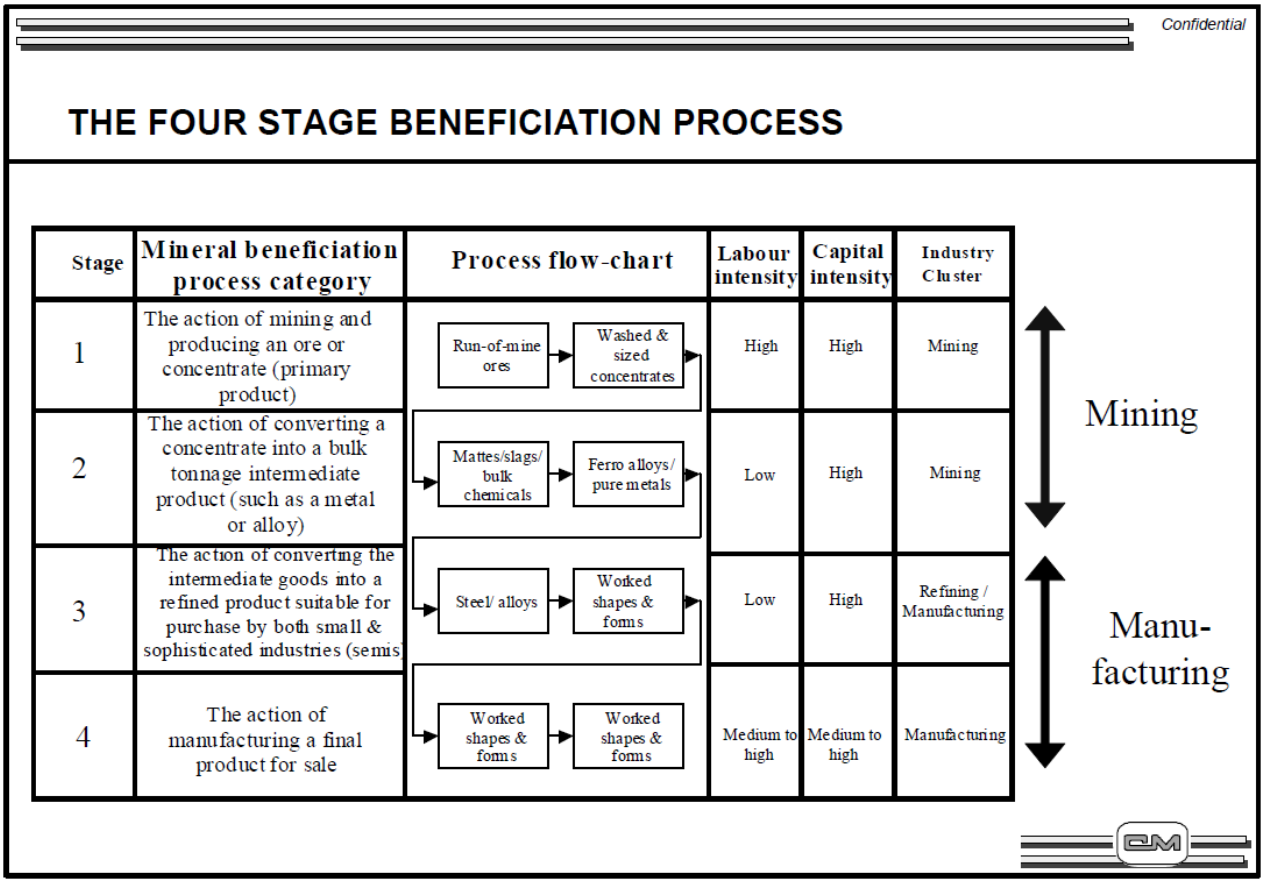


Figure 1: Mineral beneficiation stages

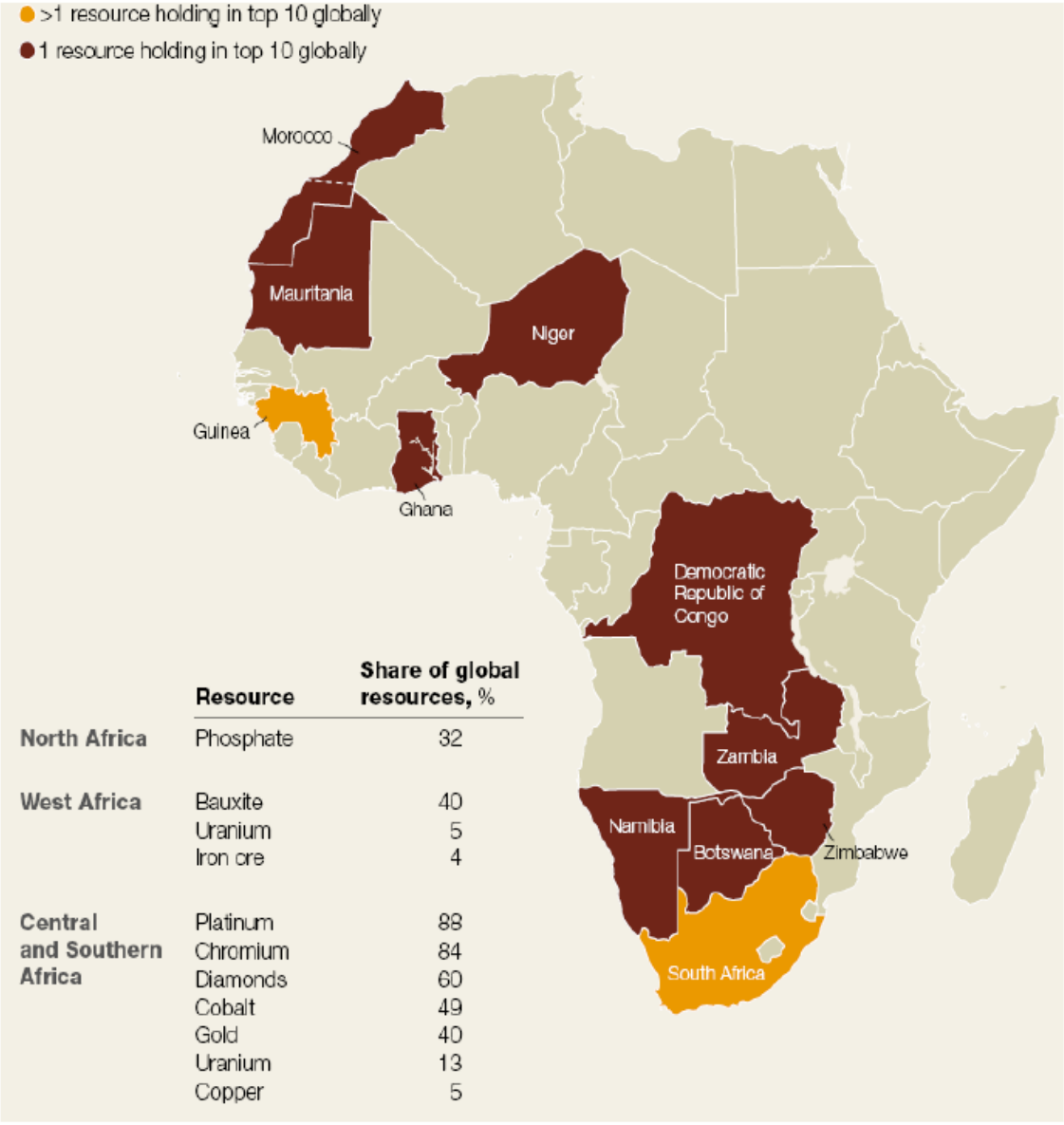
Source: Baxter (2005)

SA is not alone in the drive for mineral beneficiation. In fact the whole continent has already resolved to beneficiate its mineral resources (African Union, 2009). Mineral resources ministers of respective African states met and decided on how they can beneficiate mineral wealth that is found on the continent. They first identified mineral resources on the continent that are in the top ten world rankings (African Union, 2012). Figure 2 shows countries with minerals that are in the top ten world rankings. It can be seen that only two African countries have more than one mineral in the top ten, SA and Guinea. The majority of the minerals in the top ten are mined in SA. The same minerals form the majority of the minerals that are in SA's mineral beneficiation strategy. Africa is really pushing this agenda of mineral beneficiation throughout the continent. The

approach that they have taken of bringing all African states together and agreeing on this is a good move. Now the states have to implement the strategy. SA is making strides towards achieving that by developing its own mineral beneficiation strategy. Ahead of them all is Botswana. They have already started implementing a mineral beneficiation strategy. Previously they used to export their diamonds to sightholders in London (BIDPA & Botswana Chamber of Mines, 2012; De Beers, 2012). Local siteholders in Botswana are buying diamonds from London siteholders. Government there saw that their mineral wealth was leaving its country of origin in raw form only to come back either in the same raw form purchased from foreign siteholders or in finished goods form. Their government took it upon itself that they would not allow that to continue happening. They came up with a policy that said that diamonds that are mined within their country should be sold to local siteholders, or a major allocation should be made for the local people. That policy was passed and it was planned to be implemented by the end of 2013. SA benefited in this Botswana government policy because De Beers said that they would do likewise in this country. At least there is a buy-in from a major mining house. Hopefully the others will follow suit when asked to give first preference for sales of raw minerals to the local manufacturing sector.

This African move toward local beneficiation did not go down well with the European Union. EU came up with its own raw minerals strategy (Buggess, 2010). In this strategy, they identified critical raw minerals for them that they mine in their own regions as well as those that they import from other countries. In their strategy, it can be seen that they are bitter about the whole beneficiation strategy on which resource-rich countries are embarking. They are worried about future secure supply, tariffs, taxes and environmental risks. They go on to say that they will fight to the bitter end to make sure that they do not see themselves disadvantaged by local beneficiation in resource-rich countries. They even mention that they will exploit every avenue through governance bodies like United Nations, World Bank and International Monetary Fund in their fight against whatever measures that resource-rich countries will put in place for their own local industrialisation. This is going to be a real test, since EU are big trade partners of Africa. SA has had EU as its biggest trade partner until

recently when EU went into deep recession and saw the African trade component taking the lead over SA's EU trade partners (Africa, 2013). EU has had a lot of leverage in accessing the raw minerals in Africa through the aid that they have been offering for decades that best positioned them to negotiate favourable deals in mining licences (Ramdoo & Bilal, 2014). But now that Africa has seen that they have been giving away their most valuable wealth in exchange for aid, how is the relationship going to be with EU going forward?



	Resource	Share of global resources, %
North Africa	Phosphate	32
West Africa	Bauxite	40
	Uranium	5
	Iron ore	4
Central and Southern Africa	Platinum	88
	Chromium	84
	Diamonds	60
	Cobalt	49
	Gold	40
	Uranium	13
	Copper	5

Figure 2: African mineral resources in top ten world rankings

Source: African Union (2012)

1.2 Problem statement

Challenges associated with implementing mineral beneficiation in the country.

1.2.1 *Main problem*

The main problem of this study was the investigation of challenges that are associated with implementation of mineral beneficiation in the country. Did the government make a good move when embarking on mineral beneficiation of identified mineral resources that are mined in the country? Should it continue to export raw minerals as it has been doing for many years? What about the impact of exported employment and skills that could have been created in the country?

1.2.2 *Sub-problem One*

The first sub-problem focused on availability of mineral resources in the country. As much as the minerals are extracted from the country, licences that permit trade are held outside the borders of the mineral-rich country. For example, diamond siteholders are based in London (De Beers, 2012). Companies that want to beneficiate in their mineral-rich countries buy the quantities that they need from siteholders. This is already a channel that accumulates cost that will be a burden to customers. In the case of platinum, there is a significant beneficiation done in the country, but more can still be done. Platinum is used in the manufacture of electronic components and catalytic converters in the automotive industry. Big contracts were recently signed for supply of locally manufactured catalytic converters to the European market.

1.2.3 *Sub-problem Two*

The second sub-problem looked at the impact of local mineral beneficiation on the manufacturing sector, namely, growth and employment. The manufacturing sector has seen its dominance in gross domestic product contribution overtaken by the service sector. It is currently hampered by high costs of production and

that has made it see its business exported to Asia. Will they be able to compete in this space when compared to the Asian counterparts?

1.2.4 *Sub-problem Three*

The third sub-problem looked at the impact of skills in the implementation of local mineral beneficiation. Skills shortage is currently a major problem in the country to the extent that the Minister of Higher Education has gazetted a list of the top hundred scarce skills in the country (Republic of South Africa, 2014). How will the reported skills problem impact on the whole beneficiation strategy?

1.3 Purpose of the study

The purpose of the study was to look at implementation of local mineral beneficiation. The mineral beneficiation strategy clearly articulated which minerals should be beneficiated in the country. Some of the minerals are currently beneficiated in the country to produce finished goods. A few examples that can be mentioned are coal, iron ore, platinum, diamond and gold. These minerals form part of the minerals that are mentioned in the minerals beneficiation strategy. More value can still be created when beneficiating these minerals (Baxter, 2005). They add very little value on other minerals by beneficiation because they are only prepared before exportation for further beneficiation. The preparation that is done to them is more like removal of waste, cleaning and smelting to create ingots and bars that are ready for the next beneficiation stages.

The study looked at the entire mineral beneficiation value chain to see if the proposed mineral beneficiation strategy can be implemented in the country. It engaged the beneficiation economic linkages where role players were selected to be interviewed about implementation of the mineral beneficiation strategy in the country. This was done in order to get their point of view about the strategy and how are they seeing it and the contribution it can make in the country.

1.4 Significance of the study

This research makes an invaluable contribution to all role players (government, mining companies, manufacturers, research institutions, consultants, education institutions) in mineral beneficiation, investors that are looking at investing in new projects, countries and companies that are currently doing local beneficiation and those that are still thinking about it.

The beneficiaries of this study are all role players in the beneficiation process, the main one being government. Why government? Government is the main player here in the sense that it has come up with the beneficiation strategy, and also has powers to create an enabling environment that will see the strategy being realised. The study is expected to inform government about views that other stakeholders have about the beneficiation strategy. It will also help government in its planning for the implementation of the strategy.

Mining companies will know what influence they have in the success of the mineral beneficiation strategy. They will also know about other stakeholders' position and how that impacts on them. The manufacturing sector is expected to be the most benefiting stakeholder as production of finished goods involves manufacturing. They will learn about their industry's expected involvement and the benefits.

There are many linkages to the mineral beneficiation value chain that also bring in other supporting institutions that may be seen as remote to the entire value chain. Mineral beneficiation is energy and technology intensive. New technologies will need to be created that are more advanced and take cognisance of the global challenges of saving the planet. Old thinking of saying that resources are in abundance then creating technology that can be used during the lifetime of the resource do not have a place these days. Innovation is what is needed. Innovation should not only wait for a crisis to occur before making a breakthrough. It should be done very early. For example, steel was in abundance many decades ago. Heavy cars were made with steel decades ago and there was also an abundance of oil to fuel these heavy vehicles. However, when the oil crisis hit the world cars had to be made lighter with more weight

allocation going to payload. That was just a start. Today, cars pay tax for greenhouse gas emissions. These taxes should drive research institutions and educational institutions to come up with ideas that can be employed in mineral beneficiation. They can do a number of things, such as looking at innovative processes, develop new uses of mineral resources, develop new technologies, etc.

New infrastructure will be needed. That infrastructure will have to be built and maintained. Skills will be needed in order to implement and maintain the infrastructure. Those skills do not necessarily have to reside in the firms that will be directly involved in mineral beneficiation. They will need the services of consultants that can do that part for them so that they can get the required infrastructure to run operations. Consultants need to identify what opportunities they can take when mineral beneficiation starts happening.

1.5 Delimitations of the study

The study focused on mineral beneficiation in the country within the framework that has been presented in the minerals beneficiation strategy that government is embarking on. Senior management, academics, strategists and economists in related sectors and experts were interviewed that are associated with mining related activities as well as manufacturing. The analysis that was done in the study is based on the information gathered in the field interviews. The findings of the study could not be generalised since this is a qualitative research.

The scope of the study stayed within mineral beneficiation linkages. Efforts were made to get major role players in beneficiation stages from extraction through to the finished manufactured components. The list of respondents that participated in the study appear in the results section of the study, Chapter 4.

1.6 Definition of terms

Beneficiation - “Beneficiation is the process of value addition in the country through processes like manufacturing and refining. It creates greater short-term value through raising the value of the exported materials and, more importantly,

it provides a foundation for post-mining economies built on greater technical skills, improved economic and physical infrastructure and strengthened linkages between productive economic sectors" (De Beers, 2012, pg. 8).

Sightholder – "A Sightholder is a company on the Diamond Trading Company's (DTC) list of authorized bulk purchasers of rough diamonds" (Grynberg, 2013, pg. 2).

1.7 Assumptions

The following were assumed in this study about the people that would be consulted / interviewed;

- They would be willing to share their views about the strategy.
- They would freely express their company's position on the realisation of government's beneficiation strategy.
- They would not have problems with the publication of their responses in the final report.
- They would make time in their diary for interview questions related to this study.
- They would accommodate interviews in time for one to be able to prepare a write-up and submit the report on time to the school.

1.8 The rest of the report

This chapter is followed by five more chapters; Chapter 2 through Chapter 6. Chapter 2 talks about literature review. The literature review is a section that consults work that has been done by other researchers that is related to this study. Lessons that could be learnt from their work were noted. Literature also helped in the development of research questions for this study. The literature also came in later in the justification of the findings of this study.

Chapter 3 discusses the research methodology that was used in the study. This is the section of the report that shows the roadmap. Preparation of the research strategy, its execution and wrapping up is described in this section. After all

groundwork has been done, this section gives direction of what should be done next, how it should be done, what data should be gathered and the treatment of the data. The approach of the analysis is explained in Chapter 3. The following sections draw from the strategy that has been presented in this section.

Chapter 4 presents the results of the study. This section deals with the treatment of the gathered field interviews. The presentation is done in preparation of their analysis. In Chapter 4 the demographics of the respondents are also presented and discussed.

Chapter 5 deals with the analysis and discussion of the results of the study. In this section the literature is revisited in the justification of the findings. All the work that was done in the study is realised in this section. The results discussion prepares for conclusions that can be drawn on the study.

Chapter 6 deals with the conclusions and recommendations of the study. This is where the deliberations on the findings of the study are concluded. What was noted from the study and areas of research that would be good to pursue further are mentioned in this section under recommendations.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

In this section literature shall be reviewed in line with the problems that have been identified in Chapter 1 where one main problem was identified with three sub-problems. This section is divided into subsections that deal with what was mentioned in Chapter 1. All research questions are discussed with literature helping to understand the extent of the problem even more.

2.2 Definition of topic or background discussion

A typical example of a full beneficiation process is shown in Figure 3. In the figure full beneficiation of mine ore to produce steel is shown. Here the processes that are involved in the beneficiation of mine ore are shown from the stage when ore has been crushed to size that can be used in secondary processes. This is a good example that displays what opportunities are lost when minerals are exported in their raw form. Figure 4 shows mineral beneficiation economic linkages. The value added that is shown in this figure cannot be realised when minerals are exported in their raw form. Usually when the minerals are exported in raw form they are beneficiated in the country up to processing stage where they would have been prepared by cleaning, separation and smelting. The beneficiation strategy aims to change that. It aims to see other economic linkages come to the party. That can be achieved with the full beneficiation of a mineral to produce finished goods. There is a spill over effect on other supporting links that are either directly or indirectly linked to mineral beneficiation value chain. Local mineral beneficiation will make a valuable contribution in their growth.

There are several economic linkages that support mineral beneficiation throughout the entire value chain from extraction to finished goods. In the upstream linkages there are firms that supply goods and services that are needed for mineral extraction (Ramdoo & Bilal, 2014). Things like water supply,

mining equipment and consumables, mining plants, consulting, etc. are provided in the upstream linkages. Downstream linkages make use of extracted minerals in their production activities. The manufacture of finished goods also forms part of downstream linkages. In all these activities finances are needed to make things happen. Fiscal linkages are contributing to the maximisation of the value chain through the financing of other economic activities. There are also lateral linkages like agriculture that see the demand for their supplies needed in the value chain. They also get by-products from the value chain that they use in their agricultural production. Other economic linkages that benefit from local beneficiation are special linkages. Transport infrastructure is a serious challenge between economic hubs, more especially outside big cities (Bogetic & Fedderke, 2005). With local mineral beneficiation this situation is expected to improve. It is expected to have ripple effects in the borders that connect the country to other economic hubs in the continent. The contribution that will be made by knowledge linkages cannot be overemphasized. More skills will be developed that will be utilised directly and indirectly in the beneficiation value chain. These skills can also be employed elsewhere in the economy. The skill is liquid. Someone who possesses good skills that are in demand can walk into opportunities.

Arcellor Mittal, formerly known as Iscor when it was a state-owned entity back then, manufactures steel in the country. There are other players like Columbus Steel and Highveld Evraz Steel that also manufacture steel locally. In their steel manufacturing, the local content is in excess of 70% with only coking coal that they need to import at most (Kumba Iron Ore, 2011). These are excellent case studies for rolling out beneficiation in other minerals that are mined in the country. They are also big employers in locations where they have operations.

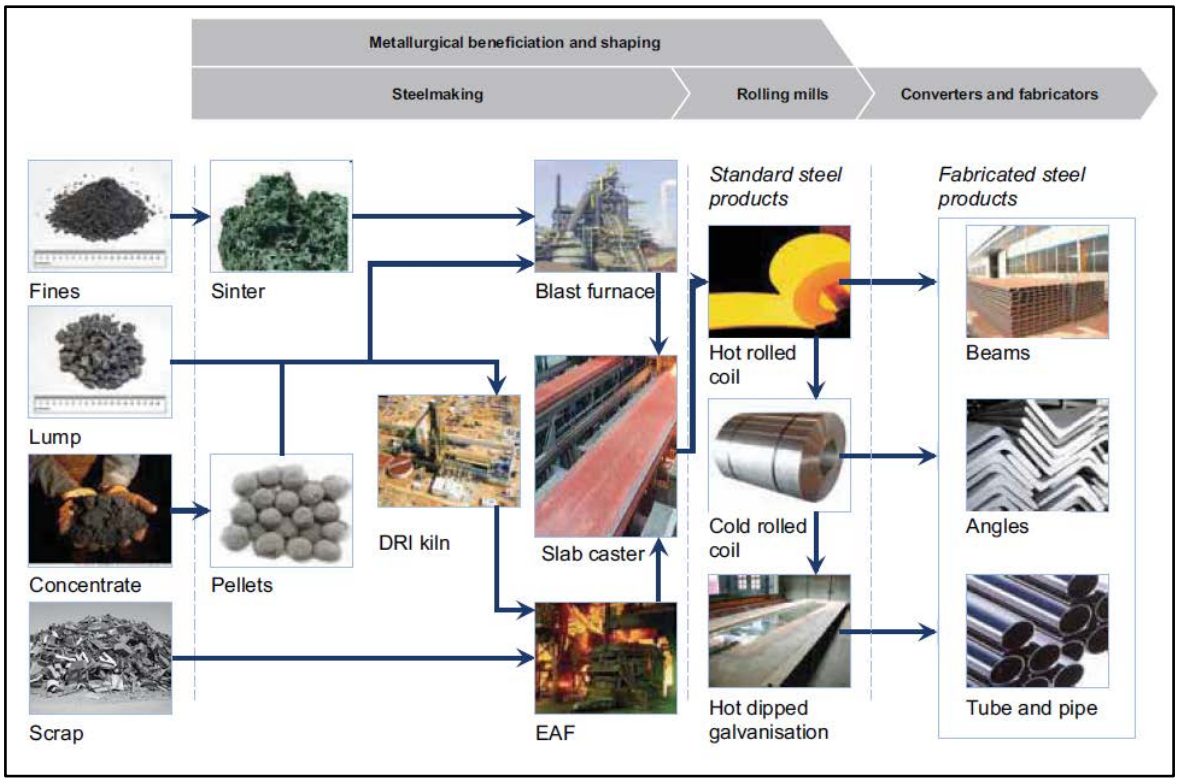


Figure 3**:** Metallurgical beneficiation and shaping

Source: Kumba Iron Ore (2011)



Figure 4: Beneficiation economic linkages

Source: Ramdoo and Bilal (2014)

2.3 Secure supply of minerals

2.3.1 *Minerals availability*

Minerals that are exported out of the country have long term contracts between mining companies and the market that they are exporting them to. Some took mining licences after committing to provide a secure supply to their market. With local beneficiation that means that they will need to make available some allocation to the local market. This may not happen out of their will, so government involvement can help resolve the situation. This may need a policy or the amendment of mining licences. This is likely to be contested as there are already opponents to the local beneficiation. Hausmann, Klinger and Lawrence (2008) are outspoken in their opposition of mineral-rich countries doing full beneficiation in their own countries. They even spell it out that beneficiation is a

bad policy. They believe that Africa should only focus on mineral extraction and leave beneficiation of minerals in the hands of countries that have established themselves in mineral beneficiation. This sort of implies that there is no need of accumulating infrastructure that would be needed to do mineral beneficiation when there are countries that have already done that investment. The European Commission (2010) also came out strongly when it heard about the beneficiation strategy that most mineral-rich African countries are embarking on. In their response they are clear about the line of action they will pursue to ensure that their supply is not interrupted. The local opposition to the mineral beneficiation points out that it is misguided (Stillwell, 2004). Stillwell (2004) says that the mines should not be drawn into the mineral beneficiation conversation. They cannot be left out because they are part of the equation. They should be engaged as they are a major stakeholder as the only supplier of minerals in the country.

The other challenge that is currently experienced by mining companies that may have a detrimental effect in the future is the difficulty in extracting minerals in the old mines. SA mines shafts that have been mined for decades are deep and present challenges in extracting minerals from them. They cannot be mined without the use of new technology either. This may present a challenge in keeping beneficiation plants in operation for long. A need may arise where minerals will have to be imported to make up for short supply. Outside the borders of the country, still on the continent, there are many countries that have mineral wealth. They can be engaged as fellow African countries before going abroad.

The extraction of minerals out of the ground also needs other resources. The two major resources are energy and water. A secure energy supply is critical. The challenges that are faced by the country on energy supply are discussed in the following subsections. Water is another critical resource that has a bearing in mining operations. Without water, mining operations cannot happen. It criticality carries the same weight as the energy. There are mineral reserves that cannot be mined at this stage because of the scarce water resources. For example, Waterberg Coalfield has coal reserves that are yet to be mined but the

scarce water resources poses a challenge (Jeffrey, 2005a). Mines are big consumers of water resources. Unavailability or scarcity of this resource can diminish the potential economic contribution of the mine. This mining area, for example, is situated in Limpopo province. This is one of the two provinces in the country that are in deep poverty. Now, with such wealth of coal reserves that are lying in such a province there is a potential for huge economic gains. More job opportunities can be created by this mine taking a lot of people off the streets. The biggest employer in such provinces is government. This situation can change if the mine can start operating in the area. More economic activities can take place. Other industries can benefit from that as well.

This shows how critical minerals are in the entire value chain. Their availability is vitally important, for example, the reserves that are estimated to last many decades to come are assuring all stakeholders of the business potential. Investment can be pumped into something that shows the potential for growth. The advantage of mining is that it is a long term investment. Beneficiaries to the existence of the mine are communities that provide labour for the mine, those that get royalties, tax collection, businesses and suppliers. If there can be a mine close to every community with the replication of this benefit the country is likely to see a large growth in economic activity.

2.3.2 *Minerals regulation*

Mineral beneficiation calls for amendments in mineral regulation and all other related laws that are applicable in the mining sector that were designed around export of raw minerals with no full beneficiation in the country. Parliamentarians are already engaging in robust debates about the regulations that should be implemented that aid in local beneficiation. In recent debates in parliament there was a call for allocating 20% of mining production of each identified mineral for local beneficiation (Ensor, 2014). This should increase over time. It is reported that during the debate some were calling for the immediate implementation of 50% allocation for local beneficiation, but consensus was reached for 20% instead.

Government will have to pull its muscle in the minerals regulation. Big economies were very decisive in the issue of minerals that are critical to their economy and wanted them controlled. They limited the export of such minerals. One such example is China which controls a significant number of its mineral resources. They are known for regulating their exports and imposing high tariffs. They took a policy position on this (Goode, 2006; Karapinar, 2010). Their economy is doing well. This is a good example that SA can learn from. It is good that in the beneficiation strategy government makes mention of China as the country it wants to learn about implementing local beneficiation. It will have to make brave decisions that may not be palatable to other countries abroad that secure their supply of raw minerals from SA. Policies should be promulgated that support local mineral beneficiation. The work that was done long time ago that called for South Africa to start beneficiating its mineral resources will be brought to fruition. James (1985) added his voice to this call for the country to move away from the export of raw minerals and start adding value to them. In his contribution he said the country should be market oriented, be innovative in its processes, and do product development. The mineral beneficiation strategy captures the latter. Firms that will be producing products need to establish a market for their products.

The minerals regulation is under immense pressure. People outside the country might be seeing it as a barrier for them to come and invest in the country. There are also critics inside the country. They are all hammering hard on the regulation impact in the mining sector (Basson, Curr & Gericke, 2007; van der Zwan & Nel, 2010). They are seeing the regulation as hurting employment, unfriendly to foreign investment and no good to the future of mining industry. These are strong views that carry weight. Unemployment is a burning issue as many people that are supposed to be economically active are sitting without employment. It is of everyone's interest seeing the economy creating more employment opportunities that can take people off the streets. Foreign investment is another very important area that the country would like to see growing. If investors see that doing business in the country is investor friendly prospects are good that they will put their money in the country. Foreign

investment opens up more opportunities for employment and industry growth that will fuel economic growth.

There is a talk from a number of commentators that see regulations as a threat to the future of mining industry. The mining industry makes a big contribution to the country's economic activities. The mines are a big employer that employs the bulk of people in in the country. Their existence is critical to many other industries in the country. The Mining industry's years of operation creates certainty. Business needs certainty and predictability. Also, for sustainability of their own businesses they want to see that there is demand for their products and services.

The government is in a very difficult position when it comes to the regulation of the minerals. In its position it needs to cover all angles without leaving itself and its people vulnerable to exploitation. The critics raise very important points that are also vitally important to government. A balance needs to be struck at the end of the day, however, there are many industries and interested parties and it would be impossible for everyone to be satisfied by the government's regulation.

2.3.3 *Access to international markets*

There needs to be new trade agreements entered into with international markets to ensure the acceptance of local beneficiation and that finished goods will be exported to those markets. South Africa is currently commanding the leading position in the supply and reserves of the ten minerals that have been identified for mineral beneficiation (Republic of South Africa, 2013). It is currently meeting the demand for raw minerals that are coming from foreign markets. It remains to be seen if that same demand will be seen for finished goods that will be manufactured through local beneficiation. There is hope that the demand will follow the new model of local beneficiation. Industries will have to aggressively market their products in foreign destinations so that they can create demand for their products. Government should create an enabling environment for them to be able to do business in the country and also sell to foreign markets. Any unfair advantage in the country that will see their products

barred from entering foreign markets should be prevented. Since South Africa is a member of the World Trade Organisation (WTO) that in itself limits temptations for quotas. China imposed restraints on the export of their rare earth minerals while India started earlier with the imposition of export tax (Bin, 2011). Some countries felt aggrieved by that and wanted to take this up with the WTO.

The market issue is a big challenge. The existence of any business is because there is a market that consumes its products. Currently there is an export market for raw minerals, but that needs to change. With local mineral beneficiation, the exported raw minerals will be brought back into the country. The next hurdle now is accessing international markets. The drive should be to access the same market that is currently supplied by those that beneficiate South African minerals. They need to compete to get a market share. China protects its domestic market by imposing high tariffs (Karapinar, 2010). India does likewise. These are examples of the countries where mineral beneficiation is done at a large scale. They are protecting their domestic market and also providing support for mineral beneficiation that makes them more competitive when they take their products to international market. They took this position because they saw that the collapsed internal market will leave them only having to survive through the international market. They developed the local market because they saw the risk before the bad times started showing up on the horizon, besides, they want their economy to thrive from within (Goode, 2006). These are the policy positions that fellow BRICS members are using to keep their economic growth at an appreciating rate.

When mineral beneficiation is implemented it will be interesting to see if South Africa can follow similar a policy position to that of China and India. The free market issue is a serious challenge for the country. Maybe the country will show a brave face to the WTO. These examples that have been given about China and India have made them regulars at WTO Dispute Resolution Committee. There are many challenges that have been filed by mostly the west complaining about the protectionist practices in these countries. But that does not stop this practice. What they are doing is understandable because they are still

developing countries, and those that are opposing them are developed countries. They have already gone through what the developing countries are going through. They are in a more advantageous position when they compete with developing countries because they are already well established. The challenges that are faced by developing countries do not exist in their countries. If they do exist, they are so small in comparison to the developing countries'.

a. ***Location***

South Africa's geographic location has been found to be the most challenging part when dealing with trade partners abroad. Transportation of products from the country to foreign destinations is a major trade barrier. The distance between trading partners has a bearing in their business relationship (Hummels, 1999, 2001). Transportation costs are exorbitant. Other local suppliers are getting around this situation by excluding transport in the costing of their product and ask their clients to organise their own transport. This arrangement does not work for other clients and that at times becomes a challenge in securing business.

The African market is another area that needs a lot of work. Challenges start at the South African border where it takes a significant amount of time to get through. On average, it takes four days to get through the busiest borders. These are the corridors that lead to economic hubs that trade with the country. Government is working hard on the road and rail network between the country and other SADC countries. There is success that was achieved in the past with the development of the Maputo corridor. This is an indication that it can be done elsewhere as well. Regional networks will fuel the growth of trade between the SADC member countries. Carrère (2014) pointed out that regional network infrastructure plays a significant role in economic growth in the region. A joint effort among the member countries is crucial. South Africa needs to drive this because it already has goals that it has set to capture the African market. Accelerating this development will help in expanding the network further up into the continent. The economic growth of other member countries is higher than that of South Africa which supports network integration. South Africa stands to make significant gains from this.

The location issue is worsened by the burden of logistics cost. Logistics costs are said to be as high as about 15% of the country's GDP (Basson, Curr & Gericke, 2007; Pooe & Mathu, 2011). This is considerably higher than that of the United States of America (Pooe & Mathu, 2011). This cost poses serious challenges for products competing in other markets with similar products that are unburdened by high logistic costs. The location of minerals in the country is in favour of the logistics industry sector. The majority of mines are inland. The ports that they need to get to when exiting the country to international markets are hundreds of kilometres away from ports. This is one of the challenges facing the Waterberg Coalfields (Jeffrey, 2005a). Logistics as a business this is a good revenue for them. They are so expensive because of other contributing factors that are input costs on their side. Infrastructure and energy are the two most important components of their costs. The sources of the logistics high cost need to be identified and work needs to be done on reducing them.

Countries are geographically distanced from one another. However, they need one another in order to do trade. South Africa cannot run away from the position that is in. Location cannot be controlled. This situation calls for the improvement in infrastructure and other contributing costs which is within the country's control. A transport network that is efficient and supports economic activities needs to be built. These are things that will go a long way in reducing the cost of products that are destined to customers overseas. There are logistic costs that accumulate on the product that are outside of the country's control, i.e. South African Ports Regulator can help with port pricing. Korinek and Sourdin (2009) found that shipping costs on some routes are ten times that of others. If this situation results in the product reaching the port at a higher price because of domestic logistics then the final product price will grow exponentially. In order to keep that market, the cost that can be controlled should be manageable. Somewhere an advantage should be created, like logistics costs that have been reduced significantly.

2.3.4 *Research Question 1*

What should be done to ensure a secure supply of minerals for local beneficiation?

2.4 Establishing a manufacturing sector

Besides the good example that is available in South Africa of steel manufacturing there's also an example in Botswana of mineral beneficiation where they have already started establishing industries that will support their local beneficiation (De Beers, 2012; Grynberg, 2012). Establishing industries that will support local beneficiation has always enjoyed support within the country (Baxter, 2005; Jourdan, 2001; Leeuw, 2012; Mohlala, 2010). Most of them advocated for the establishment of supporting industries long before the beneficiation strategy was effected. Value added was quantified throughout the value chain.

Figure 5 shows value added in the commodity chain. Manufacturing is the lowest value added in the commodity chain. The cost of production is the most important component as it has a direct impact on the sale of finished goods. As long as the means of production are kept at minimum, there is a good chance of selling the finished goods. This figure shows that other incremental costs push up the selling price. Here it can be seen that logistics push up the price exponentially. This supports what was mentioned in the previous sections that transport is a big cost in the sale price of finished goods.

Manufacturing is involved in most of the products that are used. Most products result from the transformation of some raw material to a useful product. The mineral resources need to be transformed into products that can be consumed by market as finished goods. This is a good opportunity for the manufacturing sector to make the best of what is intended by mineral beneficiation strategy. They have government policy in their support. The policy is there to give assurance, but there are challenges that they need work through. They need to build new infrastructure for their operations. This is better because it is part of their investment that they need to put into their businesses. By supporting

infrastructure that is built by government, manufactures hope that the construction of such infrastructure is finished on time so that the price of their product is not increased. They also have to put up with the energy crisis that is facing the country. The mining industry was asked by the power utility to operate below its capacity so that it could free energy in the power grid (Pooe & Mathu, 2011).

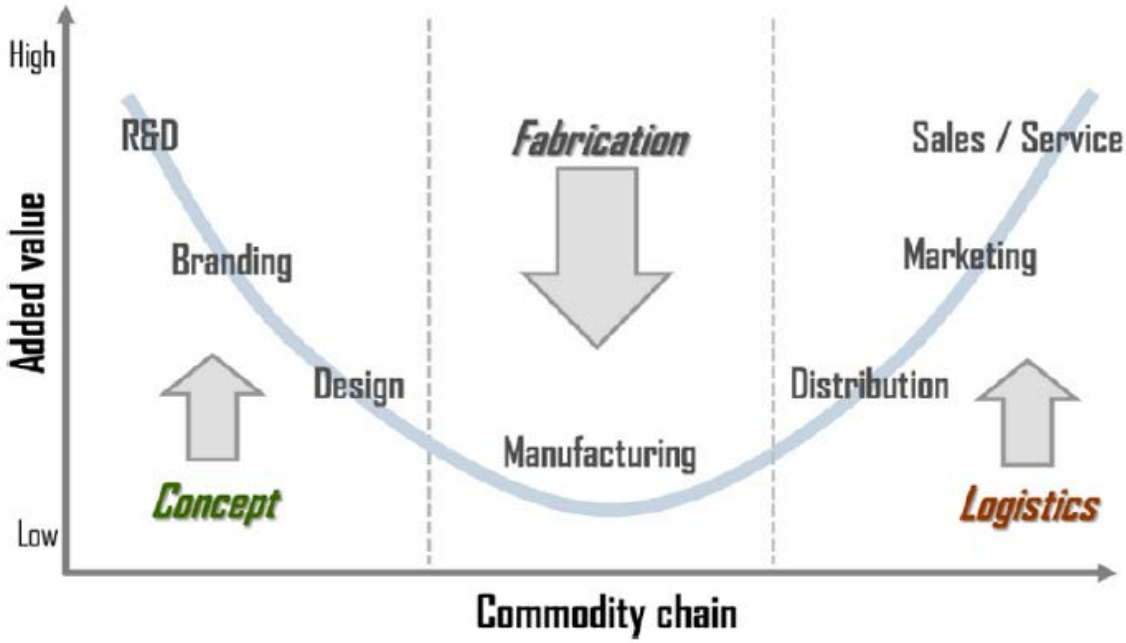


Figure 5: Value add through commodity chain

Source: Ramdoo and Bilal (2014)

2.4.1 *Infrastructure*

Existing infrastructure was designed to suit local beneficiation. It was designed around railway lines transporting bulk raw minerals to ports around the country. Soko and Balchim (2012) mentioned that the current infrastructure still needs to be uplifted to a level that can support full local beneficiation. This is a new requirement that needs to be met. A new infrastructure will have to be built to create a network between locations where minerals are mined and to support the industries that will do beneficiation. The crucial point of proximity that was mentioned by Porter (1990) means that if it were to be exploited there will be spread of beneficiation around the seven provinces which have mines within

them. This will be a boost to local industries in the provinces unlike the current situation where most mining related activities that result in local industrialisation are only concentrated in three provinces, namely; Gauteng, Mpumalanga and Northwest. The building of infrastructure will have a ripple effect in regional economies.

The current infrastructure cannot efficiently support running operations. It has been brought up as the biggest obstacle to the running of the industry (Basson et al., 2007; Cawthorn, 1999; Jeffrey, 2005a). The most challenged area is Limpopo province. In the coalfields that are found in this province there is no operational rail infrastructure. This situation is delaying the start of coal mining in that area. The mining that is currently running is for local industry supply. They manage to use road infrastructure and land conveyors to reach those industries. But the amount of coal that they have is capable of supplying the domestic market and export market. They need to get their coal to other industries around the country and also transport it to the ports. For that they need rail infrastructure. The rail infrastructure is an urgent matter because without it they will not be able to reach the market as they wish. The potential business that this situation is hampering is huge (Jeffrey, 2005a). This situation needs to be improved for effective mineral beneficiation to happen. The secure supply of minerals that was discussed in the preceding subsections is immediately threatened by this situation. If there is no proper infrastructure to support current operations it poses a challenge for new initiatives. For instance, this coal has been earmarked for export market as well. The rail infrastructure needs to be built quickly so that this window of opportunity will not be missed.

The existing rail network in other provinces is operational but needs to be upgraded in order to keep up with volume that needs to be moved every day. There is already a backlog for network upgrades. This will have to be done in in time so that when mineral beneficiation is implemented, the infrastructure is ready to carry a large volume of goods to reach the market.

2.4.2 *Industrialisation*

For industrialisation to take full effect there needs to be supporting links already established and well maintained. Infrastructure should be in good condition that can fuel economic growth. Bjorvatn (2000) pointed out that poor infrastructure inhibits industrialisation. In the work of (Kudo, 2005, pg. 35), he pointed out that “industrialisation is neither easy nor an automatic process”. A lot of work needs to be done to get to a level of full industrialisation. Most of it will be new development as the scale of mineral beneficiation that will be embarked on is very high compared to what the country did in the past. This is a good development as opportunities that will be created in the process. Infrastructure builds projects have been at the forefront of creating business and job opportunities. This will be another opportunity to create business and job opportunities. Government is already working on creating special economic zones close to mining operations and ports.

The immediate beneficiaries are communities that will be living in close proximity to the industrial economic zones. This will have ripple effects on neighbouring communities. There will be relief of the high concentration in the cities that is also depleting urban infrastructure.

It is anticipated that many industries will be created. Currently, if there is any industry that is being launched job creation is the first thing that gets addressed. The industry is expected to make a significant indentation to the high unemployment rate. The industrialisation that will be created by mineral beneficiation will be expected to create employment. The economy needs to generate jobs. The more industries are built the more job opportunities are expected to be created. But like Kudo (2005) said, industrialisation will take time to get to its fruition.

2.4.3 *Labour cost*

Labour cost, in most cases, is the biggest cost in manufacturing. This usually ranges between 30 and 40% in an engineering firm. Labour cost in the country is also regarded as the highest when compared to other developing economies

(Golub, 2000). Unions in the country negotiate pay hikes that are way above inflation. The mining sector set a precedence when it bowed to the pressure of giving pay increases that are higher than the inflation rate. That immediately saw other sectors, such as engineering, hiking their demands as well. This is a challenge that South Africa will have to work on soon in order to compete with Asian and Latin American countries that also beneficiate products in their countries. These countries boast low production costs, including labour. South Africa is still on the back foot after the collapse of local textile industry. It could not compete with China in this industry. As a result it lost a huge market share to China. This is still fresh in the minds of South Africans. So, production cost in mineral beneficiation should be kept in check at all times. The collapse of the textile industry was a big lesson and any repeat should be prevented.

The labour cost is escalating with other costs like energy (Daavittila, Honkaniemi, & Jokinen, 2004). Can it be contained? It would be good if these costs can be brought under control. Will the implementation of mineral beneficiation put a dent to the labour cost? Businesses would like to be more profitable. For them to realize profitability they would have to start internally by cutting down on cost. In the reduced costs they would like labour cost to be in the basket as well. However, the cost cutting should preferably not translate to reducing head count. The beneficiation strategy intends to keep more people employed.

2.4.4 *Secure energy supply*

The power outages that South Africa has been experiencing since 2008 are a serious concern for good initiatives like local industrialisation. The demand for energy will go up in the midst of all current supply challenges. Questions will come up about how initiatives that are known to be energy intensive are ever thought about before sorting secure energy supply first. Eskom entered into new agreements with intensive energy consumers about cutting back on their consumption. The biggest consumers that were identified in that exercise were the mines and steel manufacturing companies. These are the primary components in the mineral beneficiation value chain. There is a need for

generating more power that can support the establishment of local industry that will create a competitive advantage of the country. The energy challenge has been seen as the biggest stumbling block that stands in the way of local beneficiation (Mining Weekly, 2013; Takolia & Dharamlall, 2011). All necessary primary drivers of the economy need to be brought to the right standard in order to get the ball rolling for other linkages.

The lagging of energy supply is creating an opportunity for other innovative ideas to be brought on the table that can help produce products through less intensive energy processes. The shortage of energy has already created a boom in alternative energy sources and more suppliers are awarded contracts to connect their environment-friendly energy sources to the main grid to fill in the demand that cannot be met at this stage. More and more calls are made to independent power producers to come up with innovative ways of meeting the existing demand.

The demand that cannot be met at this stage needs more power stations to be built. Coal power stations are still going to be built despite the call for power stations that are environmental-friendly. In an article that was published by industrial metallurgy ("Carbon Tax: Plunging Africa to more poverty?," 2013) they questioned the timing of government's imposition of carbon tax at the time when the country was in dire need of energy. Maybe it is because of strong views like theirs that government has postponed the implementation of carbon tax. Coal as a source of energy, forms part of the plan for the future in government's plan of meeting the energy demand.

Energy supply has proven itself as the heart of economic growth. Other developing economies are also battling with a short supply in energy. China and India are examples of big developing economies that are battling with short energy supply. China has started engaging other countries where there is excess capacity asking them to export to China (Daojiong, 2006). This is inevitable for South Africa in order to meet its demand. Cheap electricity that used to be a selling point for South Africa (Kohler, 2006) will be a thing of the past. That is currently being eroded by exponential increases in electricity prices. In India they have done some studies to evaluate the impact of the

unreliable energy supply in their economy. They found that power outages were resulting in big business losses in their economy (Singh, 2013).

2.4.5 *Research Question 2*

Will mineral beneficiation improve manufacturing?

2.5 Skills

Skills shortage in the country have been widely reported (Mining Weekly, 2013; SAPA, 2014; Takolia & Dharamlall, 2011). This is an area in which government has explored in many ways through the introduction of different policy curricula trying to improve products. A lot has been and continues to be done in order to improve the situation. In the latest attempt to bring about improvements, government has stated that they will be changing school curriculum to ensure that all learners do mathematics and science. This is because not many people pursue careers that use skills that are in demand. The school curriculum that prescribes mathematics and science to every learner is intended to generate interest in them to make career choices in skills that are in demand.

The skills issue is the most important thing that any country should prioritise. It has a bearing on economic activities, social life, and many more. Lack of skills are immediately noted when trade needs to be done between different countries or multinationals. In most cases, multinationals deploy skills from their own pool in foreign operations where there is a lack of skills. That takes opportunities away from the locals that could have been employed to service those territories. Some multinationals make it their responsibility to develop resources in the countries where they have operations.

In this country the skills issue is in communities where there are firms operating mostly outside big cities but there is also a serious challenge of skills that can be employed by firms operating there. When firms come to those communities they are welcomed with open arms because the community is seeing an opportunity that will give them jobs. Problems start when the firm starts hiring, however, the skills that are employed by the firm are not available in the local

community. The firm resorts to sourcing the skills from anywhere in the country. The community reacts to that by protesting in other places bringing firm operations to a halt. They demand that the firm should have a quota system where a significant percentage of the people employed by the firm should be local residents. It has been witnessed in many operations taking place close to big communities and projects that are happening within communities.

2.5.1 *Research and development*

There are supporting initiatives that have been put into place by government that will ensure skills are developed that will facilitate full beneficiation. There is an advanced manufacturing technology strategy (Republic of South Africa, 2005) that has already been put together after the skills gap was noted as the primary area that needs advancement. Research and development (R & D) is the area that will help industries to stay competitive. Innovative ways of producing quality products at a cost that will be affordable to customers usually come through R & D. New applications of different types of minerals and their manufactured products to be investigated through R & D. The demand for a skill set that will be tasked with product and applications development will enhance the knowledge economy of the country. Knowledge linkages are vitally important in driving innovation (Ramdoo & Bilal, 2014). This is the area that needs to keep development going. Innovation should constantly come through in every production process, technology, operations, etc. That is most likely to happen in places where there is R & D. Here they need to continuously challenge themselves for better solutions to existing solutions. They should think about better ways that can be employed. This will create products that are competitive in the market. The technology used may even give the country international accolades.

More involvement in R & D will provide support to the development of skills in tandem with technologies and products.

2.5.2 *Specialised skills*

Specialised skills need a foundation of basic skills. The demand for specialised skills helps in many ways. First, it brings awareness of the availability of basic skills. Second, it generates interest in those with basic skills to develop themselves further into specialised skills. Asian countries have made a success of that (Mayer, 2000). They built large pool of basic skills. After doing that they developed their people further. Stacey, Hadjigeorgiou, and Potvin (2008) highlighted that the development of special skills should be a long term strategy. Skills need to be produced for continuous support of industries.

In this country the need for more basic skills to be developed is even higher. Since mineral beneficiation needs specialised skills as well the task that the country has is to build a large pool of basic skills and at the same time have a plan of developing specialised skills. Experience should be gained in practice by those with basic skills in order to proceed with learning specialised skills. This can only happen where there are job opportunities that can absorb the basic skills.

2.5.3 *Productivity*

Productivity in a work environment is severely impacted when there is a shortage of skills. Research has been done in this area where it was found that productivity diminishes with increase in skills shortage (Bennett & McGuinness, 2009). In other work that was done by (Houghton & Sheehan, 2000) they emphasize human capital as the driver of increased productivity levels. Mayer (2000) pointed out that other countries should learn from East Asian countries' achievement of rapid industrialisation and skill accumulation. He said that they achieved this through the expansion of their education system in line with the upgrading of skill intensity in their economic activities. South Africa needs to take a leaf from the aforementioned experiences. There needs to be more skills development. Currently there is a cry for technical skills. There is a huge demand for these skills. These are the same skills that are needed in mineral beneficiation. This is going to add on to the already existing demand. This, on

the other hand, should be a good motivation for more institutions of higher learning and vocational education to be built.

In the country a call has been made by government for the development of a workforce. There is a skills development act that government put in place to attend to the skills development in a working environment. Employers are motivated to develop their workforce by annual reimbursements that are paid to employers for the development expenditure on their workforce. Professional associations are also supporting skills development by encouraging professionals to do continuous development. Further development of skills will enhance productivity (Bennett & McGuinness, 2009; Houghton & Sheehan, 2000; Mitra, 2006). Continuous development does not stop. Its appreciation by professional associations and the support of government will go a long way raising labour productivity.

2.5.4 *Research Question 3*

What impact will skills have on mineral beneficiation?

2.6 Conclusion of Literature Review

The thorny issue seems to be government regulation. The literature indicates that government regulations are a barrier in foreign direct investment, progression of existing operations and labour issues. Investors want to see stability. They want certainty, predictability and an environment that is favourable for their investment. The literature finds that government, by putting up regulations, at times that threatens foreign investment. This is a dilemma for government because it has to govern over everything within the borders of the country. It needs to look into the future beyond current investment. Investors may use current developments as a yardstick for what will happen in the future. So, it is tough for them as well to hope for a better future when they do not see prospects at present. Regulations are needed to have control, not to make it difficult for business to take place. But the literature finds that in the process when government is putting regulations in place with the intent to create an

enabling environment for business to happen, some find regulations to be a barrier in their businesses.

Minerals are available for extraction but their extraction comes with challenges. The challenges that have come from the literature are things like scarce water resources, shortage in the energy supply, lack of infrastructure and difficulty in accessing the minerals. There are regions where water has been identified as scarce and is threatening the mining activities in those regions. Water is one of the most important resources that any mine needs in order to run its operations. Unavailability of water is seen as a biggest obstacle to the extraction of minerals. Water is not alone as a biggest obstacle to mining operations, a secure energy supply is also an obstacle. Energy shortage is also a big challenge to mineral extraction. They need a secure supply of water resources and energy supply in mineral extraction and beneficiation. These resources are needed in all industrial activities as well. So, their availability is essential for economic activities to happen.

Manufacturing creates a large numbers of job opportunities. The linkages to the manufacturing sector makes it a beneficiation stage that employs many people and also develops a lot of skills. It develops skills that are directly involved in manufacturing activities and those that are indirectly involved. It is a sector that develops skills that can be employed in other industrial sectors. There are also entrepreneurs that come out of manufacturing. This is the sector that has been seen as playing a pivotal role in economic activities.

The literature indicates that securing supply of minerals resources is a market issue. This means that even though South Africa has mineral resources but they are supposed to pay a market related price for the amount of minerals they want for their manufacturing. The advantage of close proximity does not necessary benefit them when they have to take the price from the market. Therefore access to mineral resources is not a given in that case.

Improvement of manufacturing due to mineral beneficiation does not seem to be a direct relationship. The value add seems to be more on other commodity chains than it is in manufacturing. The improvement is still, but like it has been

mentioned earlier, is not as high as in other commodities. But this does not negate the impact that manufacturing will make in the country if mineral beneficiation is done locally.

Skills have been seen as the biggest benefit that will be enjoyed. The technologies that will need to be employed for mineral beneficiation will need specialised skills. This will help in creating large pool of skills that will make a significant contribution in growing skill set in the country. These skills can be employed in other areas where they can make immediate impact. An advantage of a skill is that it makes one versatile at times. Mineral beneficiation will be a multiplier of the skills available to make a valuable contribution in the country.

CHAPTER 3. RESEARCH METHODOLOGY

This chapter talks about the research methodology that was used to conduct the study about implementation of local mineral beneficiation. Description of the research methodology, research design, population through to data validation will be discussed in the following subsections.

3.1 Research methodology / paradigm

Qualitative research methodology was used in this research. The type of qualitative research that was used is called a basic interpretive qualitative study. (Merrian, 2002, pg. 6) defines this type of study as:

> "a study that exemplifies all characteristics of qualitative research; that is, a researcher is interested in understanding how participants make meaning of a situation or phenomenon, this meaning is mediated through the researcher as instrument, the strategy is inductive, and the outcome is descriptive. In conducting a basic qualitative study, you seek to discover and understand a phenomenon, a process, the perspectives and worldviews of the people involved, or a combination of these".

The reason for this study is the perspectives and worldviews of the respondents. This methodology was chosen on the basis that the aim of the study is to get as much relevant information as possible from respondents. The best way to achieve that was to employ a strategy that would allow one to develop questions during data collection or have follow up questions where necessary. The flexibility of qualitative methodology has made it a compelling choice to make. As it was expected that the environment during data collection might force the process from one setting to another to change slightly and this methodology does accommodate that. This was also another advantage seen in employing qualitative methodology. Other researchers praise it as well for its flexibility and bringing out more in-depth knowledge in that subject area whenever it is employed (Bryman, 2012; Kothari, 2004; MacDonald & Headlam, 2008).

This methodology was employed in this study with the hope that respondents would avail themselves to answer questions and be broad. Assumptions that were made were that respondents would be frank in their responses, fully engaged and show interest in the study.

3.2 Research Design

In this study, interviews were conducted. The type of qualitative interviews that were conducted are called semi-structured interviews. Wahyuni (2012, pg. 74) defines the semi-structured as a “hybrid type of interview which lies in between a structured interview and in-depth interview”. Wahyuni (2012, pg. 74) goes on to say that “it offers the merit of using a list of predetermined themes and questions as in a structured interview, while keeping enough flexibility to enable the interviewee to talk freely about any topic raised during the interview”. With face to face interaction the setting can always be swayed to be favourable in order to get quality responses to the questions.

The power of detecting direction in data collection can only be captured in face to face interaction where signals from the respondent can be witnessed. Flexibility of deciding there and then to continue or ask for a later date is another advantage of doing contact interviews. The flexibility of semi-structured interviews was effectively employed in the field interviews. Respondents were from diverse sectors, holding different positions and roles. Flexibility was very instrumental in adapting to that type of environment. Ramnath (2012) used semi-structured interviews as well in her study where she was looking at the impact of South African mineral beneficiation strategy to platinum group metals industry (PGM).

The interviews that were conducted in this study are sixteen in total, but only fourteen are reported in the results. The other two could not be reported about because of different circumstances that came up. One respondent set many conditions among them being that his interview should not be published. So, the gathered data could not be used. The other one could not finish the interview and indicated that she did not have time for another interview when she was

asked if it could be rescheduled. At the time of stopping the interview not much data had been gathered from the interview, hence it was not reported in the results.

Interviews were conducted at respondents' workplaces, with the exception of one who chose a neutral venue. The interviews were scheduled for one hour in each setting. A few went over the set time because of the respondents' keen interest in the field of research and they found this as an opportunity to engage in this topic. Others went for longer because of the wealth of experience that they have – these were generally the oldest respondents.

The study was also designed around beneficiation stages and linkages. Respondents came from industries that are directly linked to the mineral beneficiation and those that are not directly linked. That spread was captured in the interviews as desired.

3.3 Population and sample

3.3.1 *Population*

The target population for the study comprises of the minerals sector, manufacturing sector, government, energy sector, policy makers, research institutes and academics. This population is thought to have keen interest in local mineral beneficiation. One way or another, these stakeholders will have some degree of influence in the local beneficiation strategy.

3.3.2 *Sample and sampling method*

The sampling method that was used in the study is purposive sampling method. It was chosen on the basis that the study wanted to get a sample that would make a vital contribution to the conclusions that will be drawn at the completion of the study. This type of sampling method recruits participants with experience and knowledge, where a lot can be learnt from them (Merrian, 2001; Ryan, Coughlan & Cronin, 2007). The sample for the study was people in senior management and/or senior staff in their organisations. People holding influential

positions were targeted as they are decision makers that shape organisations. Other people that have interest in this type of study and are outspoken on new developments, like scholars, were targeted as well.

In this study the number of interviews that were expected to be conducted and produce quality responses was eight. This is the number that was anticipated before starting with the field interviews, see the original plan shown in Table 1. The actual number of the interviews that were conducted in the study is sixteen. More detail about the interviews conducted is shown in Table 2. The conducted interviews were data intensive. This is the advantage of conducting semi-structured interviews. The data that is collected is given priority more than the number of interviews. Bryman (2012) states that there seems to be no agreement amongst researchers on the number of interviews. He mentions that interviews can be a small number but that small number should produce quality response to the questions.

Table 1: Profile of respondents

Description of respondent	Number to be sampled (planned)
Senior managers from industries that are part of mineral beneficiation value chain	4
Scholars/academics	1
Policy makers/strategists	1
Economists	2

3.4 Demographic profile of respondents

The sample planned for the research was eight respondents. This quantity was planned as a minimum. The planned quantity was exceeded by six more respondents than the original plan, shown in Table 2, thanks to the snow balling effect that effectively worked in this research. Referrals from interviewees honoured requests for interviews and they were people that were highly regarded by the people that gave out their names and contact details. This was not without change of plan from people that initially confirmed their availability

for interviews but changed their minds and cancelled at the eleventh hour. They cancelled with no alternative slot indicated for another date. They said they were no longer available for the interviews and they will take no further part in the study.

Table 2: Profile of respondents (planned vs actual)

Description of respondent	Number of respondents	
	Planned	**Actual**
Senior managers from industries that are part of mineral beneficiation value chain	4	11
Scholars/academics	1	1
Policy makers/strategists	1	1
Economists	2	1

3.5 The research instrument

The research instrument that was used in the study is semi-structured interviews. Ramnath (2012) also used semi-structured interviews in her study that was about platinum group metals. She managed to get the information she needed from her study's respondents using this method. In this study semi-structured interviews were chosen because of the flexibility they bring to different settings. Respondents could make a contribution to the study looking at it from different perspectives. They had latitude in the engagement. This is something that they enjoyed.

Interviews were scheduled at respondents' workplaces. Majority of the interviews took place as scheduled at the respondents' workplaces. They were scheduled for one hour in each setting. An hour was chosen as sufficient and

appropriate time that one would have to gather valuable data for the study. It was also taken into consideration that interviews were taking place during office hours, so, the respondent's schedule had to be minimally disrupted by the interview. Respondents were contacted by e-mail and telephone when scheduling interviews. Time was allowed before the requested interview date. In most cases respondents were a requested for an interview a week before the interview date. Due to unavailability on the requested date some were proposing dates that were earlier than the requested date. That flexibility was allowed and they were also accommodated when they indicated different time slots to those that were requested.

In the requests for interviews, the purpose of the study was explained to the respondents. The ethics part was also explained to them. The same was done at the opening of interviews on the days of interviews. The rights of the respondent were explained at the opening of the interviews. Disclosure and publication of the gathered from the interview was explained and discussed. Permission was requested from the respondent to capture on record and audio-record the interview. This was contained in the consent form that was completed and signed by the respondent at the beginning of the interview. The consent is shown in Appendix A.

3.6 Procedure for data collection

The primary source of data collection in the study was semi-structured interviews. This is the commonly used type of data collection method in qualitative studies (Creswell, 2003; Ryan, Coughlan, & Cronin, 2007; Wahyuni, 2012). Interviews took place predominantly at the respondents' workplaces. This was the best location because respondents were more comfortable in their own space. A rapport was built before the start of the interview. At the opening of the interview administration issues were the first to be addressed. There the respondent was familiarised with their rights, completion of the consent form and completing information about the demographics of the respondent. The consent form dealt with ethics and requested permission from the respondent to audio-record the interview. The respondents were given an opportunity to ask

questions and express themselves on any issue that is related to the administration part. That was concluded by signing of the consent form.

Interviews were mostly one hour long with a few going beyond the scheduled time. After the completion of the administration part, an audio recorder was switched on so that the questions could be captured on record. The whole interview was captured on the audio recorder. Notes were taken down as well, but that was done in such a way that no disruption could be caused. Open-ended questions were asked of the respondent. The main question would develop into many questions or from follow up questions more data was gathered. The first question allowed the respondent to take any direction of the conversation that would like to talk about. The list of semi-structured interview questions is shown in Appendix B. This was done so in order to get the most valuable contribution from the respondent. They were very comfortable with that because they got an opportunity to share their knowledge and express their views. The number of questions was not the same to all respondents. Those that were not as broad in their responses were asked more questions in order to prompt them to talk more and also give direction where it was necessary. At the end of the interview the respondent was debriefed and the interview was concluded by thanking the respondent for participating in the study.

Recorded interviews were backed up in a safe storage afterwards. This was followed by transcribing of the interviews.

3.7 Data analysis and interpretation

The qualitative data analysis approach that was taken in this study is called thematic content analysis (Bryman, 2012). The patterns that were observed in the data were categorised into themes. This approach was fit for this study because of the massive amount of data that was gathered from the interviews. It enjoys popularity among qualitative researchers (Lacey & Luff, 2001; Ryan et al., 2007).

Transcribed data was checked against the audio record to confirm that it was captured accordingly. The text data was then categorised according to themes

that were picked up in the data patterns. The analysis framework of the data is not rigid in qualitative studies (Ryan et al., 2007). Lacey and Luff (2001, pgs. 6 - 7) developed the following framework for qualitative data analysis:

- "Familiarisation with data through review, reading, listening etc.
- Transcription of tape recorded material
- Organising and indexing of data for easy retrieval and identification
- Anonymising of sensitive data
- Coding (may be called indexing)
- Identification of themes
- Re-coding
- Development of provisional categories
- Exploration of relationships between categories
- Development of theory and incorporation of pre-existing knowledge
- Testing of theory against the data
- Report writing, including excerpts from original data if appropriate (eg quotes from interviews)".

Lacey and Luff (2001) highlighted that qualitative data analysis goes through some of the stages in this framework, at times, through all the stages. This study followed this framework. This framework was a good guideline for planning, execution and preparing write up of the feedback received from the respondents during interviews.

3.8 Limitations of the study

3.8.1 *Research Sample*

Attempts were made to secure more interviews over and above the interviews that were conducted. In fact, more interviews were scheduled but some respondents pulled out at the eleventh hour. More people were identified by respondents as appropriate to interview for the study. Their availability was a problem because the study was conducted in the last quarter of the year when people were preparing to wrap up the year and go on holiday. A few could avail

themselves, but the majority declined. The timing issue had material impact on other interviews where a request for rescheduling could not be accommodated by respondents because of their unavailability after that date. The time that was available to gather data and produce a report was short. It was further reduced by the festive holidays.

3.8.2 *Other Limitations*

Geographical location was also a limitation in this study. Beneficiation linkages spread across the country, but because of the travelling distance to get to these places it was decided to focus the study to participants that could be reached in Gauteng. People outside Gauteng were contacted to ask them if they could accommodate interviews in case they were travelling to Gauteng during the time of the study. This request was sent after receiving referrals from their colleagues that are based in Gauteng.

3.9 Validity and reliability

Validity and reliability relate to the authenticity of the research data (Bryman, 2012). Validity looks at the integrity of the research findings and conclusions. Reliability looks at the repeatability of the study. The latter attempts to answer questions like: can the research findings be replicated? In this section the validity and reliability of the research results will be discussed. Since this is a qualitative study there are no actual measurements that can be used to measure validity and reliability quantitatively (Wahyuni, 2012). The integrity of the results is a key determining factor. The fact that the study involved interviewing respondents, the authenticity of the people that were interviewed is another type of check that can be used for validity and reliability.

3.9.1 *External validity*

“External validity is the extent to which the findings of a study can be applied to other situations” (Merrian, 1995, pg. 57). The findings of the study cannot be generalised to the general population in the industries that have linkages to

mineral beneficiation. Qualitative studies cannot be generalized (Bryman, 2012; Merrian, 1995), but for verification, transcripts from interviews and audio recording can be made available on request. This is a controlled item because of ethical issues and disclosure issues that were agreed to with respondents.

3.9.2 *Internal validity*

“Internal validity asks the question: how congruent are one’s findings with reality?” (Merrian, 1995, pg. 53). The issue that is addressed here is how realistic the findings are from the study. The study drew conclusions from data that was collected from authentic people. The source of the gathered and analysed data is real and can be verified. The data was supported by documents that were made available by respondents and those that could be sourced elsewhere.

The respondents were not influenced to give a specific response. The semi-structured interview questions were open so that they could take any direction they felt when answering the questions. This reflected in the diverse responses they came up with in response to the questions.

3.9.3 *Reliability*

“Reliability is concerned with the question of the extent to which one’s findings will be found again” (Merrian, 1995, pg.55). The issue of repeatability of the findings is not guaranteed in qualitative research. The fact that it involves people, their behaviour changes and each person behaves differently. This study learnt that when the same question was asked in different settings, different answers came up. The reliability that can be engaged in this study is the consistency of the results of the study with the collected data. The gathered data was categorised into themes. Content analysis of the themes was done that led to the findings of the study.

3.10 Conclusion of research methodology

The research methodology that was used in the study is semi-structured interviews. The interview was opened with a very open question that would make the interviewee free to speak at length on their thinking about that particular question that is related to mineral beneficiation. This was done so to make them share as much relevant information as they possible could on the subject. To strike a balance with time sometimes the interview was given a direction where it was felt that the interviewee spends more time on one question or they were spending more time on general things that were not relevant to the study. This worked very well and the interviewees were very coorperative.

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

The results are presented in descriptive method with more detail covered under discussion in Chapter 5. They are tabulated under each research question in the sections that follow. It was mentioned in the preceding sections that the type of results analysis that will be used in this study is content analysis. That will be seen in the next chapter.

4.2 Demographic profile of respondents

Demographic profile of respondents in this study is presented in Table 3 below. The age range of the respondents is between late thirties and late sixties. The youngest aged 37 and the oldest aged 69 years old. The spread of their age is two in the thirties, three in the forties, two in the fifties and seven in the sixties. Their average age is 54 years. Gender is male dominated with only one female.

The respondents are highly qualified individuals in their fields of study with highly technical skills. They have a wealth of experience of many years as practitioners. Some have their cumulative experience that they gained from different employers. In this study, only years of employment at the employer when the respondent was interviewed for this study are recorded in the demographic table. The actual work experience that they have in their careers is not part of the scope in this study.

The respondents came from different companies that are in diverse industry sectors. They have keen interest in mineral beneficiation. Some have a direct involvement because they form part of government departments. Some are directly involved because of the linkages in the entire mineral beneficiation value chain. Others come from support institutions that, because of their nature of work, have some linkage to mineral beneficiations even though it is not necessarily directly. But the majority of them have a direct involvement in the mineral beneficiation value chain.

The geographical location of the respondents is in Gauteng, based in Johannesburg and Tshwane metropolitan areas. Their work areas are in the same geographical area.

The abbreviations that are used in the demographic table represent the following:

CSIR – Council for Scientific and Industrial Research

BIDPA – Botswana Institute for Development Policy Analysis

MBA – Master of Business Administration

MBL – Master of Business Leadership

CEO – Chief Executive Officer.

Table 3: Demographic profile of the respondents

Respondent	Company name	Gender	Age	Education	Key attributes	Job title	Job tenure
A	CSIR	Male	54	MBL	Procurement/strategic management	Project leader	8 months
B	SA Institute of Foundrymen	Male	69	BSc Eng. Metallurgy	Foundry technology specialist	CEO	5 years
C	SA Chamber of Mines	Male	67	B Eng.		Deputy Head: Mineral Economics	40 years
D	SA Chamber of Mines	Male	37	BTech		Technologist	2 years
E	Scaw Metals	Male	56	MTech	Foundry technology	R & D Manager	5 years

Table 3 cont.

Respondent	Company name	Gender	Age	Education	Key attributes	Job title	Job tenure
F	Independent Consultant	Male	63	BSc Eng Chem	Process engineering	Metallurgical consultant	12 years
G	Mintek	Female	38	PhD, MBA	Process development	Head: Market Development	6 years
H	Industrial Development Corporation (IDC)	Male	45	BCom, CASA	Minerals technology	Project Leader: Mining and Mineral Beneficiation	13 years
I	Anglogold Ashanti	Male	40	BA, LLB	Market specialist	Senior Vice President: Investor Relations	6 years
J	Macsteel	Male	60	BCom	Business development	General Manager	25 years

Table 3 cont.

Respondent	Company name	Gender	Age	Education	Key attributes	Job title	Job tenure
K	Howden	Male	46	BTech, GDE		General Manager	6 months
L	CSIR	Male	60	PhD Chem Eng	Technology development	Research Group Leader	16 years
M	Wits University	Male	62	PhD	Mineral Economics	Lecturer	5 years
N	BIDPA	Male	61	PhD	Mineral Economics	Senior Research Fellow	3 years

4.3 Results pertaining to Research Question 1

4.3.1 *Diverse respondents' feedback*

About secure supply of mineral resources for local beneficiation there were diverse responses that were received from respondents. There were those that saw the status quo need not change, and there were those that saw a need for government to introduce policy that will be favourable to local beneficiation. Others also had other views that related to market, contracts, pricing, to mention just a few. There were interesting views coming from those in mining and manufacturing sectors. This was the most burning issue to both of them. The manufacturing sector strongly supports the local beneficiation for the obvious reason that they are a sector that stands to benefit the most from doing mineral beneficiation. On the other hand, mining would like the status quo to remain. In the event that there are future changes, mining's support for changes will be based on the potential benefits that they will get from them.

Table 4 below shows themes that relate to question 1 that were extracted from the interviews.

Table 4: Core themes extracted from question 1 interviews

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
A This was a strategic manager in a procurement department at CSIR.	Minerals should be made available to local manufacturing companies.	Minerals should be offered at a price that can make local manufacturers competitive.	There should be a buy-in from mining companies that extract minerals in the country.	Implement policies that support national development plan.	It should be made part of mining licence condition allocation of minerals for local beneficiation.	There needs to be one coherent strategy for all commodities.	Africa as a whole should be looked at as a source of minerals for beneficiation in the country. This is necessary to prevent interrupted supply.	SA should not only look at itself. It should also consider doing mineral beneficiation jointly with other African countries.
B This was a CEO in a foundry technology of SA. They are a representative body of foundries.	There should be an allocation of minerals made available to local market.		All stakeholders must work together toward achieving an agreed solution.	Policies should suppose local mineral beneficiation.		Minerals beneficiation should be implemented. Too many proposals would not add value if they are not implemented.		It is not necessary to do full beneficiation in the country. Other beneficiation stages can be done outside the country.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
C Chamber of mines is an affiliation body of the majority of mining companies in the country.	Mineral resources are already made available to local market.	The price charged for mineral resources is fair.	Mining companies are willing to work with other stakeholders.	Rules should be favourable to doing business in SA. They should be flexible.	There is no need to make changes in the way mining licences are issued.			There are beneficiation activities in the country that more can still be done on it, but focus is only on mineral beneficiation. There are misconceptions about mineral prices in the country. There is a belief that locals are overpaying for the minerals. The minerals prices are offered by the market, not SA mining companies.
D The second Chamber of Mines person.	Minerals are available to anyone that can buy at a market price.	The price offered for mineral resources is fair.		There should be no additional laws on top of what is in existence.	Only need tight control in terms of quantity issued, but no changes to conditions.			

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
E Scaw Metals is one of the biggest steel manufacturing companies in the country.		They should be offered at a price that supports local beneficiation.		Laws should guard against those that will deliberately pull in a differed direction.				A lot of business was lost by local manufacturers because of high price that makes them unprofitable.
F This was an independent metallurgist.		The price offered for mineral should produce good internal rate of return for local beneficiation.	Government support is vital important. Other stakeholders should show commitment as well.	Local industry should be protected. There should be policies developed to do that.			Get some minerals from other African countries, more especially neighbouring countries.	Need to do a joint venture with other African countries. Beneficiate what makes economic sense for S A.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
G Mintek is a state owned company that does research that is related to minerals.	Some minerals should be prioritised for local beneficiation.	Prices should be discounted for local beneficiation.		Rules should be favourable to local beneficiation more than exports.				Decide on strategic mineral feedstock. There is no need to beneficiate everything in the country.
H IDC is a state owned company that finances businesses.	Make allocation for local mineral beneficiation.	Local market should not be charged the same price as foreign market.	All stakeholders should put interests of the country firs.	Regulations are created to support local industry and support business as a whole. Laws should not be seen as inhibiting.	Where necessary issuing of mining licences should be amended. As long as it supports local beneficiation.	The strategy has already been agreed upon, it now needs to be fully implemented.		Efforts have been made in the development of the strategy, all that is needed is positive contribution from other stakeholders.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
I AngloGold Ashanti is a division of Anglo.	It is becoming difficult extracting minerals as mines are too deep and old. There is less product per carried ton out of the ground. Need new mining methods and technologies. Minerals should be extracted competitively.	Price offered for mineral is fair. Some old mines are not profitable at the current price.	Business is willing to participate in anything that is for the benefit of the country as long as it economically viable. All stakeholders should commit themselves to making local beneficiation work.	Rules that control mines and labour should be made flexible. This will make it globally competitive doing local beneficiation.	Mining licences should not be amended as that may impact negatively on profitability of the mines. Investment that is injected in local mines comes from abroad, so, changes should be cautious not to scare investors away.			There is already beneficiation done in the country by mining companies. They own company that are directly involved mineral value add in the country.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
J Macsteel is the biggest steel trading company in the contry.	Local content is crucial. Mines should make allocation for local industry.	Mineral resources' prices should be discounted for local industry since they operate in close proximity to mineral resources.	All stakeholders should commit to the local beneficiation strategy. It would not be of benefit if government initiatives are not supported.					Local industry should be prioritised for it to prosper. After satisfying the local industry then exporting to foreign market can be considered.
K Howden is one of the biggest steel fabrication company that supplies power generation industry.	Minerals are already available in abundance to local industry.	The price that is offered to the market should not differ to that offered to local industry. There should be no unfair advantage create.	There is too much government interference. Business should be allowed to do business and government only focus at the running on the country.	Regulations should be relaxed and allow markets to dictate.	Relax conditions that are contained in mining licences.			Government should not get too involved. It should allow market forces to dictate what should happen in the market.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
L This was a research group leader from one of CSIR divisions.	There is no problem with local supply of minerals.	Mineral are sold in market where they will enjoy a good return. If the price in foreign market brings better returns, it makes economic sense exporting mineral to that market.						It is not necessary to do everything. For example, in Botswana they cut and polish their diamond, but full beneficiation is done outside their country.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
M This was a fundi in the subject of mineral beneficiation. He contributed in the submissions of government's mineral beneficiation strategy.	There should be an allocation of mineral resources for local industry.	A development price should be offered to local industry. The current price that is offered local industry there is no way it can compete globally. For example, the steel produced in SA cannot compete with that made in Shanghai.	The source of minerals, the mining company, need to commit to offering a development price for local industry to be able to beneficiate profitably. Currently there is a monopoly price charged to local industry.	Local industry should be protected. Policies should be implemented that will promote development price for local industry.	If it calls for amendment of mining licences in order to support local industry, it should be done.	Government departments should speak with one voice. Currently differed departments claim ownership of the local mineral beneficiation strategy.	Africa has an abundance of mineral resources. SA will be making a mistake if it does not consider sourcing some minerals in the continent.	Not everything can be beneficiated in the country, but those mineral that have been identified should really add value.

Table 4 cont.

Respondent	Theme							
	Minerals availability	Fair price	Political will	Regulations	Licences	Coherent strategy	Africa as a source	General comment
N This was a highly respected person in Botswana for his contribution in the establishment of their country's mineral beneficiation policy.	SA can make an allocation of minerals to local industry. Botswana is doing it, so they can do it.		A buy-in from all stakeholders is vitally important. This is a good opportunity to add value in the country's minerals.					It is beneficial doing at least a few beneficiation stages in the country. It saves transport costs of waste that is usually part of unprocessed mineral.

4.3.2 *Conclusion*

The secure supply of minerals for local beneficiation is highly contested because everyone in the supply chain is looking at their bottom line. Manufacturing sector's strong support for local beneficiation is based on the fact that they are the ones that stand to gain the most. They want to revive their industries. This is the opportunity for them to resurrect the industry that has been losing ground over time. The mining sector is a bit sceptical about local beneficiation because the export market is lucrative for them.

4.4 Results pertaining to Research Question 2

4.4.1 *Diverse respondents' feedback*

Question 2 relates to manufacturing sector. It is asking if the mineral beneficiation in the country will improve manufacturing sector. The impact of mineral beneficiation on the manufacturing sector is seen as going to bring about a lot of improvements. This saw a convergence of views from respondents as they were interviewed. There were differences in opinion here and there, but in general, they were in agreement. There are positive ripple effects that are seen as going to make a huge impact in other industries whether directly or indirectly. There are many linkages to the manufacturing sector that stand to gain from it when it is doing well.

Table 5 below shows themes that relate to question 2 that were extracted from the interviews. Detailed discussion will follow in the next chapter.

Table 5: Core themes extracted from question 2 interviews

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
A	Labour productivity is not in line with steep salary demands. If the labour were to come to the party a lot could be achieved in advancing local manufacturing sector.	Broad-based Black Economic Empowerment (BBBEE) is a challenge in local business growth. This regulation creates a lot of uncertainties for both new and existing businesses.	There is not enough market in the country to consume finish locally manufactured goods. An advantage for Asian countries is that they also have local market over and above export market. SA used to have local market when it was exclude from global market by sanctions.	Local manufacturing charges exorbitant mark-up prices. As high as 150% on some product. If this practice continues local manufacturing goods will find it difficult to sell in the market.	To support local manufacturing more energy resources are needed. Beneficiation processes are energy intensive. With the current energy crisis a new source of energy will have to be brought forward.	More job opportunities will be created in the process.	Cost of running a business in SA is very high. This is a problem that has seen some businesses in forced to shut down in the past. This is one cost that can hurt the industry again if it is not carefully considered.	Local mineral beneficiation will improve local manufacturing.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
B	Labour development will help in supplying skills to other industrial sectors in the country. Local beneficiation will be a breeding ground of technical skills.	Local industry should be protected. Other countries achieved international competitiveness because they protected and supported their local industries.	There is potential African market that is still growing. SA can look at exporting finished goods to that market.	Raw minerals should be supplied at a price that will make local manufacturing globally competitive.	More power stations should be built in order to meet demand of energy that is required to do local mineral beneficiation.	This will be an opportunity to create jobs. This sector will come to the rescue with the fall of construction sector which has been one of the biggest employers.	Running costs need to be curbed. Otherwise, businesses' closure is inevitable.	SA is well positioned to be a hub for SADC region's industrialisation.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
C	Labour productivity at times is letting down employers. This needs to improve for SA to compete among other better performing emerging economies.	BBBEE is a challenge for companies to do business in the country. Other thorny issue is a minimum wage. It is generally accepted that some employers underpay employees and that makes them raise their demands or move to other better paying jobs.	Bulk of the market of finished goods is outside the country. An appetite needs to be generated on local market to demand more local manufactured goods.	There is a problem of import parity pricing. For example a local steel supplier charges the same price to local market as delivered to foreign market. This is an area that needs to be improved. Otherwise, local market will source finished goods from foreign suppliers.	The country is battling with blackouts that slow economic growth. Immediate attention needs to be given to energy supply issues. Sourcing energy from other countries should be explored as well.	More jobs create in the economy is a good thing. There are huge prospects that more jobs will be created with the resurrection of manufacturing sector.	This cost is on an incline. It needs to be kept under check. It is killing a lot of businesses.	Infrastructure should be improved substantially to allow movement of goods in the county as well as reaching other foreign markets.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
D	Latest labour demands are not creating appetite for business to invest more in the country. This situation is a threat to any good initiative like local beneficiation.	Laws favour labour and trade unions. It is surprising because they do not create employment. The laws should be business friendly.	Domestic market is not enough to absorb all that is local beneficiated.	A fair price should be charged for locally manufactured goods.	Power crisis need to be resolved.	Local manufacturing will create more employment opportunities.		
E	Cost of labour is high and that has a negative impact on selling price. At times this cost prices products out of the market.	Laws should be supportive of local manufacturing. The local industry should be protected.	Local market should be developed to reduce reliance on foreign markets.	Raw materials for manufacturing should be supplied at a fair price. Advantage of being closer to the mineral resources should work for local manufacturers.	More energy is needed to support local mineral beneficiation.	Definitely, jobs will be created. Manufacturing has done that before that is expected to happen when doing local mineral beneficiation as well.	Overheads should be capped at a level that would not jeopardise sale of finished goods.	Labour productivity is low. This needs to be improved for current setting and in preparation of local mineral beneficiation.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
F	Cost of labour is the biggest cost in production of a product. Minimum wage does not help in resolving that situation.	Labour regulations are not supporting local industry development. They are more favourable to employee and trade unions.	Market of finished goods is a problem. There is benefit of doing local beneficiation if there is no market.	Locally manufactured goods should be globally competitive and be able to capture market.	Uncertainty about future availability of power and unpredictable future power prices are big problems. Major projects have recently been lost due to power shortages. Power is a very critical resource for local industrialisation.	More jobs are expected to be created when implementing local beneficiation strategy.	Anything that can be done to reduce overheads or process optimisation would be SA's advantage. Innovation is needed in this area.	Free market rule in order to comply as WTO member will present challenges for SA if it were to protect its infant industry.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
G	Social issues are a big problem. They have a bearing in the labour performance.	There should be a legal system that supports local beneficiation.	There is no sufficient demand in the country to support local beneficiation.	Investors in mining sector dictate where they want minerals to be beneficiated. To make them agree to offer minerals to local industry may come at a premium.	SA should explore working jointly with other SADC countries in using water resources from them for hydropower. This will help in making available require energy for local beneficiation.	With local mineral beneficiation economy is expected to create more jobs.	Beneficiating jointly with other countries in the continent can be beneficial in the reduction of overheads.	Free market under WTO makes it difficult to support local industrialisation.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
H	Labour used to be cheap, but not anymore. Better technologies and process innovation should be employed to counter high labour cost.	Environmental regulations are working against mineral beneficiation initiatives. These regulations should be in sync with the new initiatives.	The big market for finished goods is outside Africa, only a small market is in the continent. More market development still needs to be done.	Import parity pricing should be rooted out as it hampers local manufacturing.	Energy security is a big concern. This is a challenge that needs to be speedily resolved.	Local manufacturing will create more jobs. This will bring more people to economic activity and that will grow tax base. There will be more revenue for the country.	At the beginning this is expected to be high because of capital cost and infrastructure. But it should improve over time. Other factor that might arise is idling equipment due to insufficient supply of minerals. There is a copper plant that is currently experiencing that problem.	Energy and logistics are biggest cost in steel manufacturing. Reducing these costs will go a long way in improving competitiveness of locally manufactured product.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
I	Labour productivity is low, and it does not look like it will change soon. Salary increases are higher than inflation.	Labour laws need to be flexible. Companies are hamstrung by the rigid labour laws that at times are not helping them.	Lack of local market. Volumes are low. This needs to improve in order for manufacturers to be profitable.	Manufacturers are offered minerals at a market price. They should also charge a market related price for finished goods.	Lack of predictable power. Lack of predictable power price. Power used to be 7% of mining cost, but now it is 20%.	Local manufacturing will definitely create job opportunities.	Mining is becoming more expensive. Manufacturing infrastructure is ageing and it is old technology that is energy intensive.	Competition from Asian countries is intense. Local beneficiation needs to be globally competitive in order for local manufacturers to become global players.
J	Labour productivity is less than what it should be. Labour instability is another problem.	Labour laws are not working for business.	Big market is outside the country. For example, steel production currently too large for local market. Most of their market is export.	Price for manufactured goods should be market related. Prices of finished goods will fall if more companies are beneficiating.	Energy shortages is a problem. New generation capacity is needed urgently.	Job opportunities will be create.	Doing business in SA is expensive. This should improve for local manufacturing to be able to make good returns.	Local manufacturing will definitely improve.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
K	Train more people so that they can do more beneficiation on their own.	BBBEE is a threat to business. Create enabling environment for investors to come invest in the country.	There is not enough local market for finished goods.	Free market allows for better price. This will secure supply and lower the price.	There is not enough energy to support beneficiation. More generation capacity needs to be built.	Absolutely. More jobs will be created by local manufacturing.	Lower operational costs in order for local manufacturing to be profitable.	Learn from other countries. Do not close gate for them to come in. There should be an appreciation of foreign investment as that will make a significant contribution to the country's economic activities.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
L	Labour should also have interest of the country in their hearts. They should show that by raising productivity.	Need to protect local industry. Countries like USA protect their industries. For example, try exporting sulphur to their country. They will not allow your product into their country. Europe is also protecting its agricultural industry.	SA is far away from the market.	Import parity pricing is a problem. It was applied when the country was excluded from the world, but some manufacturers are still using it. That should change.	New generation capacity is needed in order to keep up with high energy demand.	Local manufacturing will create a lot of job opportunities.	Overheads should be kept under close watch. Otherwise, they can turn what is promising to be a good business opportunity to a no starter.	Local beneficiation will create opportunities for local manufacturing to export finished goods. Without beneficiation the country will not be able to compete globally.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
M	Productivity level needs to improve. There is a potential. It should show in good performance.	Local industry should be protected.	There is not enough local to consume locally manufactured goods. Need to do more market development locally and outside the country.	Import parity pricing should not be charged to local market. Local beneficiation will improve manufacturing if development price is charged.	Beneficiation is energy intensive. More generation capacity is needed. Consider collaborating with other SADC countries in building hydropower using water resources in the region.	Job opportunities will improve people's lives. India and China moved people out of poverty through manufacturing.	Focus on lowering cost of doing business in the country.	No need to do full beneficiation. Just do what is economically viable. There is no need to produce to dominate the world supply. Only focus on strategic feedstocks that will create jobs.

Table 5 cont.

Respondent	Theme							
	Labour	Regulations	Market	Fair price	Energy	Job creation	Overheads	General comment
N						Jobs will be created, but not significantly at the lower ends of the value chain.		Globalization has acted as a specific impediment to beneficiation. The further down the value chain you go the more you come into competition with existing producers who are already competitive and already in the market. Unless you are able to give local firms an advantage from producing locally then beneficiation will not occur.

4.4.2 *Conclusion*

The manufacturing sector is a key industry sector that makes a significant contribution in the economy of the country. Any improvement in manufacturing is celebrated as that will be immediately felt by the economy. There are many positive things that manufacturing brings to fruition.

The feedback received from interviews showed different perspectives that interviewees had about mineral beneficiation and its impact on the improvement of local manufacturing sector. There was a sharp contrast between respondent K and respondent M. Respondent K was against government's intervention in the mineral beneficiation. He felt that the government is too involved in the space that is supposed to be controlled by the market. He said SA manufacturers should not be treated differently. They should pay the market price. There should be no discounted price because of their close proximity to the minerals. On the other hand respondent M felt that government should implement a policy that will push for a development price that will be offered to SA manufacturing companies when buying minerals. He held a strong view that mineral resources are overpriced for local suppliers because of import parity pricing. He felt that there should be an allocation of mineral resources for local manufacturing companies. There is a huge contrast between the two. This shows that there is a huge task for the government to get majority in the country to support local mineral beneficiation strategy.

4.5 Results pertaining to Research Question 3

4.5.1 *Diverse respondents' feedback*

Question 3 relates to the skills issue. There were also differences in points of view about impact of skills in implementing local mineral beneficiation. There were those that saw skills as available in the country but sitting in areas that are not core to mineral beneficiation. Skills are seen as a commodity that will always move to industries where there is high demand and they are highly compensated. There were also other views that saw a huge gap that still needs

to be filled by technical skills that will help deliver in the implementation of local beneficiation. They saw that the technical skills that are required for existing industries are in short supply. They are advocating for training more people so that the skill set that is required can be sourced within the borders of the country.

Table 6 shows themes that relate to question 3 that were extracted from the interviews. Discussion for the presented results is also following in the next chapter.

Table 6: Core themes extracted from question 3 interviews

Respondent	Theme				
	Technology	Trade	Development	Specialists	General comment
A	More technology is coming in to replace people. More people need to be trained.	There is not enough artisans, fitters, electricians and welders. This is another are that needs to be improved.	In comparison with other countries, from time to time, SA skills fall behind. More people should be developed.	Specialists cost a lot, but they are engine room of the economy. Beneficiation will need more of these skills.	There is a huge pool of youth that is unemployed. Train that youth so that it will be economic active.
B	There is a lot of mining technology that is manufactured in the country. More people can be trained to develop new technologies.	Need more artisans.	Need labour intensive jobs that will absorb more people.		Highly automated countries have lowest unemployment. So, more people with skills will help them employable and also be in a position to establish themselves.
C		Need more artisans and technicians.		Need more engineers and scientists that. Beneficiation will need these skills.	Ratio of artisans/technicians to an engineer is far less than that of other countries like Japan where there are hundreds of artisans/technicians to an engineer.

Table 6 cont.

Respondent	Theme				
	Technology	Trade	Development	Specialists	General comment
D	Technology is fast becoming a solution to labour issues. So, more technology operators should be trained.		Need to develop more people to get them out of poverty and make them part of economic main stream.	Highly specialised skills are needed to drive economy.	
E	Advanced technologies are replacing old technologies. Need new skills that will be developed.		Develop mining related skills, i. e. engineers, technologists, artisans and technicians.		
F			Training and development is the only way to get people skilled up. Invest more in training people.		Skills transfer will help a lot. This is the most effective method of training people.
G	Need more technologies to be developed in the country. More skills			Train more people to become specialists.	Resource-based growth needs more skills. Skills development will contribute toward achieving that.

Table 6 cont.

Respondent	Theme				
	Technology	Trade	Development	Specialists	General comment
	are required that can do that.				
H	Need new skills that will be able to operate technologies that are coming through.		More skills will be developed when doing local mineral beneficiation.		More people with requisite skills will make positive contribution in the country's economic improvement.
I	More skills are needed to support new technologies.	Need more artisans and technicians.	Develop more people. Develop local labour pool.	There will be more people with specialised skills that will be the product of local beneficiation.	Education is the way to go for people to get skills.
J	Need more operators of new technologies. Develop skills that can create new technologies.	Need more fitters, turners, electricians, artisans and technicians.	More people will be developed.	When there are more people with skills that will also increase number of specialists in the country.	
K	Focus more on developing		Get people to school. More education and training.	More skills development that will drive economy.	Spend more money on education. Offer free education.

Table 6 cont.

Respondent	Theme				
	Technology	Trade	Development	Specialists	General comment
	technologies locally.				
L			Develop more people so that they can be entrepreneurs. These are skills that will definitely contribute toward improvement of economic situation.	There are specialist skills sitting in positions that are not driving economic improvement. More skills should be incentivised to become part of local beneficiation.	Skills can be imported with a plan to transfer skills to local people.
M		Need more artisans and technicians.	Need to develop more people.		Skill is an international commodity. It can be imported and do skills transfer on the job.
N			Need to develop more people.		Clearly the absence of local skills weakens the incentives to downstream processing.

4.5.2 *Conclusion*

Skills play a significant role in the economy. More people should be trained so that they can be economic active. A large pool of skills will feed into different industry sectors as well as entrepreneurship. There was consensus among the respondents about the issue of skills and the impact they will have on the local mineral beneficiation is vitally important. They went further saying that the advantage of skills is that they can be employed in other industry sectors as well. A person that has a sellable skill should not battle to secure employment or starting his/her business that achieves good success. The linkages as well to the mineral beneficiation show the ripple effect on skills development that would happen in either directly or indirectly involved industries to the mineral beneficiation.

There is a tremendous support for implementing the local beneficiation of mineral resources. The differences are seen when they lean more towards each organisation's view of what could be the impact on its bottom line. When looking at the bigger picture of the benefits that will be enjoyed by the country and global perspective, the country takes centre stage. Respondents see that the country needs to boost its economic situation. Anything that will help in improving the economic situation will enjoy great support as long as it does not negatively impact on their business performance.

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

This chapter discusses the results in depth. Where applicable, reference will be made to the literature on the feedback received from respondents. This chapter intends to paint a clear picture of the views received from the respondents, of the impact of the study, and how the outcome compares to what was found from the literature. The structure is developed from each question's subsections. But not all questions have the same number of subsections.

5.2 Demographic profile of respondents

Demographic profile of respondents is as described in chapter four, under subsection 4.2. The results that are discussed in this chapter come from interviews that were conducted with the participation of the respondents.

5.3 Discussion pertaining to Research Question 1

Respondents from the mining sector and a few from other sectors expressed the view that there is already a secure supply of minerals in the country. They said that local beneficiation should be done in the existing framework without making any policy changes. They justified their argument by using the market size and the viability of doing beneficiation in the country as reasons. They do not think it would make sense for the country to force to beneficiate its mineral resources. They said that the minerals that are currently beneficiated in the country do not experience challenges in terms of trading their finished goods in international markets. Competition forces markets to source where the cost is lower, and South Africa falls off the bus when it comes to the cost competitiveness of finished goods. But the manufacturing sector, among others, holds a different view to that. They believe that with the technologies that they are capable of developing, by drawing from flagship projects like Sasol and steel they can do more. They can improve on the cost of finished goods.

Thematic analysis of research question one is covered in the following subsections.

5.3.1 *Minerals availability*

There was overwhelming support from respondents for the allocation of minerals for local beneficiation. South Africa boasts mineral reserves that can still be mined for many decades to come (Cawthorn, 1999; Jeffrey, 2005b). In the years still to come for the mines they said that there should be an allocation made and that should form part of mineral policies. In many studies that have been conducted it has been shown that SA's mineral reserves can sustain the mining sector for many years and there are even mineral deposits that have not been explored (Ramnath, 2012). With this wealth of mineral reserves it will be beneficial for the country to implement local mineral beneficiation. Availability of mineral resources is not a problem for the country. There was a general consensus on this from the respondents. Differences of opinions emanated mostly from their industry sectors. The mining sector felt that it was making mineral resources for everyone in the market, including local market. That point was contested by the manufacturing sector on the basis that they are closer to the mineral source, so, they must be allocated minerals for beneficiation at a discounted price. They also wanted assurance that there will be percentage allocation from the mines that they will make available in the mineral extraction. This is a form of securing the supply for local beneficiation.

The other challenge that was brought by the mining sector under the availability of mineral resources is their extraction. They said that mining is becoming more expensive especially in the old mines. This is because the shafts are deep and the latest mining technology cannot be used in that environment. They spend more money blasting and transporting mined material to plants on surface. There is more waste rock than the minerals carried out of the ground. That makes them not achieve the same production levels they used to when the shafts were not as deep. This challenge they deem has a detrimental effect in their commitment to the allocation of minerals for local beneficiation and the

export market they have always had for many years. This might make them stick to the price that they are offering to the export market.

5.3.2 *Minerals fair price*

This is a highly contested issue between the manufacturing sector and the mining sector. The mining sector feels that there is misconception amongst South African manufacturing companies about minerals prices. They said that they are charging fair prices as prices are set internationally. On the other hand, the manufacturing sector is accusing the mining sector of charging local industries prices that they charge for minerals delivered to foreign destination. They feel that they should be charged only the price for the extraction of minerals since this is the only cost that is incurred by mines when selling raw minerals to local industries. But they feel that import parity pricing (IPP) is used by mines to their disadvantage. They said that they are paying the price that is inclusive of logistics that account for transporting raw minerals from mines to the international market. That makes local industries unable to compete with global players because the price of raw mineral immediately sets them on the back foot. Other input costs that are difficult to cut down add on that.

The mining sector has dismissed the price issue as a misconception, but it was interesting to hear them talking about the similar price problem saying that it is done by other industries outside the mining sector. That showed that they are well aware of the situation and the impact of IPP in local industries. Their gains from keeping the status quo far outweighed need for them to revise their pricing structure. For local beneficiation there is a call for a development price that should be offered by the mines to local industry. They feel that they will not be globally competitive if they get minerals at the same price as is offered on the open market. What they are asking for is already happening in Asia. In China, local industry is offered a lower price for the same minerals that are offered in the open market. Figures 6 through 8 show prices that are offered by the Chinese mining sector to its local market and abroad. It can be seen from these figures that they support their local industry. With this price policy they manage to develop local market for their manufactured goods. In South Africa the local

market is lean. A development price will also help the development of the local market for beneficiated products.

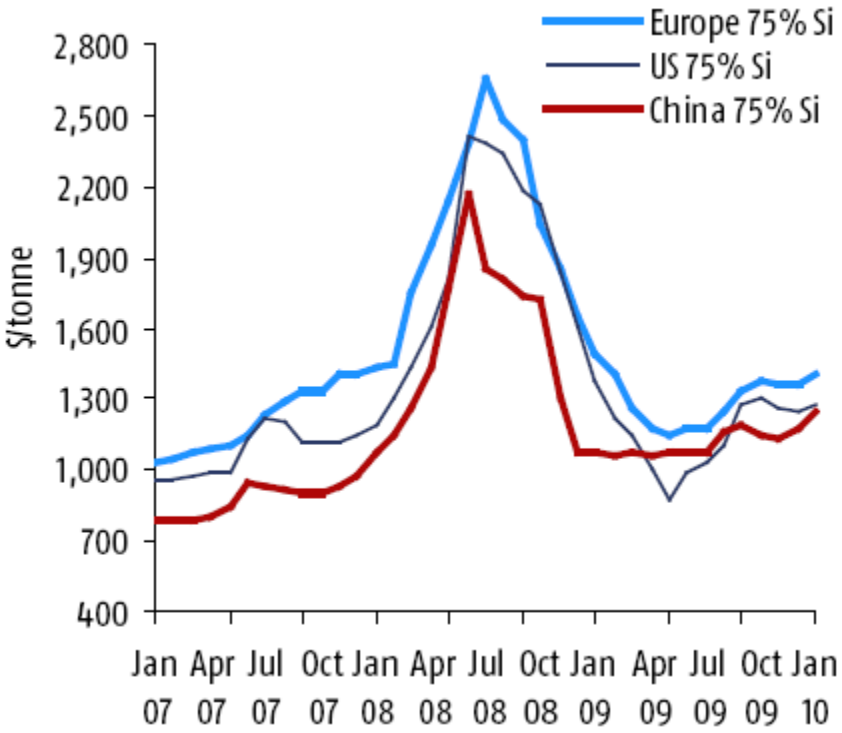


Figure 6: Ferro-silicon prices

Source: Karapinar (2010)

Figure 6 shows ferro-silicon prices over a three-year period between 2007 and 2010. The price comparison is done between three areas, USA, Europe and China. China beat the other two by consistently offering a better over this period. This made a China a preferred area to source ferro-silicon from it because of its better price offering. This makes a significant contribution in driving Chinese economic growth.

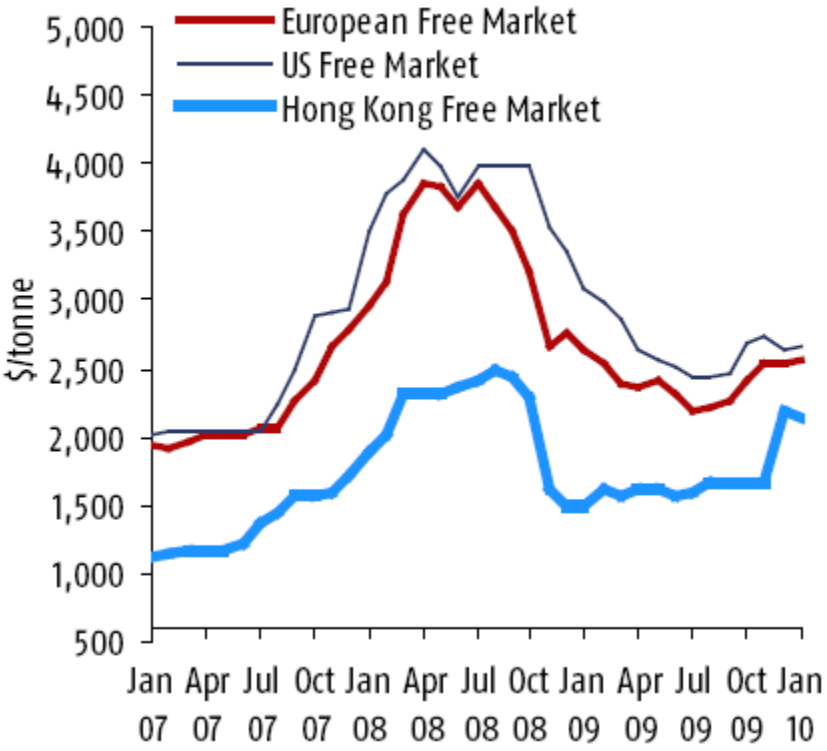


Figure 7: Silicon metal prices

Source: Karapinar (2010)

Figure 7 shows silicon metal prices that looks at free market prices that were offered by three regions over the same period as in the case of ferro-silicon above. Again here Asia did very well when compared to the western counterparts. In this Hong Kong is compared to USA and Europe. USA and Europe could not match the price that was offered by Hong Kong, not even once over this period. This market situation was favourable to local manufacturers in Hong Kong that were benefiting from the better price. This also improved their imports as foreign manufacturers were sourcing silicon metal from Hong Kong because of the better price that they were enjoying there.

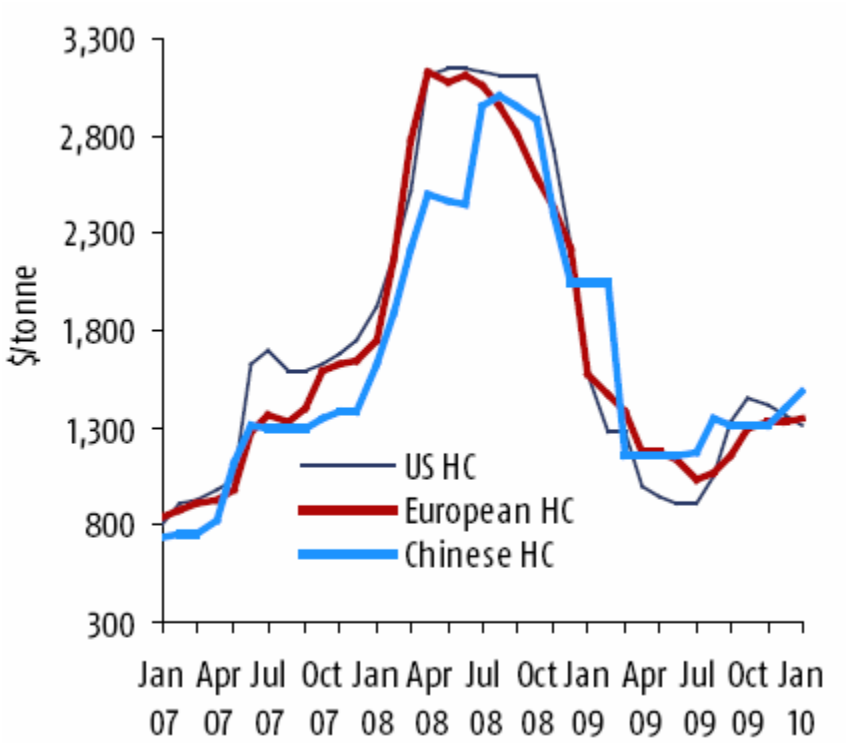


Figure 8: Ferro-Manganese prices

Source: Karapinar (2010)

Figure 8 also compares USA, Europe and China over the same period on the ferro-manganese prices. Here China did well between 2007 and 2008, but beyond that they could not maintain a lower price offer in comparison to others. Their price showed fluctuation, but notable remaining higher than what USA and Europe were offering. China seemed to be losing its popularity as the preferred destination to source these metals at the end of this period.

5.3.3 *Political will*

Respondents are seeing the potential growth of local mineral beneficiation and the contribution it will make in the country's economic growth. They are in agreement on getting a buy-in from all stakeholders for the implementation of mineral beneficiation. They all need to take ownership of this initiative. It was interesting to see that they do have the interest of the country in their hearts. The issues that make them at times seem to not agree on the implementation of the strategy, is the impact it will make on their bottom line. The Chinese

example is an excellent one in this case. Their economy is doing well, growing at a rate that is greater than South Africa's economic growth. They are the best performing emerging economy. South Africa would like to improve its current economic situation. The implementation of local mineral beneficiation should be a vehicle that can help the country achieve that.

5.3.4 *Government regulations*

There are different views that are held on government policies and its involvement. There are those that felt that government is too involved in minerals resources. They felt that it should be left to market forces to dictate how minerals should be traded. They feel that government control had its time when South Africa was excluded from the outside world. There it could regulate the market as it was only focusing on domestic market. During that time it managed to bring up parastatals that were a force to be reckoned with. But that was only good for domestic consumption as the government was the biggest consumer of those goods. Now that South Africa is part of free economic world, they feel that government should let go and not even think about the grip it had on economic control.

In contrast, the manufacturing sector feels that there should be a development price charged to local industries. They feel that the price should make it competitive for them to do mineral beneficiation in the country. They want that to be part of mining contracts. Whenever a mining licence is issued, the licence holder should agree to offer mineral resources to local industries at a developmental price. The existing mining licences need to be reviewed so that there can be alignment between the new and existing license conditions. Otherwise, if that is not done it will be unfair to those applying for new licences to be the only ones that are subjected to the licence conditions. That will resolve the IPP issues that put local industries at a disadvantage. There need to be policies that protect local industry and bind mining companies to commit to local industry development. Government's role does not diminish even if the economy is really open (Kudo, 2005). Policies are needed to give guidance in the running of businesses in the country. There are opponents to that amongst

the respondents. They were critical of the current regulations of minerals in the country. It was good to see that they had differences but they could see the good intent of the policies from government.

5.3.5 *Mining licences*

The mining sector is seeing the risk of these proposals to their existing mining contracts. They said that investors brought their investments into the country because of stable and certain environments that was presented to them showing that South Africa is a good destination. They committed to long term contracts hoping that there will be no changes along the way. From those commitments they also committed to other markets outside the country that will ensure a secure supply to those markets. With the introduction of local beneficiation they are seeing violation of terms of their investment looming and them defaulting on their agreements with international markets. They are stressing that the government should only create an enabling environment for investors to come and invest in the country without much involvement on the operations and how investors do business. That is not what the government is prepared to do because it has the interests of its' people to serve over and above the interests of foreign investors. Government wants to attract more foreign investments, but while doing that it does not want to appear as if its people are not as important as investors.

There is a strong motivation for pushing for amendments to the minerals act and issuing licences. There is a general feeling that the implementation of local beneficiation will encounter challenges if licences control is not taken into consideration during the development of the beneficiation strategy. This is the same position that was taken by the Chinese government (Karapinar, 2010). The issuing of new mining licences should pave the way for supporting local mineral beneficiation. It will be hard at the beginning, but they will eventually get used to it and come on board. There is a number of policies that have been introduced over time in different industries that faced resistance at the beginning, but they got accepted and the affected industries complied. Change is inevitable, but coping with the change is what usually shows resistance.

5.3.6 *Coherent strategy*

The strategy issue was more about agreeing on one thing and the direction that needs to be taken. When looking at the minerals allocation, local industry and mining sector should be in agreement on what they want to achieve. The most important primary stakeholders in the implementation of local mineral beneficiation are the mining sector and manufacturing sector. If the two parties can agree on the allocation of minerals and the price that will be offered to local industry, then that will be the first milestone that would make other stakeholders quickly get on board. On the government side, coherence is needed from its departments that speak with different voices. They do not need to compete for ownership of mineral beneficiation strategy. All that is needed is a concerted effort. They need to channel their energies toward achieving one goal of implementing local mineral beneficiation.

5.3.7 *Africa as a source*

There was a general feeling that South Africa should also consider sourcing mineral resources from the continent. There was also an interesting comment from one of the respondents where he said that South Africa should not look at itself as superior to Africa. He was making a point that there is huge potential in the continent. Minerals that are in short supply can be sourced from the continent. Besides, mineral extraction cost in other countries on the continent is less than what it costs in the country. That cost advantage will go a long way in making locally manufactured goods more global competitive.

There are already initiatives in the road and rail network infrastructure that will link SADC countries. That network will be established to ease the flow of goods between member countries. Depleted infrastructure is inhibiting economic activities in the continent. The impact of the condition of infrastructure in economic activities has been identified as very instrumental (Bjorvatn, 2000; Carrère, 2014). This is also important for strengthening relationships with other countries in the continent.

5.3.8 *Conclusion*

The security of the supply of mineral resources for local beneficiation is a starting point, and a critical issue. This is the foundation for the success of local mineral beneficiation. If local industries cannot be competitive when taking their finished goods to the global market, it would not make economic sense for them to do local beneficiation. It would be unfair if that is caused by things like IPP that they have identified as the most contributing factor in the high price that they have to pay for minerals that are mined in their country. The market is also a big issue. Without a market there is no need to beneficiate minerals. This supports the point that was raised that was critical of governments' position about mineral beneficiation (Hausmann et al., 2008). It would be difficult to strike a balance without bringing all stakeholders around the table and to thrash out these issues. They should be made part of formulating the solution so that they can take ownership of it. The argument of the resource curse that mineral-rich countries cannot grow as much as those that do not have mineral resources wealth can be proven otherwise. Butkiewicz and Yanikkaya (2008) in their study found that the mineral resource curse does not exist where there are strong institutions. There is already China showing a strongest economic growth that cannot be matched by other big economies. SA can turn its economic situation for the better with the implementation of local mineral beneficiation.

5.4 Discussion pertaining to Research Question 2

There was overwhelming support for mineral beneficiation when looking at the improvements that it will bring to the manufacturing sector. The view of the market that will consume finished goods from locally beneficiated minerals was still held. They said that there should be a market that will consume these products, and that they should be globally competitive. It should be done in line with World Trade Organisation (WTO) agreements. The taxpayer should not subsidise local industries. They feel that since it was done in the past when the country was under global sanctions they are concerned that it might be done again. However, that will be against the WTO agreements. South Africa is expected to 'run with the pack' and develop at a pace in line with its' long term

goals, however, its' economic situation is not conducive to reducing unemployment and, in reality, may not reach these goals on time.

The themes from question two's findings are discussed in the following subsections.

5.4.1 *Labour*

People are needed for everything from the start of processes to their completion. Even if the processes are automated people are still needed to create such processes. With all the emphasis on the importance of labour, it also came out from respondents that labour is one of their biggest problems. In addition to that, it poses problems for their cost structure predictability. They mentioned two major issues that they have with labour, namely, productivity and salary increases. There is a serious concern that there is no correlation between labour cost and productivity. This sentiment supports what research is saying about productivity (Burger & Teal, 2014; Hall & Jones, 1998; Hardman, 1996; Philippe, Braun, & Fedderke, 2008). They feel that production levels are down yet the cost of labour remains high. If it was not for the power of organised labour, they said that they were going to try bringing the cost down. They feel that productivity levels can be improved if labour can start showing that it really wants to improve the situation. Respondents see salary increases as unsustainable. Demands that are above inflation put a strain on business. They said that if this persists they will be forced to cut down on personnel. Local mineral beneficiation is not going to be immune from these challenges. It is expected to battle to find ground in such a volatile environment.

There were a number of issues that were raised about labour. There are mixed feelings about contributions that are made by labour to the success of business in the country. Unfortunately, the majority of what came from the respondents indicated that labour is not playing its part to the best of its ability in its economic contribution. Most respondents commented on low labour productivity that they are witnessing in the country. They felt that labour can change that if it wishes to do so. They would like to see labour improving because productivity decay will be a big blow for any efforts of industrialisation. They contrasted the

low productivity with pay demands that are rising. There is no congruency between pay demands and the effort that is put in by labour on the job. A good picture would be seeing pay demand lagging behind productivity. Labour cost was identified as one of the major costs in the means of production. It has been found to be more than that of other emerging economies in Asia and Latin America (Golub, 2000).

Minimum wage was also mentioned as another challenge that is seen as going to cripple business. These are challenges that are going to threaten local mineral beneficiation. Labour needs to work with business and government in order for business to reap good returns. It was good to hear from some respondents about labour that is underpaid in some employment positions. They gave an indication that they were seeing that it is not a right thing to do. They also felt that labour and trade unions have too much power which they enjoy thanks to government rules. They raised these issues as potential hurdles to the implementation of mineral beneficiation. This realisation goes to show that labour and trade unions need to be engaged about local beneficiation. For that matter, they need to be engaged in any business activity where they are involved.

5.4.2 *Government regulations*

Government creates an enabling environment for conducting business. This is supported by all when government regulations are favourable to all. However, it is not possible that regulations can be applauded by all because people engage in different business activities. Local industry wants to see the government protecting their industry. They want government be on their side like governments in other countries are. Asian countries that are also part of BRICS together with South Africa, India and China, do protect their local industries (Goode, 2006; Karapinar, 2010; Yu, 2011). The import of raw minerals into their country enjoys free or low import tariffs. They charge exorbitant tariffs for raw mineral exports. They show that they are really discouraging export of raw minerals. They encourage processing trade. The South African local manufacturing sector feels that government can protect them as well if big

economies like India and China are doing it. This is a position that the country can take. It will be beneficial to the country as a whole. There is a lean domestic market for locally manufactured goods. That needs to be developed. Its development can be a success if there are policies that protect local industry.

Government tries not to lose grip of the economic situation in the country and mineral resources. Most respondents said that the government is too involved. They believe that it should let go and allow market forces to dictate. They feel that there are too many policies that impede doing business in the country. They picked on two as the most problematic when it comes to attracting foreign investment. They mentioned broad-based black economic empowerment and minerals act as the sticking points. They said that if they had a way they would ask for these acts to be withdrawn, or, if not possible, to be relaxed. These sentiments are in support of what was found by (Basson et al., 2007) when they were evaluating the status of the ferroalloy industry and also looking at its future. This is a situation that government would really find it difficult to swallow as investors seem to be seeing its policies as discouraging investment. However, the government has a bigger role where it needs to create an environment that is welcoming to all, but not at the expense of losing its people's wealth. Out of all stakeholders, the government is the only one that needs to do more than any other.

5.4.3 *Market*

The market issue was common to all respondents. They do not see a large enough domestic market that will absorb locally beneficiated products. They mentioned a lot of examples of locally beneficiated products that cannot be absorbed by local market. Among them they mentioned steel and jewellery. Steel is consumed mostly in the country with surplus exported to foreign destinations. Jewellery is surviving, but not doing great. There are other examples that they gave of beneficiation plants that are idling because there is no sufficient demand in the country. They see no point of beneficiating in the country when the market sits outside the country. They prefer beneficiating where it is cost competitive, and closer to the end user. This supports the point

about beneficiating closer to the market that was raised by Hausmann et al. (2008). The market location is a trade barrier as it has a significant impact on the volume of trade between the exporting country and the delivery point. A number of studies have shown that the distance between trade partners has an inverse relationship to trade volume. A study that was done by Atkin and Donaldson (2012) where they looked at intra-national trade costs for Nigeria and Ethiopia, they found that transport costs are between 7 to 15 times the road transport cost between Canada and USA. In another study that was done by Korinek and Sourdin (2009) where they looked at maritime costs and their impact on trade, they found that on some routes shipping costs are 10 times more than others. The feedback received from respondents supports the findings from these studies. This shows that market location is vitally important. Local and continental market development should be prioritised for finished goods.

Market volatility had significant impact. Rand volatility was also seen as the inhibitor of implementing mineral beneficiation hoping to be profitable at the end of the day. That exposure is seen as a risk to the sustainability of producing finished goods in the country hoping that international market will absorb them. Geographic location to international market was also seen as a disadvantage.

5.4.4 *Fair price*

The price issue was raised about securing the allocation of mineral resources for local beneficiation. The manufacturing sector said that mining sector is charging them import parity price (IPP). The IPP came up again about pricing of finished goods. Manufacturing this time around was accused of that practice. Specific products that were mentioned as charging IPP are oil, gas and steel. These are products that were beneficiated in the country during the time of sanctions that were imposed on the country. When sanctions were lifted they did not stop using IPP. The manufacturing sector has been requested to stop this practice as it makes finished products expensive to the local market. There are businesses in the country that have already resorted to sourcing steel from abroad where it is cheaper. This has impacted negatively on the local supply

chain. The greed of steel manufacturers has taken away business that could have been given to other suppliers in the country.

The other burning issue is a mark-up on finished goods. It came up from respondents that some businesses charge a 150% mark-up. If there is another mark-up that another business need to charge to the end user how much the end user will eventually be paying for the product? This is a serious problem that makes businesses and users end up sourcing some products abroad when the same products are available in the country. This ridiculous mark-up exports business opportunities that would be benefitting the country.

5.4.5 *Energy*

Minerals beneficiation is an energy intensive process. The prevailing energy challenges are not favourable for the introduction of processes that will consume a lot of energy. Respondents see energy as the biggest problem for the country. They see it as the inhibitor to whatever good initiative that is put on the table. They feel that energy should be prioritised so that it can support the economy and help businesses stay open. At the moment they are seeing businesses battling to stay open under the current energy strain. Businesses are asked to cut back on their energy consumption which forces them to not run. The other challenge is the predictability of energy costs going into the future. The power utility is asking for increases from the energy regulator that are double digits, high above inflation, and, with the economic situation, that is not helping at all. The mining sector said that energy used to amount to 7% of their cost, but now is above 20%. Other sectors mentioned that another 20% increase in energy cost will force them to close down. That is the extent of the problem of energy constraint to existing businesses. With the opening up of new industries that situation is expected to get worse.

Developments of the energy crisis are presenting a picture that was feared by Kohler (2006). In his study about the economic impact of rising energy prices, he mentioned that it will slow economic growth and hamper the efforts of poverty reduction. A few years down the line, that is being experienced by the country. Once the energy issue became a national issue the country pulled out

all the stops trying to contain it. China, as big as it is, is also experiencing energy shortages. They have embarked on sourcing energy from other countries that have surplus (Daojiong, 2006). South Africa can look to the north of its borders at other SADC member countries that have an abundance of water resources. They can work together in building hydropower plants that can be used in the country as well as in the source country.

5.4.6 *Job creation*

Job creation is one area that has been seen as going to be the most beneficiary in the implementation of local mineral beneficiation. In general, respondents saw a lot of job opportunities that will be created across the board. Mineral beneficiation stages differ in the number of job opportunities they create. With the current employment challenges and other industry sectors battling to stay afloat, mineral beneficiation is seen as the vehicle that will improve that situation. Mineral beneficiation creates job opportunities in other sectors that are not directly involved in mineral beneficiation, but through economic linkages.

The manufacturing sector employs scores of people. Local beneficiation is expected to improve the current situation. Regulations have been sighted as a threat to job creation, specifically labour regulations. This supports the findings in the study that was done about the decline of employment in labour intensive manufacturing in Indonesia (Aswicahyono, Brooks, & Manning, 2011). In the economy that wants more people to be economically active, regulations have been cited as the potential hurdle. Businesses want labour laws to be flexible. They are arguing that that will create more employment. In a study that was conducted by Mitra (2006) where he looked at the issues and facts about wages and employment, he indicated that without focus too much on the wages employment creation can be improved.

5.4.7 *Overheads*

Overheads are a headache to all businesses. They are seen as difficult to contain in local business. There are many things that are cited as the major

hurdles that push overheads up, among them, energy costs, resources, and labour. They mentioned that doing business in the country is fast becoming a problem and leads to a lot of businesses closing down. The runaway cost of electricity was mentioned as one cost that escalates at a rate that cannot be met by businesses. Water resources are also cited as fast becoming a scarce resource. In beneficiation stages there is a high utilisation of water. The water crisis that has started surfacing in the country raised eyebrows about the implementation of new initiatives that require a lot of water resources.

Opportunities have been lost and some businesses have had to close down because of unsustainable operational costs. Despite all this, the country still needs to develop. Innovative processes and technologies that are not energy intensive and also not heavy on water utilisation are needed to reduce operational costs. Now is the opportunity to come up with innovative solutions and processes. More entrepreneurs are needed to drive the economy.

5.4.8 *Conclusion*

The selling points that South Africa used to use when attracting investors into the country have now become major constraints. Things like cheap energy costs, cheap labour and cheap raw materials are quick becoming a thing of the past. In an article that looked at the ferroalloy beneficiation in the country, in 1992, they projected a good picture of beneficiation cost structure because of the favourable situation back then (von Below, 1992). Energy hikes have shown that it is fast becoming one of the biggest costs. A few decades ago when energy was cheap, it saw the development of aluminium beneficiation in the country. This is an energy intensive process, but it could be done in the country because energy was cheap and there were no supply issues. The recent energy crisis has forced the same aluminium beneficiation plant to close down part of its operations due to high energy costs (Allix, 2014). Labour as well used to be cheap, but not anymore. Raw materials are becoming difficult to mine. These are all the things that were benefits of doing business in South Africa. They are seen as threats to the success of local beneficiation initiative. In a recent article by Rodger (2014) where he looked at platinum mining costs over

a five-year period, he showed that cost escalation is increasing exponentially. Energy cost shows an escalation that is in excess of 200%.

Besides all the challenges that have been identified, local mineral beneficiation will improve the manufacturing sector in the country. More economic linkages will also benefit from local mineral beneficiation.

5.5 Discussion pertaining to Research Question 3

Skills shortage is a challenge that respondents agreed on. There was a divergence of views around which skills are really necessary. They saw the current skill set in the country as insufficient to embark on local beneficiation and run with it. They said that existing industries in the country are battling to source skills in the country that are critical for their operations. They mentioned that more people need to be trained and developed in order to contribute positively to economic improvement. They felt that the situation is not dire since people can be trained. Mineral beneficiation needs certain technical skills that are core to beneficiation processes. This is seen as a challenge at the beginning that can be sorted out by importing skills with a goal to transfer skills to locals. It can be done on fixed term contracts where it can be made part of the contract that a consultant will have to train local people that will take over from him/her at the end of the employment contract.

There was a consensus on skills development. They felt that local beneficiation will be a vehicle that will help accelerate skills development. They stressed that there should be more training and development done. Education should be prioritised, its quality being a corner stone. These sentiments are in support of what research is saying about education and skills (Hanushek & Woessmann, 2007; Olaniyan & Okemakinde, 2008).

5.5.1 *Technology*

Some local industries are still using old technologies. They were created many years ago when challenges that are in existence today were not thought about. Some of the technologies are expensive to keep in operation. Skills are needed

that will create better performing technologies. Innovative processes and technologies are needed. Local mineral beneficiation is seen as a breeding ground for skills and technologies. It is energy intensive which opens up opportunities for the design of technologies and innovative processes that use less energy. This will help to free energy that is consumed by energy intensive technologies.

The other skill that will be produced by local mineral beneficiation is that of technology operators. Beneficiation stages will be more technology intensive. These technologies will need people to operate them and those that will support them as well. There are more skills that will be needed. This is a good sign that this initiative is going to make huge economic impact.

5.5.2 *Trade skills*

Respondents highlighted a huge demand for trade skills. They said that more artisans, technicians, fitters, electricians and boilermakers are currently in demand and they will be needed for mineral beneficiation as well. They even indicated that the ratio of artisans to engineers is low in the country. More of these skills are needed. This supports the findings of the study that was performed by Dias and Posel (2007) where they looked at unemployment, education and skills constraints post-apartheid. They found that skills that are required by the economy are in short supply. They noted that skills continued to be produced but they were not the right skills that are needed by the economy. From the respondents the same point was also made about skills that continue to grow but are not the right skills that the economy needs. In another study that was done by Stacey et al. (2008) where they looked at the technical skills in mining sector, they found that there are skill shortages in the mining industry. They noted that the skills shortage problem in the mining industry needed a long term strategy in order to resolve it. Mining is a long term investment with many decades of mining one site. There needs to be a plan of producing skills over term that will feed this industry. The same industry will be producing minerals for local beneficiation. So, the supply of skills for mineral beneficiation will have to track the skills demand.

5.5.3 *Skills development*

Skills development is another area that will benefit from local mineral beneficiation. Respondents saw this as an opportunity to develop more people. They said that expenditure in education should increase to produce more people with skills. This will also add to the improvement of the quality of education. This supports the findings in the study that was done by Olaniyan and Okemakinde (2008). In their study they were looking at human capital, specifically looking at its implications to educational development. They indicated that education should be of quality for it to make a valuable economic contribution. The skill base in the country will be widened. With more people with skills competition for job opportunities will be heightened. That competition will be healthy for the economy because it will help in reducing labour cost.

5.5.4 *Specialist skills*

More people with specialist skills are currently in demand. The country is battling to fill many open specialist skills positions. The current supply of specialist skills will find it difficult to catch up with demand. With more people trained there is hope that more and more people will move on to specialist skills. These are skills that drive economy. They do not sit without employment because they are in demand. In mineral beneficiation these skills are needed in large numbers. So, there will be a need to develop more of these skills. More people can be trained to become specialists. In the early stages they can be imported with the long term plan of producing more locally.

5.6 Conclusion

The security of the supply of mineral resources needs to be ensured. Local industries will beneficiate minerals as it is of benefit to their businesses as long as there is a secure supply and it makes economic sense beneficiating such minerals in the country. They would like to enter into long term contracts with their markets and that can mean sustainability, predictability and certainty.

Mineral beneficiation in the country will definitely improve manufacturing. This is seen by potential jobs that will be created by manufacturing sector. It will generate revenue for the country. The benefits that will be enjoyed makes it compelling to implement local mineral beneficiation within the borders of the country.

The skills shortage is seen as the challenge only at the beginning of minerals beneficiation. With time, it is expected that more skills will be developed. More skills will create more entrepreneurs. That will produce more innovative ideas that will take the country forward.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter contains the conclusions and recommendations of the study. The first part of this section deliberates on conclusions that were made. The conclusions are made by tying the findings of the study to the main problem of the study and research questions that were addressed. The last part of this section then talks about recommendations and suggestions for further studies.

6.2 Conclusions of the study

Before deliberating on the conclusions of the study, the reader is first reminded about the main problem of the study. This study investigated the challenges that are associated with doing mineral beneficiation. It was a qualitative study that was conducted through interviews. Industry practitioners and relevant fields were interviewed, as indicated in the sample profile.

The findings from the study show that there are challenges that will be encountered when embarking on the local beneficiation strategy that government has put on the table. It is a good strategy that, if it works, will boost the economic condition of the country. There are many benefits that will be enjoyed such as: job opportunities, skills development, large tax base, industrialisation, country's current account, more investments, economic growth and social status improvement, to mention just a few. In order to enjoy these benefits, ground work needs to be done around challenges that have been identified as potential hurdles to the fruition of local mineral beneficiation. That should be a starting point before implementing the beneficiation strategy. The risk, if the strategy was to be implemented before doing that, will be putting out fires when things are not working as expected just because proper planning was not done in the first place.

6.2.1 *Secure supply of minerals*

A secure supply of minerals is critical to the success of mineral beneficiation strategy. The mining sector needs to be engaged in the plans around the secure supply of minerals for local beneficiation. They are the key stakeholder in mineral extraction. They are already committed to agreements with foreign markets of which most of them came long before local mineral beneficiation strategy. This issue should be treated with care to not upset diplomatic ties and business relations that the country has with investors and other countries.

The issuing of new mining licences and renewal of existing ones is very important in the implementation of the mineral beneficiation strategy. Local mineral beneficiation policy should be incorporated in mining licences agreements. The existing mining licences will have to be amended to incorporate the local mineral beneficiation policy. This is a very important cornerstone of ensuring that mining sector does make allocation of mineral resources for local manufacturers.

6.2.2 *Manufacturing improvement*

There is no doubt about the positive impact that local mineral beneficiation will have in improving the manufacturing sector in the country. Local mineral beneficiation will be a big boost to the industry that has had challenges for many years. This is a sector that breeds skills, and, given a good performance, it drives economy. The other good thing about manufacturing is that it creates job opportunities.

6.2.3 *Skills*

The skills shortage is a short term problem that can be dealt with without having to wait for skills development to start producing results. Skills can be imported with a long term plan of developing local resources that will take over in the running of operations in future. This is a common practice on big projects of importing skills that are not available at the time of the project. Local mineral

beneficiation will be a vehicle that will drive skills development. There will be a large pool of skills that will be produced.

6.3 Recommendations

In this section recommendations are made in relation to their relevance to the identified stakeholders in this study.

6.3.1 *Government*

Government is the biggest role player in the whole beneficiation strategy. It is in a position where it needs to create an enabling environment for investors to put their money into business operations in the country. It also wants to attend to social issues that are more important to ordinary people. Government should try to coordinate its activities in a manner that is not seen as bias towards one party of stakeholders. It should encourage more investors to come invest in the country, but should not let investors twist its' arm. It should be firm on its policies.

The other thing that government should work on is its' internal affairs. For instance, mineral beneficiation is handled by too many departments. There is Trade and Industry, Science and Technology, Minerals and Resources, all working on mineral beneficiation and talking with different voices. There needs to be a coherent strategy of dealing with mineral beneficiation, then they can coordinate it better than they are currently doing.

6.3.2 *Mining companies*

It is understandable that mining companies are already committed to contracts that they entered into with investors and their markets. They also obtained mining licences before the introduction of the local mineral beneficiation strategy. However, that should not make them not come to the table and make contributions to the success of local beneficiation. They are a key stakeholder in securing a supply of minerals resources. They should also bring clarity to local industries about how are they pricing their minerals. Otherwise, if they do not

clarify that, the issue about import parity pricing and unfair prices charged to local industries will live with them.

6.3.3 *Manufacturing sector*

Local beneficiation will help this industry sector. Government has taken an initiative to support this sector by introducing local mineral beneficiation. The manufacturing sector must do its part as well. It should find markets for its locally beneficiated products.

6.3.4 *Research institutions*

This is the opportunity for them to come up with innovative ideas, new applications of beneficiated products, efficient processes and build partnerships with industries. The research institutions should provide support to industries. They need to constantly come up with ideas that will take the country to the top of the world.

6.3.5 *Consulting firms*

They also have a big role to play. Industries will not be able to do everything by themselves. Consulting firms should come in with ideas that will make the country realise the local mineral beneficiation strategy. This is a challenge that they need to take head on to make an impact on this strategy. They should not wait for after effects where they will start identifying where they can make a contribution. This study has already done ground work. Issues are now in the open that need to be attended to.

6.3.6 *Education institutions*

The study has presented findings about the impact of skills in local mineral beneficiation. Educational institutions need to produce skills that are required in order to make the country's strategy a success. There has been a huge call for skills, and this study affirms that. More skills development is needed.

6.4 Suggestions for further research

This study has dealt with the mineral beneficiation strategy throughout the entire value chain from mineral extraction to finished goods. Taking from this study's findings, it is suggested that further studies should be done around the constraints of doing mineral beneficiation. The one that is top of the list is energy. Without energy economic activity falls flat. There is a lot of uncertainty around the future of energy in terms of capacity, type of energy source, and when the will the energy crisis come to an end. Energy challenges are hampering the country's economic growth. Some business opportunities have been lost due to the energy issues.

REFERENCES

Africa, R. o. S. (2013). *2013 Budget Speech*. Cape Town: Government Printer.

African Union. (2009). Africa Mining Vision: Transparent, equitable and optimal expolitation of mineral resources to underpin broad-based sustainable growth and socio-economic development. Kenya: African Union.

African Union. (2012). Action plan from the implementation of the Africa Mining Vision. Kenya: African Union.

Allix, M. (2014, 17 July 2014). BHP Billiton eyes closure of Bayside, *BusinessDay*.

Aswicahyono, H. H., Brooks, D. H., & Manning, C. (2011). Exports and employment in Indonesia: The decline in labor-intensive manufacturing and the rise of services. n.l.: Asian Development Bank.

Atkin, D., & Donaldson, D. (2012). Who's Getting Globalized? The Size and Nature of Intranational Trade Costs. *Yale University and MIT, unpublished mimeo*.

Basson, J., Curr, T., & Gericke, W. (2007). *South Africa's ferro alloys industry-present status and future outlook.* Paper presented at the Eleventh International Ferro Alloys Congress. New Delhi.

Basson, J., Curr, T. R., & Gericke WA. (2007). South Africa's ferroalloy industry - present status and future outlook *INFACON*. Johannesburg: INFACON.

Baxter R. (2005). Mineral Beneficiation: The Mining Industry Viewpoint. Johannesburg: South African Chamber of Mines.

Baxter R. (2014). Platinum state of the nation (pp. 1 - 5). Johannesburg: South African Chamber of Mines.

Bennett, J., & McGuinness, S. (2009). Assessing the impact of skill shortages on the productivity performance of high-tech firms in Northern Ireland. *Applied Economics, 41*(6), 727-737.

BIDPA & Botswana Chamber of Mines. (2012). Map way forward for base metal beneficiation. Retrieved 27 March 2014, 2014

Bin G U. (2011). Mineral export restraints and sustainable development - are rare earths testing the WTO's loopholes? *Journal of International Economic Law*(42), 1 - 42.

Bjorvatn, K. (2000). Urban infrastructure and industrialization. *Journal of Urban Economics, 48*(2), 205-218.

Bryman A. (2012). *Social Research Methods* (4th ed.). New York: Oxford University Press.

Bugges A. (2010). Critical raw materials for the EU (E. Development, Trans.) (pp. 1 - 85). Brussels: European Commission Enterprise and Industry.

Burger, R. P., & Teal, F. J. (2014). The effect of schooling on worker productivity: Evidence from a South African industry panel (pp. 1 - 13). Oxford: Oxford University, Centre for the Study of African Economies.

Butkiewicz, J. L., & Yanikkaya, H. (2008). Minerals, openness, institutions and growth: an empirical analysis (pp. 1-26). Delaware: University of Delaware

Carbon Tax: Plunging Africa to more poverty? (2013). *Industrial Metallurgy*, 36.

Carrère, C. (2014). Regional Agreements and Welfare in the South: When Scale Economies in Transport Matter. *Journal of African Economies, 23*(3), 321 - 345.

Cawthorn, R. (1999). The platinum and palladium resources of the Bushveld Complex. *South African Journal of Science, 95*(11/12), 481-489.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches,* Los Angeles: Jossey Bass.

Daavittila, J., Honkaniemi, M., & Jokinen, P. (2004). *The transformation of ferrochromium smelting technologies during the last decades.* Paper presented at the Proceedings, Tenth International Ferro Alloys Congress, Cape Town.

Daojiong, Z. (2006). China's energy security: Domestic and international issues. *Survival, 48*(1), 179-190.

De Beers. (2012). Diamond dialogues: Natural resources & national development (Vol. 2, pp. 1 - 9). London, UK: De Beers.

Dias, R., & Posel, D. (2007). *Unemployment, education and skills constraints in post-apartheid South Africa*. Cape Town: Development Policy Research Unit, University of Cape Town.

Ensor, L. (2014, 14 July 2014). Force local benefitiacion through quota, *BusinessDay,* p. 1.

Golub, S. (2000). *South Africa's international cost competitiveness.* Paper presented at the TIPS annual forum.

Goode, R. (2006). Impact of China and India on Sub-Saharan African Metals, Ores and Minerals–Issues and Challenges. *A Framework Paper for AERC Project on "The Impact of Asian Drivers on Sub-Saharan Africa*.

Grynberg R. (2013). Some like them rough: The future of diamond beneficiation in Botswana. *European Centre for Development Policy Management, 142*.

Hall, R. E., & Jones, C. (1998). Why do some countries produce so much more output per worker than others? Stanford: Stanford University.

Hanushek, E. A., & Woessmann, L. (2007). The role of school improvement in economic development *CESifo* (Vol. 1911). Munich: Leinzbniz Institute for Economic Research, University of Munich.

Hardman, D. (1996). Coal-mining productivity in South Africa compared with Australia and the USA *SAIMM*. Johannesburg: SAIMM.

Hausmann, R., Klinger, B., & Lawrence, R. (2008). Examining beneficiation (Vol. 162). Boston: Centre for International Development, Harvard University.

Houghton, J., & Sheehan, P. (2000). A primer on the knowledge economy. Victoria University of Technology, Australia: Centre for Strategic Economic Studies.

Hummels, D. (1999). Have international transportation costs declined? Chicago: University of Chicago

Hummels, D. (2001). Toward a geography of trade costs: Mimeo, Purdue University.

James, H. E. (1985). In search of a new development strategy for the beneficiation and export of South Africa's minerals. *Journal of the South African Institute of Mining & Metallurgy, 85*(9), 309 - 321.

Jeffrey, L. S. (2005a). Challenges associated with further development of the Waterberg Coalfield. *Journal of the South African Institute of Mining & Metallurgy, 105*(6), 453.

Jeffrey, L. S. (2005b). Characterization of the coal resources of South Africa. *Journal of the South African Institute of Mining & Metallurgy, 105*(2), 95-102.

Jourdan P. (2001). Links with domestic domestic industry, downstream processing and the provision of inputs: Resource based industrialisation in South Africa.

Karapinar, B. (2010). Export Restrictions and the WTO Law:‘Regulatory Deficiency’or ‘Unintended Policy Space,’ : working paper. s.l.: s.n.

Kohler, M. (2006). *The Economic Impact of Rising Energy Prices: A Constraint on South Africa’s Growth and Poverty Reduction Opportunities.* Paper presented at the TIPS/DPRU Forum, Johannesburg, South Africa.

Korinek, J., & Sourdin, P. (2009). Maritime transport costs and their impact on trade. Geneva: Organization for Economic Co-operation and Development

Kothari C R. (2004). *Research Methodology Methods and Techniques* (2nd Ed.). New Delhi, India: New Age Publishers.

Kudo, T. (2005). Stunted and Distorted Industrialization in Myanmar. Chiba, Japan: Institute of Developing Economies.

Kumba Iron Ore. (2011). Creating growing and sustainable iron and steel value chain in South Africa. Pretoria: The Company.

Lacey, A., & Luff. (2001). *Qualitative data analysis*. Sheffield: Trent Focus.

Leeuw, P. J. K. (2012). South African Mineral based model: A plausible model. Johannesburg: The Author.

MacDonald, S., & Headlam N. (2008). *Research Methods Handbook*. s.l.: s.n.

Mayer, J. (2000). Globalization, technology transfer, and skill accumulation in low-income countries. *Globalization, Marginalization and Development*.

Merriam, S. (1995). What Can You Tell From An N ofl?: Issues of validity and reliability in qualitative research. *PAACE Journal of Lifelong Learning, 4*, 50-60.

Merriam, S. B. (2002). Introduction to qualitative research. *Qualitative research in practice: Examples for discussion and analysis*, 3-17.

Mining Weekly. (2013, 9 December 2013). Local mineral beneficiation to present challenges. *Mining Weekly*.

Mitra, A. (2006). Wages and employment: Issues and facts. *The Indian Journal of Labour Economics, 49*(4), 587-603.

Mohlala P. (2010). The minerals processing & beneficiation (MP&B) industry transformation, growth and development charter 2010. Johannesburg, South Africa: SAIMM.

Olaniyan, D., & Okemakinde, T. (2008). Human capital theory: Implications for educational development. *Pakistan Journal of Social Sciences, 5*(5), 479-483.

Olaniyan, D. A., & Okemakinde, T. (2008). Human capital theory: Implications of educational development. *Pakistan Journal of Social Sciences, 5*(5), 479 - 483.

Philippe, A., Braun, M., & Fedderke, J. (2008). Competition and productivity growth in South Africa. *Economics of Transition, 16*(4), 741 - 768.

Pooe, D., & Mathu, K. (2011). The South African coal mining industry: A need for a more efficient and collaborative supply chain. *Journal of Transport and Supply Chain Management, 5*(1), 316-336.

Porter, M. E. (1990). The competitive advantage of nations. *Harvard Business Review*.

Ramdoo, I., & Bilal, S. (2014). Extractive Resources for Development. s.l.: s.n.

Ramnath E. (2012). The impact of the government beneficiation strategy on the platinum group metals industry in South Africa. Johannesburg, South Africa: Wits Business School.

Republic of South Africa. (2005). *A national advanced manufacturing technology strategy for South Africa*. Pretoria: Government Printer.

Republic of South Africa. (2011). *A beneficiation strategy for the minerals industry of South Africa*. Pretoria, South Africa: Government Printer.

Republic of South Africa. (2013). *South Africa Yearbook 2012/2013*. Pretoria: Government Printer.

Republic of South Africa. (2014). *Call for comments on the national scarce skills list: Top 100 occupations in demand*. Pretoria: Government Printer.

Robinson, I. C., & von Below, M. A. (1990). The role of domestic market in promoting the beneficiation of raw materials in South Africa. *J S Afr. Inst. Min. Metall., 90*(4), 91 - 98.

Ryan, F., Coughlan, M., & Cronin, P. (2007). Step-by-step guide to critiquing research. Part 2: qualitative research. *British Journal of Nursing, 16*(12), 738-745.

SAPA. (2014, 09 May 2014). Skills shortage hampers business - survey, *South African Press Association*.

Singh, H. S. M. H. (2013). Impact of Long Duration Planned Outages on Paper Mills: A Comparative Study of Three Paper Mills. *International Journal of Computer and Electrical Engineering, 5*(5), 505 - 510.

Soko, M., & Balchin, N. (2012, 04 December 2012). A process rich in opportunities for SA, *Cape Times,* p. 9.

Stacey, T. R., Hadjigeorgiou, J., & Potvin, Y. (2008). Technical skills--A major strategic issue. *Journal of the South African Institute of Mining & Metallurgy, 108*(12), 775.

Stillwell, L. C. (2004). *Platinum in the South African economy*. Paper presented at the International Platinum Conference 'Platinum Adding Value', Johannesburg, South Africa.

Takolia, E., & Dharamlall, S. (2011). Positioning for mineral beneficiation (pp. 1 - 16). Johannesburg, South Africa: Deloitte & Touche.

Van der Zwan, P., & Nel, P. (2010). The impact of the Minerals and Petroleum Resources Royalty Act on the South African mining industry: a critical analysis. *Meditari Accountancy Research, 18*(2), 89-103.

von Below MA. (1992). Planning for future of ferroalloy production in South Africa *INFACON* (Vol. 1, pp. 261 - 268). Johannesburg: SAIMM.

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. n.p.: Institute of Certified Management Accountants.

Yu, M. (2011). Processing trade, tariff reductions, and firm productivity: Evidence from Chinese products. *Manuscript, Peking University*.

Appendix A

Interview consent form

The following is the consent that was issued to interviewee at the beginning of the interview, and they were asked to sign it;

I, _____agree to participate in the research study conducted by Richard Shandu from Wits Business School. I agree to the following:

- The purpose and nature of the study has been explained to me in writing and/or verbally.
- My participation is voluntary, and I understand that I can withdraw at any time during the study without any repercussions.
- I understand and give permissions that extracts from the interview may be quoted and published in the research report.
- I also understand that confidentiality will be ensured in the research report and that no identifying features will be attached.

Signed: _____ Date: _____

I give permission for interview to be audio-recorded Yes / No

Signed: _____ Date: _____

Appendix B

Semi-structured interview questions

1. What should be done to ensure secure supply of minerals for local beneficiation?
2. Will mineral beneficiation improve manufacturing to levels that it once enjoyed before of being the biggest contributor to the country's GDP?
3. What impact will skills shortage have on mineral beneficiation?
4. Is it a good move for SA to do full local mineral beneficiation?
5. Are there specific challenges likely to be overcome when implementing local beneficiation?
6. What significant contributions can be made by local beneficiation?
7. Which supporting and/or affected institutions that will benefit from local beneficiation?
8. What will SA benefit from doing local beneficiation?