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# A conceptual framework for understanding the risk profile of junior miners in the South African context

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# *A Conceptual Framework for Understanding the Risk Profile of Junior Miners in the South African Context*

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A Research Report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Masters in Engineering.

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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF MECHANICAL, INDUSTRIAL & AERONAUTICAL ENGINEERING

**INDIVIDUAL DECLARATION WITH TASK SUBMITTED FOR ASSESSMENT**

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in partial fulfillment or full fulfillment of the requirements of the above course.

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**ABSTRACT**

For decades, the South African mining industry was characterised by major miners. The existence of junior miners was largely ignored until 1994 when South Africa obtained its democracy. In an effort to redress historic imbalances, the new government formally acknowledged the socio-economic impact of junior miners through the Reconstruction and Development Programme. As part of the commitment to transformation, a study was conducted in 1998 with the objective of providing context on small-scale mining activities. Almost three decades since the attainment of democracy, the structural challenges faced by junior miners in South Africa remain unabated, including the lack of a clear and agreed upon definition of junior mining which this study sought to investigate.

A poor understanding of the junior mining sector has contributed to the peripheral position which has been assigned to it at international, regional and local policy level. This has led to the generalisation of the sector's activities despite the varying complexities of mining projects. This paper reflects critically on previous models that have attempted to distinguish the different levels of junior mining specifically from the perspective of revenue, employment and to a lesser extent, production output. The evidence presented by literature within this regard suggests the current definitions of junior mining lack the acknowledgement and appreciation of mining risks. This is a critical gap given that each mining operation has a unique context which dictates specific risk exposures. It was the aim of this research to bridge this definitional gap by developing a risk-adjusted conceptual framework for understanding the various risk profiles of junior miners in South Africa.

The conceptual framework was tested against data collected from a series of audio recorded semi-structured interviews with 13 mining professionals. The data was transcribed, narrated, and presented as a modified risk-adjusted framework. It was found that the main risk types to be considered when classifying a junior miner were mining asset risk, market risk, corporate risk, legal risk, financial risk, and infrastructure. Notably, the challenges faced by junior miners overlapped with the risks identified and thus formed the basis of the proposed framework. Given the universality of mining risks, this framework can be applied to understand the risk profile of any junior miner in any jurisdiction.

The exploratory investigation concluded that while the junior mining sector is yet to make a mark on the economic agenda, host governments should prioritise regulatory support structures and partnerships aimed at driving the development and growth of the sector given its prominent socio-economic feature as a poverty alleviation strategy.

I dedicate this research to my husband, my bubu, Nkosinathi Msimango. I am grateful for your unwavering support. Thank you for believing in me and for being my pillar of strength. Thank you for being understanding when I sacrificed precious family time to achieve this personal milestone. It is done!

Also, to my dear mama, Rosalina J. Sorota, I Am because You Are.

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## NOMENCLATURE

| | |
|---|---|
| AIM | Alternative Investment Market on the London Stock Exchange |
| ASM | Artisanal small-scale mining |
| ASX | Australian Stock Exchange |
| BEE | Black Economic Empowerment |
| BBBEE | Broad-based Black Economic Empowerment |
| Brownfield | A previously explored and developed area with prior history of mineral extraction |
| Capex | Capital expenditure |
| DMRE | Department of Mineral Resources and Energy |
| Greenfield | An area with little or no prior history of mineral extraction |
| IPO | Initial public offering at a stock exchange |
| JV | Joint Venture |
| JSE | Johannesburg Stock Exchange |
| LOM | Life of Mine |
| LSE | London Stock Exchange |
| LSM | Large-scale mining/miners (large and established multinational mining companies with a host of medium to large scale mining operations) |
| Majors | Used interchangeably with LSM |
| Mid-tier Miner | A junior mining company that is in the process of evolving into a major mining company with multiple mining operations and mining projects |

# CHAPTER 1

## 1. INTRODUCTION

### *1.1. Background*

South Africa is a mineral-rich country which is well-known for its abundance of a variety of mineral resources altogether accounting for a significant proportion of the world's most valuable mineral production and reserves (Van de Vyver, 2012). It is ranked as the world's fifth-largest mining sector in terms of Gross Domestic Product (GDP) value (Antin, 2013; Baxter, 2015). It is the largest exporter of platinum group metals (PGMs), chrome and manganese ore with a mineral base estimation of USD2.5 trillion (Antin, 2013). This is testament to the importance of mineral resources in economic value creation. For the purpose of this research, the term mining is used to define the extraction of naturally occurring mineral substances that have been formed through a geological process (Van de Vyver, 2012).

Historically, the mining industry in South Africa was dominated by a structure of large-scale mining (LSM) firms (mostly multinationals) (Mutemeri and Petersen, 2002) who set the agenda and wrote the narrative on behalf of the mining fraternity in the country (Louw, 2019). That construct was a product of discriminatory policies and practices as facilitated by the apartheid regime. It was disrupted during the dawn of democracy in 1994 (Ledwaba and Mutemeri, 2018) when the government introduced various polices and legislation whose objective was set towards a progressive, inclusive and just society. Part of the policy adjustment was Black Economic Empowerment (BEE) as per the Mining Charter which advocated for the remedial of previous ills by accelerating the inclusion of previously disadvantaged communities in economic activities including the mining business (Ledwaba, 2017).

The adoption of the Mining Charter in the democratic era opened up the mining sector to previously disadvantaged groups who mostly started their mining activities as junior miners (Mkubukeli & Tengeh, 2016). This change in economic policy together with the divestment of large-scale miners (LSM) who are departing from South Africa for varied reasons, has threatened the mineral production capacity of South Africa.

According to Landu (2014), LSM's constitute about 90% of the mining enterprises in South Africa. However, with the depletion of large mineral reserves which are rendering LSM operations unprofitable, there is an increasing belief the future of mining in South Africa lies in the promotion of junior mining enterprises (Minerals Council of South Africa, 2019). Companies referred to as junior miners (also referred to as emerging miners or artisanal and small scale miners), are trying to

fill the void left by the global players, while also creating a space for themselves in a geological landscape full of opportunities for streamlined smaller operators (Louw, 2019).

Heffernan (1998) describes major mining companies (used interchangeably to refer to LSM) as those companies with established assets, earning records and credit ratings which generate revenues from producing mines and arrange mining project finance through traditional market channels, such as underwriting, private placements of debt, sales of common or preferred shares. While this definition for large scale miners is generally accepted within the mining industry, there seems to be no real consensus in the definition of small to mid-scale miners (Ledwaba, 2017) hence the bucket classification of 'junior miners'. In fact, the most probable connotation of a Junior miner in the South African context is an undercapitalised small company whose principal activity is operating a single asset, single commodity at a small-scale (Major, 2020 and Seeger, 2006).

The divestment of various majors such as Anglo American and BHP Billiton from South Africa has presented the mining industry both with challenges and opportunities. Challenges include financial and technological capacity losses, both which have historically contributed positively to the development of the South African mining industry (Robinson, 2016). In addition to these challenges, the South African mining sector has stagnated over the past decade. In real terms, the sector's value declined by 4% between 2007 and 2017. The decline is also reflected in the declining employment rate from a peak of 518,000 employees in 2008 to 464,000 in 2017 (Goodman, *et al.*, 2019).

Despite the divestment of majors, most industry analysts agree the global demand for minerals and metal resources is set to increase (Valenta *et al*., 2019) thereby requiring mining companies to either expand their existing operations or bring new projects into development. This positions junior miners with a unique opportunity to contribute towards alleviating economic pressures required for meeting the projected future demand.

Furthermore, the likelihood that these expansions and new developments will result in further points of contact between the LSM and the junior mining sector is high (Verbrugge, 2017). However, the potential benefits presented by collaborative opportunities between juniors and majors may be threatened by a poor understanding of the junior mining context hence the need to have models that accurately define the junior mining sector.

In addition to contributing towards the global supply chain of minerals, the role of junior mining in South Africa has socio-economic importance as a poverty alleviating strategy for many communities across the country. It is for these reasons that South Africa needs to focus on developing and nurturing a strong, growing, and resilient junior mining sector. This is especially important from an

industry sustainability perspective given the divestment of majors. While the importance of this sector is recognised and acknowledged, previous efforts by the government to support this sector have not amounted to much. Until junior miners are properly understood and defined appropriately, the future prospects of this sector will continue to remain bleak and unrealised.

In a country where a culture of smaller scale mining operations and greenfield exploration has failed to take root, the challenge has always been how to define a junior or emerging miner (Louw, 2019). This research aims to challenge the bucket classification of junior miners through a closer examination of the junior mining landscape specifically from a risk perspective by using the concept of risk profiling to classify junior miners into various tiers according to their unique risk profile.

### *1.2. Problem Statement*

Through critical analysis of relevant literature, it is evident there are different interpretations of junior mining. Although largely associated with prospecting and exploration activity, the challenge of understanding and defining junior mining further expands into the financial regulatory landscape given that no definition exists for either prospecting or exploration in the Income Tax Act 58 of 1962 (Income Tax Act). As such, the tax treatment of prospecting expenditure (which includes expenditure on surveys, boreholes, trenches, pits and other preliminary work required to establish a mine) by junior exploration companies has resulted in various interpretations and treatment from an Income Tax perspective (Sturdy and Cronje, 2013). This challenge of effective tax application has been further exacerbated by the lack of relevant research and case law as it relates to the junior mining industry.

The junior mining definitional challenge has created an opportunity for further research. This is the first step towards addressing the myriad of challenges faced by this unique and important sector. Driven by the need to contextualize the definitional issues within this niche sector, this research aims to contribute to enhancing the understanding of the environment within which junior miners operate. The objective is to classify junior miners into various categories based on the outcome of a systematic risk assessment. This will result into a classification system based on unique risk profiles as opposed to a single blanket definition of junior miners.

The anticipated outcome from the risk-adjusted framework is for policy makers and investors to better understand the risk profile of junior miners so as to assess them accordingly with regards to policy and funding opportunities. Deep understanding of this sector through risk profiling could also contribute towards the creation of formal and functional support structures that will assist in growing the sector.

### *1.3. Central Research Question*

This research aims to answer the following The Critical Research Question (CRQ): "*How can the risk profile of junior miners in the South African context be defined*"?

### *1.4. Research Objectives*

The objective of this study was to develop a risk-adjusted framework for understanding the risk profile of junior miners in South Africa. This was achieved by studying and examining various risk factors that exist along the mining project value chain. A risk management process was adopted as a theoretical foundation for building a research inquiry which evolved into a conceptual risk-adjusted framework. This approach was further supported by Atkinson *et al.* (1997) in their article on risk management for mining projects which outlined the increasing need for mining companies to focus on project risks.

The objectives of this research are summarised as follows:

a. Develop an initial conceptual framework for the definition of junior miners in South Africa
b. Test the framework
c. Propose a final revised framework

### *1.5. Summary of a Research Method*

This study was primarily a desk-based assessment in order to understand the junior mining sector in South Africa. Key secondary sources of data included the South African Department of Mineral Resources (DMR), Minerals Council of South Africa, Junior Mining Association (JMA) and other data repositories including journal articles, research reports and publications available in the public domain. Anecdotal information was obtained from 13 research participants through semi-structured interviews that were conducted during the months of December 2020 to April 2021.

Owing to the objective of understanding and describing the junior mining landscape in South Africa, this research study was exploratory in nature thus lending it towards a qualitative research paradigm both for data collection and data analysis (Merriam and Tisdell, 2015). Critical review of existing literature provided an initial layer of data collection and enhanced the understanding of the mining industry in general before narrowing down to the junior mining landscape. As such, a critical review of literature led to the development of a generic representation of the initial conceptual framework.

The Briggs-Wengraf Model asserts that semi-structured interviews can used both for model-building and model-testing. The initial conceptual framework was tested against the narrative description of participant's professional views and opinions that were collected from the interview process. This method served as a means to construct and verify theory by asking similar questions in a similar order

(Richards & Morse, 2013) with a view to identifying themes and congruency between the participants. The resultant themes that emerged from the data collection process were extracted and used to propose a final, revised framework

All research activities were conducted in line with the Ethics guidelines from the University of the Witwatersrand (Ethics Clearance Number MIAEC 119/20).

### *1.6. Delimitations and Assumptions*

The junior mining sector generally has vast topics that could be investigated owing largely to its organic establishment and growth. One of the topics that experts and scholars have previously attempted and continue to study is distinguishing between informal artisanal miners and illegal miners, particularly within the African continent. Data availability and reliability on informal and illegal mining activities is one of the factors that has inhibited scholars from thoroughly exploring this area of research. Part of the contributing factor towards the said challenge is because illegal and informal mining may have different meaning in different jurisdictions, sometimes without a clear distinction between the two. To this extent, there appears to be no common definition of illegal mining both internationally and locally (Hentschel, *et al*., 2003).

From a South African perspective, mining operations can be categorised broadly as: (1) registered operations (classified as formal businesses), (2) informal operations (mainly sand and clay mining) and (3) Zama-Zama operations. The second and third categories are both recognised as informal activities which operate outside the legal framework (due to the absence of a mining permit as per the Mineral and Petroleum Resources Development Act, also referred to in this document as MPRDA). However, activities of the Zama-Zama type mining differ from general informal mining in that it is associated with criminality and organized crime. These miners partake in invasive mining that occurs when miners illegally enter old, decommissioned mines (mostly gold mines) (Nhlengetwa and Hein, 2014).

The distinction between informal and illegal mining remains a major challenge within the mining industry for which through various analysis of literature, a clear distinction is yet to emerge. Research studies on this topic have been particularly challenging owing to the differences in regulations and policies from country to country (Wilson, 2018). While this challenge remains an important recommendation for future research studies, the focus of this study was only limited to legal mining activities which relate to miners who have successfully obtained the necessary legal mining permits and rights to extract minerals from the earth’s surface.

Additional limitations include:

a) Due to the Covid-19 pandemic, face-to-face interviews were not possible (for health and safety reasons). As such, interviews were conducted via Microsoft Teams and Zoom
b) Given the fact that most junior mining firms are not listed on the stock exchange, it was challenging to find and identify such firms. Therefore, the data collected could be better enhanced by including more views and insights from junior miners.
c) Lastly, the research relied only on risk management strategies and theories and not technical, geological theories in developing the framework.

### *1.7. Outline of Chapters*

The report structure is as follows:

| | |
|---|---|
| Chapter 1 | Introduction and context to the research study |
| Chapter 2 | An extensive literature review on the mining industry with a focus on junior mining in South Africa. This culminated into a Conceptual Framework |
| Chapter 3 | Research methodology discussion with a focus on the research design and approach |
| Chapter 4 | Presentation and narration of research interview findings and results |
| Chapter 5 | Presentation of a modified risk-adjusted framework aligned with interview results and a highlight of key lessons and insights |
| Chapter 6 | Discussion of the research findings with a focus on research contributions |
| Chapter 7 | Conclusion on the research findings and suggestions for future research |
| References | Exhaustive list of data sources (both references and bibliography) that were consulted for this research and cited accordingly |
| Appendix A | A participant information sheet that was sent to research participants |
| Appendix B | Participant consent form |
| Appendix C | Research interview questions |
| Appendix D | Interview participant's profiles |
| Appendix E | Interview analysis (snapshot) |

# CHAPTER 2

## 2. LITERATURE REVIEW

This chapter presents a critical review of literature which relates to the general history of the mining industry in South Africa. A lens is applied specifically to junior mining in South Africa with a focus on current definitions and challenges as provided by various scholars and industry bodies. The review culminates into the development of a risk-adjusted conceptual framework, which is the first objective of this study.

### *2.1. Introduction*

The mining sector is a key contributor to the South African economy and has historically been a cornerstone of the economic development of the country through its significant contribution to the Gross Domestic Product (GDP). Established miners have generally flourished while the junior mining sector remains confronted with a myriad of challenges and is yet to realise its full potential (Mutemeri and Petersen, 2002). This section discusses the current state of the junior mining sector with a specific focus on the definitional challenges that exist within the South African context through a critical review of previous literature.

According to Yin (2014), a Literature Review is useful in showing mastery of the research subject. Furthermore, such an approach assists in the development of an appropriate and relevant research question while also referring to key citations from previous and relevant research. Noting the limited literature available on the subject matter both from a local and global perspective, this research has drawn from available literature to contextualise the subject of junior mining from a South African perspective.

### *2.2. Mining Project Value Chain*

Businesses within the mining industry are broadly divided into two main categories: major mining and junior mining with a further segmentation on the activities of junior miners which include exploration and development, in addition to production and operation. Regardless of the category of classification, mining ventures are long-term, irreversible ventures that require massive capital investments before a mine can be developed and operated. The environment within which miners operate is filled with great uncertainty which requires impressive managerial flexibility. Unfortunately, the value of such managerial flexibilities has been ignored owing to their qualitative nature which is challenging to measure. To this extent, their flexibility and option-like characteristics has not been captured in traditional valuation techniques (such as the discounted cashflow model) (Miranda *et al.*, 2017).

In comparison to other industries, mining operations are complex, have a long lead-time and are capital-intensive. The development process of mining projects requires thorough due diligence across each stage in the mining life cycle (Seeger, 2006). A mining project value chain is a popular concept used extensively in mine development and investment. It encompasses generic key elements that are applicable to all mining projects (from exploration to mine closure/rehabilitation) regardless of the mineral commodity that is being explored. The process initiates with greenfield exploration and mineral discovery. It is typically conducted by prospectors whose objective is to identify areas of high potential for further mining development. Once such a site is identified, the exploration firm raises capital in order to perform geological and geophysical surveys, tests, drilling and sampling as required for the assessment of mineral deposit value and the full extent of the resource (Miranda *et al*., 2017).

It is during this stage that an orebody is identified as a mineral resource. A mineral resource is defined as concentrated material which is assessed and recognised to be of economic interest. This assessment is concluded on the basis of the mineral form, quality and quantity. Mineral resources are subdivided into inferred, indicated and measured categories listed in order of increasing confidence. Once a mineral resource has been measured and defined, it is further analysed and concluded as a mineral reserve (figure 1) which refers to economic mineable material (Williams, 2012). As such, it can then be deduced that prospecting and exploration activities are the embryo of the industry without which, no mining operation will exist.

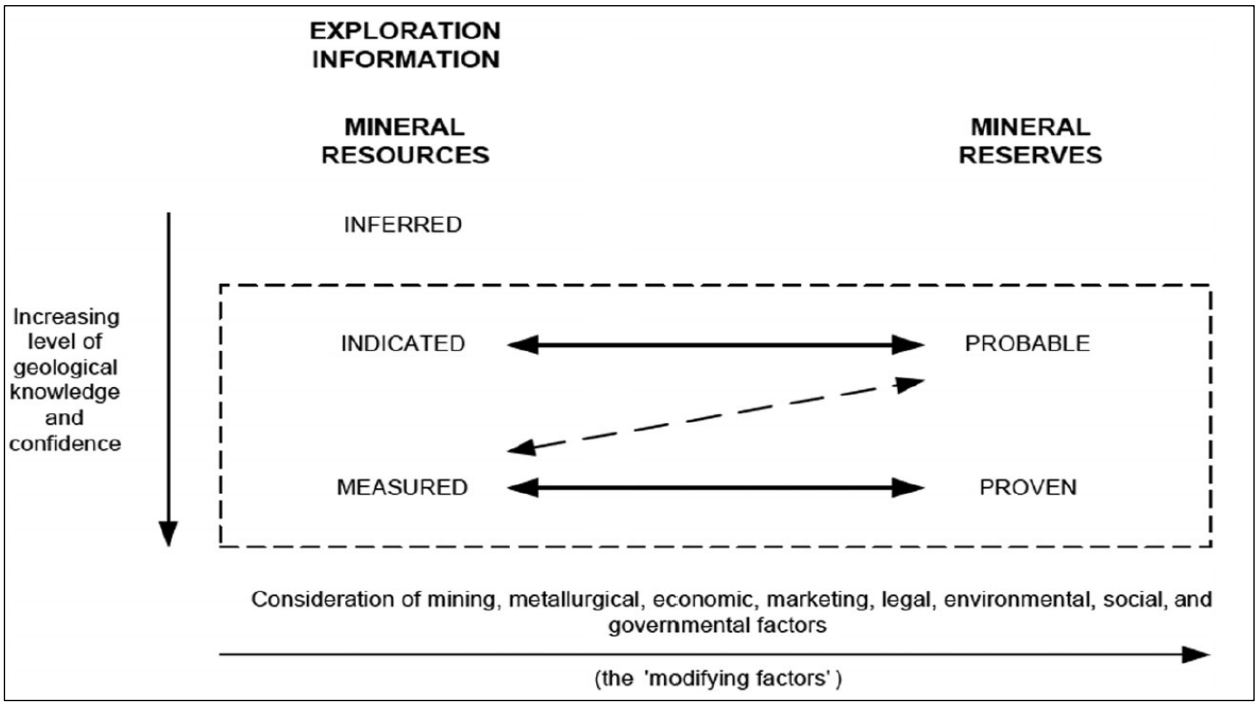



*Figure 1: Categories of Resource Classification*

(Source: Canadian Institute of Mining)

A legal right is required to undertake exploration activity. Prospecting and exploration accounts for the most risk within the mining project value chain since this phase is characterised by limited knowledge on the actual content that lies beneath the earth surface (Mining Media Inc., 2011). The extent of the exploration risk is highlighted by Mutemeri *et. al.,* (2016) who asserts that for every 1000 geological deposits only 100 are explored as projects which reduce to 10 feasible projects that eventually result in a single producing mine.

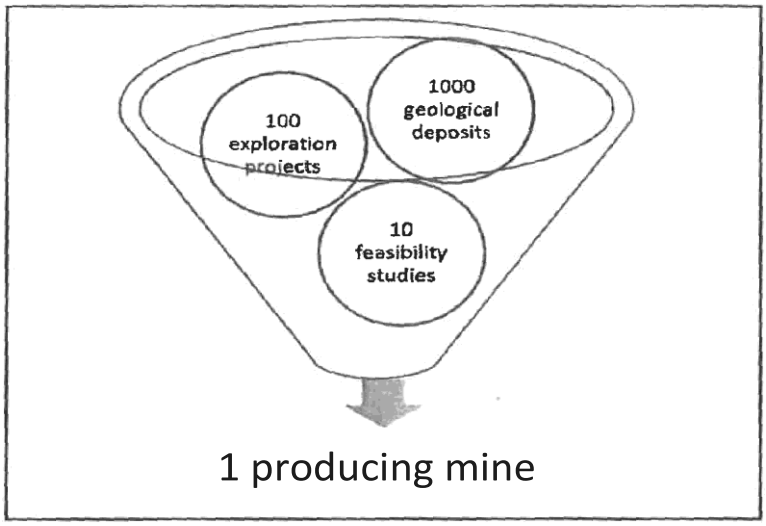



*Figure 2: Exploration Risk Conceptualised*
(Source: Mutemeri *et al*., 2016)

Major miners frequently join forces with exploration companies to promote the generation of new discovery opportunities and buy the mineral deposits from companies who do not wish to develop the project through to production (Miranda, *et al*., 2017). Following the discovery of a significant mineral deposit, the next phase of the mining project lifecycle relates to feasibility studies and project development.

The completion of feasibility studies marks an important milestone since the output is a critical decision point on whether to pursue the mineral deposit or not; a decision which is based on the assumed profitability of the mine (Warner, 2018). Apart from the economic analysis, a feasibility study also considers factors such as the appropriate mining method to be used (and the safety thereof), and whether the project will be environmentally and socially responsible. Exploration data is used as input when conducting feasibility studies (Garcia, *et al*., 2019).

Once the economic viability of the deposit has been ascertained, project development activities commence. At this point, the firm obtains all required permits and approvals for mineral extraction and proceeds to prepare a production plan which supports the business case (Warner, 2018). Part of this process includes the construction of the mine and relevant infrastructure such as roads, railway

lines, processing facilities, waste contamination & water treatment plants, employee housing and other necessary facilities (LePan, 2019).

The development stage commences once a 'go-no-go' decision has been made. Following the development of a mine, (i.e. once construction and commissioning is complete) production activities commences (Newman, 2010). Given that it takes approximately 10 years to take a project through the first stages up to production (Hodgkinson, 2010 & Tajvidi, *et al.*, 2019), only the most robust of projects make it to a stage of final implementation, with many projects remaining at the feasibility stage (Seeger, 2006).

The first step in production is the extraction of the ore in order to recover the minerals. Following mineral recovery, the ore is processed through mills or crushers which intend to separate commercially valuable minerals. Once processed, the ore is transported to smelting facilities (this is specifically for gold mining since not all commodities go through the smelting process) where smelting (the final step of production) occurs. Concentrate is then melted in a furnace to extract the metal from its ore. The ore is then poured into moulds, producing bars of bullion, which are then ready for sale.

The two most common mining methods are surface (open-cast or open-pit) and underground mining. While surface mining is the preferred method due to relatively lower costs and lower risks, the final mining method is determined by the characteristics of the mineral deposit and the limits imposed by technology, safety, economic and environmental concerns (Warner, 2018).

The final stage in the mining life cycle is closure and reclamation. This stage occurs after the mineral resources have been economically extracted and depleted from the surface (Warner, 2018). All facilities on site are dismantled to prepare for the reclamation process where the land is transformed to a usable state. According to Hodgkinson *et al*. (2010), the typical Life of Mine (LOM) is between 8 – 30 years. Figure 3 summarises the mining value life cycle including key activities that take place in each stage.

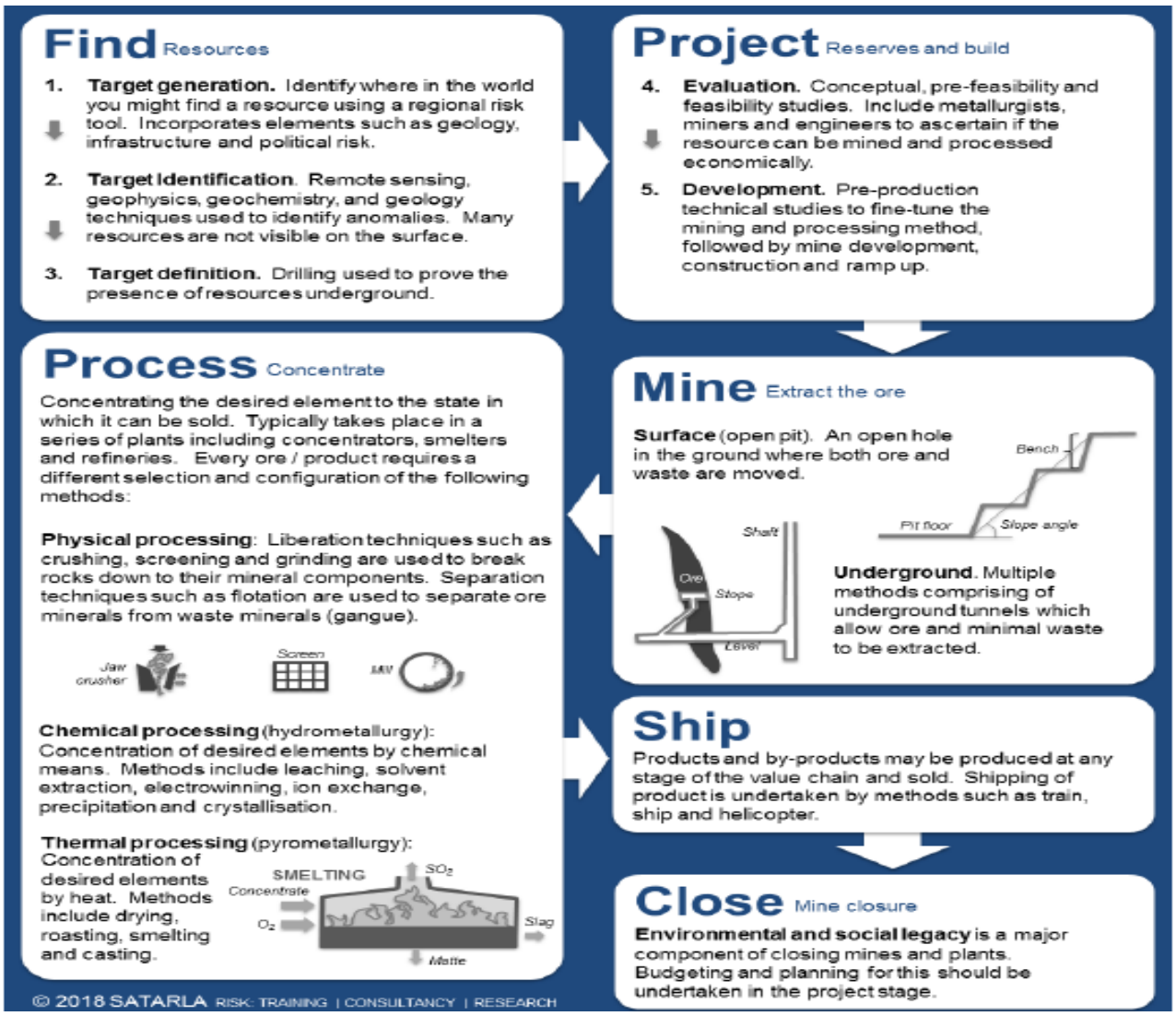



*Figure 3: Overview of the Mining Value Chain*

(Source: Llyod's, Satarla, 2018)

To carry out mining activities as described by Figure 3, Hentschel *et al.* (2002) explains that the firm has to adhere with the following legal activities. It must be:

(i) In possession of a mining title or valid contract with concession holder;

(ii) Compliant with environmental legislation;

(iii) In possession of an environmental operation licence;

(iv) Registered with the mining authority or other fiscal authorities;

(v) Able to pay taxes and royalties;

(vi) Able to enrol staff in the national social security system; and

(vii) Able to legally export the products.

It is the fulfilment and compliance of the above conditions that separates mining operations that operate within the legal framework (i.e. legal mining) from those that do not (i.e. illegal mining).

### *2.3. Background to the Mining Industry*

The mining industry is one of the world's oldest industries with evidence of the oldest mine found to be in Swaziland, Africa. The oldest ore deposit was carbon dated to 41,000 BCE (Silva, 2016) and today, the world continues with the economic exploitation of minerals. Mining activities have continuously played an important part of human existence (Madigan, 1981) and have evolved from mining for survival in prehistoric times to mining for commercial gain in current times.

Mining companies engage in a host of different activities including the development of new mining ventures, engage in collaboration and partnerships with other mining companies, brownfield project expansions, optimising existing mining operations to increase efficiencies, and pursuing value-added opportunities through beneficiation activities (Seeger, 2006). In addition to economic contribution, these activities are carried out to the satisfaction of investors and shareholders' economic interests.

Currently, the mining industry is experiencing a period of rapid change which includes an upswing in commodity prices coupled with increased demand for novel materials such as rhodium, platinum group metals (PGM's), bulk commodities and rare earth elements (Gordon *et al.*, 2018). These developments have revitalised the sector and have created further opportunities for junior miners to actively participate in this sector. The graph below reflects strong underlying industrial demand over the last four years with China and India driving most of the demand.

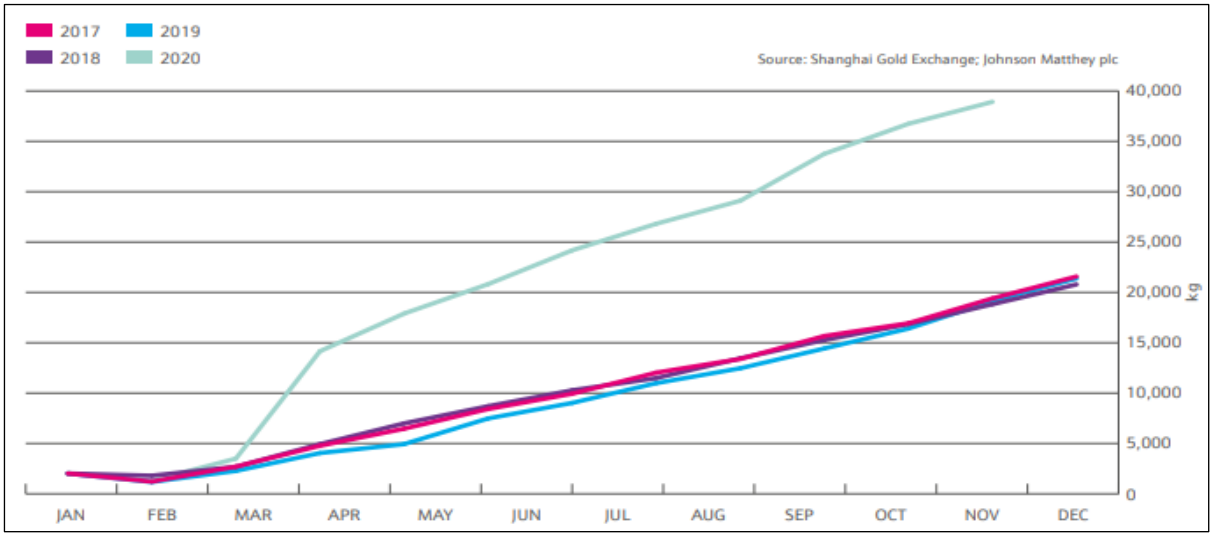



*Figure 4: Cumulative SGE Platinum Sales*

(Source: Cowley, 2021, Shanghai Gold Exchange; Johnson Matthey plc)

The commodity upswing is further supported by figure 5 below which illustrates PGM and Coal sales performance between the period 2007 to 2020. Notably, in 2020, PGM sales outperformed coal sales for the first time since 2010.

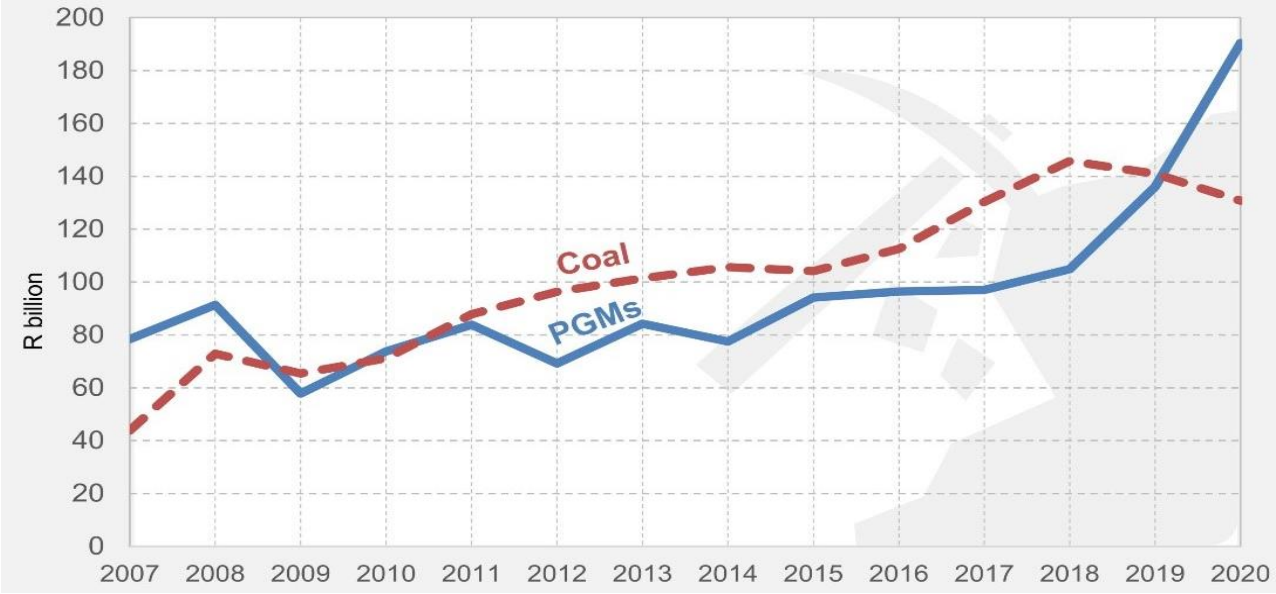



*Figure 5: Coal vs PGM Sales in South Africa*

(Source: StatsS, Mining: production and sales, April 2021)

The need for products that have been produced by the mining sector is driven by survival and lifestyle requirements which uses products in the manufacture of steel and concrete, smartphones and other electronics, transportation systems, and even salt for our food. Demand is therefore increasing as the global population continues to grow. The value of each metal and mineral is dynamic and fluctuates in line with associated economic demand resulting in a cyclical commodity market. Having weathered a prolonged downturn since 2011, the market is now improving, driving increased activity in the sector (Gordon *et al*., 2018).

The mix of metals and minerals required by society also changes in accordance with social norms. For example, while coal remains the main source of electricity production in South Africa, the move to renewable energy has reduced global projections on the use of thermal coal and increased the requirement for rare earth elements (IRENA, IEA and REN21, 2018). These minerals form several critical components used by technology such as wind turbines and solar panels.

The South Africa economy was built on the foundation of mining activities, specifically against the backdrop of gold mining following its discovery in the Highveld in1886. The discovery of gold in the Witwatersrand, together with that of diamonds in Kimberley resulted in the incredible economic growth of South Africa. Although the country's gold resources have depleted significantly over time, this decline has been partially offset by the emergence of PGMs which are estimated to be three-quarters of the world reserves. To this day, the main mining sectors in South Africa remain coal, platinum, gold and diamonds (Mapungubwe Institute, 2018).

The estimated worth of South Africa's mining industry is approximately R20.3 trillion, making it the world's fifth largest mining sector. This contribution in terms of GDP accounts for eight percent of the South African GDP (Chibba, 2020). To this extent, the mining industry has strategic importance to the socio-economic and political landscape of South Africa. The Table below highlights the dominant position of South Africa's contribution to world mineral reserves as at 2019.

*Table 1: South Africa's contribution to world mineral reserves*

| Commodity | Unit | South Africa's reserves | World | |
|---|---|---|---|---|
| | | | Rank | % |
| Chromium | Mt | 230,000 | 1 | 40.4 |
| Coal | Mt | 53,156 | 8 | 3.5 |
| Copper | kt | 11,000 | 11 | 1.6 |
| Fluorspar (Contained CaF ) | kt | 41,000 | 3 | 13.2 |
| Gold (Metal) | t | 3,200 | 3 | 11.8 |
| Iron ore | Mt | 690 | 10 | 0.9 |
| Lead (Metal) | kt | 300 | 6 | 0.3 |
| Manganese (Metal) | Mt | 260 | 1 | 32.0 |
| Nickel | Mt | 3,700 | n/a | 4.2 |
| Platinum Group Metals | t | 63,000 | 1 | 95.5 |
| Phosphate rock (Contained concentrates) | kt | 1,400 000 | n/a | 2.0 |
| Titanium minerals (Metals) | Mt | 35 | 5 | 4.5 |
| Uranium (Metal, up to $US 80/kg U ) | t | 279,100 | 6 | 5.2 |
| Vanadium (Metal) | kt | 3,500 | 4 | 15.9 |
| Vermiculite | kt | 14,000 | 1 | n/a |
| Zinc (Metal) | kt | 14,000 | n/a | n/a |
| Zirconium minerals (Metals) | kt | 6,500 | 3 | 10.4 |

(Source: Department of Mineral Resources and Energy, US Geological Survey 2019)

The South African Mining industry contributes more than R300 billion to GDP, directly employs more than 450,000 people and is the economic anchor of many communities around the country (Goodman, *et al.*, 2019). Unfortunately, in the last decade, the South African mining industry has been declining resulting in falling mining employment by approximately 1/10 which is a net loss of more than 50,000 jobs (Mutemeri, *et al.*, 2016).

Despite attractive financial gains, the business of mining is not easy. On the contrary, mining has always been characterised by a low-skilled, labour-intensive model. The labour-intensive model was supported by mine management due to low labour costs. The continued use of this operating model together with outdated mining methods reflects the current operating model in the Southern African region while miners in developed economies such as Australia, Canada and London have embraced

technological advances as reflected by their mechanised processes and relatively lower employee complement (Cairns, *et al.*, 2010).

Analysis conducted by McKinsey in 2018 shows that the productivity of South African mining operations for key commodities has declined over the past five years all while mining companies in other regions have made rapid gains in productivity. According to the McKinsey MineLens productivity Index (2018) which tracks over 240 mining operations globally, the productivity of South Africa's mining industry has fallen steadily. Even sharper declines in economic fortunes are projected which can only be circumvented by an improvement in cost-competitiveness in the South African mining industry. Research conducted by McKinsey found that 47 percent of South African mining jobs, along with 42 percent of revenues, are in the vulnerable bottom quartile of global cost competitiveness (Goodman, *et al.*, 2019).

While these challenges have a real impact on the future of South African mining as well as the economic contribution from this sector, the South African mining industry still has a real potential to return to growth especially through nurturing the junior mining sector. The opportunities to rekindle growth and job-creation include localizing the value chain from mining operations, expanding downstream processing and beneficiation for key commodities, and unlocking the potential of the country's rich ore bodies (Creamer, 2020). Key commodities include iron ore, manganese resources in the Northern Cape (which account for 80% of world's manganese resource), and PGMs. Other niche commodities such as vanadium are also included due to their strategic positioning as it is key to battery technology applications in electric vehicles. These commodities are also useful for general energy storage (especially renewable energy) and industrial minerals (Creamer, 2020).

South Africa has limited exploration for new mining opportunities with almost no new investment going into discovering and developing new mines. The capital flows into South African mining are depleting as evidenced by a reduction in capex projects whose objective is to expand and maintain existing mines. The reality, then, is that South Africa is consistently mining out a declining pool of reserves. If this trajectory continues without active investment in new mineral discoveries, the output will inevitably shrink, as is the case with current South African mining operations (Mbazima, 2020).

Future investments in the mining sector will be crucial in the acceleration of growth in South Africa's junior mining sector and the broader economy. Considering the life of a mine can be extended to 30 years or more (through innovation and entrepreneurship) (Mutemeri, *et al.*, 2016), mining can then be considered as an important driver of long-term investment.

Based on a forward-looking view, junior mining has a major role to play in terms of steering the industry towards a new direction, specifically with regards to the extraction of minerals that are required for the global green energy transformation agenda.

A low hanging fruit for junior mining operations is cost containment which is one of the key challenging factors in large mining operations. As such, improved management of junior mining operations could prove to be far more economically viable than that of major miners.

### *2.4. Current Junior Mining Definitions*

Desktop review and analysis of existing literature from contributing scholars and researchers has shown that there has been limited scholarship on non-major mining (i.e. artisanal and small-scale mining, junior mining and/or emerging mining). While research subjects in this field have been gauged from different perspectives (Mkubukeli and Tengeh, 2015 & Phiri, 2011), a common gap is the universal definitional challenge which has been investigated by various scholars (Hilson, 2009) with little success. At current, a generally accepted understanding and definition for this form of mining is yet to be formulated (Hentschel *et al.*, 2002) which is why researchers are still preoccupied with studying this subject with the objective of arriving at a universally accepted definition.

The word 'ASM' is mostly used by scholars and is most popular within the rest of the African continent while 'Junior Mining' is the preferred term in corporate South Africa especially within the investment fraternity. The words 'ASM', 'Junior Miner' and 'Emerging Miner' are used interchangeably to refer to a group of miners who are in the start-up phase as well as those who operate small to mid-scale operations. Other scholars have asserted that this group of miners comprises of people who are in search of business opportunities ideally looking to 'get rich quick' (Hilson and McQuilken, 2014). For the avoidance of any doubt and ambiguity, this research will adopt the term 'Junior Miner' to refer to non-major miners.

Landu (2014) defined a junior mining enterprise as a small-to-medium sized mining company with a market capitalisation of between $20 million to $1billion. In addition, the author asserts that most companies complying with these levels of capitalisation are a product of the Broad Based Black Economic Empowerment (BBBEE) programme. The BBBEE programme was implemented by the government to address the economic injustices of colonialism (Landu, 2014). Mutemeri and Petersen (2002) have defined a junior mining firm as a business that employs less than 200 people and has an annual revenue ranging between R7.5 million – R30 million while another scholar, Everett and Gilboy (2003), stating that a firm is a junior mining firm if it possesses fewer than $100 000 in assets.

The definitional attempts above align with Cranstoun (2010) who proposed that junior miners should be distinguished based on their revenue sources. There have been other qualitative factors guiding the definitions of junior miners such as that proposed by Seeger (2006) who defined a junior mining enterprise as a small, entrepreneurial company that is involved in exploration, feasibility studies and at times development of mines. Hentschel *et al*., (2002) & Mkubukeli and Tengeh (2016) contend that small-scale mining refers to mining operations with limited mechanisation, carried out by poverty-stricken individuals or families and young children throughout the world in pursuit of much needed income for survival.

Apart from scholarly definitions as presented above, various government support structures such as the Minerals Council of South Africa have a Junior and Emerging Miners' Desk whose focus is to support the junior mining industry. The Minerals Council of SA conducted a research study that asserted the term 'junior mining' has taken on a wider meaning which is inclusive of exploration companies, small and mid-tier producers (Mineral Council of South Africa website). It affirms this group of miners range from informal, family-run artisanal miners to sophisticated operations that have an annual turnover of R500 million (Louw, 2019).

The Department of Mineral Resources (DMR) has also contributed to the definition by stating that junior and emerging miners are companies with a R150 million annual revenue (Department of Mineral Resources website). In the past, the DMR's definition of junior mining was criticised that it only benefits the smallest of companies while the vast majority of junior mining companies are subjected to stipulations that are onerous and difficult to meet (Louw, 2019).

The Small-Scale Mining Directorate has also participated in the pursuit to contribute to the understanding of junior mining by differentiating junior miners based on three categories: (1) artisanal or subsistence mining operations used to refer to new entrants, (2) sub-optimal formal mining operations; and (3) entrepreneurs with upfront capital (Nhlengetwa, 2019). This attempt at defining junior miners in this manner stems from the acknowledgement that junior miners engage in various activities ranging from a spectrum of exploration to production from multiple operations.

In addition to a lack of consensus on the definition of junior mining from a South African perspective, it has been widely agreed that definitions vary by country in relation to the different commodity resources and general geographic, social and political landscape. Most analysts have defined junior mining using a combination of various criteria such as revenue, employment and production to arrive at a working definition of junior mining. The United Nations define junior mining in production terms by placing an "upper boundary" of 50,000 tons per annum for underground mines and 100,000 tons a year for surface mines (Glazewski, 2015). In addition, a limit of $5 million has been assigned

on the project finance criteria for small-scale operations who are expected to have less than 50 workers.

Other research topics with an overlap on the definitional challenge focused on the comparison between the South African junior mining sector with other commodity-rich countries within the African continent mainly from a policy and regulation perspective. Additional studies have focused on informal and illegal Artisanal and Small-scale Mining collectively known as 'ASM' which addresses mining for socio-economic reasons i.e. poverty and survival.

The definitional attempts by scholars was primarily from a perspective of revenue and number of people employed. This ignores other mining specific definitional factors such as the size and quality of the geology (orebody), the commodity mined, mining method used and experience of management team. Phiri (2011) attempted to define small-scale mining by using benchmarking. The determinants used for the study were the size of the mine, legality (law abiding or not) of operations, and mining paradigm. While this definition is notable, it does not encompass all factors that characterise the mining industry, specifically from a risk perspective.

While there have been few attempts at defining Junior Mining as reviewed in the preceding text, the definition and classification of small-scale and junior mining companies in South Africa is quite confusing with overlaps in some characteristics such as the number of employees and annual revenues (Manzi, 2017). The fact that there is no real consensus on a single agreed upon definition of junior mining (Nhlengetwa, 2019) may be attributed to the complexities of the sector's activities as outlined by Hilson and McQuilken (2014). Furthermore, the fact that local definitions may vary from country to country based on the macroeconomic situation, the geological framework, the mining history and the legal conditions creates additional complexities in studying and understanding the subject of junior mining.

Notwithstanding the confusion in the classification, understanding the nature of these miners is crucial in developing an insight into their risk profiles and specific characteristics. As such, it is the aim of this research study to contribute towards narrowing the Junior Mining definitional gap through the development of a risk-adjusted framework for defining junior mining within the South African context.

### *2.5. Current Junior Mining Landscape*

The purpose of this section is to gain an understanding on the current dynamics of the global, regional and national mineral resources sector. With reference to this report, the regional focus refers to the African continent and the national focus is South Africa while the global mining centres are

Australia, Canada, and the United Kingdom (UK).

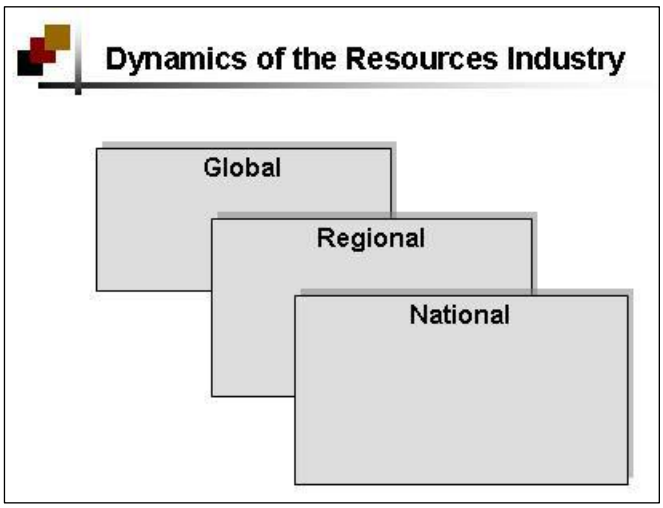



*Figure 6: Dynamics of the Resources Industry*

(Source: Seeger, 2006)

### *2.5.1. Global Junior Mining Sector*

The rich mining history and culture of Canada has made it a world leader in potash, uranium and diamond mining (Garside, 2020) and has continued to sustain its position as the global mining leader largely driven by the structure of its government support programmes especially as they relate to incentive schemes. The share-flow through structure is a well-known incentive structure setup by the Canadian govern to incentivise the formation and financing of junior firms. The Canadian government is aware of the crucial role that junior miners play in high-risk exploration activities. It further acknowledges that its control over mineral value chains depends on the stability and success of the junior mining sector which is why it made the decision to subsidize these companies through its 'flow-through' policy. The policy makes 100% of capital invested in domestic junior activity tax deductible for the investor (Dougherty, 2013).

Due to the favourable incentive structure, many junior miners made the decision to legally base themselves in Canada where corporate governance and investor incentives favour junior firms. Dougherty (2013) has documented that one high-ranking functionary of Guatemala's Ministry of Energy and Mines once commented that Canadian law design allows junior miners to function effectively in that a junior miner can list publicly from the moment of company formation. The stock exchange requirements are not onerous relative to other jurisdictions. Generally, the Toronto Stock Exchange (TSX) requirements specifically for junior firms are relaxed.

It is such structures that enable juniors to commence exploration activity contrary to the New York Stock Exchange (NYSE) and the Johannesburg Stock Exchange (JSE) where companies have to

satisfy a heap of onerous requirements prior to listing on the stock market (Dougherty, 2013). Equity financing for mining on the TSX is greater than all other major global exchanges combined, making Canadian junior mining firms the most competitive when it comes to raising finance capital for their operations (Matheson, 2003).

Australia has also been dubbed as a leading mining destination given its long mining history. However, of late, there has been threats on the sustainability of its base metal and precious metal mining industries. This is driven by a sharp decline in the rate of new greenfield mineral discoveries. The current production profile is characterised by a strong concentration of relatively few maturing mines most of which were discovered more than two decades ago (Cairns *et a*l., 2010).

The top 10 Australian exports by value (as per the figure below) are made up of 7 natural resources where coal, iron ore, gold and base metals make up the top four largest contributors to income earned, respectively. The economic contribution of the Australian mining sector grew from approximately 4.5% of GDP in 1993 – 1994 to almost 8% in 2006 – 2007. Its notable contribution is further supported by a rapid increase in export volumes (Cairns *et a*l., 2010) which further asserts the importance of its resource sector.

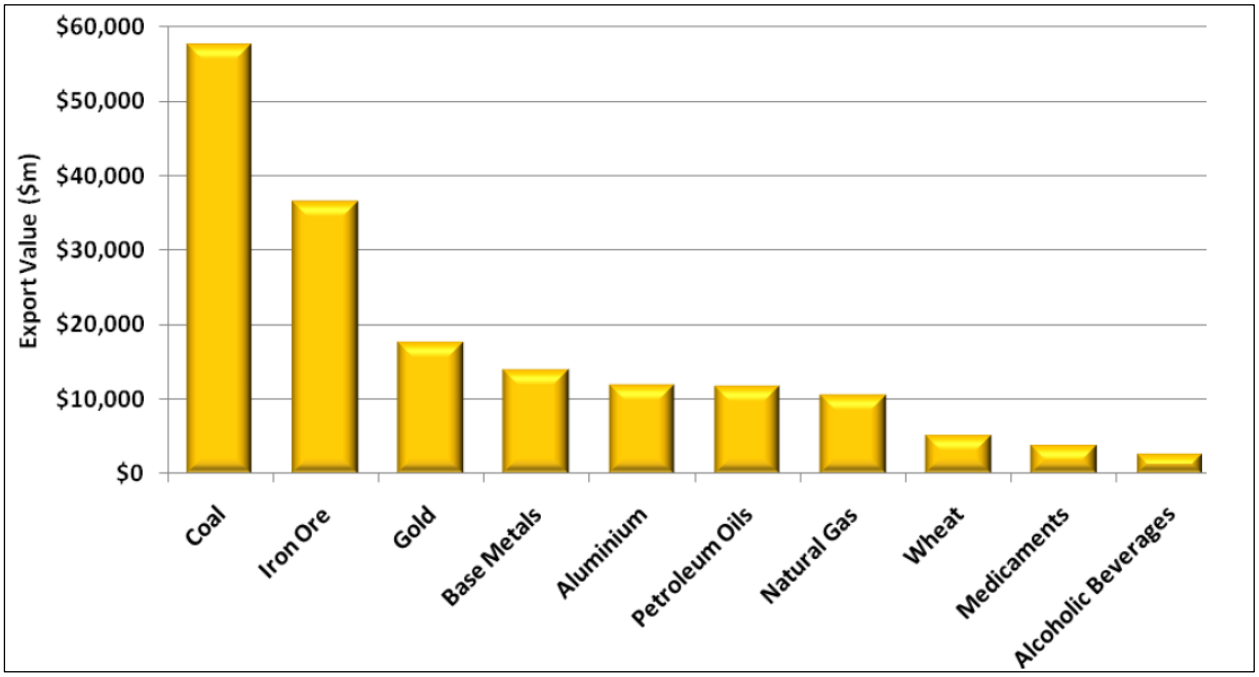



*Figure 7: Australia's 10 Largest Exports by Value (between 2008 - 2009)*

(Source: Cairns *et al.*, 2010)

The economic contribution of the mining sector in Australia is substantial, therefore, the threat to its sustainability (posed by decreasing exploration) requires the government and other relevant stakeholders to take action so as to nurture and protect this sector. A major role towards unlocking the mining prospects requires concentrated and focused efforts both by major and junior miners.

Despite the comparative maturity of the junior mining industry in Canada and Australia, the classification of junior miners is somewhat ambiguous in these regions, as is the case with other mining regions across the world. There are primarily three classification groups for mining companies in matured jurisdictions namely: major miner, mid-tier miner and junior miner (Dougherty, 2013). These Firms are categorized by the numbers of sites they operate, levels of capitalization, and sources of revenue. For example, Australia defines junior miners as small companies with a market capitalisation of less than $200 million and a mid-cap producer as a company with a market capitalisation between $200 million to $1 billion (Williams, 2012).

Interestingly, Australia has about 800 small mining companies which have been listed on the Australian stock exchange most of whom engage in exploration activities (Williams, 2012). As such, the majority of junior mining firms are regarded largely as exploration companies with no or few production sites. Mid-tier firms are characterised as companies that begin life as juniors and eventually go into production on the basis of their own discoveries, whereas major producers possess many production sites over multiple world regions mining various commodities.

**Summary of Global Mining Industry Dynamics**

Globally, the top 150 mining firms control 80% of global mineral production even though they only account for 4% of companies. The estimated one thousand mid-tier firms account for approximately 19% of global mineral production whereas the multiple thousands of juniors account for the remaining 1% of global production. Since the 1990s, volatile commodity prices and changing regulatory climates have created an environment where mid-tier firms are forced to either merge and consolidate into majors or disappear completely (Dobra, 2002; Everett and Gilboy, 2003). As mid-level producers disappear, junior firms in Canada and Australia have flourished (Everett and Gilboy, 2003) mostly due to favourable and active government support which allows them to raise capital thereby ensuring survival and growth of their operations (Dougherty, 2013).

### *2.5.2. Regional Junior Mining Sector*

Junior Mining activities are widespread in developing countries including Africa, Asia, Oceania, and Central and South America. Most mining investment previously undertaken on the African continent related to projects in the greenstone belts of West Africa, the Copperbelt in Zambia and the Democratic Republic of Congo (DRC), and the goldfields of Lake Victoria in Tanzania (Seeger, 2006). Though the informal nature and on the whole un-mechanized operation generally results in relatively lower productivity, the sector represents an important livelihood and source of income for the poverty affected local population (Levin, 2013) as supported by the figure below. The size of

each bubble represents poverty rates at US$1.9 per person per day in Purchasing Power Parity terms (World Bank, 2019).

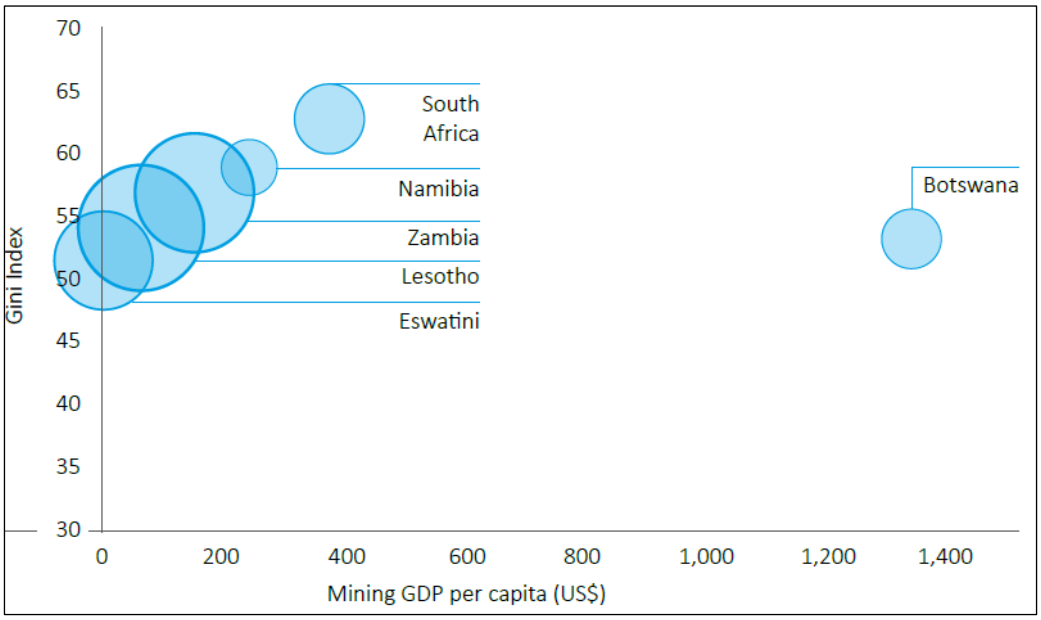



*Figure 8: Mining GDP per capita in Southern Africa*

(Source: World Bank)

In more recent times, junior mining has become better recognised as a poverty alleviation strategy and a vital source of income among rural and migrant communities. Kwai and Hilson (2010) suggest that in Tanzania, junior mining has overtaken agriculture as a primary industry. The World Bank and Pact (2019) released a report that describes junior mining as being "the most important rural non-farm activity in the developing world". The report estimates that more than 40 million people work in this sector globally (World Bank, 2019) making it one of the largest employers on the land.

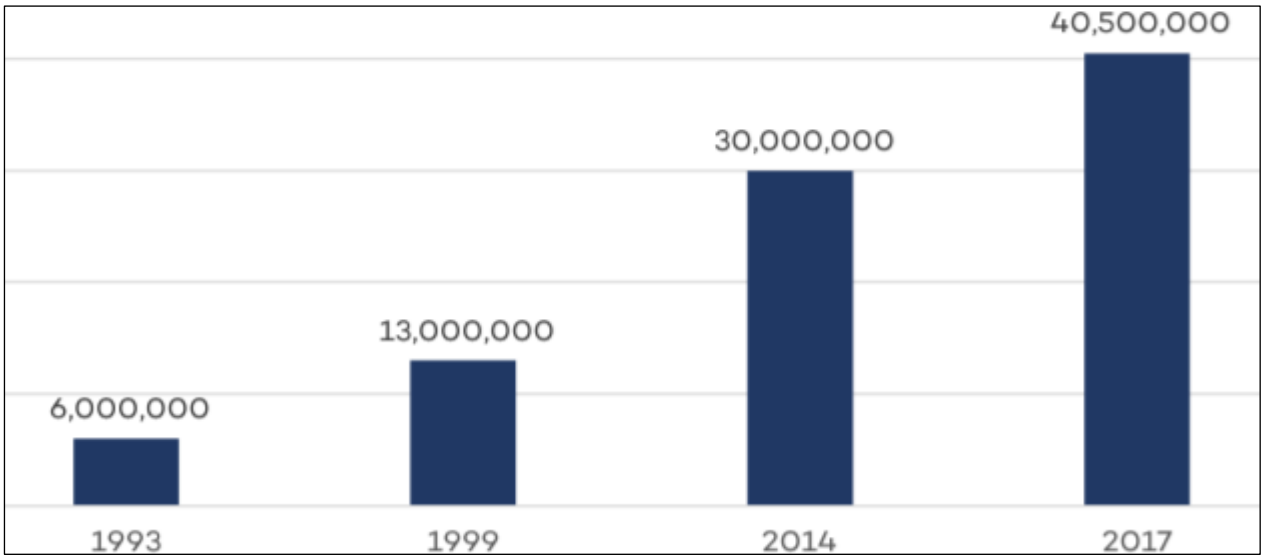



*Figure 9: Number of Junior Mining Operators Worldwide between 1993 – 2017*

(Source: ILO, 1999; Levin, 2014)

There has been attempted calls and efforts to operationalize junior mining across the African continent, however, development framework has proved to be tedious and ineffective (Debrah *et al.*, 2014). The complexities of developing sustainable development framework for small-scale miners has been attributed to a lack of context and an understanding of the continuum from prospecting/exploration through to project development and production. Driven by the need to contextualize some of the definitional issues in this niche sector, and to gain a clearer understanding of their peculiar challenges, Debrah *et al.* (2014) contributed to the debate on junior mining by considering two of Africa's resource-rich countries, Ghana and South Africa in the narrative below.

Ghana, one of the oldest mining countries in Africa, has rich mineral endowments in commodities such as gold, diamonds, bauxite, and manganese. Junior mining in Ghana has been said to precede the arrival of the Europeans based on its 2000-year history of gold mining (Hilson, 2002). This type of economic activity has been a source of livelihood for many artisanal miners, their families and others involved directly or indirectly in the sub-sector. Junior mining has often been overlooked as an effective contributor to gross foreign earnings because production is mostly at a low scale. Hilson (2002) conducted extensive research on small-scale mining which concluded the junior mining sector in Ghana is overly reliant on gold mainly due to its perceived propensity to generate wealth quickly.

South Africa has made greater inroads in terms of addressing some of the structural challenges faced by junior miners at the formal level than most developing countries. However, even in this context, a significant proportion of the sub-sector is still not captured and does not operate within the legal framework (Debrah, *et al.*, 2014). Despite the relative progress from a policy and regulatory perspective, the small-to-mid scale mining sector in South Africa, as with other jurisdictions, is very difficult to classify and categorise (Mutemeri *et al.*, 2010). The table below highlights the main similarities and differences which emerged from the study conducted by Hilson (2002) on the comparison between the junior mining landscape in South African and Ghana.

*Table 2: Comparison between Junior Mining in South Africa and Ghana*

| Parallels and similarities between South Africa and Ghana's ASM regimes | | |
|---|---|---|
| | **South Africa's MPRDA** | **Ghana's MMA, Act 703** |
| Definitional issues | a) The law does not define small-scale mining but makes provision for a mining permit, for small–scale operations.<br>b) No provision is made for artisanal mining in the Act.<br>c) Regulation covers all minerals, whether occurring naturally or in residue deposits or residue stockpiles.<br>d) Guidelines to assist small-scale miners have been developed within various government departments, including Mineral Resources and Water Affairs. | a) The law is applicable to only small-scale mining with no reference to the different categories of small-scale miners<br>b) No provision is made for artisanal mining in the Act or attempt to define them<br>c) Regulation is tailored to mining only gold, diamonds, and some forms of industrial minerals and winning and quarrying, but even at the artisanal level there is no clarity or distinction<br>d) No environmental limits and guidelines specific to the varied artisanal and small-scale miner needs are provided. |
| **Rights** | **Mining Permit** | **Mining License** |
| Size and duration | 1.5 ha for 2 years, renewable for a further 3 periods each not exceeding 1 year. | 21 ha for 5 years, renewable subject to the Minister's discretion. |
| Environmental requirements | An Environmental Management Plan is required prior to granting the Mining Permit (vs. Environmental Management Programme required for Mining Rights for large-scale mining). Additional requirements in other pieces of legislation. | Government body (Environmental Protection Agency does the assessment). No EMP is required of the miner applicant at the small-scale level. |
| Fund for rehabilitation | Requirement to make financial provision for rehabilitation and management of negative environmental impacts. This should be reassessed annually. | Payment of lump sum to the District Office (Environment) and a subsequent annual payment. No production and financial reporting as a pre-requisite for the payment of lump sum when project is exhausted. |
| Social and Labour Plans (SLP) | No Social and Labour Plan requirements for Mining Permit. | No Social and Labour Plan requirements for Mining License. |
| Royalties | The legislation requires holders of a Mining Permit to pay the state royalties. However, below a certain threshold level (R100 000) this is waived (as per Mineral and Petroleum Resources Royalty Act 28 of 2008). | Payment of between 3% to 6% required of small-scale miners as royalty. |
| Market access | No specific provisions around marketing. | Subsidized below market price and saleable only to the requisite government body – in this case the Precious Mineral and Marketing Company (PMMC). |
| Level of reach of regulatory body. | Mineral resources are a national competency with regional offices based in each of the nine regions (provinces). | District Offices of the Minerals Commission are located in all areas where small-scale mining activity is present. |
| Support structures | Various agencies providing services, including the Department of Mineral Resources: Small-Scale Mining Directorate, Mintek, Mining Qualifications Authority, Council for Geoscience, Small Enterprise Finance Agency (previously Khula). | Minerals Commission, Ministry of Lands and Natural Resources, Geological and Survey Department. |
| Cohesion between LSM and ASM | The relationship between ASM and large-scale mining ranges from support and assistance, cooperation to conflict. | There is non-cohesion between LSM and ASM, although some LSM companies have implemented programmes to facilitate cohesion. |
| Other legal frameworks | Environmental requirements under the National Environmental Management Act, water use and licensing requirements in terms of the National Water Act, Mine Health and Safety Act; and a range of other pieces of legislation related to labour and skills and business operation. | Environmental Protection Act, 490; New instruments to aid in the MMA- mine support services, compensation and re-settlement, licensing, explosives and health and safety regulations have been recently passed in 2011. However, as to their application to the sub-sector, this is not very clear. |

(Source: Debra *et al.*. 2014)

From both a Ghanaian and South African context, it is evident that the lack of a definition of junior mining and the shortage of reliable data has become a hindrance to the development of a functional and productive regional junior mining sector.

In some West African countries (such as Mali), small-scale mining is differentiated from artisanal mining on the basis of the presence of permanent, fixed installations that are established once an ore body is confirmed (Hentschel, *et al.*, 2002). For Burkina Faso, the junior mining sector is explicitly accommodated for from a regulatory perspective. The 2015 mining code offers the possibility for artisanal miners to formalize and improve the structure of their operations (Mutemeri and Petersen, 2002). Countries such as Burkina Faso have since 2009 consistently relied upon the export of the gold commodity even though its commercial gold production has never reached the level that South Africa once did (Wilson, 2018).

The DRC considers the junior mining sector as an important source of livelihood through the creation of employment which subsequently provides income for miners and their families, and on which several millions of other people depend (Chipangura, 2019 & Kemp and Owen, 2019). This is a general consideration for junior miners across the African continent who enter the sector due to desperation resulting from a lack of employment and income with most miners having been retrenched from mines. Figure 10 further supports the notion on active participation in junior mining by African countries.

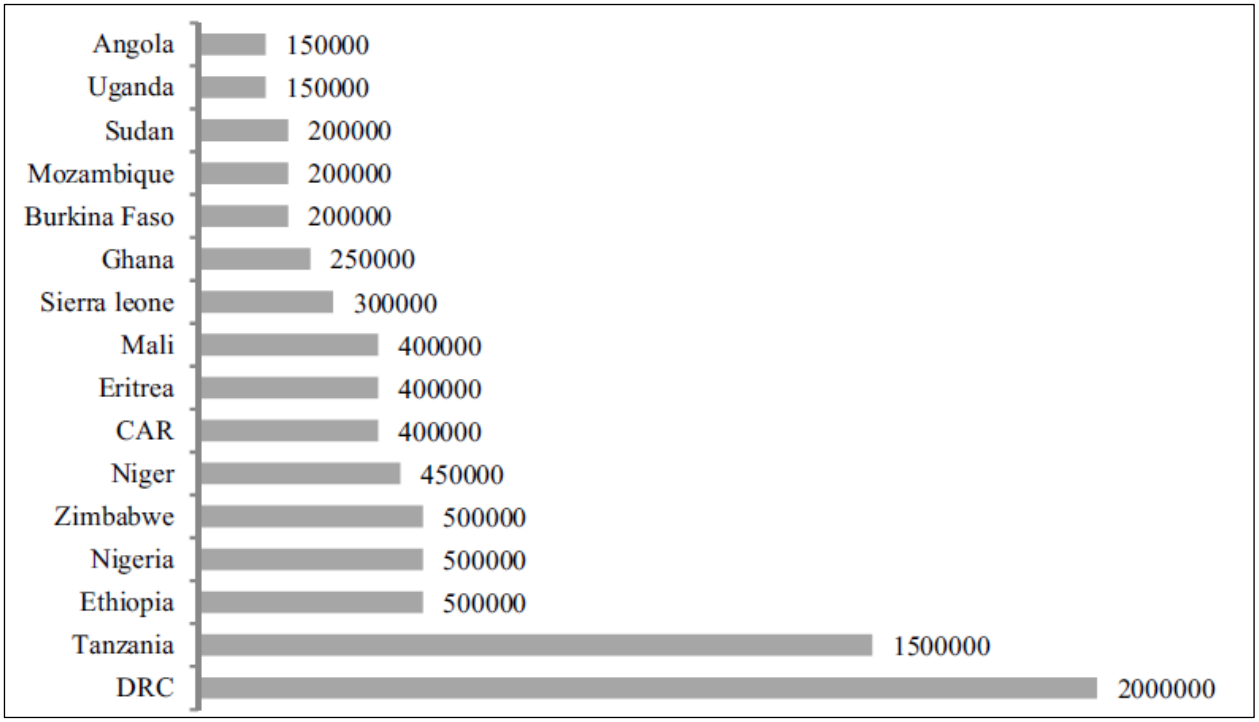



*Figure 10: Junior Mining Regions in Africa where the miner population is greater than 150,000*
(Source: PACT, 2008)

The DRC and Tanzania represent African countries with the largest junior mining population. Despite the relative progress, the South African junior mining sector does not feature in the top 10 mining regions in Africa given the junior mining population estimation of less than 150,000.

The understanding is that countries such as Guinea, Mali and Ghana consider mining activities as a way of life while junior miners in Tanzania participate in mining to supplement their income from seasonal farming (Minerals Council of South Africa). Tanzania's growth is attributed to the fact that every year since 1998, a new mine came into production (Tassel, 2003). That together with the introduction of a new fiscal regime in 1997 and a new liberalised mining act in 1998 has positively stimulated mining investment (Seeger, 2006).

Generally, there is a tendency to only associate Junior Mining with high value minerals such as gold and diamonds (Mutemeri *et al.,* 2016). This is supported by a study conducted by the World Gold Council in 2011 which estimated that annual Junior Mining gold production was approximately 13% of annual global production. The United Nations Development Project conducted a more recent study which takes the figure closer to 20% of the world's annual gold production.

While this section attempted to provide context on the junior mining sector within the African region, it is noted the challenge with drawing comparisons from different countries is inhibited by pertinent issues such as lack of a common definition for junior mining. The inability to distinguish and categorize the different types and levels of junior miners is further exacerbated by different jurisdictional benchmarks and standards for environmental and social regulations, and other geo-political dynamics (Debrah, *et al.,* 2014). As the junior mining sector cannot be generalised, it requires specifically tailored solutions.

### *2.5.3. South African Junior Mining Sector*

**History and timeline**

South Africa has a long history of mining, both from a small-scale and large-scale perspective. The discovery of copper followed by diamonds and gold in the mid-1800's were the first mining activities to be recorded in the country. These minerals were initially exploited by large numbers of artisanal and small-scale (ASM) enterprises (Ledwaba *et al.,* 2019). It is the growth and consolidation of the sector that led to the emergence of large-scale mining as a dominant feature of the modern South African economy.

There are various studies which suggest that large mining industries started as junior mining operations (e.g. the case of copper mining in Namaqualand in the Northern Cape Province) (Solomon, 2012). However, despite such evidence, the history of the mining industry largely ignored the junior mining sector deferring to the profile of large-scale miners as a dominant feature of the modern South African economy. It wasn't until the advent of a democratic South Africa in 1994 that changes in legislation recognised the participation and socio-economic impact of junior mining (Ledwaba, *et al.,* 2019) through the Reconstruction and Development Programme (RDP).

The RDP (a policy framework aimed at eradicating past injustices created by the apartheid government) identified junior mining among the key socio-economic programmes (Ledwaba, 2017). The objective to redress historic imbalances of ownership that were created by the apartheid regime in the mining industry would be achieved through the empowerment of disadvantaged communities by equipping them with relevant skills to stimulate an entrepreneurial spirit in South Africa along with improved utilization of mineral resources (African National Congress, 1990). Further to the provision of skills, the government was urged to consider additional means of encouraging and supporting small-scale mining through means such as but not limited to financial and technical aid and access to mineral rights (Government Gazette, 1994).

In 1998, a study was undertaken by the Minerals and Energy Policy Centre (MEPC) on small-scale mining in South Africa with the aim of providing context for small-scale mining activities in South Africa. Included in the study was the contribution of the sector to the economy, regulation and compliance matters, as well as possible institutional support to foster promotion of the sector (Scott *et al.*, 1998).

Additional spotlight on the junior mining sector was through the release of a White Paper on Minerals and Mining Policy of South Africa in October 1998. The paper explicitly stated the position that the government took to encourage and facilitate the sustainable development of small-scale mining in South Africa. The legislative objective was to ensure that small mineral deposits were exploited in an optimal manner so as to enable the sector to make a positive contribution to the national, provincial and local economic agenda (Ledwaba, *et al.*, 2019).

The White Paper expanded further to recognise and acknowledge the various challenges that junior miners face which include a lack of access to mineral rights, a lack of technical skills, poor access to appropriate technology and finance, limited market opportunities, and onerous regulatory and administrative requirements. These challenges have been acknowledged as constraining factors in the development of the junior mining sector. A number of programmes were established and put in place as a response towards supporting and facilitating small-scale mining. The outcome of such programmes had mixed results since the aforementioned challenges still prevail to this day and continue to hinder the growth and success of the participants in the sector (Ledwaba, *et al.*, 2019).

As can be seen, both the White Paper and the study conducted by MEPC on junior mining had similar objectives. There is alignment with regards to the role of the sector. The economic contributions, albeit small relative to LSM, have been recognised as fundamentally enriching host communities both at the national and local level. The conclusion reached by both papers was that

the development and growth of the junior mining sector would inevitably drive mineral exploration (Ledwaba, 2017) and discovery which consequently impacts economic growth. With this understanding, it is clear that more effort should be geared towards fostering this type of economic activity to sustain livelihoods (Debrah, *et al.*, 2014) and empower the economy.

The South African junior mining sector has progressed over the years as per the timeline below which shows the evolution over time as outlined by Mutemeri and Ledwaba (2017).

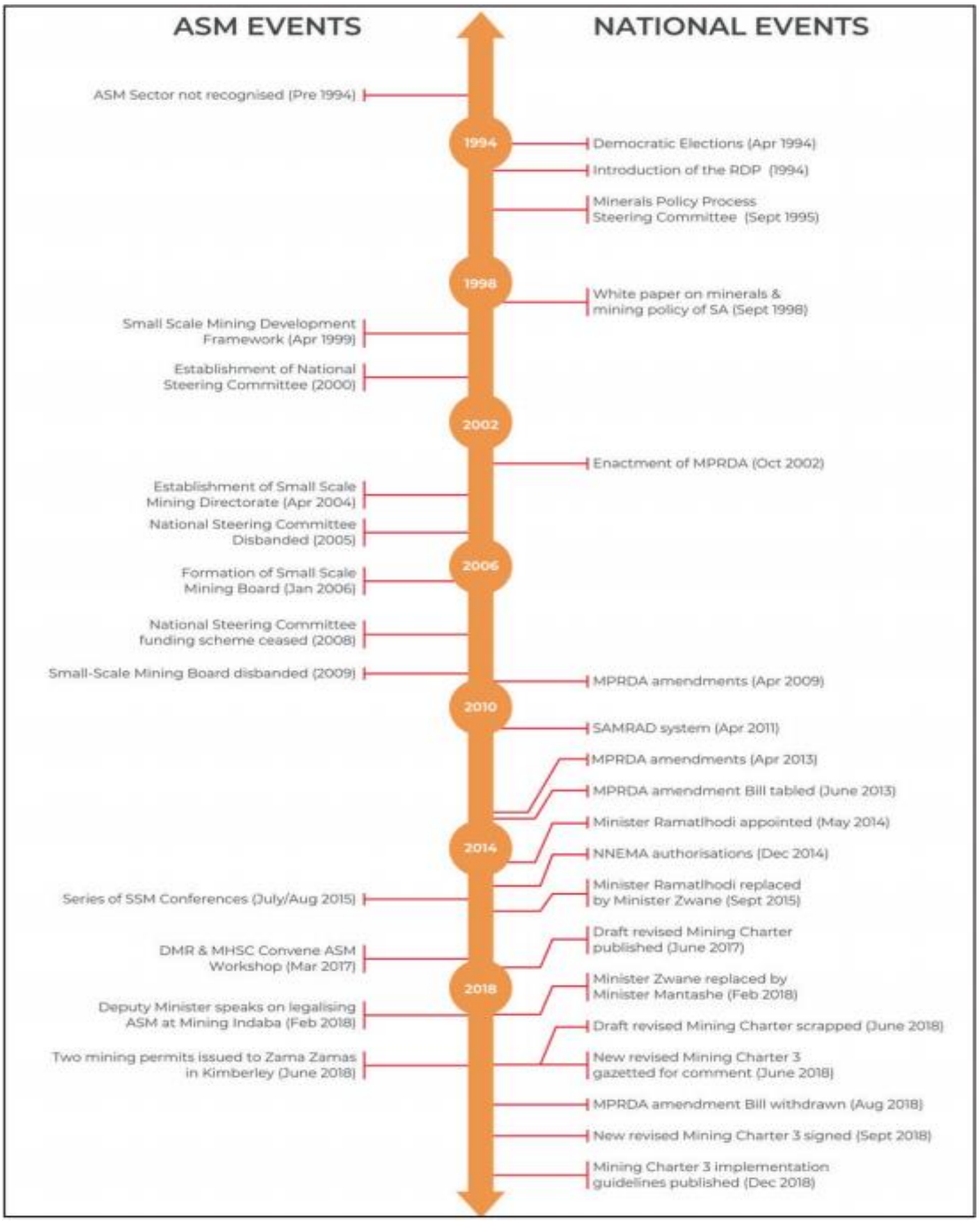



*Figure 11: Junior Mining Timeline in South Africa*

(Source: Mutemeri and Ledwaba 2017)

**Commodities and regional participation**

Junior mining activities are related to the exploitation of relatively 'easy to mine' commodities. These usually include shallow deposits which can be extracted through rudimentary processes such as the use of a pick and shovel. Part of the reason for the preference of such commodities by junior miners is the low-cost base with which they are required to operate within in order to realise meaningful profits. The table below shows some of the mineral commodities that are exploited by junior miners in South Africa.

*Table 3: Minerals commodities mined by juniors in SA*

| Category | Commodity Type | Location |
|---|---|---|
| **Precious Minerals** | Gold | Gauteng, Northwest, Mpumalanga |
| | Diamonds | Northern cape, North West, Free state |
| **Semi-precious minerals** | Tiger's eye, rose quartz, amethyst, feldspar, jasper | Northern cape |
| **Bulk minerals** | Coal, Iron ore, Manganese, | Mpumalanga, KwaZulu Natal, Northern Cape |
| **Alloys** | Iron ore, manganese | Northern Cape, Limpopo |
| **Industrial Minerals** | Granite, sandstone, slate, aggregate, clay, gypsum, etc. | All nine provinces |

(Source: adapted from Mahlatsi, *et al.*, 2011).

To further supplement the data on popularly mined commodities within the junior mining sector, the Minerals Council of South Africa conducted a survey involving junior miners to understand the commodities which are most explored by junior miners. Upon data collection and analysis, it was found that almost 60% of junior mining rights were issued to miners within the Industrial minerals' commodities space.

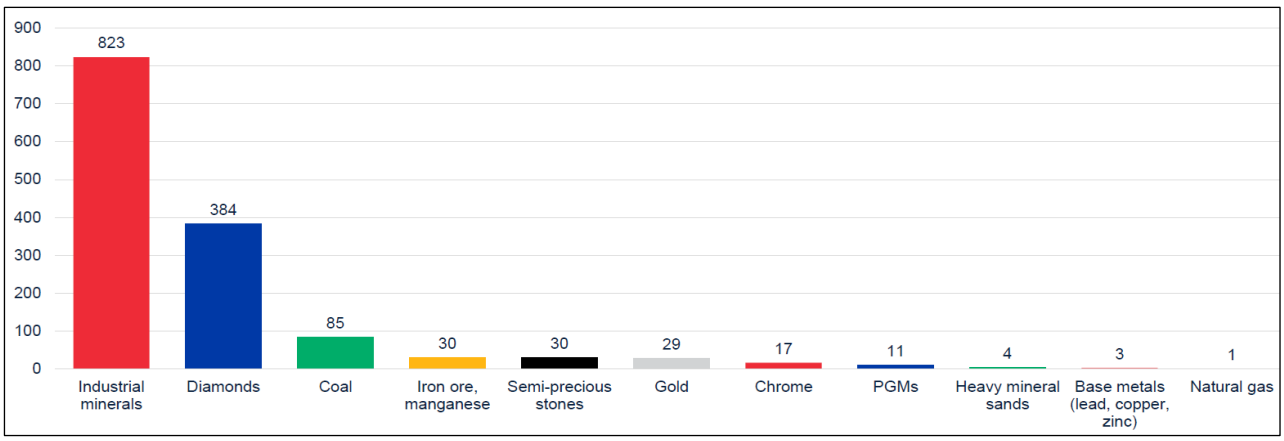



*Figure 12: Junior Mining licences in South Africa (2017)*
(Source: Source: DMR Statistics Tables 2017)

Industrial minerals are widely available minerals that are not sources of metals, fuel or gemstone but are rather have multiple applications and are used as raw materials and production input in many industrial processes. These minerals include lime, limestone and phosphates which are used primarily within the agriculture industries as fertilisers, sands, limestone and dimension stone in construction, and many other minerals used in pharmaceuticals, chemicals, andalusite, lime and the metallurgical sector (Modiselle, Muravha, *et al.*, 2017).

Junior Mining takes place in all nine of South Africa's provinces. Although the number of miners is comparatively small compared with other continental jurisdictions (Rouse, 2013) the sector continues to grow in spite of limited support from government and other LSM players. While the precise number of junior miners in South Africa is unknown, (owing largely to a lack of a comprehensive and coordinated support framework), it is estimated that this sector accounts for approximately 10% of direct employment (Minerals Council of South Africa) with the majority of junior miners operating in relatively more economically depressed provinces such as the Free State, Limpopo, Mpumalanga, North West and Northern Cape Eastern Cape (Mutemeri and Petersen, 2002). The table below shows the provincial economic contribution from the mining sector.

*Table 4: Mining Sector Contribution to Provincial Economies*

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eastern Cape | 0.3% | 0.4% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.2% | 0.1% | 0.2% | 0.2% | **0.2%** |
| Free State | 10.8% | 10.5% | 11.0% | 10.7% | 10.5% | 10.6% | 10.5% | 8.5% | 8.7% | 9.1% | 8.3% | **8.7%** |
| Gauteng | 2.4% | 2.4% | 2.5% | 2.5% | 2.5% | 2.4% | 2.2% | 2.0% | 2.1% | 2.1% | 1.8% | **1.8%** |
| KwaZulu-Natal | 1.5% | 1.4% | 1.5% | 1.4% | 1.4% | 1.4% | 1.4% | 1.2% | 1.3% | 1.3% | 1.3% | **1.3%** |
| Limpopo | 27.6% | 26.0% | 26.5% | 28.7% | 28.3% | 28.3% | 27.9% | 26.8% | 28.4% | 28.1% | 28.5% | **30.3%** |
| Mpumalanga | 19.1% | 18.5% | 19.1% | 20.6% | 21.5% | 20.1% | 18.9% | 17.9% | 18.2% | 18.1% | 18.5% | **19.5%** |
| North West | 30.8% | 30.2% | 31.2% | 33.3% | 30.0% | 33.0% | 32.8% | 32.0% | 32.8% | 32.0% | 32.7% | **34.1%** |
| Northern Cape | 23.3% | 24.0% | 24.6% | 24.0% | 24.0% | 25.3% | 22.8% | 20.1% | 20.6% | 21.9% | 22.5% | **24.1%** |
| Western Cape | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | **0.2%** |
| **South Africa** | **6.9%** | **6.9%** | **7.1%** | **7.5%** | **7.3%** | **7.4%** | **7.2%** | **6.7%** | **7.0%** | **6.9%** | **6.9%** | **7.3%** |

(Source: Minerals Council of South Africa, 2020)

**Summary of the Dynamics of the Mining industry**

Canada, Australia, the UK, the US and South Africa are the countries known for mineral abundance and have been significantly explored to extract mineral deposits. Their current maturity and decreasing mine-finding potential is forcing junior miners to focus on other mineral-rich countries for mineral extraction. The viable countries are those that do not have a long history of exploration thus representing a greater likelihood of finding big deposits (Seeger, 2006).

Figure 12 shows the focus areas of global leaders along the different stages of the mining life cycle.

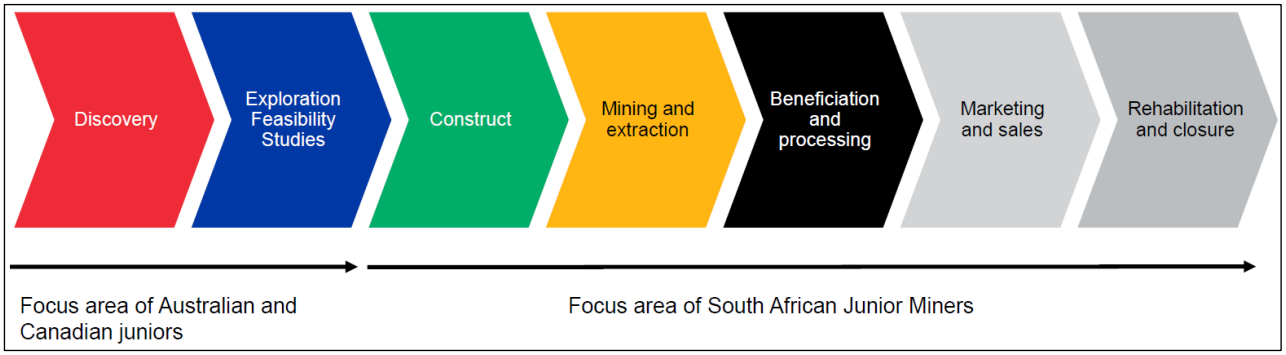



*Figure 13: Simplified Mining Value Chain - Global and South African Lens*

(Source: Mineral Council of South Africa)

The objective of the Mineral and Petroleum Resources Act, No.28 of 2002 (MPRDA) was to transform the mining sector by broadening access to South Africa's mineral resources. Most notable is the Act does not explicitly recognise junior mining as a subset of the mining sector, however, it does make provision for mining permits (which are distinct from a mining right) which provide access to the mining sector for junior miners. The permits are awarded on condition that junior miners achieve compliance with environmental law, are able to demonstrate financial capacity for rehabilitation, can prove technical ability and consulting with interested and with affected parties (Ledwaba, *et al.*, 2019). These conditions create further barriers to entry.

Host governments have generally given very low priority to formalizing and supporting the junior mining sector over the years (Kemp and Owen, 2019). Furthermore, unlike Canadian and Australian junior miners, South African junior miners do not actively participate on the ultra-high-risk stages of the mining life cycle (exploration and feasibility stages) (Figure 12). These stages are considered the embryo of the mining industry and if no immediate action is taken, this risk-aversion approach threatens the growth and sustainability of this sector.

Figure 13 summarises the dynamics of the mining industry from the global, regional and national perspective.

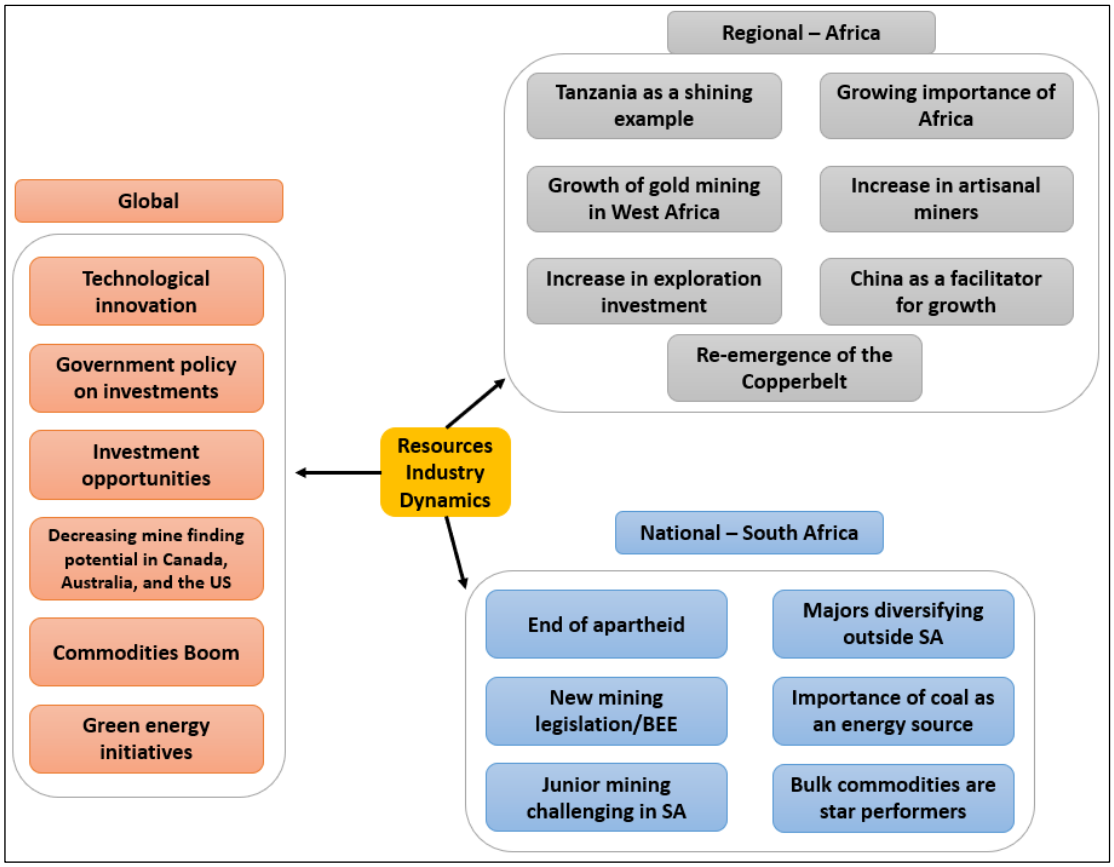



*Figure 14: Summary of the Dynamics of the Resources Sector*

### *2.6. Analysing the Challenges faced by South African Junior Miners*

Junior mining firms are confronted with a variety of challenges from the exploration phase right through to the start-up and growth phase, not only in South Africa but across the world (Mkubukeli and Tengeh, 2016). While small-scale mining has been explored from different perspectives, authors Hilson and McQuilken (2014) have examined support for small-scale mining entrepreneurs and found that despite small-scale mining being critical to rural economic growth, policy makers' perceptions of this sector has not changed. It could be argued that even after many decades, governments have not focused on understanding and supporting the sector therefore, Junior miners are losing prospects available to them.

There is consensus that a thriving junior mining sector is vital for the sustainability of the mining sector. To this extent, in South Africa, there have been claims of an outbreak in regulatory certainty, however the prospects of a successful exploration and junior mining sector is received with scepticism (Miller, 2019). Mutemeri and Petersen (2002) argue that effective participation of junior miners is hampered by their lack of relevant skills which include technical skills, business, finance and general management.

In addition, limited access to mineral deposits, access to financial markets and investments and strict regulations and policies have been cited as challenges facing the junior mining sector. While the government has received much criticism on the failure to create a conducive environment, it was noted that some of these hindrances have been inherited from the imbalances of the colonial and apartheid eras and continue to act as barriers, making entrance to the industry difficult.

In 2019, the Mineral Council of South Africa surveyed 17 Junior miner members on factors they perceived to be their greatest challenge. The results are as follows:

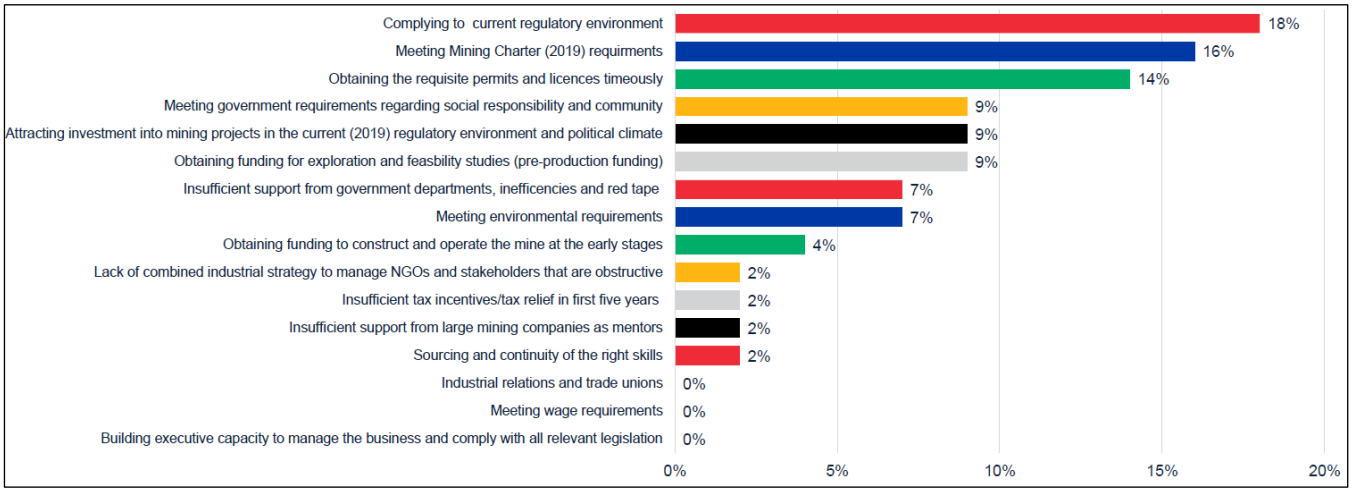



*Figure 15: Challenges Faced by Junior Miners in South Africa*

(Source: Mineral Council of South Africa)

The challenges recorded from the 2017 Minerals Council Survey (Figure 14), align with those raised by miners on the ground and documented in the 1998 White Paper. These can be grouped into five main themes namely:

(i) Access to mineral rights

(ii) Access to capital

(iii) Technology and skills

(iv) Access to a reliable and transparent Information System (Cadastre System)

(v) Institutional support

These challenges were identified during the consultation process and have remained the focus over the last two decades (Ledwaba, 2017). These are discussed further in the section that follows.

### *2.6.1. Changes in Government Policy – access to mineral rights and policy uncertainty*

In the past, the structure of mineral rights in South Africa followed a dual system where some mineral rights belonged to the State and some to private holders (Ledwaba, 2017). This structure, which was in accordance with the Mineral Act (MA) 50 of 1991 made it difficult for the majority of the

population to own or access mineral rights. In order to prevent private landowners from blocking mine development, the MPRDA Act 28 of 2002 (which regulates the extraction of mineral resources in South Africa) (Van der Schyff, 2017) abolished the MA principles. This decision effectively positioned the state as the custodian of South Africa's mineral and petroleum resources with a duty to administer resources for the benefit of all South Africans (Leyden and Leon, 2019).

With this act in place, the owners of surface rights have no claim to minerals found on the surface of their land. Instead, everyone who wishes to exploit mineral resources in South Africa requires permission from the DMRE. Permission may take the form of a prospecting right, a mining right, a retention permit or a mining permit (Leyden and Leon, 2019). The typical duration of validity for a prospecting right is up to five years and a mining right up to 30 years (Leyden and Leon, 2019).

According to the South African Government (2021), a mining right may be granted if the following conditions are in place:

- the mineral can be mined optimally
- you have the funds and expertise to conduct the proposed mining operation optimally
- the financing plan is compatible with the intended mining operation and for the duration thereof
- no unacceptable pollution or damage to the environment will occur as a result of the mining operation
- you have made financial and other provisions for the prescribed social and labour plan
- you are not contravening the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA)
- the operation is in line with the Mining Charter.

Prior to the establishment of the MPRDA Act (which took effect on 1 May 2004), there was little provision made for junior miners in South Africa. When the Act came into effect, all forms of mining activities were then recognised and acknowledged, including junior mining. However, the Act falls short on clearly distinguishing between the different categories of mining. Junior mining activities are accommodated in the form of a mining permit which is limited to optimally mining a commodity for a period of two years in an area which does not exceed 5.0 hectares (an increase from 1.5 hectares previously) (Ledwaba, 2017).

Acknowledging the limited scope associated with a mining permit (compared with a mining right), Scott *et al*., (1998) relays that the main concern for junior miners specifically pertains to qualifying for formal mineral rights, finding land or suitable deposits and complex administrative processes.

The MEPC conducted a study in which all operators (79 operations) that participated in the research shared the difficulties in accessing viable mineral deposits. The main reason shared was that LSM companies effectively controlled good potential deposits as part of their long-term production strategies (Scott *et. al.*, 1998). To this end, the following recommendations were gazetted as a means to address the issue of access to mineral rights (Ledwaba, 2017):

- Junior miners require information on the availability of mineral rights and mineral deposits
- Unfragmented and adequate information is required on mineral regulations, geology, mining and environmental aspects, and mineral marketing
- Regulations in respect of mining should be relevant, understandable, and affordable to the junior miner
- Administrative procedures need to be simplified and fast-tracked

These regulations follow a one-size fits all approach in that all miners (major and junior) are required to apply for a new mining right from the DMR every time they mine in a new area, and that process can take up to four years (Louw, 2019). Junior mining is regulated by the same legislation (i.e., for the environment, labour, mineral rights, exploration and mining permitting, and skills development) as large–scale mining. However, where junior miners are concerned, general compliance is low (Hilson, *et al.*, 2021).

Regulations for small scale diamond mining companies, are even more strenuous in that they typically only mine a portion of one farm. Ancient Rivers and terraces never followed farm boundaries, as such expanding the operations would mean extending onto the adjacent farm and that is particularly challenging because every new permit carries a cost of more than R500 000, which is a substantial amount for a junior miner (Louw, 2019).

According to Khumalo (2019) the one-size-fits-all approach, where all junior mining companies are required to comply with the same regulations as the big mining houses, is still the biggest challenge Junior miners face today. This statement is further supported by Errol Smart (CEO of Orion Minerals and chairman of the Minerals Council Junior and Emerging Miners' Leadership Forum), who contends the junior mining sector has to deal with rules and regulations developed for deep level gold mines more than 100 years ago (Louw, 2019). These regulations are backward looking and are yet to be adapted for a more inclusive mining environment.

The argument is not that regulations should not be followed but rather they are onerous for junior miners who face various challenges while striving to survive on limited resources compared with major miners. The regulatory and policy framework aimed at formalising the sector has struggled to

make inroads. The consequent lack of progress makes improvements to the livelihoods of junior miners and their dependent communities difficult to achieve (Hentschel, *et al.*, 2003).

Many of the potential economic benefits of the junior mining sector are lost through poor practice in mining, processing and marketing the target minerals. While South Africa has a world-class regulatory system, the challenge lies in that the regime is a one-size-fits-all system and is not fit for both junior and major mining companies (Mining Review, 2021). The absence of adequate legal frameworks and secure rights for miners and communities exacerbates this problem.

Local governance structures and institutions are typically underdeveloped. Junior miners are often marginalized and there can be very serious disputes with communities, government agencies and large-scale mining interests. In other parts of the world such as Canada and Australia, junior mining activities have been approached with at least the same importance as large-scale mining activities, particularly in terms of the numbers of people employed (Hentschel, *et al.*, 2003). As such, concentrated efforts on this sector, similar to the Canadian and Australian governance structures, would help sustain and grow this sector.

Gwede Mantashe, the Minister of Mineral Resources in South Africa, has on multiple occasions reiterated that the department is increasingly aware of the sector's importance in terms of poverty reduction and national income contribution. Furthermore, he has assured the sector of the commitment by the department to strengthen its administrative capacity to ensure transparency and short turnaround times for the processing of mining and prospecting licences (Mining weekly, 2020).

In a keynote address at the 2020 Junior Indaba in November, the Minister acknowledged that the future development and sustainability of South Africa's mining industry rested with junior miners. This was further affirmed through a target for South Africa to move from 1% of global exploration spend to 5% within the next five years. The Minister further stated that in Canada, the actual engine room for exploration is junior mining and that South Africa should revive sterile mines in addition to discovering new minerals (address by the Minister of Mineral Resources to the Junior Indaba, 03 November 2020) (Mining weekly, 2020).

In recent years, a number of governments have recognized the importance of the sector and have committed to facilitating a favourable environment in this regard. Despite these commitments, the implementation of legislation at a local level remains problematic and many miners do not have faith in the ability or commitment of their governments to provide assistance (Hentschel, *et al.*, 2003).

### *2.6.2. Access to Financial Markets*

The turn of the millennium saw many years of steady growths, however by the middle of the second decade, the global mining industry started experiencing a challenging economic environment. The challenges were driven by commodity price volatility and a sharp reduction in prices. A host of mining projects, especially those in the early stage of the mining lifecycle, battled to fund their capital investment needs since investors grew weary of the value the project would generate if commodity prices sustained their declining trajectory (Miranda, *et al.*, 2017). A simple representation of commodity price cycles is included below.

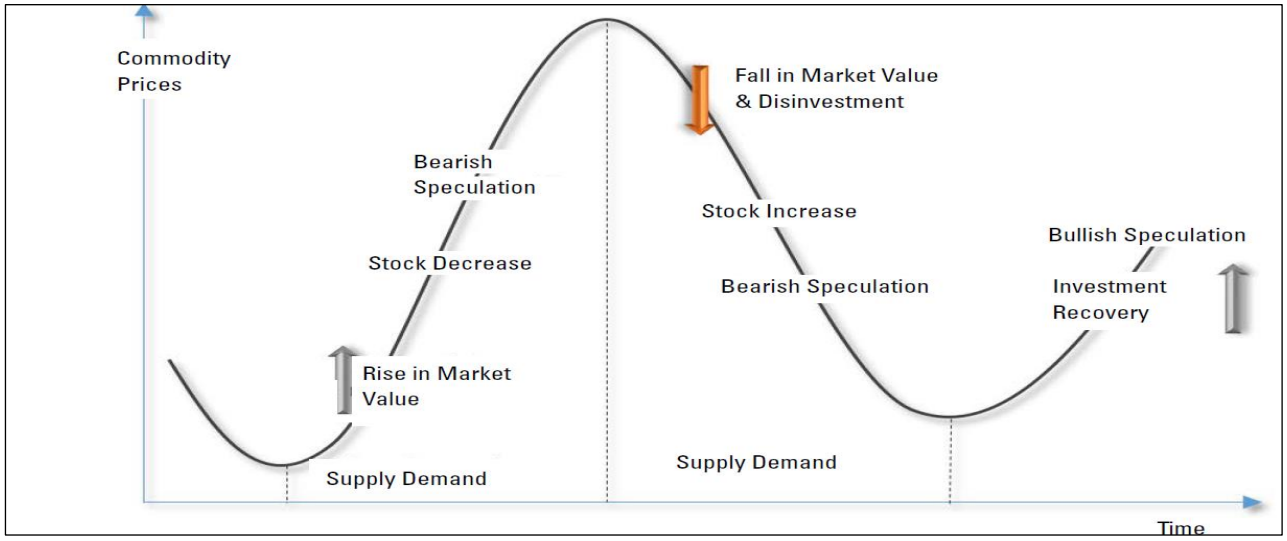



*Figure 16: Representation of Commodity Price Cycles*
(Source: Jegourel, 2018)

The cyclicity of global commodity prices presents a challenge to junior miners as the probability of a successful capital raise is significantly reduced during a downturn. In general, access to finance remains one of the biggest constraints to junior mining projects, especially for projects that are still in early exploration or development stages. S&P data show that SA's share of Africa's exploration budgets crashed from 35% in 2002 to 8% in 2018. It should be noted that during that period, the Mineral & Petroleum Resources Development Act (MPRDA) was already in existence. It had provided the industry with its first three Mining Charters, all aimed at creating a transformative and inclusive environment. After years of South Africa being seen as the preferred mining jurisdiction in Africa, five other African countries now attract more exploration investment than South Africa, namely: The DRC, Burkina Faso, Ghana, Ivory Coast and Mali (Miller, 2019).

In South Africa, investment funds are limited especially for junior mining ventures (Mothomogolo, 2012). Louw (2019) relays that investors are reluctant to pour money into any junior mining undertaking and would not even consider funding a greenfield exploration project. Many financing institutions consider junior mining projects as high risk and consequently reserve their participation

in such projects. Financial institutions that are willing to deal with junior miners tend to charge high interest rates. This challenges the viability of many projects (Hentschel, *et al.*, 2003).

Mining jurisdictions such as Canada and Australia, whose mining industries were once dwarfed by SA, today each attract approximately 14 times the total exploration spend of SA. These thriving junior mining and exploration regions benefit from investment incentives that not only serve to direct investment into smaller companies but also actively develop the public capital markets and attract a diversity of market participants. Canada is a prime example through its flow-through share scheme which affords retail investors generous tax incentives to invest and participate directly in the junior mining sector (Miller, 2019).

This model was introduced in 1958 and is designed to forego tax in favour of the investor. In simple terms, the investor concludes a subscription agreement with an operating company for the issue of and the subscription for a share called a flow-through share. The model of the flow-through share scheme is such that the investor is provided with all the rights they would have as an ordinary shareholder with the added advantage of the right to deduct exploration expenditure that would have been incurred by the operating company which thus reduces its normal tax liability (Moodley, 2021).

In the UK, capital gains tax advantages are available to retail investors in AIM (sub-market of the London stock market), which ensures the flow of capital to smaller companies. Smaller Australian companies benefit from initiatives like self-managed superannuation funds that encourage diverse participation in the public markets and from direct grants received from the Australian government to exploration companies (Miller, 2019).

These two examples provide the key to effective investment incentives. Incentives should be designed to benefit and develop the public markets while deliberately directing funding to smaller companies, including junior miners and explorers. Unfortunately, in SA the opposite is true at present. In the past 20 years, the sheer weight of regulation applied to the savings and investments regime has served to disincentivise direct investment in the public markets and has disadvantaged smaller investment management companies. It is well understood that large firms benefit from greater regulation at the expense of smaller firms, which simply don’t have the people or expertise to cope with the regulatory burden (Miller, 2019).

The Minerals Council of South Africa conducted a survey to identify the main impediments to attracting investment as perceived by junior miners. The results below are consistent with the narrative discussion of an unfavourable regulatory environment.

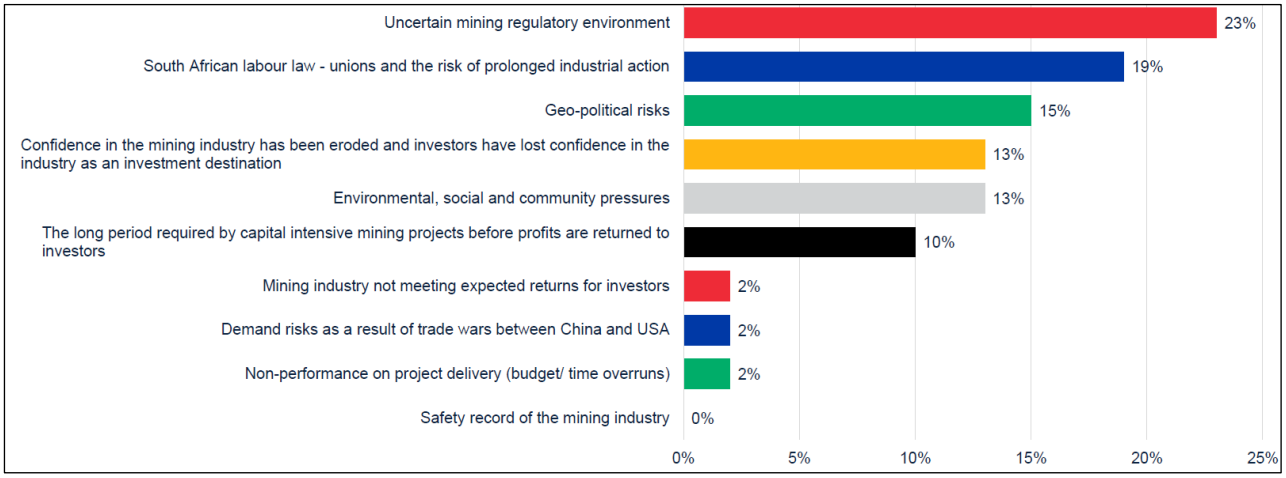



*Figure 17: Perceived Impediments to Attracting Investment by Junior Miners*

(Source: Minerals Council of South Africa)

The TSX in Canada, the ASX in Australia and the AIM market of the London Stock Exchange constitute the three most proven international junior mining public capital markets. These markets provide risk capital to all the world's geologically prospective countries provided they have investible policies in place (Mining Review Africa, 2020). Another key aspect for successful capital raising for juniors in these countries is that junior mining firms consult with advisors who have expertise in capital raising and debt advisory. The use of an advisor ensures that a firm positions itself in a manner that is relevant and desirable for investors, unlike in South Africa where most junior mining firms undertake to manage their own capital raising activities which has historically resulted in low success rates given the lack of relevant skills in this area.

Owing to the effectiveness of the three most successful stock exchanges for junior mining firms, an article published in March 2021 on 'Mining Review Africa' focused on the question of whether SA junior miners should consider listing on the JSE as a capital raising strategy. While investing in stocks is common practice in countries such as Australia where individuals are allowed to manage their own investment portfolios and pension funds, the same is not true in South Africa. Instead, individuals are, by law, required to use authorised financial service providers or advisors when making high risk investment decisions.

Therefore, a question on whether junior miners in South Africa can raise capital from the stock exchange is challenging to answer since, unlike in Australia and Canada, where there is a pool of investors ready to risk their money and there are tax incentives that draw individuals into investing in these mining jurisdictions, the South African capital market for junior mining investment is a "dead sector" according to Errol Smart (MD and CEO of Orion Minerals who also chairs the Junior and Emerging Miners Leadership Forum within the Minerals Council South Africa) (Kotze, 2021). The lack of investment incentives in South Africa has further exacerbated the lack of funding or

capital available for the junior mining sector (Kotze, 2021). Additionally, listing on the stock exchange has several constraining factors such as the level of responsibility, transparency and governance requirements (JSE, 2021). The JSE has sought to support the growth of small and medium sized businesses (including junior miners) by relaxing its requirements specifically relating to the appointment of a designated adviser for venture capital companies (VCCs). It has also indicated its willingness to engage with the junior mining industry to unpack its listing requirements and consider other barriers to entry into the market (Cavvadas, McFadden and Nhlapho, 2020).

The investor profile in South Africa has shifted and is now characterized by increasing risk-aversion, which is negatively affecting emerging markets. In addition to relatively high commodity-price volatility, the task of attracting investors in South Africa is made even tougher due to regulatory uncertainty and political instability (Goodman, *et al.*, 2019).

Even if SA succeeds in creating a regulatory and policy environment that supports junior mining and exploration, the local capital markets do not stand ready to provide the financial support that junior mining firms so desperately require to succeed (Miller, 2019). There is a need for an investor environment in South Africa that actively encourages exploration and welcomes the risk-takers and investors that have the vision to discover new deposits, whether small or large, and fund these during the highest risk stages of development. Compared to Australia, which has approximately 700 listed juniors and Canada's 1200 listed juniors, there are only 10 listed junior mining companies on the JSE (Cavvadas, McFadden, and Nhlapho, 2020).

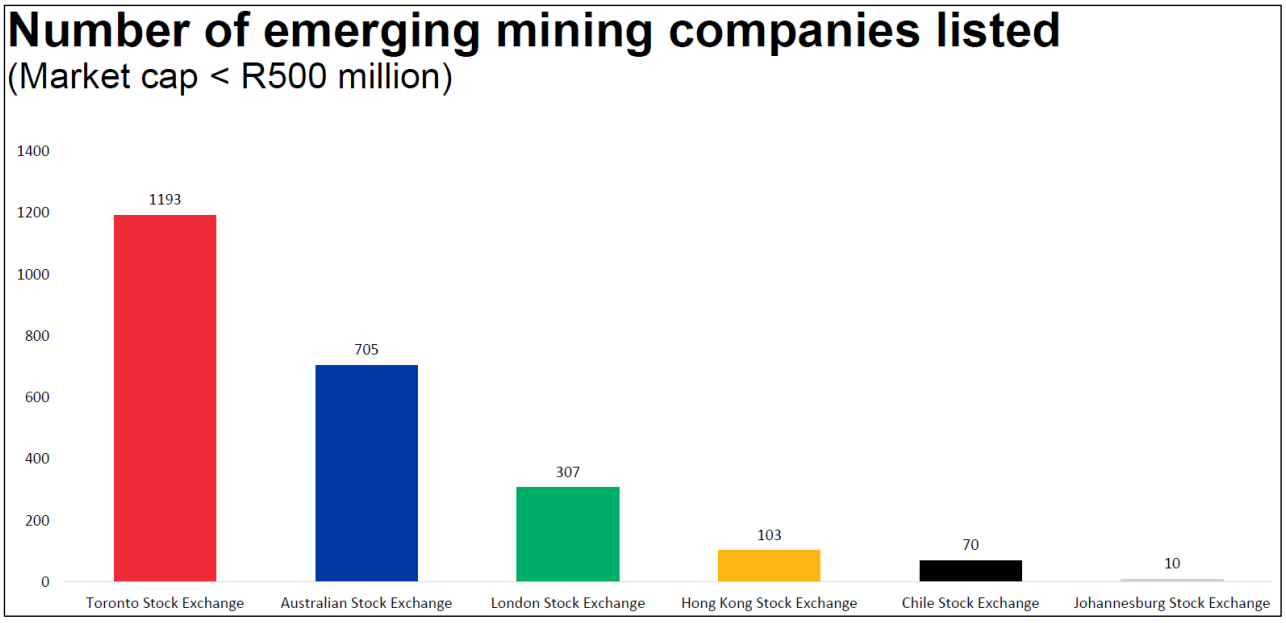



*Figure 18: Number of Emerging Mining Companies Listed*

(Source: Mineral council of South Africa)

### *2.6.3. Technology and Skills*

Generally, the junior mining sector in South Africa (and the rest of the African continent) is associated with low technology deployment. The operating model for junior miners ranges from rudimentary tools to mechanization on a limited scale. The operations are usually driven by manual labour with tools of the trade mainly being a pick and shovel (Ledwaba, 2017). The need for appropriate technology in the sector goes beyond improving operations to cost reduction which is a challenge for most junior miners who collectively earned a revenue of c.R55bn but also incurred expenses worth c.R55bn (Minerals Council of SA, 2018).

The technology and skills challenge has led to the outsourcing of contract mining services by junior miners for management functions as well as daily operations. Unfortunately, contract mining creates dependency and threatens the loss of intellectual property if contractors are changed during a project (Rupprecht, 2015). The outsourcing of mining activities may also escalate operating costs resulting in uncompetitive behaviour. The graph below shows the cost competitiveness of the South African mining sector per commodity (not an exhaustive list).

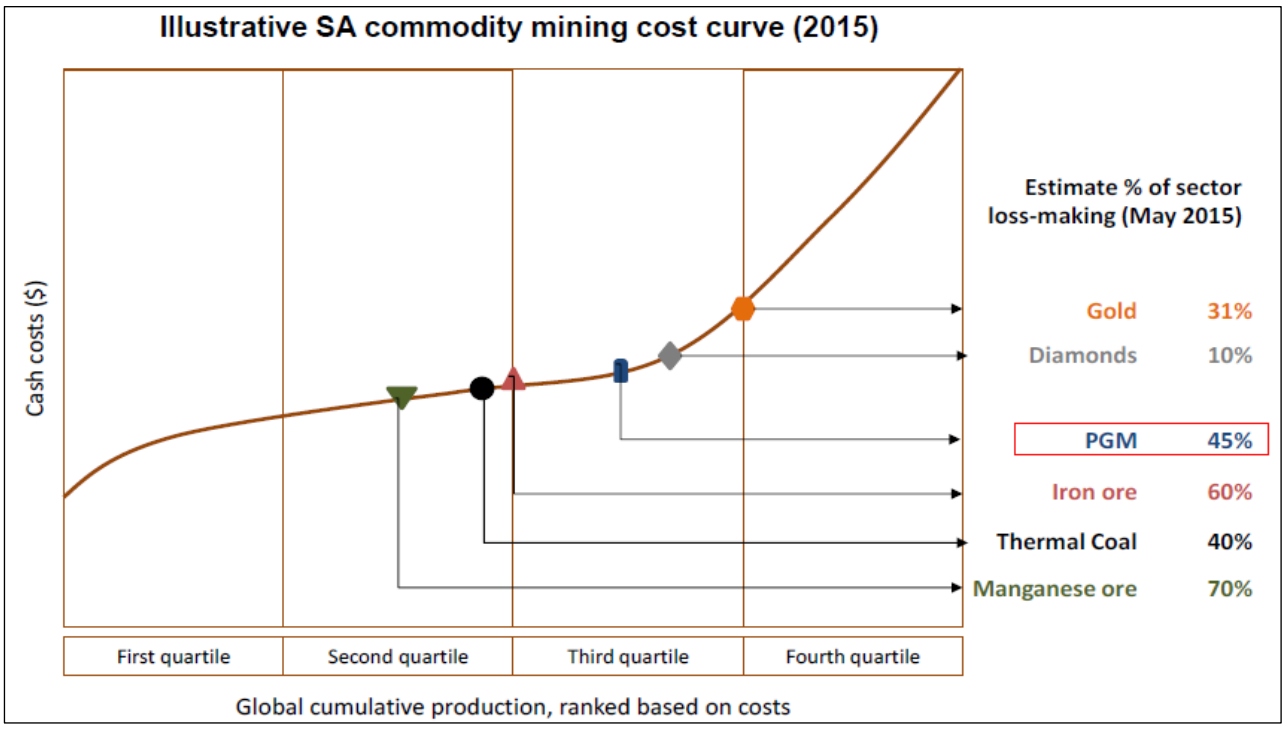



*Figure 19: SA Commodity Mining Cost Curve as at 2015*

(Source: Chamber of Mines member estimates, bank analyst estimates)

Technological innovations have played a part both in mineral discoveries and as a cost reduction strategy through optimal mineral extraction and processing techniques (Seeger, 2006). To this end, junior miners who can afford to adopt new technologies have the opportunity to differentiate themselves and compete more effectively.

### *2.6.4. Access to a Reliable and Transparent Information System – Cadastre System*

In SA, the policy environment is markedly different compared with other mining regions. The administration of prospecting and mining rights is not at all transparent and it is widely regarded as both incompetent and corrupt. This unfortunate perception of widespread incompetence and corruption is now supported by an increasingly large number of court documents. This is despite recent clean-up efforts where certain administrative offices have been summarily closed (Miller, 2019).

Junior miners often lack the necessary information specifically on the location of minerals, geology and mineral quality, technical mining and processing techniques, minerals marketing, regulatory and legislation issues, and compliance (Ledwaba, 2017). In an address during the 2021 Platinum Group Metals (PGMs) Industry Day conference, the Minister of Mineral Resources shared that the department's biggest concern was the lack of a functional, online mining cadastre system which is a crucial step towards data transparency (Stoddard, 2021). A cadastre system is a publicly accessible data room, which typically provides information on things such as existing mining rights, geological data and other data on land.

SA is the only top 10 African exploration country that does not have an accessible, online mining cadastre. The challenge is not due to a lack of skills, technology or expertise. In fact, seven of the other top 10 African mining countries, are using a Flexicadastre system which was developed in SA (Miller, 2021). The lack of such a system in SA is disappointing especially when contrasted against other African countries who are not as well developed. An example is The DRC (hardly famed for transparency in its resource sector) which has a functional and publicly accessible cadastre system (Stoddard, 2021).

The lack of a cadastre system has been flagged as a key concern among the investor community. This is one of the issues that South Africa has not managed to correct, and lack of transparency is sure to drive investors away, especially in a sector that already has a high risk on investment. In early March 2021, the DMRE said in a presentation to Parliament that it was working on replacing the current data system (SAMRAD) which was erratic and dysfunctional from inception over a decade ago (Kotze, 2021).

The DMRE had committed to a project timeline of six months to achieve this milestone (Stoddard, 2021). Additionally, the government had allocated over R268 million towards the establishment of a geoscience research library and for geological mapping aimed at improving the quality of geoscience information available for investors through the Council for Geoscience (Kotze, 2021).

### *2.6.5. Institutional support*

In an effort to facilitate the development of the junior mining sector, the government has in the past established several programmes that were designed to act as support structures. These included the National Small-Scale Development Framework (1999), National Steering Committee of Service Providers (NSC) (2000), Small Scale Mining Directorate (2004), and Small-Scale Mining Board (2006). The primary objective of the programmes was to provide technical, managerial, and financial support to junior mining projects (Dreschler, 2001& Mutemeri and Petersen, 2002).

In parallel to these government-led initiatives, other institutions such as the Mining Quality Assurance (MQA) introduced similar programmes to support the development of junior mining. The MQA partnered with key role-players to develop qualifications, learnerships, and skills programmes for junior mining projects (Solomons, 2012). While these efforts are commendable, the MQA has since discontinued the training programmes citing that its impact to the sector was unclear (MQA, 2014).

Despite various commitments from the government to support the junior mining sector in South Africa, a lack of effective support structures was identified as one of the most critical gaps and challenges faced by junior miners. The recommendation for functional support structures was made by the Mining, Minerals and Sustainable Development (MMSD) report. The report expanded further to call for partnerships between all relevant stakeholders including government bodies, academic institutions, private companies, donors and investors (Ledwaba, 2017).

The table below shows examples of programmes that were established to support the junior mining sector in South Africa.

*Table 5: Programmes that were Established to Support the Junior Mining Sector in SA*
(Source: Ledwaba and Mutemeri, 2018)

| Year established | Name of programme | Organisation | Objectives | Programme status | Activities and status |
|---|---|---|---|---|---|
| 2006 | Small Scale Mining Board (SSMB) | DMR and other stakeholders | To provide services required by the small scale mining sector. | Disbanded | About 171 projects were supported through the SSMB programme |
| 2005 | ASM Training School | Mintek | To provide outcome-based training to small scale miners. | Still exists | The training programme is accredited by the Mining Qualification Authority. Mintek has trained over 2500 people. |
| 2004 | Small Scale Mining Directorate | DMR and other stakeholders | To work in conjunction with the NSC to support the small scale mining sector. | Still exists | Currently provides non-financial support to ASM operators |
| 2002 | Small Scale Mining and Beneficiation division | Mintek | To support the SMME sector through research and development of relevant technologies and provide training. | Still exists | Mintek developed the iGoli technology to eliminate the use of mercury during ASM gold processing. |
| 2002 | Zenzele Technology Demonstration Centre | Small Enterprise Development Agency (SEDA) | To provide technical and research support to small scale mining and mineral-related enterprises. | Disbanded | Stopped operating in 2016 due to financial difficulties. |
| 2000 | National Steering Committee of Service Providers | DMR and other stakeholders | To identify potential small scale mining projects and provide support to produce viable projects | Disbanded | The disbanded in 2005 due to failure to produce viable projects. |
| 2000 | Small Scale Skills Development Programme | Mining Qualification Authority (MQA) | To administer skills development programmes in the mining sector (for both large-scale and small scale operations). | Still exists | The programme offers qualifications, learnerships and skills programmes to small scale miners. These trainings are implemented by several organisations e.g. Mintek. |
| 1999 | National Small Scale Development Framework | DMR and other stakeholders | To provide small scale miners with the necessary technical and financial assistance to ensure the success of their operations | Disbanded | |
| 1993 | Miningtek | The Council for Scientific and Industrial Research (CSIR) | To develop the mine plans and the technology for Small-Scale Mining Projects. | Disbanded | The formerly known Miningtek division at CSIR is now called the Mining Precinct which has been launched in 2016. The focus of the programme is still on mining technology. It is still unclear if whether it has specific projects on ASM. |
| 1999 | Minerals, Energy, Education Training Institute (MEETI) | Minerals and Energy Policy Centre | To provide training courses to small scale miners | Disbanded | |
| 1996 | Ntsika Enterprise Promotion Agency | | To provide non-financial support in the form of training and capacity building | Disbanded | Ntsika Enterprise Promotion Agency was merged with two other state-owned enterprises to form the Small Enterprise Development Agency (SEDA) which provides business development and support to small businesses. |

There has been reports that the South African government has committed to supporting exploration activities by means of an exploration fund. This junior miners' programme was launched by the DMR through a partnership with the Industrial Development Corporation (IDC) to provide exploration investment capital especially to black owned emerging miners (Cavvadas and Nhlapho, 2019).

This programme has various unknown variables such as the amount to be raised, the source of capital as well as the funding criteria to be applied when extending capital. It was understood that the private sector would be requested to assist through various contributions. The minister of the DMR further added that R20 billion has been dedicated as a national investment fund aimed to boost global investment in local exploration. This investment fund was said to be available over 10 years and will be used to assist South Africa to secure new resources for the purpose of economic development and growth, employment creation, and accelerating the transformation agenda (Cavvadas and Nhlapho, 2019).

Partnerships and collaboration are key to the prosperity of the junior mining sector because of the interrelatedness of challenges faced by all participants within the mining industry. A formal and coherent structure will address the needs of the industry thus resulting in a mutually beneficial and conducive environment.

**Concluding remarks on challenges faced by junior miners in SA**

In summary, the challenges faced by junior miners in South Africa manifests into an uneven distribution of mining operations as per the figure below. Ideally, host countries should consider the inclusion of junior miners in economic development programmes and policies so as to stimulate and support the junior mining sector. Unfortunately, in South Africa the profile of miners continues to be dominated by large-scale mining firms.

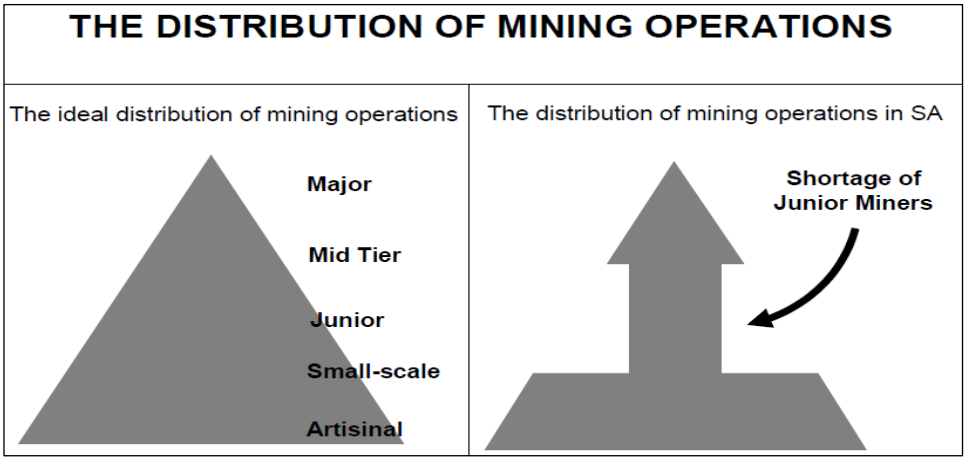



*Figure 20: Distribution of Mining Operations: Ideal vs South African Context*
(Source: Seeger, 2006)

### *2.6.6. Junior Mining Success Factors*

A distinguishing factor between countries that have a thriving junior mining and exploration sector is the role of government in recognising the value of investing significantly into their country's mineral endowment. Governments either do it themselves or lobby international organisations and investors to do it for them. This includes financially supporting primary geological research, regional surveys and mapping, and the curation of historical exploration data, which is then made freely available to all prospective explorers.

In SA, there has been encouraging talk on the Council for Geoscience to receive funding of R268 million towards the establishment of a geoscience research library and for geological mapping (Kotze, 2021). If implemented, this will go a long way towards availing geological data that will stimulate a culture of exploration and new mine development in the South African junior mining sector.

Once junior miners have access to relevant geological data, the next important factor is ensuring access to finance and investment. Any prospects of a thriving junior mining sector are easily diminished by a lack of funding. The government has an important role to play in stimulating a culture of saving and investment through favourable policies and investments with the aim of encouraging a diverse investor profile comprising of both local and international investors.

Another success factor suggested by Hentschel *et al.* (2003) is the adoption of collaborative approaches between Majors and Juniors. It would be productive to foster such relationships that would favour all stakeholders across the mining project value chain. A number of successful relationships have been established before, including the Ingwe coal mine in South Africa, the Gold Fields project in Ghana, and Placer Dome's programme in Venezuela (Hentschel, *et al.*, 2003).

In conclusion, South Africa's mining industry is locked in an old paradigm characterised by rapid contraction with a consequent loss of jobs. Present policy is detrimental to the mining industry, unsupportive of exploration, discovery and new mine development, and 'negative' to new investment. The mining sector requires an internationally competitive mining policy environment overseen by competent administrators using world-class systems.

South Africa can adopt lessons from Canada and Australia whose policy environment is not shaped by bargaining between incumbent major mining companies and the government. Instead, mining policies are the outcome of a process undertaken by technocrats who consider the jurisdiction's unique circumstances as well as appropriate international precedent and expert advice. Healthy synergies are required between junior explorers and developers who can identify new deposits and large mining companies that can develop large capital-intensive mine projects. This will assist South

Africa to fully realise its exceptional mineral wealth while simultaneously supporting job creation and economic growth.

## *2.7. Distinguishing Junior Miners by means of a Conceptual Framework*

### *2.7.1. The Case for a Risk Management Model*

An article published by Atkinson *et al.* (1997) outlined the increasing need for mining projects to focus on the risks of projects. The objective was to focus on risk management for mining projects, a topic which has guided the conceptual framework adopted in this study. The unique context of each mining operation along different stages of the mining lifecycle (as per the figure below) dictates the type and impact of risk. As such, risk mitigating factors should be tailored accordingly (Gordon, *et al.*, 2018). Each mining project and the associated risks should be viewed in their full context to assess the financial, technological, social, political and environmental drivers of risk in their entirety.

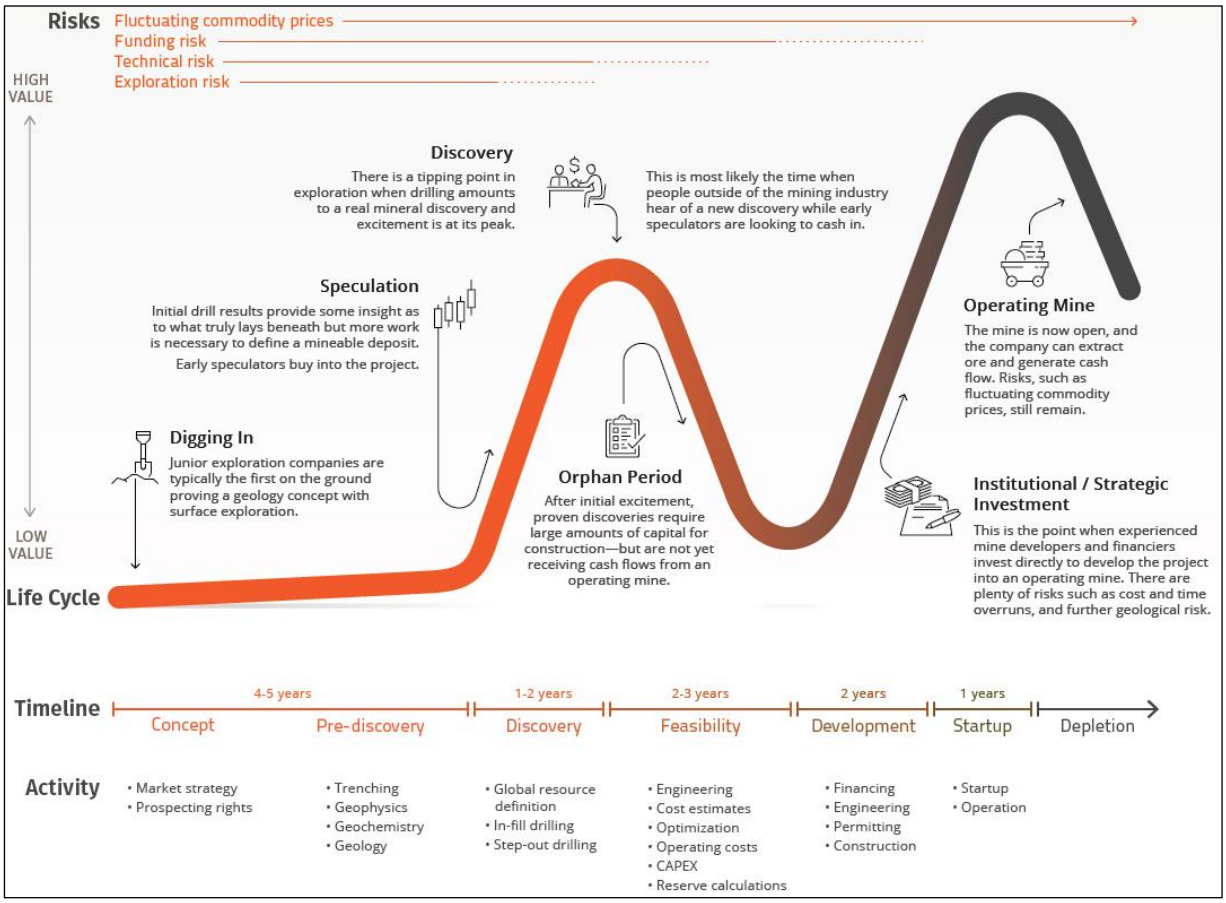



*Figure 21: The Lifecycle of a Mineral Discovery*

(Source: LePan, 2019)

The mining project value chain highlights the activities and average timeline spent in each stage. Evidently, mining projects have long lead times with the effective risk exposure decreasing through the progression from one stage to the next. Junior mining companies are mostly active in the ultra-

high-risk zones such as exploration and mineral discovery through to conducting feasibility studies. These zones require high capital exposure before the investor can yield returns (Seeger, 2006).

Contrary to most junior mining firms, major miners participate primarily in the higher capital, lower risk and lower asset value growth zone of development and production (Seeger, 2006). The table below provides the current classification of small businesses that partake in mining and quarrying activities as set out in accordance with the National Small Business Amendment Act, No. 25 of 2003. The classification is done in accordance to revenue, number of employees and asset value.

*Table 6: Classification of Small Business - Mining and Quarrying in South Africa*

| Size category | Full-time employees | Total annual turnover | Total gross asset value (excl fixed property) |
|---|---|---|---|
| Medium | 200 | R 39 million | R 23 million |
| Small | 50 | R 10 million | R 6 million |
| Very small | 20 | R 4 million | R 2 million |
| Micro | 5 | R 0.2 million | R 0.1 million |

(Source: National Small Business Amendment Act, No. 25 of 2003)

The Companies Act of South Africa has defined junior mining in accordance to the following model:

*Table 7: Defining Junior Mining in South Africa as per the Companies Act*

| | Prospectors (exploration) | Mine developers (from emerging mine sector) | Micro mining enterprises | Miners | | Large-scale mining enterprises |
|---|---|---|---|---|---|---|
| | | | | Small-scale mining enterprises | Medium-scale mining enterprises | |
| **Definitive criteria 1** | Prospecting right holder | Mining right holder | Mining right or mining permit holder | Mining right or mining permit holder | Mining right holder | Mining right holder |
| **Criteria 2** | | 5 years mining right until mine has positive revenue | Revenue in past tax year <R10 million | Revenue in past tax year of R10 to R50 million | Revenue in past tax year of R50 to R500 million | Revenue in past tax year >R500 million |
| **Criteria 3** | | | <150 employees | <250 employees | <500 employees | >500 employees |
| **Criteria 4** | Companies or any controlling shareholder* that does not have revenue generated from other mining rights | Companies or any controlling shareholder* that does not have revenue generated from other mining rights which when aggregated exceeds R500 million | Companies or any controlling shareholder* that does not have revenue generated from other Mining Rights which when aggregated exceeds R500 million | Companies or any controlling shareholder* that does not have revenue generated from other Mining Rights which when aggregated exceeds R500 million | Companies or any controlling shareholder* that does not have revenue generated from other Mining Rights which when aggregated exceeds R500 million | Companies or any controlling shareholder* that does not have revenue generated from other Mining Rights which when aggregated exceeds R500 million |
| **Compliance Element** | Full exemption | Partial exemption | Full exemption | Partial exemption | Partial exemption | Full compliance |
| **% of Mineral Council Junior members per category** | 35% | | 18% | 18% | 30% | 0% |

(Source: Minerals Council of South Africa)

Mutemeri and Petersen (2002) are scholars who have also provided a model for classifying Mining and quarrying operations as set out in the table below.

*Table 8: Scholarly Classification of Mining and Quarrying Operations*

| Category | Micro Class 1 | Very Small Class 2 | Small Class 3 | Medium Junior Class 4 |
|---|---|---|---|---|
| Number of employees | <5 | <20 | <50 | <200 |
| Assets (property excluded) | <R100 000 | < R 1.8m | < R 4.5m | <R 18m |
| Annual Revenue | <R 150 000 | < R 3m | < R 7.5 m | <R 30m |
| Description of operation | Commonly informal (i.e. not registered for purposes of mining, taxation or labour legislation. Commonly part-time. | Locally based producers. | Provincially based producers. | South African based contractors, production and exploration companies. |
| Level of technology and mechanization | Artisanal, rudimentary and non-mechanised equipment. | Simple technology, simple mechanised equipment. | Low to medium technology and levels of mechanisation. | High levels of technology and mechanisation. |

(Source: Mutemeri and Petersen, 2002)

The metrics in the model provided by scholars Mutemeri and Petersen (2002) is consistent with the model that has been presented by the National Small Business Amendment Act and the Companies Act. The models' approach the classification of mining and quarrying firms primarily from a revenue, employment, and asset value perspective. The Companies Act also include compliance level while Mutemeri and Petersen (2002) expand further to differentiate the classes from a technology level perspective.

Literature addresses various models of defining junior mining however, there is none that fully incorporates the elements of varying mining risk along the mining lifecycle. This critical gap is addressed through this research which has adopted a risk management theorical approach, specifically risk profiling.

The objective of any risk management process is to optimise potential opportunities and minimise adverse effects to achieve a favourable outcome (Owen, 2010). Risk management provides an alternative lens to understanding and classifying small businesses within the mining industry by way of characterising their unique risk profile along various stages of the mining lifecycle. The risk management approach adopted is in accordance to the PMBOK Guide which refers to the "systematic process of identifying, analysing, and responding to project risks" through the coordination of resources and activities (Project Management Institute, 2017).

The ISO 31000:2009 process describes risk management through a flowchart as depicted below.

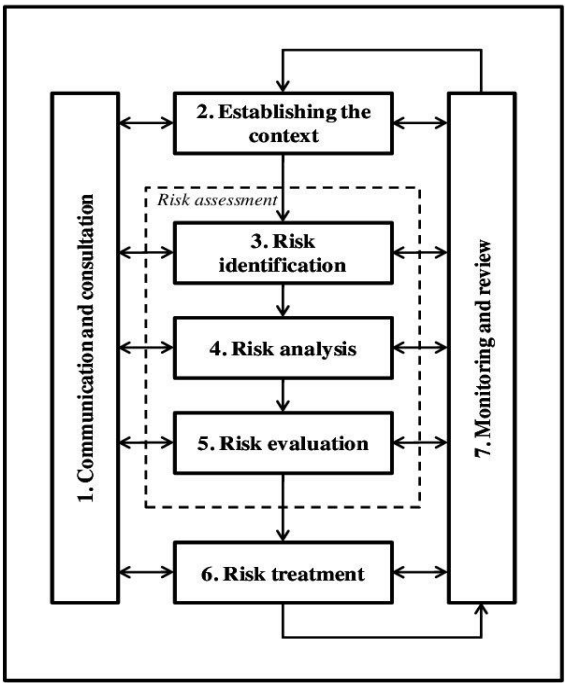



*Figure 22: ISO 31000 Risk Management Process*

(Source: ISO, 2009)

The ISO 31000 model was deemed applicable on the topic of risk management in mining projects. The model approach seeks to provide a generic risk management framework that can be adopted for different problem scope and subsequently applied to different industries (Oehmen, Ben-Daya, *et al.*, 2010). The model is a seven-step process starting with communication and consultation; establishing the context; risk identification; risk analysis; risk evaluation; risk treatment; and concluding with the monitoring and review process.

The first two steps of a risk management process pertain to effectively engaging with stakeholders so as to establish a holistic context (both internal and external) which describes the boundaries of the scope of analysis. Part of this stage requires the accurate consideration of various criteria against which the risk(s) will be assessed. Upon successful establishment of the risk context, the next steps require the identification, analysis and evaluation of the risk(s) concerned. This includes listing specific details about the risk(s) such as ‘what’, ‘where’, ‘when’, ‘why’ and ‘how’ the occurrence of particular events could prevent, delay, degrade or enhance the achievement of organisational goals and objectives. Risk analysis pertains to the determination of the likelihood and consequence of the associated risk(s) as well as identifying and evaluating existing controls within the organisation (Owen, 2010).

The objective of the risk evaluation step is to consider the balance between potential benefits and adverse outcomes by comparing the estimated level of risk against set criteria. Once the risk is

understood, the organisation develops and implements action plans and specific cost-effective strategies which are decided upon based on the likelihood and severity of each risk occurrence. This is done to protect the organisation from adverse impacts and maximise any potential benefits for the organisation (Owen, 2010). The foundation and success of the risk management process relies upon communication and consultation with stakeholders as well as monitoring and reviewing the effectiveness of each step and action plan.

### *2.7.2. Risk Profiling Approach*

Risk profiling is a concept that is popularly used across fields such as statistics & insurance, banking & investments (finance), and healthcare. Risk profiling refers to an evaluation process that is aimed at identifying and analysing the types of risks (threats) to which an organisation, project, and/or individual is exposed to (Rouse, 2013). Once a risk profile has been developed, a decision is made based on the willingness and ability an organisation has to accept the risks (Barone, 2019).

A risk profile is created when the following factors intersect: (1) risk capacity (the risk you can afford to take), (2) risk tolerance (the risk you are prepared to take), and (3) risk appetite (the risk you need to take) (DSP, 2017). While the goal of risk profiling is to provide a non-subjective understanding of various risks, it should be noted that risk profiling includes both tangible and intangible threats and thus is not an exact science but rather an accurate assessment of the risk environment within which an organisation operates from (Rouse, 2013).

The development of a risk profile requires the identification of risks to which an organisation is exposed with a clear distinction made between systematic risk (non-diversifiable) and non-systematic risk (diversifiable risk). In this research, the factors that define a junior miner will be specific mining risks along the five stages of the mining lifecycle. As per the ISO 31000 risk management process, the risks will be identified, analysed and evaluated in the data collection and data analysis process.

Following the risk identification and analysis stage, junior miners will fall into six distinct risk categories that exhibit the following risk behaviour (Canaccord):

(i) Conservative
(ii) Moderate
(iii) Balanced
(iv) Growth
(v) Aggressive
(vi) Very Aggressive

### *2.7.3. Risk-adjusted Framework Model*

The problem underpinning this study can be best described using a conceptual risk management framework. Grant and Osanloo (2015) concede that a theoretical framework is a guide for research which is based on an existing theory in a specific field of inquiry. Secondary data from wide sources have formed the basis of literature. These have been critically reviewed and serve as a lens to identify prevalent risk exposures within mining industry from exploration to rehabilitation of a mining site.

Review of existing literature revealed the models that are currently used to define junior mining in South Africa. Current existing models neglect the important component of mining risks when distinguishing between different levels of miners. In the absence of such a risk management framework, the author has a proposed a conceptual framework model (as per figure 21) that which will be tested and validated through qualitative reasoning techniques.

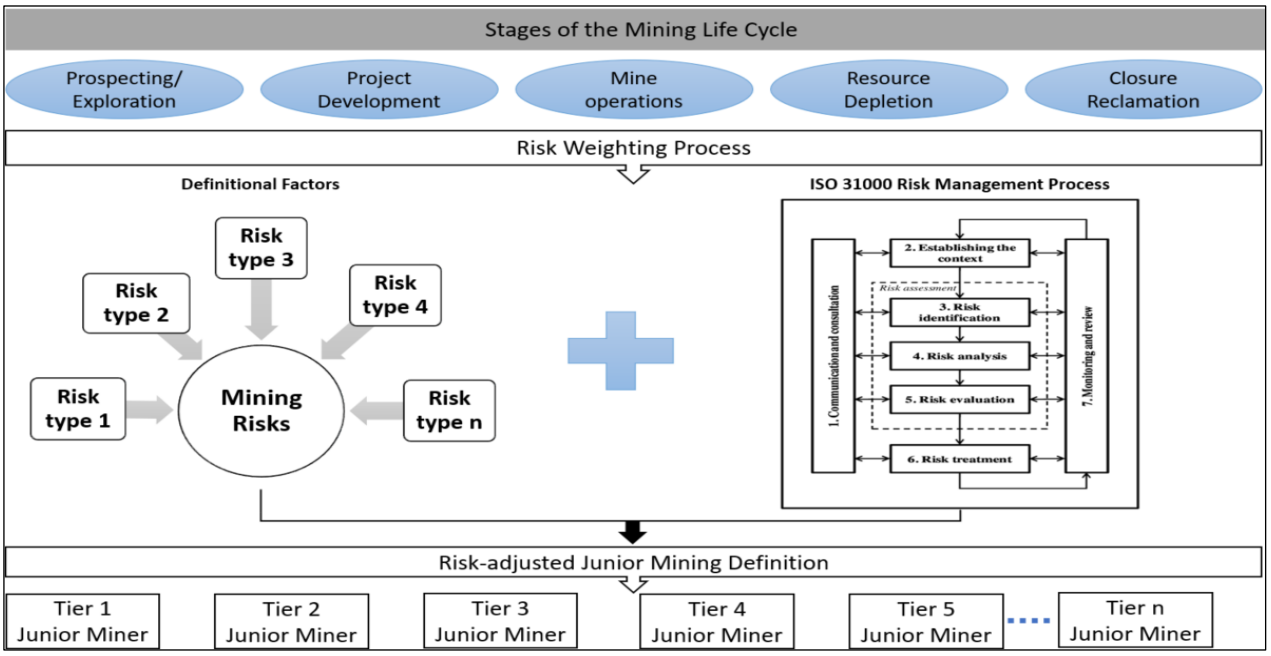



*Figure 23: Initial Conceptual Framework*
(Source: Author)

The initial conceptual framework for defining junior miners has been designed and proposed from preceding literature. The framework suggests that given the unique mineral characteristics that define each mining project, definitional factors (in the form of mining risks) can be applied to arrive at a risk profile for a junior miner. This framework considers a risk-adjusted approach and has been designed to be dynamic so as to allow a universal application through adapting the definitional factors.

The next chapters will focus on testing the framework following which a revised, final framework will be presented.

# CHAPTER 3

## 3. RESEARCH METHODS

### *3.1. Qualitative Reasoning*

Scientific inquiry and applied research is based on theorical ideas which are used to lay the canvas and contextualise the research topic based on existing scholarship with the aim of improving our understanding of a problem or phenomena (Corbin and Strauss, 2008). Empirical evidence then enhances, supports, confirms, or disconfirm the theories and ideas (Van de Ven, 2007) associated with the phenomenon in question. Different methods of data collection and analysis are selected based on their relevance on the research questions and objectives. Eisenhardt (1989) and Yin, (2003) have provided scholarship on initiating, displaying and analysing, data obtained from sources such as documents, archival records, interviews, direct observation and physical artifacts.

The two main research design approaches that can be adopted are qualitative and quantitative methods and are usually juxtaposed as representing two different world views. Qualitative and quantitative methods can be applied separately or together (mixed method), depending on the research question and objectives (Chan and Mazzocco, 2021). While it is possible to combine the two methods in the same study, this approach is challenging, and great care should be taken to ensure that the theory behind each method is compatible, and the methods are fit for purpose.

The use of quantitative research methods is appropriate when the data required to answer the research question is verifiable through measurement and observation. The implementation of this method is through control variables that can be isolated and defined (Hammarberg, Kirkman, and de Lacey, 2016) and are carefully measured by the researcher to determine the objective reality of a phenomenon being studied. In the quantitative approach, cause and effect can be determined, and the results can be generalized to other similar cases thus lending itself to be seen as the objective discovery of truth, and the investigator is the impartial discoverer of these truths (Brinkmaan, 2020).

In contrast, information that is difficult to obtain through a quantitatively oriented approach defaults to qualitative reasoning which was introduced by De Kleer (1975). This concept is widely adopted in research studies as a means to develop representation and reasoning techniques without necessarily using precise quantitative information (Homem, *et al.*, 2020). Nkwi, Nyamongo, and Ryan (2001) assert that “qualitative research involves any research that uses data that does not indicate ordinal values.” The defining criterion from the perspective of these scholars is the type of data generated and/or used. This includes understanding the meaning that people have constructed as well as different perspectives based on unique lived experienced, most often from the standpoint

of the participant (Merriam, 2009 and Parkinson & Drislane, 2011).

The approach described above allows for the inclusion of various kinds of data collection and analysis techniques, as well as the diversity of theoretical and epistemological frameworks that are associated with qualitative research. Quantitative circles critic this research approach because of the limited population sample which may not be representative of the broader population. Furthermore, this research design is not seen as objective because of researchers' own experiences, biases, and personal philosophies (Homem, et al., 2020).

The objective of this research was to understand and describe the junior mining landscape in South Africa through the development of a conceptual framework using a risk-based classification approach. This was achieved through a structured and systematic inquiry. To this extent, the study was of an exploratory nature thus lending it towards a qualitative design approach. Given the nature and characteristics of qualitative research, a successful study using this research design method requires a questioning stance, that is the proposition of "what" and "how". Further to that, a qualitative inquiry requires a high tolerance for ambiguity and careful observation (Merriam and Tisdell, 2015 & Sunjka and Sklar-Chik, 2012).

Owing to the explanatory nature of this research study, a qualitative approach was be adopted. Bias was minimized by way of a standardized interview process to ensure that interview questions follow a similar order as much as possible. The figure below shows the typology of qualitative research.

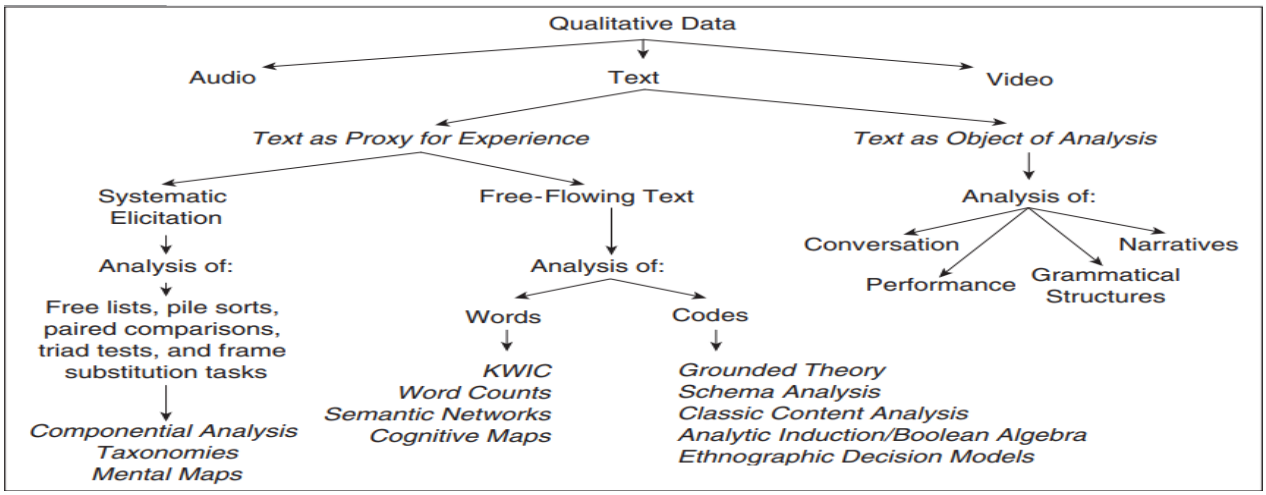



*Figure 24: Typology of Qualitative Research*

[KWIC = key words in context] (Source: Ryan and Bernard, 2000)

The datasets represented in figure 22 are usually not amenable to counting or measuring.

### *3.2. Methodological Design*

The objective of this research study was to understand the risk profile of junior miners in South Africa by developing a conceptual risk-adjusted framework which can be used to classify junior mining firms into various categories based on their unique risk profiles. Qualitative research can be identified through four characteristics namely:

(1) focusing on the process, understanding and meaning;
(2) the researcher is the primary instrument of data collection and analysis;
(3) the process is inductive; and
(4) the product is richly descriptive.

The use of a qualitative approach was motivated by professionals such as scientists and engineers who usually resort to qualitative reasoning when initially understanding a problem. Ryan and Bernard (2000) presented a model which can be used when conducting and analysing a qualitative type of inquiry. The most notable theories are listed below:

1. Grounded Theory
2. Schema Analysis
3. Classic Content Analysis
4. Analytic Induction/Boolean Algebra
5. Ethnographic Decision Models

This study drew from the above techniques as a means to identify themes and patterns, which is one of the most fundamental techniques in qualitative research.

The data collection method was via semi-structured interviews which were later transcribed to analyse the text so as to (1) discover themes and subthemes, (2) winnow themes to a manageable few (i.e. deciding which themes are important to consider), (3) build hierarchies of themes or code books, and (4) link themes to theoretical frameworks and models. Grounded theorists refer to the act of discovering themes as ‘open coding’ and while classic content analysts refer to the same as qualitative analysis (Berelson, 1952) or latent coding (Shapiro and Markoff 1997).

Opler (1945) established three principles for thematic analysis. The first one involved the observation that the discovery and visibility of themes manifests in the expression of data and that expressions are meaningless without if no reference to themes are made. The second principle was that “expressions of a theme are obvious and culturally agreed on, while others are subtler, symbolic, and even idiosyncratic”. The last principle observed by Opler (1945) was that cultural systems generally tend to comprise of sets of inter-related themes.

According to Opler (1945) when analysing data to identify themes, it is important to note the frequency with which a specific theme appears and the level to which it is pervasive across different types of ideas. Equally important to note is how people react when a specific theme is violated and the degree to which a theme's expression is influenced and controlled by specific contexts (Ryan and Bernard, 2000).

Themes are abstract constructs that present themselves in various forms. They originate both from the datasets (i.e. an inductive approach) and from the investigator's prior theoretical understanding of the subject matter under study (a priori approach). Bulmer (1979), Strauss (1987) and Maxwell (1996) concede that a priori theme emanates from various angles such as the characteristics of the topic being studied, from already agreed upon professional definitions highlighted in the literature review, from local, common sense constructs, and from researchers' personal experiences and theoretical orientations. Strauss and Corbin (1990) referred to this as theoretical sensitivity.

The decision over the topics to be covered in an interview and the best query method thereof is a rich source of a priori themes (Dey, 1993). While the first themes are often generated from the questions in an interview protocol (Coffey and Atkinson, 1996), most themes are induced from empirical data. Even when an investigator has conducted a thorough and exhaustive literature review, one cannot fully anticipate all the themes that arise post interview data analysis.

### *3.3. Interview Methodology*

Based on the nature of this study, a semi-structured interview questionnaire was developed in accordance to the conceptual framework. The questionnaire served as an interview guide while taking into account the various definitional risk factors and characteristics of mining entities along the mining life cycle. This data collection instrument was used to gather perspectives on the current state of the junior mining industry in South Africa from experienced professionals.

The use of an interview in a scientific research process has to do with gathering information for the purpose of better understanding a particular subject or topic. Wengraf (2001) argues that 'semi-structured depth interviews' revolve around the interviewer in a process of both model-building and model-testing so as to construct and verify theory either from the same session or from a series of sessions. For the purpose of this study, the interview session with each participant was in the form of a single session for approximately 1-hour. The Briggs-Wengraf Mode as set out below provides a guide in terms of the design and use of interviews in a research process (Wengraf, 2001).

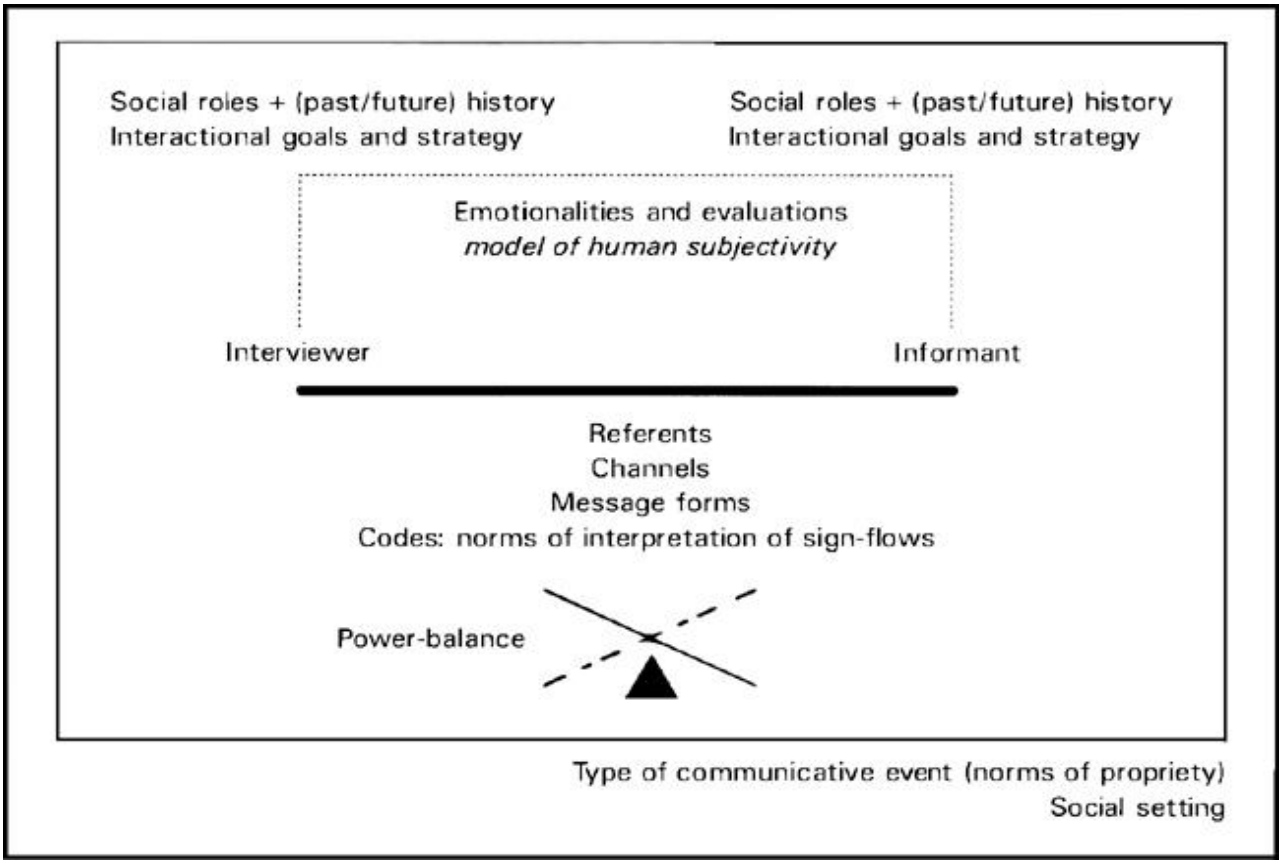



*Figure 25: Conceptual Frameworks for Studying and Inferring from Interview Interaction Practice*

(Source: Wengraf, 2001)

According to the Briggs-Wengraf Model, the interview process as it relates to a research study is affected by various components, the first of which being the 'Social Setting'. This refers to factors such as the location, type and time of day, social constraints, physical and social arrangements and any possible interruptions that may arise during the course of the interview (Wengraf, 2001).

The social setting consideration is especially crucial during the period of this research study since the world is currently battling with the corona virus pandemic. Initially, the semi-structured interviews were planned to be conducted on a face-to-face basis, however, given the Covid-19 pandemic health and safety regulations which prohibit 'non-essential' gatherings other than for economic purposes, the interview with the participants was conducted via digital platforms (Microsoft Teams and Zoom).

The second consideration relates to the type of communicative event with norms of propriety. This component is about the construct of the two parties (i.e. researcher and informant) and how they may each view it very differently. For example, the semi-structured depth interview may be viewed as a professional operation for the researcher while the informant may view the process as a social event. The next component, 'Social Roles and Past/Future History', is about the question of social

roles which has been designed to emphasize that both the researcher and informant participate in the interview with positive and negative personal history that may be similar or different and may affect the interview outcome (Wengraf, 2001).

The researcher and informant may have different goals and strategies for the interview that will in turn affect how the interview proceeds and the outcome thereof. While each participant may come with different goals and emotions about the subject, it is important to note that these are not fixed and may be adjusted depending on the interaction between the two parties. The interaction during the interview may be affected by power-knowledge, domination and resistance which should not be overlooked (Wengraf, 2001).

Finally, the subject of referent and channel are perhaps the most crucial to ensure accuracy in decoding the information that is being transferred across the parties. The topic on referent is important since there may be more than one referent, even though only one may be explicit. To avoid ambiguity and ensure data accuracy, the researcher should ensure clarity at all times during the interview process. In terms of the channel, while only spoken words may be transcribed, the researcher should pay attention to ironical tones and non-verbal communication that may occur (Wengraf, 2001).

### *3.3.1. Interview Participants*

This research made use of purposive sampling methods to access a relevant subset of professionals which are involved within the Mining Industry from various roles. The maximum variation technique was used to ensure that data was collected from all available angles thereby achieving a greater understanding of the subject (Wengraf, 2001 & Etikan, 2016).

The population under consideration was heterogeneous and ranged across different professionals within the mining industry. The informants were selected based on their experience and involvement within the mining industry and mining-related activities. Generally, informants with more than five years' experience were preferred with the assumption they are subject-matter experts. To this extent, the population sample included managing directors, engineers, finance professionals, mining consultants and academics who have conducted relevant research within the mining industry.

The sampling population was intentionally designed to be as diverse as possible to ensure the richness of views and insights collected. This approach followed the purposive sampling method which is a technique in which the researcher relies on their sound judgement when selecting a sample.

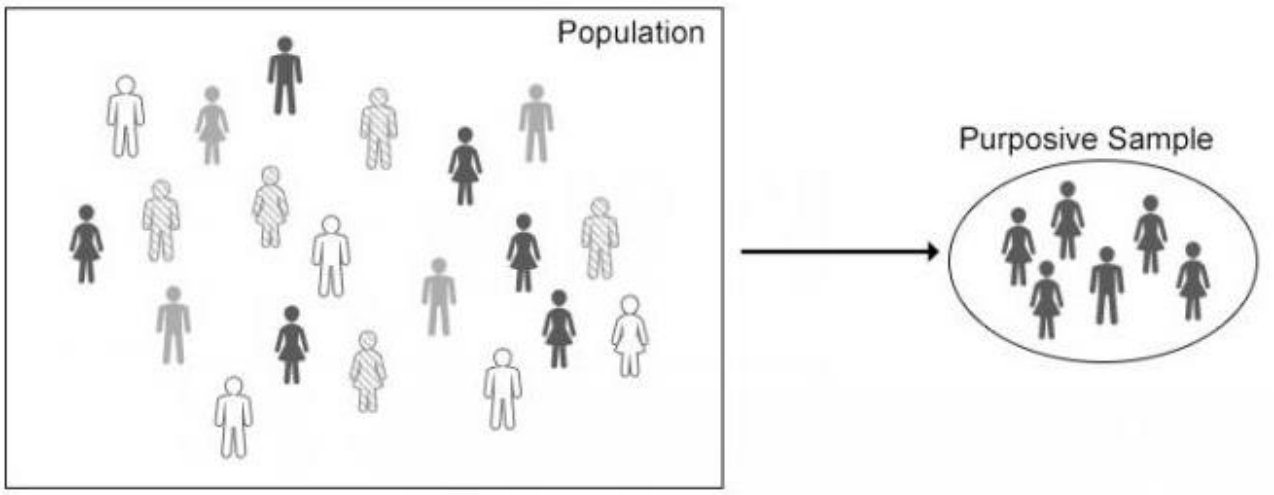



*Figure 26: Purposive Sample Method*

(Source: Saunders, *et al*, 2012)

This is a non-probability sampling method and is effective for achieving a manageable amount of data especially in qualitative synthesis where saturation is present (Morse, 2015). Scholars such as Glaser and Strauss (1967) have studied the phenomenon of saturation and have defined it as "The criterion for judging when to stop sampling…". This refers to a point in qualitative data collection where no additional, new data is found.

Saturation is a deductive approach where codes and/or themes emerging from a data sample are adequately represented. A number of articles and book chapters provide guidance on the sample size which ranges from 5 – 50 participants. This study consisted of 13 subject matter experts who were selected based on their deep knowledge and understanding of the mining industry. The sample size was deemed to be sufficient as per Huberman and Miles (2009) who suggested that involving more than 15 participants can make the data analysis complex and "unwieldy". Given the size and heterogeneity of participants, the researcher is confident that saturation point was reached in the data collection process.

### *3.3.2. Interview Questions*

Seidman (2012) asserts that interviews have a wide range of applicability as a data collection instrument for qualitative research. Research interviews are broken down into three fundamental types. Namely:

(i) Structured
(ii) Semi-structured and
(iii) Unstructured

Structured interviews are verbally administered questionnaires with a list of predetermined questions. They are standardised, closed-type questions with little to no variation and with no scope. As such, they are relatively quick and easy to administer and may the preferred type when clarification of certain questions is required. The answers are usually constrained to limited options and are, therefore not useful if 'depth' is required.

In contrast, unstructured interviews do not reflect any preconceived theories or ideas and are performed with little or no organisation (Morse, 1991). Such an interview consists of open-ended questions which provide limited guidance and will progress based on the initial response. Given that various participants will share different answers, usually based on their lived experience and knowledge, these types of interviews require an experienced interviewer as they can be difficult to manage and are time-consuming. The relevance of such interviews is when significant depth is required or where little is known about a subject area.

Semi-structured interviews are a blend of the two methods. They consist of several key questions aimed at outlining and defining the area of interest while allowing both the interviewer and interviewee to diverge in order to pursue an idea or response in more detail (Britten, 1999). This type of interview is agile and flexible, specifically when compared with structured interviews. It allows for elaboration of relevant information central to the investigators focus area.

The data collection method for this research was through semi-structured interviews which were conducted in the form of telephonic and video conferencing facilities as face-to-face interviews were not possible due to the Covid-19 pandemic. A single interview questionnaire was structured to be used across all research participants. The structure was such that answers would yield as much information as possible about the junior mining landscape in South Africa. The questions were open-ended to facilitate deeper insights. The first question was relatively easy so as to put respondents at ease while building up their confidence and rapport between the interviewer and the interviewee (Britten, 1999). Each interview lasted between 45 – 90 minutes.

In conjunction to the conceptual framework, the interview questions were designed based on the following overarching ideas:

1. Establishing the context of the current state of the mining industry in South Africa.
2. Given the mining lifecycle has various stages, a clear description of activities along each stage of the lifecycle.
3. Distinction between junior mining and major mining activities.
4. Understanding the challenges and risks prevalent within the mining industry.

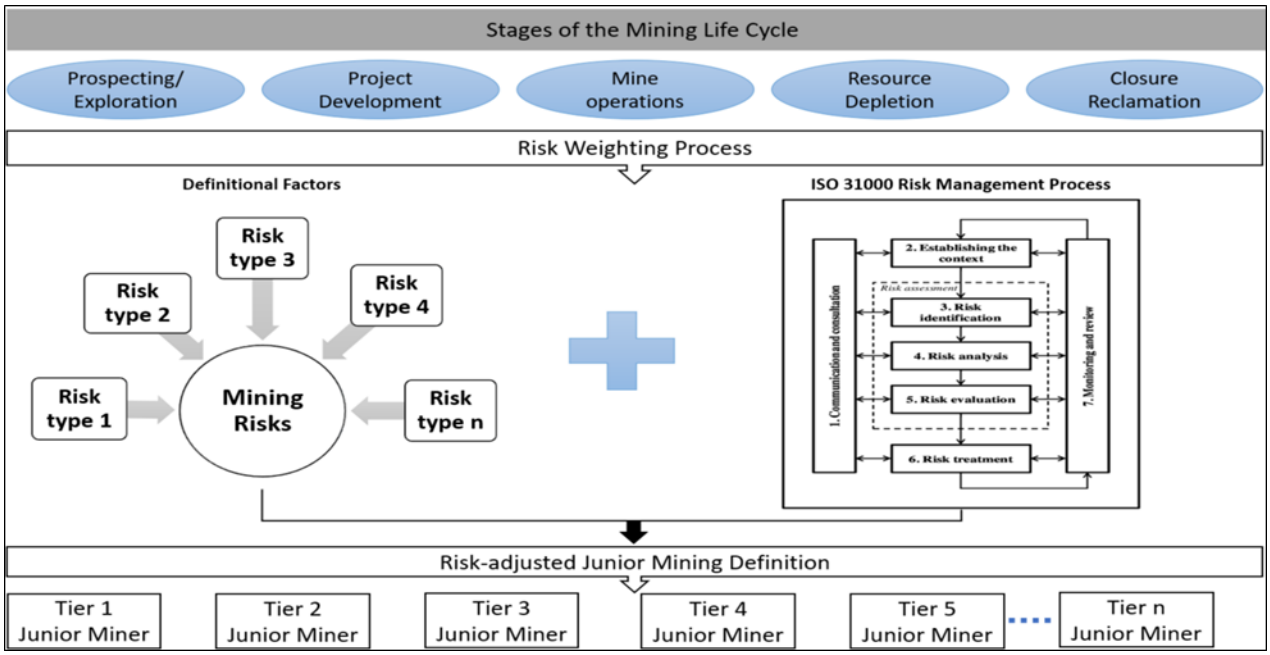



*Figure 27: Initial Conceptual Framework*

**(a) Establishing the context on the current state of the mining industry in South Africa**

This area was identified to be a relevant guide for the design of the interview questions because of the central research question which is specifically centered on understanding junior miners within the South African context. While the conceptual framework provides an initial guide on how junior miners can be defined, in order to arrive at a specific definition of junior miners in South Africa, the overall context within which they operate should be understood (ISO, 2009). The precise definition of a subject matter remains unclear without the context on the operating environment. It is this understanding that provides further validation to the reliability of the solution.

The risk management framework as adopted in the conceptual framework is generic. As such, to ensure relevance of the solution with regards to the research question that this study sought to investigate, the South African mining industry should be clearly defined and understood prior to narrowing down to its sub-sector, junior mining. Even though the dynamics of the global mining industry have been critically reviewed and discussed, a specific lens is applied to the South Africa region. To this extent, this approach also lends itself as part of scope management.

**(b) A clear description of various activities along each stage of the mining lifecycle.**

This area was identified for the interview because the mining lifecycle has various stages as discussed in the preceding literature. It is important to understand the activities that comprise each stage so as to identify the relevant mining risks and how they progress along the lifecycle. This area

relates to the conceptual framework given the theoretical foundation of the framework design is rooted in risk management, a process that requires the identification and valuation of risks.

The inclusion of this area is associated with effective risk management which requires a thorough understanding of the source of risk. It is such an understanding that leads to a relevant schema that is useful for typifying a specific risk type (Sunjka and Sklar-Chik, 2012). This study will refer to the specific activities in each stage of the mining lifecycle to trace a risk type to a specific activity.

**(c) Distinction between junior mining and major mining activities**

As this study seeks to define junior mining, there should be a clear differentiation between the two main sub-sectors in the mining industry, being major and junior mining. While the focus was on junior mining, the absence of a discussion on major mining activities makes it challenging to understand the context this study sought to investigate. It is noted that there is a possible overlap between this area and that described in (b), however, this area has been included as an interview guide to avoid ambiguity and doubt that may be associated with understanding the two sub-sectors.

**(d) Understanding the challenges and risks that are prevalent within the mining industry**

The approach of this study was mainly from a risk perspective. Therefore, to understand and describe the junior mining sector in this regard required a thorough focus and discussion on the challenges and risks that prevail within the business of mining. This area was central in achieving the second objective of this research which was to test the conceptual framework. Since the conceptual framework was developed from literature that critically discussed challenges faced by junior miners, this area was included to test the presence of any relationship that might exist between the challenges discussed in literature and risks that emerged in the interview data collection process.

Acknowledging that each respondent in the interview may use different semantics, the overall themes were expected to create a consistent and rich picture. Where the discussion was on risks and challenges, the investigator pursued these points with vigour in order to collect information that could be analysed in line with the conceptual framework.

A vebatim account of the interviews (Appendix F) was done through tape recording to allow for transcription of the audio. A copy of the questionnaire that was used to guide the interview process is presented in Appendix C.

### *3.3.3. Data Presentation and Analysis*

Lathlean (2006) suggested that qualitative data be analysed in a rigorous and systematic manner noting that qualitative data is usually reduced or condensed through a system of coding. Subsequent analysis entails the development of themes and categories from the data. This is consistent with the Grounded Theory which seeks to ensure the validity of qualitative data by 'grounding' the analysis in the concepts used by respondents.

Huberman (2009) identified the following three major activities in data analysis:

(i) Data reduction which refers to transcribing data so as to simplify and focus the data.

(ii) Data display which seeks to visibly present data through graphical means, whether as a graph, chart or table to show possible congruency.

(iii) Verification of possible conclusions and explanations made from the data set.

From the interview transcriptions, the complete dataset was analysed to determine whether the same codes had been used repeatedly by various participants. The codes were then defined in accordance with the definitional factors as set out in the Conceptual Framework in order to link the collected data with the developed Conceptual Framework.

Due to the heterogenous nature of the interview participants, it is possible for the dataset to be categorized in a manner in which the data is not exactly similar, however, the categorization may be due to commonality that may exist and how it relates to the definitional factors from the Conceptual Framework (Golafshani, 2003). Various categories set out below may be used to identify and group data patterns from a data set:

- Similarity (things happen the same way)
- Difference (they happen in predictably different ways)
- Frequency (they happen often or seldom)
- Sequence (they happen in a certain order)
- Correspondence (they happen in relation to other activities or events)
- Causation (one appears to cause another)

While the above categories serve as a guide to grouping patterns, it is equally important to wear a researcher's analytic lens so as to filter out noise and biases from the data. Following the codifying process of grouping and regrouping of data in accordance with similar codes, data was analysed to determine whether there were any strongly recurring and connected themes from the data. Thematic content analysis was based on the critical research question, conceptual framework and relevant

literature that has been critically reviewed. Once determined, the themes were fitted into appropriate theoretical concepts similar as guided by the model below (Golafshani, 2003).

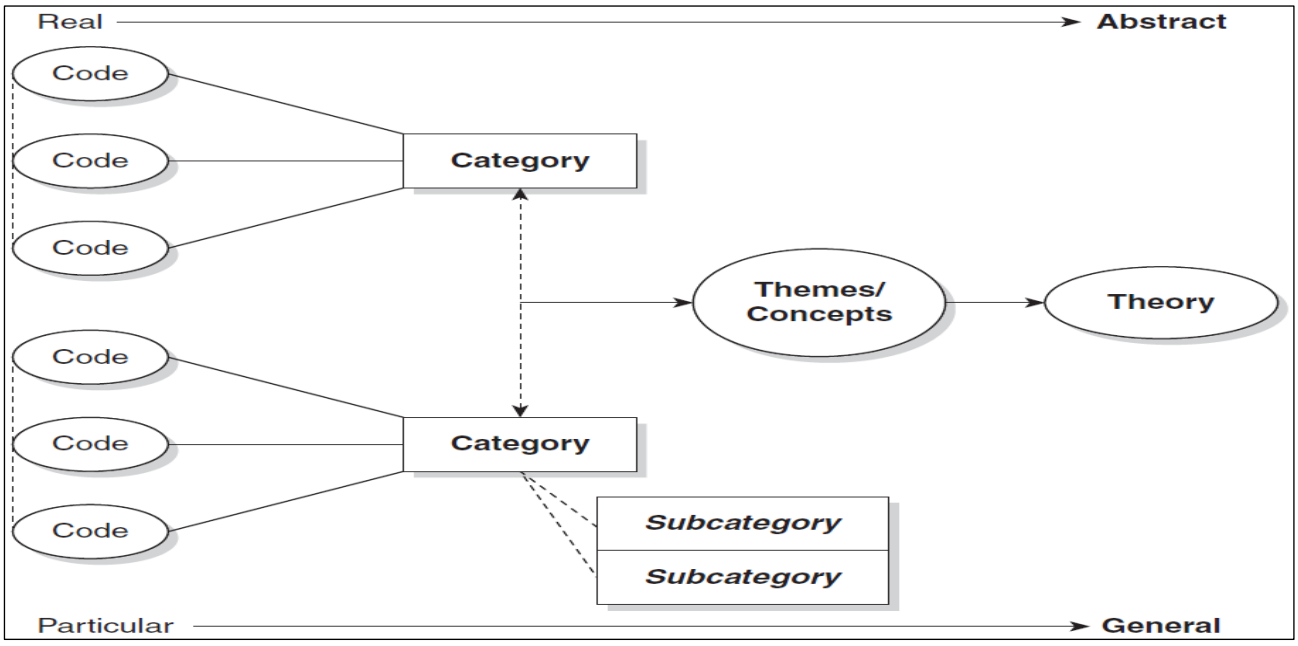



*Figure 28: A streamlined Codes-to-Theory Model for Qualitative Inquiry*
(Source: Golafshani, 2003)

**Thematic Analysis**

Marshall and Rossman (1999, p.150) suggested that data analysis is the process of '…bringing order, structure and interpretation to the mass of collected data. … It is the search for general statements about relationships among categories of data … it is the search among data to identify content.' Thematic analysis is considered as the principal technique among scholars for analysing qualitative date. Consistent with this approach, the data collected in this study was analysed using thematic analysis, more specifically grounded theory. This is both a methodological and epistemological approach which seeks to ensure the validity of the data collected by 'grounding' the analysis in the themes and concepts used by participants.

The strategy used for analysing the interview data was a deductive approach which followed a top-down approach starting with the theory (from literature), testing the theory, and finally confirming or rejecting the theory (Wilson, 2010) as illustrated below.




*Figure 29: Deductive Reasoning Approach (Wilson, 2010, p.7)*

### *3.3.4. Validity and Repeatability of Results*

The data collection method for this research was through an interview process which is a flexible method of data collection. Given the qualitative nature of this method, the researcher was set to collect large meta-analyses which tend to reveal modest validity coefficients (Golafshani, 2003). Furthermore, validity and reliability were achieved through the credibility of research participants. Credibility was ensured thorough vetting of participants, triangulation strategies and prolonged contact with the participant (Huberman and Miles, 2009).

### *3.3.5. Ethical Considerations*

During the research proposal phase, it was determined that one of the key risks in the research process would be gathering data and access to information. This is as a result of a lack of well-documented and easily available literature on the junior mining sector, globally. As such, additional information would include interviews with participants who have expertise and knowledge about the Junior Mining Sector in South Africa. Participants were carefully selected based on their knowledge and expertise and selection was free from bias with regards to race, age, gender, qualification, and any other forms of biases (Saunders, *et. al*, 2012 and Dudovskiy, 2018).

Guidelines for Human Research Ethics Clearance Application (non-medical) from the University of the Witwatersrand were consulted on the interview approach. Given the human contact, it was required from an ethics consideration perspective to include a participant Information sheet (Appendix A) and Letter of Consent (Appendix B).

The consent was obtained voluntarily from the participants in a non-coercive manner and the participants were advised they could withdraw participation from the study at any point (Bryman and Bell, 2007). The interview process was conducted with professionally and in a respectful manner. Furthermore, adequate levels of confidentiality was ensured through anonymity where it was requested. All communication relating to the research was done with honesty and transparency without any misleading information. Research activities were conducted in line with the Ethics guidelines from the University of the Witwatersrand (Ethics Clearance Number MIAEC 119/20).

# CHAPTER 4

## 4. FINDINGS AND ANALYSIS

The data collection approach was anchored from a descriptive perspective so as to paint a rich picture of the current junior mining landscape in South Africa. This chapter details the narrative version of the audio recorded interviews that were conducted during the period from December 2020 to April 2021. This is followed by a presentation and analysis of the results and concludes with the model testing.

### *4.1. Participants' profiles*

The research participants were intentionally selected to represent diverse views from professionals who work across the mining industry, however with different roles. All participants were well versed in their respective fields and shared unbridled views and insights on the research topic. To lend weight to the views of the participants, an introduction to their professional careers and profile summary is included below.

| Date of interview | Pseudo Name | Professional training | Current Employment Area | Role/Designation |
|---|---|---|---|---|
| 10-Dec-20 | Participant 1 | Civil Engineering | Project Management | Managing Director |
| 25-Feb-21 | Participant 2 | Electrical Engineering | Major Mining Company | Reliability Engineer |
| 27-Feb-21 | Participant 3 | Industrial Engineering | Major Mining Company | Business Improvement engineer |
| 15-Mar-21 | Participant 4 | Mining & Mineral Engineering | Major Mining Company | Drilling, Blasting & Technical Manager at Anglo American |
| 24-Mar-21 | Participant 5 | Law | Consulting and Academia | Lawyer, Lecturer and Consultant on Mining Policy in Africa |
| 01-Apr-21 | Participant 6 | Geology | Consulting | Mine Finder and Developer |
| 07-Apr-21 | Participant 7 | Finance and Accounting | Junior Mining Company | Chief Executive Office |
| 07-Apr-21 | Participant 8 | Chemical Engineering | Advisory | Founder and Director |
| 10-Apr-21 | Participant 9 | Mining Engineering | Academia | Lecturer |
| 12-Apr-21 | Participant 10 | Electrical Engineering | Junior Mining Company | Chief Executive Office |
| 19-Apr-21 | Participant 11 | Finance and Accounting | Advisory | Founder and Director |
| 20-Apr-21 | Participant 12 | Mining Engineering | Advisory | Founder and Director |
| 21-Apr-21 | Participant 13 | Law | Advisory and JM Support Initiatives | Chief Advisor and Board Member |

The use of an interview as a preferred and relevant data collection method seeks to provide subject matter related views and insights, told from the direct experience and viewpoint of a participant (Denzin & Lincoln, 2005). As such, in addition to the heterogeneity of the population, this study considered participant's work experience (skills and knowledge) as a source of reliability and validity of data collected. It is for this reason their years of relevant work experience was considered

when selecting research participants. A view of the participants level of work experience is presented below.

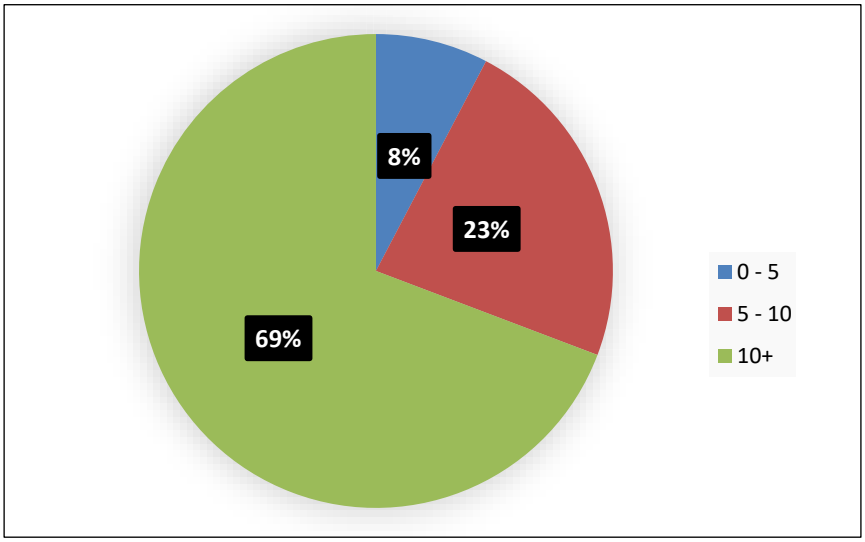



*Figure 30: Interview Participants Years of Experience*

As can be seen from the resultant pie chart, the majority of participants' have more than 10 years industrial experience. The years of relevant work experience meant that participants' comprehension of the phenomena under study was rich and meaningful. Deeper understanding exists which thus improves the quality and integrity of the data collected. Appendix D includes a detailed collection of participants professional biography.

### *4.2. Thematic Analysis*

Data was collected through a series of semi-structured interviews which were audio recorded and later transcribed for analysis. The researcher reviewed the transcripts several times to be sensitised with the data set as suggested by Tracy (2013). Once data immersion was completed, the process of data analysis commenced. Analysis of verbatim accounts from Appendix F culminated into the identification of a unit of analysis which was achieved by organising the data from the interview transcript into data sets. The data sets were then allocated a closed code from which the initial list of themes emerged.

### *4.3. Narratives*

A descriptive narrative from the participants is presented below. It is based on the questions that were asked during the interview process. Since the interviews were semi-structured, the questionnaire had three main ideas that were adapted from the conceptual framework:

Main idea 1: Establish the Context
Main Idea 2: Understanding Risks within the Mining Industry
Main Idea 3: Understanding Definitional risk factors within the mining life cycle

Each ‘main idea’ comprised of a list of ‘guiding’ questions (included in Appendix C). The richness of the data was achieved by building onto the participant’s responses through a follow-up, probing, inquiry whose stance aimed at supplementing the data. The questions designed were open-ended, clear and free of ambiguity so as to avoid data contamination and subsequently preserve data integrity. The main codes that emerged from the narratives were as follows:

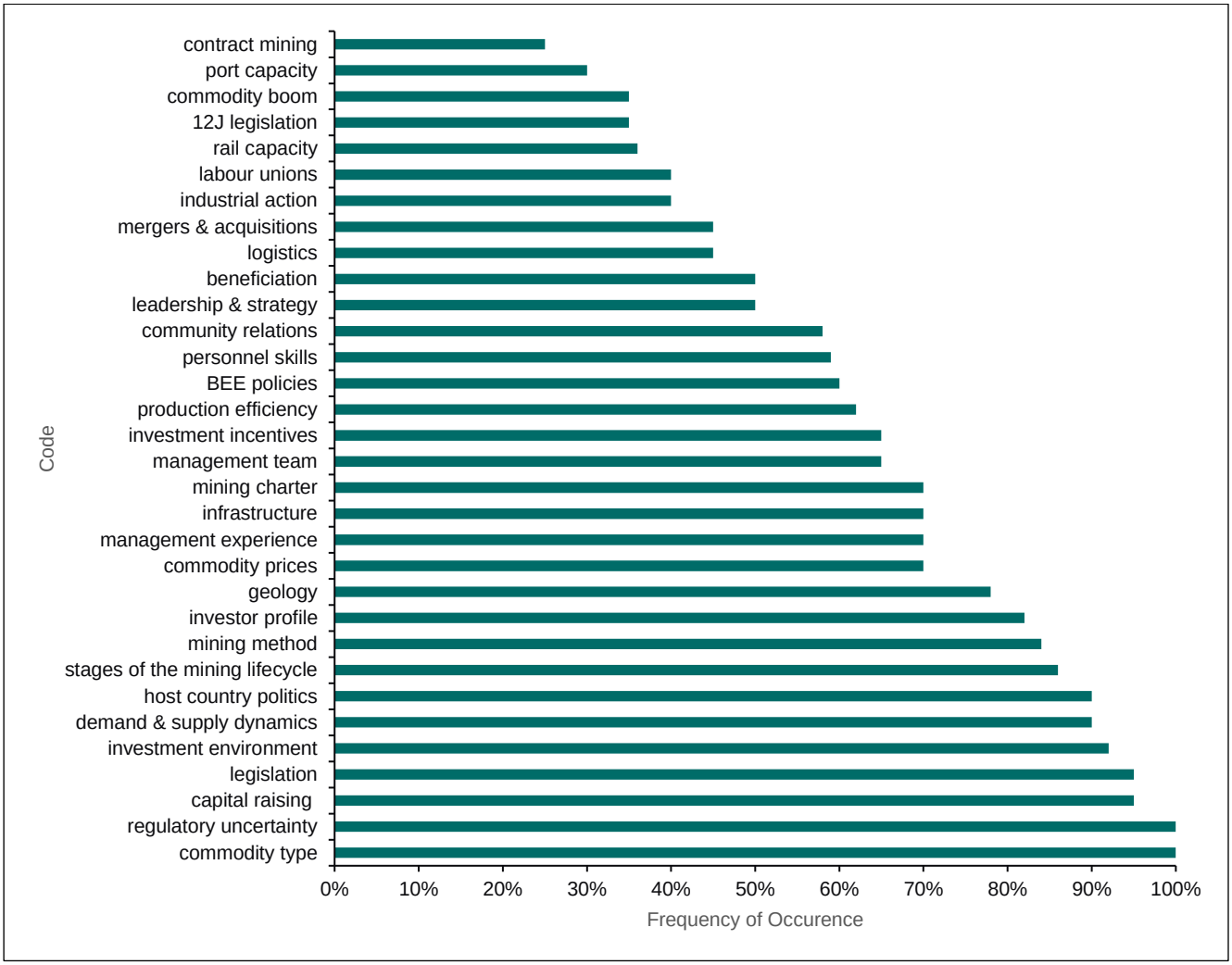



*Figure 31: Frequency of Codes from Interview Data*

These codes were extracted from the narratives that follow including quotable quotes. The section will conclude with themes that encompass the above codes based on relationships of similarities.

### *4.3.1. Main idea 1: Establish the Context*

The purpose of this idea was to clearly define the operating environment of junior miners in South Africa.

**Q1: How would you describe the state of the mining industry in South Africa?**

All interviews commenced by asking the participant to describe the current state of the mining industry in South Africa. While there were mixed responses (positive and negative), the overall sentiments were that South Africa has rich mineral endowments which, if nurtured, have the potential to position the country as a global leader in mining and minerals.

Participant 4 shared that "Africa was a pioneer in terms of underground mining but if you look at the technology advancements between Australia and South Africa, South Africa remains labour intensive with a heavy weight towards low-skilled employees while Australia invested in technology and are now heavily mechanized." Additionally, South Africa historically used to participate in secondary industries through processing of steel, diamond jewellery and other beneficiation activities. However, most of the processing plants have ceased to operate. "We had so much potential, …, our raw materials should have been a catalyst for a bigger purpose."

It was further noted that South African mining has been in existence for many years characterised by a "massive commodity boom" which inevitably led to the consolidation of many small mines to create the conglomerates that we see today. Following the 'boom', the industry experienced a "paralysis" specifically as it relates to junior mining activities. It was only post the democratic era that "things started loosening up again". Therefore, Participant 11 concludes "we are both a very old mining country and a very young mining country."

According to Participant 2, "the future is a quite bleak. We've sort of stagnated for a while, but I think we're now entering a slow decline. That's for various reasons." Upon further probing, the participant indicated that while the South African mining industry has a negative outlook that will continue for the foreseeable future, "there's a lot of opportunities for growth…"

**Q2, Q3, Q4: Distinction between major and junior miners.**

These questions have been grouped together given the sequence in which the participants responded. Most participants included the answers pertaining to all three questions in the same breadth hence the adoption of this approach in describing the narrative.

It was said that major mining companies are those with large operations and are usually listed on the stock market, "they would be listed on the JSE". They have a "well matured" corporate and operation structure which are treated as two separate functions each with dedicated personnel compared with junior miners who have a single, all-encompassing organisation structure. Participant 4 asserts that "…in terms of ownership, mining has remained in the same hands, even post democracy. We didn't see the emergence of small mining companies, the same way that Anglo American and De Beers

once were owned by two people." This sentiment is further enhanced by Participant 11 who adds that pre-democracy, "…the vast majority of South Africans were excluded from mining altogether".

Junior miners are allocated a small land to mine since they do not have funding to access a larger mining area. They do not have sophisticated mining methods and usually engage in "contract mining so they will have a four- or five-year contract". Almost all participants did not differentiate between junior, mid-tier, small scale and artisanal miners, citing that "it means the same thing."

On the contrary, Participant 11 believes there is a difference between different classes of non-major mining citing that "unfortunately, what has happened in South Africa is we've confused two things. We've confused the technical term junior mining with the developmental, emerging, new entrance or small-scale mining." The participant asserts "because the definition is used so differently in other parts of the country, for us to understand the proper definition of junior mining, we have to look at the lifecycle of a mineral deposit that's being developed" right from the beginning of the mining lifecycle. "From targeting, to discovery, to drilling to resource definition, to reserve definition, feasibility studies, pre-construction, construction, operation, closure, right. That's, in summary, the life cycle of a mine. If we draw from the definition of junior mining companies in Australia and Canada, junior mining companies are explorers and developers prior to going into production." Therefore, the definition provided on junior mining was that it is a company "that operates in all the activities before construct before production".

It was further added that "once you're in production, you are no longer a junior." The transition of a company as the mineral deposit advances through the stages of development to production can then be associated with moving from junior to senior mining". Additional insights were that "… the value curve as you transition from junior to senior goes up."

The Mining Council of South Africa reported they conducted research in their definition of junior mining which was all encompassing to include explorers, developers, and mineral producing companies; so essentially referring to companies that operate along the entire mining lifecycle value chain. Such definitions are a result of our history and the transformation objectives of the MPRDA; "… we've somehow lost the technical purity of junior mining as defined by great junior mining markets of the world… the Mineral Council has expanded the definition of juniors, because there's been so little exploration taking place in South Africa. We don't have explorers in our country."

Participant 11 argues that "… the sole objective of most juniors is to permanently remain junior." The juniors (whom have been defined by the participant as explorers and developers) incubate projects, they discover mineral deposits and then either sell what they discover with no intention of

ever mining the deposits, or transition to majors by engaging in small-scale mining and growing through collaboration and partnership to form joint ventures. Junior mining firms are "generally run by geologists". The argument presented is that clay miners, dolomite limestone miners, diamond diggers and general industrial miners have been in existence and producing well over 90 years, "they cannot be called junior because they are producing and not discovering new deposits".

Participant 13 on the other hand said junior miners are broken down into three categories, that is "pre-funding, post-funding, and operations". The pre-funding category is made up of exploration and prospecting projects, post funding are projects in the development stage and operations are actual mines that are operational. The participant adds that "We didn't put a turnover cap on the categories." This is contrary to the junior mining classification models that were presented in the literature review which all included revenue as part of the defining criteria.

#### *4.3.2. Main idea 2: Understanding Risks within the Mining Industry (Q5, Q6, Q7, Q8)*

The purpose of this idea was to explore perceived risk exposures that are prevalent to mining businesses.

The participants cited regulatory uncertainty as the biggest challenge faced by all miners (junior and major) in the industry. This finding is consistent with the challenges discussed in the literature review. Participants shared that: "…the government has ratcheted up, they've set a trajectory of ever more onerous requirements under the Mining Charters…", "…the government may impose regulations which will slow down your project", "the government is really giving us a hard time with ever-changing regulations.", " … regulatory uncertainty is hampering the effectiveness of the sector".

Participant 7 included that "… from a regulations perspective, as a junior, you are subjected to the same regulations, policies and standards as majors. It's not really fair because you don't have the same resources. But on the other hand, is, you know, the regulations are there for a reason…". The main challenge was the compliance of strict regulatory policies is difficult to attain for junior miners who have limited resources. This presents both a barrier to entry as well as effective resource allocation. The overall sentiments were that the South African economic environment is persistently weak and requires stable policies in place. If South Africa is set on attracting mining investment, it is critical for government to commit to ensuring regulatory certainty that will result in investor confidence.

Participant 10 said the risks faced by junior miners relate to raising funds & accessing finance, exploration, and operational stability. "… We have the struggles in terms of mineral exploration, operational stability and ability to raise funds." Further elaboration on these challenges revealed that the lack of mineral exploration in South Africa is threatening the growth of the industry and prosperity of the industry. When probed further on the cause of poor exploration culture, the participant shared that "I think it's the economic landscape. You know, in the South African context, our environment is not that friendly to those that explore. Because for you to be able to embark on these exploration and development projects, the economy needs to be conducive."

According to Participant 13, most junior miners struggle to raise accessing capital, and this manifests into a sustainability cycle because for juniors to access finance from traditional investors such as banks, they are required to have already conducted feasibility studies which usually cost "more than R10 million". After which they need to raise another "R70 million" for development of the mine and only once it is operational, do the banks consider them eligible for funding. Even then, "banks won't provide for funding requirements below $20 million…" because of the work required and due diligence costs. It is not optimal for banks to allocate resources to "small ticket size requests". Since most junior miners usually require funding below R200 million, they will struggle to access such funding from banks given that it is below the preferred threshold as determined by banks.

In addition to challenges related to accessing capital, "a lot of junior miners do not have a great accounting theory and do not have experienced financial managers…". Participant 13 further added that junior miners also have "corporate governance issues. … you'll see the board consists of skilled miners, but not necessarily skilled corporate directors. You normally find that there's a bit of a corporate governance lack, and then there are certain of those non-core mining services and skills that may be a bit of a shortfall within the company… these guy's doesn't understand business."

The board of directors of junior miners are said to include two or three founding members who tend to have deep technical knowledge and experience but lack corporate governance and management skills. This gap in skills and knowledge was also highlighted in the literature discussion. It manifests into a lack of mergers and acquisitions which are the engine for growth, especially within the junior mining sector.

Another risk that emerged was related to infrastructure and logistics. Access to reliable logistics is central to getting your product to the customers. Participant 2 shared that "…two or three years ago, there were a couple of derailments that ultimately cost around 6 million.". The issues on infrastructure and logistics are interrelated and some participants expressed that the government is

failing to make provisions for basic service that are required to ensure functionality. This challenge prevents junior miners from competing effectively, it inhibits smooth management of supply and demand dynamics which consequently threatens their existence.

Risks such as the volatility of commodity prices, have the potential to shut down any mining business, but especially junior mining firms owing to limited or no diversification of commodities and single operations. Participant 10 added the following with regards to commodity price risk, "… the mining business is cyclical. When price is right, the business can thrive that price is right, but then on the other side, when the tide turns, it's important for junior miners to have healthy cash flows so that they can still survive."

Generally, it was found that both junior and major miners are exposed to similar types of risks owing to the fact that they are both sub-sectors within the mining industry. While they both operate within the same environment, junior miners were exposed to additional challenges that majors were, to an extent, shielded from. These include infrastructure and logistics challenges where majors will normally be allocated rail and port capacity on a preferential basis while juniors struggle to access such national logistical capacities. Additionally, it was noted that majors, owing to their large balance sheets, listed on stock markets with multiple jurisdictional advantages, have better access to finance.

It was concluded that despite the encouraging prospects offered by a rich endowment landscape, the current existing challenges are threatening the success and prosperity of the industry.

#### *4.3.3. Main idea 3: Understanding Definitional Risk factors (Q9, Q10, Q11, Q12)*

Commodity type emerged clearly as one of the main factors when considering the success of a project. The commodity deposit (geology) determines the economic value as dictated by the quality and quantity of the commodity, as well as the mining method to be used. This was asserted by Participant 4 who stated that "the quality of your orebody has a huge impact on the success of a mining project. It determines the sophistication of your mining…".

The decision of risk assignment on each commodity is driven by the national and global strategic importance of that commodity. In terms of commodity risk along the mining lifecycle, the risk is highest during the exploration and discovery stage. This is because while the results of geological studies might allude to the presence of an economically viable deposit, it is only after the actual extraction of the mineral commodity that its characteristics can be confirmed.

The characteristic relates to the grade of the mineral as well as the actual deposit size which will dictate the initial life of mine (LOM). Once the mineral has been successfully extracted, it is then faced with dynamic supply and demand factors which are influenced by human consumption and lifestyle requirements. For example, the use of battery minerals has gained significant prominence in recent times which is stimulated by the innovation of electric vehicles that are yet to be commercialised, although the trial periods have commenced.

In this regard, Participant 12 stated that "the battery chemistry for electric vehicles is NMC-111…NMC stands for nickel, manganese, cobalt, two triple one stands for equal parts of each. So, all of these minerals are what constitutes an electric vehicle battery, and our focus should be to beneficiate manganese for the manganese portion of the electric vehicle technology." The participant went further to add that "I'm mentioning manganese because it's a very important commodity, as far as the electric vehicle revolution is concerned. That's where the world is going, that's where the markets are."

On the other hand, there has been several environmental lobbyists calling for the global discontinuance of fossil fuels (including coal, oil and gas) by the year 2050. This has received global attention with various countries having already committed to this goal. The motivation comes from a climate change sustainability perspective which is calling for the use of alternative, green, renewable energy.

Such a development poses a challenge especially in the African continent where electricity generation is driven by coal. This then represents a change in supply and demand dynamics which could have not been anticipated when coal was discovered centuries ago. As an owner of a producing coal asset, despite the decrease in commodity risk when the resources and reserves were confirmed, the commodity risk is increasing again now (even though you're in the production phase of the mining lifecycle).

Participant 10 included a comment on of green energy, especially as it relates threatening the coal commodity which currently serves as the primary source of electricity generation in South Africa. The participant said: "You know, for me, being in the coal industry, we have challenges in terms of the looming transition into green energy. However, I believe that coal is still important, we are gonna need coal for a very long time." This view was further supported by Participant 8 who mentioned that "…commodities such as coal, gold and platinum will survive far beyond our lifetime… banks are going to continue supporting coal financing. But the proportion of the coal exposure, will reduce."

Participant 9 shared that "…one of challenges in South Africa is narrow-reef mines, especially for diamonds and platinum … resources have depleted over time so now we are forced to go deep underground, ultra-deep." The challenge with underground mining when compared with surface mining is that operational processes have to be very efficient, because of this operational risk "… you tend to see quite a lot of miners go out of business because the costs are too high."

Such underground mines require shafts to be sunk in the surface where the space underground is narrow. It is both costly and requires stringent health and safety measures to be in place. Therefore, from a risk evaluation perspective, the most conservative method is surface mining. Owing to the level of risk associated with underground mining, the majority of players that engage in this type of mining are majors. They are able to do this effectively because of their formal, corporate structure which consists of various departments that have been tasked to ensure health and safety of underground personnel. These corporate businesses have sufficient resource allocation for infrastructure, optimisation teams that ensure that high grades are achieved so as to command a premium when trading the commodity (which justifies the cost of such an operation).

**Q13, Q14: Dynamics of the stock exchange?**

The most active junior mining stock exchanges are the TSX in Canada, ASX in Australia and AIM in the UK, with South Africa trailing far behind. According to Participant 5, the ability of a firm to raise capital "depends upon the stock exchange that you're in, and therefore the environment that you operate and how risk averse and how common investment is." The number of retail investors in Australia is high because the stock market is "highly regulated". This results in "… a level of confidence about the reporting…" so investors can see when a company falls off the bandwagon. Australia has a healthy appetite for investing because "… we've gotten so used to it. "Our annuities funds and investments policies allow us to manage our investments."

Participant 11 concurs that "the investment landscape in these regions consists of diverse investors ranging from institutional to retail investors. Junior miners are able to raise finance on these stock markets because investors are incentivised for investing in junior miners". Participant 6 adds that "as a junior miner, the ability to raise capital "… depends upon how common investment is and how many 'mum and dad' investors are prepared to take a shot on what's really speculative shares." Most mining businesses struggle to raise capital on the stock market because "… more people aren't risk averse".

According to Participant 11, "For almost 100 years, the Johannesburg Stock Exchange was the greatest mining investment market in the world. In fact, in 1980, more than half of all market

capitalization of mining companies was on the JSE.". There was an exploration sector on the JSE which was dedicated to supporting the exploration and discovery of new minerals. This was possible because "One of the features of our mineral rights regime was that they were private property." It represented stability for investors. This was since disrupted by the MPRDA which appointed the state as the custodian of mineral rights. "… due to poor administration" liquidity has since dried up.

The South African government introduced Section 12J of the Act aimed to incentivise individuals, companies and trusts that invest in Venture Capital Company (VCC) from a tax perspective. The VCCs were considered to be small-and medium-sized companies that displayed the potential for long-term growth, especially in capital intensive sectors such as mining. Despite this legislation, the investment market did not attract many new investors, as envisaged due to the minimum investment requirement of R100,000 which many retail investors could not afford. Participant 13 mentioned that "… unfortunately, there are ongoing discussions to potentially stop the 12J effective from next year June".

While the participants concurred the scraping of the 12J legislation will not necessarily have a major impact on the mining industry given that it was not popularly used, it was emphasized that more support was required from government to create an investment friendly environment in order to ensure that liquidity does not dry up in the market. For junior miners to be able to have an opportunity of raising capital on the stock market, the investor profile needs to be diverse. South Africa does not have a culture of investing. Favourable and functional incentives are required to stimulate retail investment, particularly related to mining investment.

A total of 32 codes were generated and these were condensed into 6 over-arching themes. The analysis of the interview transcripts can be found in Appendix E.




*Figure 32: Codes and Themes for Risk-adjusted Framework*

The six over-arching themes that emerged from the coding process were mining asset risks, market risks, corporate risks, legal risks, financial risks and operational risks.

### *4.4. Conceptual model testing*

An initial, conceptual framework was developed and presented in chapter 2. Following data collection from interviews, the next step pertains to testing the framework as per the second research objective. This is done using an example as per Table 9 below where selected codes have been used to show the classification of junior miners from a mining risk perspective. In the table, level 5 refers to preferable qualities such as an experienced management team, diverse board composition, easy access to infrastructure and logistics, sufficient cashflows generated from operations, good relationship with host communities and strong sponsors of references.

*Table 9: Classification of Junior Miners in accordance to the Risk-adjusted Framework (Risk Profiles)*

| **Definitional Factor** | **Risk Category** | | | | | |
|---|---|---|---|---|---|---|
| | **Conservative (Tier 1)** | **Moderate (Tier 2)** | **Balanced (Tier 3)** | **Growth (Tier 4)** | **Aggressive (Tier 5)** | **Very Aggressive (Tier 6)** |
| **Stage in mining lifecycle** | Production | Production | Development | Development | Exploration | Exploration |
| **Commodity type** | Industrial minerals, Bulk minerals | Bulk minerals | Bulk minerals | Precious minerals, base metals | Precious minerals, base metals | Precious minerals, base metals |
| **Mining method** | Surface | Surface | Surface/ underground | Underground | Underground/ Underwater | Underwater |
| **LOM (years)** | 30+ | 29 – 20 | 19 – 10 | 9 – 5 | 4 – 2 | 1 |
| **Operating Costs** | Low | Low - Medium | Medium | Medium | Medium - high | High |
| **Management team experience** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Board of directors** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Community relations** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Access Infrastructure and Logistics** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Level of compliance** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Sponsors of reference** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Access to finance** | Level 5 | Level 4 | Level 3 | Level 3 | Level 2 | Level 1 |
| **Company strategy** | Mergers & acquisitions | Multiple assets | Multiple assets | Multiple assets | Single asset | Single asset |
| **Managerial flexibility** | High | High | High – Med | Medium | Medium – Low | Low |

## CHAPTER 5

## 5. RESULTS: MODIFIED FRAMEWORK

This section presents a modified framework which has culminated from testing the conceptual framework by adapting the model presented by Trochim's (2002) on pattern matching.

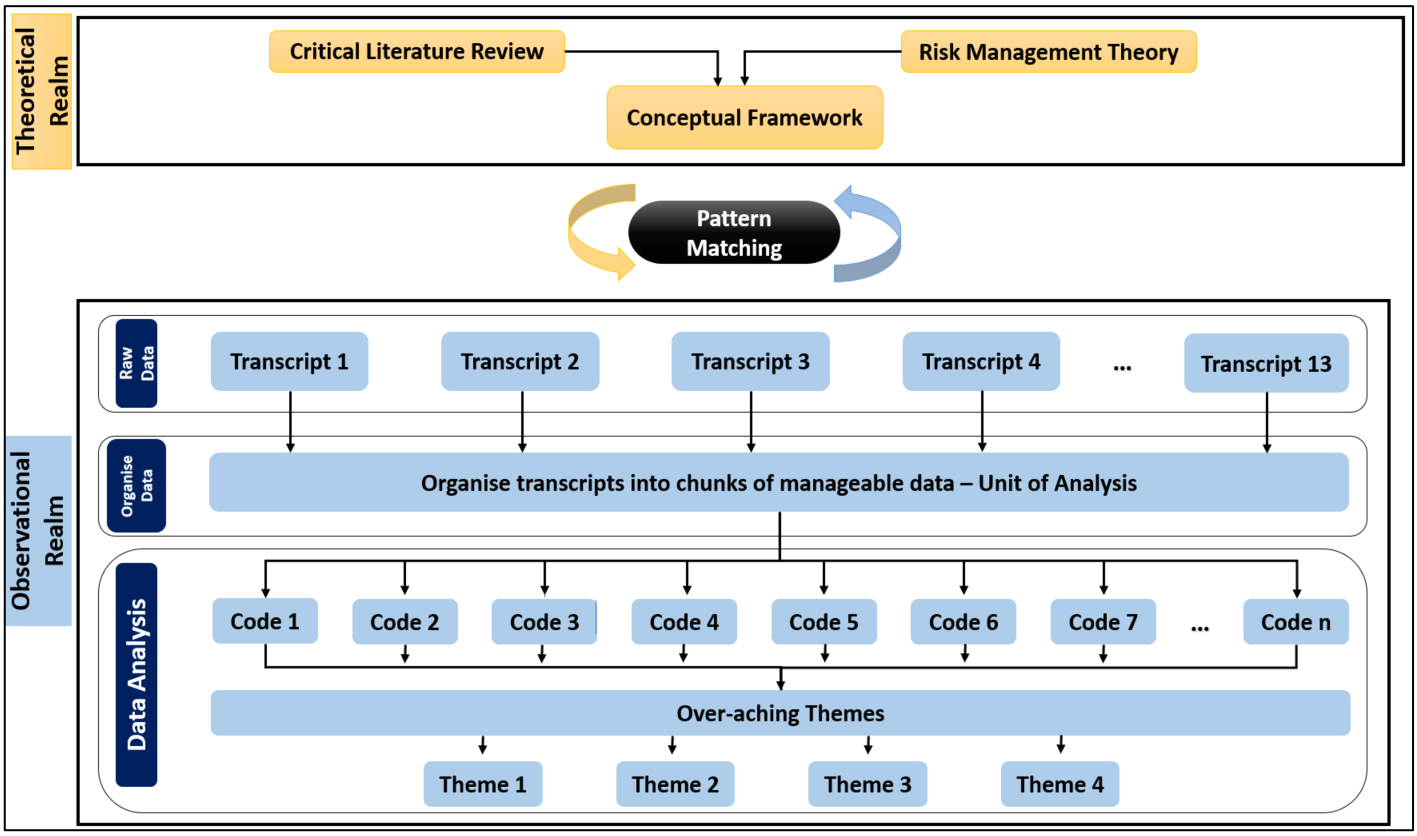



*Figure 33: Adapted Pattern Matching Model*

The model adapted to arrive at the revised risk-adjusted framework commenced with understanding and describing the junior mining sector in South, with a specific focus on challenges faced by the sector. The approach to focus on challenges was driven by the idea and 'hunch' (as per Trochim, 2002). The researcher intimately discussed the challenges that prevail within the South African junior mining industry with research participants. These challenges together with the selected research theory based on the ISO 31000 standard of Risk Management formed the basis of the theoretical realm. The observational realm consisted of datapoints from semi-structured interviews. The codes that were deduced from the narrative were further analysed to determine the over-arching themes. The observational realm was tested in the preceding section. The initial conceptual framework together with thematic analysis resulted in the development of a modified risk-adjusted framework as presented below.

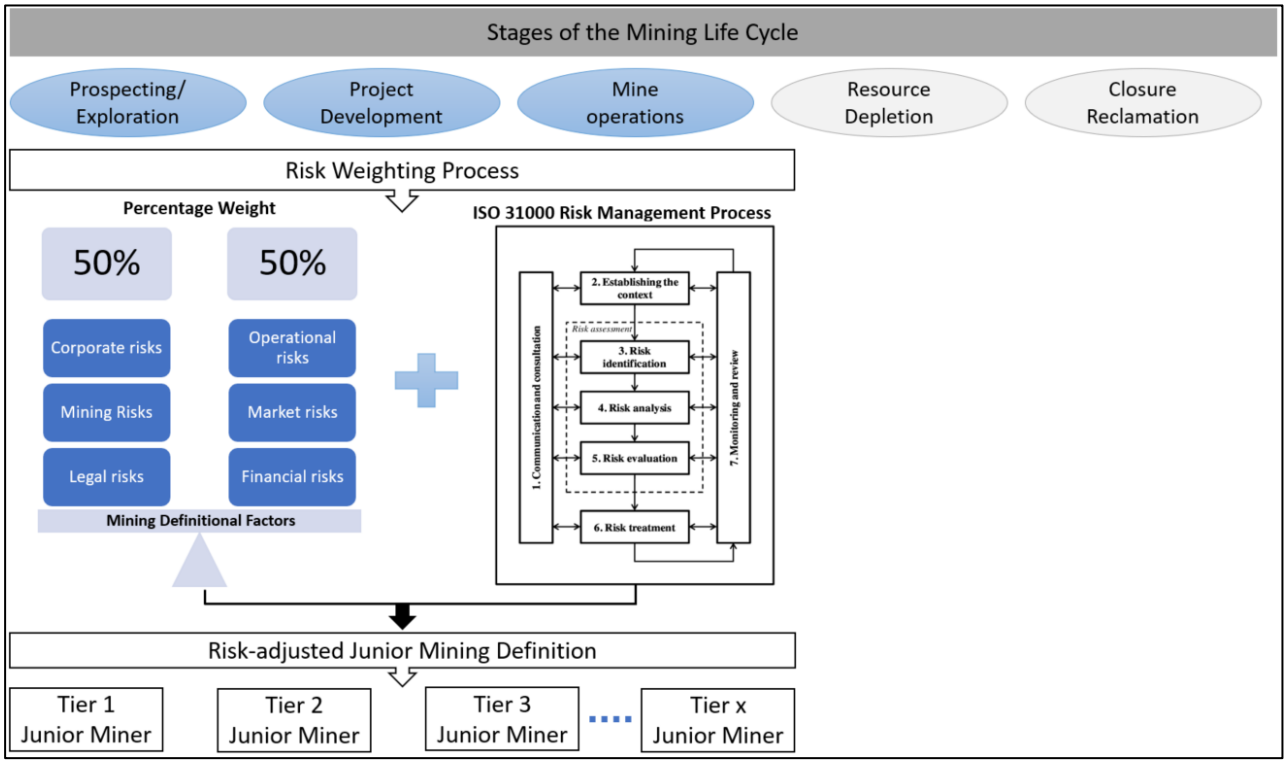



*Figure 34: Modified Risk-adjusted Framework*

## *5.1. Discussion on themes as they related to the modified framework*

### *5.1.1. Theme 1: Mining asset risks*

The codes that mainly relate to mining asset risks are stages of the life cycle, geology, commodity type, and mining method.:

**Sub-theme 1: Exploration**

A common code that emerged from the narratives of the participants with reference to exploration was around the unfriendliness of the South African environment. It was shared that the government has not created an economically conducive environment to stimulate and support exploration in South Africa. Part of the hindrance to exploration is transformation needs to happen at mining license level. In the same breath, Burger (2021) published an article in Mining Weekly stating that 'South Africa's mineral licensing system is holding back prospecting, exploration'. As at February 2021, the government had a "backlog of 5,326 applications for prospecting and mining permits and rights, cessions and renewals." Out of this backlog on application, 235 applications were for new mines.

In addition, the findings revealed that due to a poor exploration culture in South Africa, there is a desperate need for a transparent mining cadastre (which is a public portal that contains comprehensive information on geological data and mining jurisdictions including mining permits

that have been issue along with their expiry dates). Given that South Africa currently attracts less than 1% of the global exploration spend (Mining weekly, 2020), it can be seen why much attention has to be given on ensuring transparency on the geological data which may reduce part of the scepticism that is currently shared by investors and conservationists.

While investment in exploration projects is highly speculative and involves many risks, projects within this stage of the mining lifecycle are met with further resistance in South Africa due to the challenges discussed. Active exploration is necessary to ensure the sustainability of the mining industry. The lack of active exploration in South Africa is one of the major risks to the mining industry. If not resolved, the South African mining industry will continue to decline thus asserting the views of other stakeholders who contend the mining industry in SA is in its sunset phase.

When looking at the entire mining lifecycle, exploration projects represent the most risk given that there are feasibility studies that need to be conducted in order to confirm the resources and reserves. The next step involves the valuation of the project to assess the financial viability of extracting the mineral(s) from the earth surface. Once feasibility has been confirmed, only then does the project proceed to development phase and eventually production and processing. The risk is highest from exploration and reduces as one moves further along the lifecycle.

**Sub-theme 2: Geology**

South Africa is a mineral rich country with most reserves still to be discovered or delineated. When accessing mining projects from a geology perspective, the size and quality of the ore is considered important because it relates to the economics of the project.

The exploration and prospecting for different commodities are fundamentally different based on their geological formation. For example, the exploration of precious and base metals deposits is technically more challenging with longer lead times prior to discovery compared to exploration for bulk commodities such as iron ore, manganese and coal. The deposits of the latter are closely associated with the strata in which they occur thus increasing the probability of landing on a significant motherlode. Additionally, coal and, particularly iron ore deposits tend to occur close to the surface thus making exploration for these commodities less about discovering major new resources but more about improving and building on the existing knowledge of key parameters associated with known resources (Cairns, *et. al*, 2010).

Precious and base metals deposits differ as these metals were deposited post the formation of the host rock sequence. Typically, metals are transported from the depth of the surface by metal rich fluids stopping when changes in physical and chemical parameters eventually result in the metal

being deposited at a certain location. An economically feasible ore deposit forms when the process described occurs efficiently. Contrary to bulk commodities, the location of precious and base metals deposits cannot be predicted through simple extrapolation of the strata sequence. It is for this reason that its exploration risk is higher than that of bulk minerals (Cairns, *et. al*, 2010).

In discussing geology, there needs to be a balance between quality and quantity as these factors drive the economic viability as it relates to profit margin (Cairns, et. al, 2010). Therefore, in the assessment of mining projects from a geological risk perspective, better quality ore will attract a higher price (premium) while poor quality ore will trade at a discount. Additionally, the size dictates the life of a mine which is directly linked to future cashflows. The longer the life of a mine, the more attractive the project will become. In South Africa, the typical duration of validity for a prospecting right is up to five years and a mining right up to 30 years (Leyden and Leon, 2019) with most mines having a lifespan between 8 – 30 years.

**Sub-theme 3: Commodity type**

The Minerals Council of South Africa conducted a survey involving Junior Miners. Upon data collection and analysis, it was found that almost 60% of junior mining rights were issued to miners within the Industrial minerals' commodities space. This corresponds to the narratives from the participants on industrial minerals being one of the relatively easier commodities to mine because of shallow strata.

Industrial minerals are widely available minerals that are not sources of metals, fuel or gemstone but rather have multiple applications and are used as raw materials and production input in many industrial processes. These minerals include lime, limestone and phosphates which are used primarily within the agriculture industries as fertilisers, sands, limestone and dimension stone in construction, and many other minerals used in pharmaceuticals, chemicals, andalusite, lime and the metallurgical sector (Modiselle, Muravha, *et al.*, 2017).

A high volume of mining rights for industrial minerals miners is driven by high values of such resources across many parts of South Africa. This commodity is low valued compared with other Minerals. As such, its economic viability and subsequent exploitation is highly dependent on transport costs and distance to the market. This demonstrates that while there are various minerals mined in South Africa, their differences in exploitation and economic value thereof command different risk classification.

For example, the risk associated with diamond and coal are different due to various factors such as the mining method, project capital requirement, and supply & demand dynamics among other

factors. While most coal resources are mined on surface, diamond mining may take the form of either pipe mining (consisting of both open-pit and underground mining), alluvial mining or marine mining which requires more sophisticated and costly machinery relative to coal projects.

Furthermore, given the nature of diamonds (as defined by carats), there is no standard price guide since each diamond mined and sold will fetch a different price based on the 'perceived' value from the buyer (Ajediam, 2019). Coal on the other hand has standard tracked prices that can be used as reference for the domestic and export markets. The simplicity and predictability of coal supply chain dynamics makes coal projects easier to fund in relation to diamond projects (Chen, *et al.*, 2016).

This example illustrates that as far as commodities are concerned from a risk perspective, commodities such as manganese are more likely to attract investment compared to commodities such as coal and diamonds. The challenge with coal being that there is a global environmental, social and governance (ESG drive which advocates for clean, fossil fuel free energy while diamond is considered a risky commodity given the variations that exist and that each stone is valued differently. As such, in using the risk framework, different commodities will be classified differently based on their strategic importance and economic value.

**Sub-theme 4: Mining method**

The three main types of mining are open-pit mining (also referred to as surface mining), underground mining, and underwater mining. All three have different characteristics with the most common and preferred by both major and junior miners being surface mining, given its relatively low risk when compared to underground mining.

This method is favoured due to its cost-efficiency and relative safety compared to other methods. Although it's the most preferred method, it is practical when the orebody is located closer to the surface. Underground mining on the other hand requires the grades and quality of the orebody to be high enough to justify the operational costs. Underwater mining is used to mine minerals that are located within an aquatic environment like the sea floor. This is perhaps the most challenging of them all and it requires a responsible approach that will ensure minimal disruption to the aquatic ecosystem.

### *5.1.2. Theme 2: Market risks*

Market risks relate to commodity prices, which is essentially a function of demand and supply. The main ideas that emerged with regards to this theme is the mining business is cyclical owing to the economics of commodities which rise and fall in response to various drivers. One of the drivers relates to demand which may classify certain minerals as strategic commodities. For example, coal

was for the longest time one of the main strategic commodities due to its role in electricity generation. However, with the recent global drive to transition away from fossil fuels as energy sources towards clean and greener energy, coal has moved from being seen as a strategic commodity to potentially a risky commodity if alternative uses do not emerge on a large scale.

Therefore, from a risk analysis perspective, it can be concluded that new markets bring new demands as is the case with battery minerals, and renewable energy. The demand for certain commodities will make one junior miner better positioned than the other given the dynamism of commodity prices.

#### *5.1.3. Theme 3: Corporate risks (including team skills)*

This theme refers to personnel skills and company leadership. Analysis of the narratives indicated a potential risk with regards to knowledge and skills. A common idea that emerged clearly indicated the risk associated with skills does not relate to technical skills but rather general management and business skills. This is one of the contributing factors for a lack of growth in junior mining operations, hence most junior miners do not advance to becoming major miners with multiple operations, in different jurisdictions.

Understanding business management and finance in the mining sector is crucial especially when evidence suggests that large-scale mining came from the growth and consolidation of junior mining operations. Major miners have clear strategic intent and direction, they acquire high potential assets to grow their firms and divest non-profitable assets to ensure maximum profitability.

In addition to business and finance skills, the topic of corporate governance and board constitution is a threat to the growth of junior miners. It is the lack of standardisation on junior mining company boards that has influenced the addition of this factor as a criterion for defining the lack of success for junior miners. A stronger board composition is categorised with the 'conservative risk' class. Therefore, when we look at the modified risk management framework and evaluate this risk, the composition of the board of directors of a company is preferred to have members with diverse and relevant skills such as finance, technical and governance. A company with such a board constituency can be classified as a tier one from a risk perspective.

#### *5.1.4. Theme 4: Legal risks*

Codes within this theme were overlapping between the sub-themes: legal and political risks and have, been thus been grouped under one theme.

South Africa's oppressive history is well known and in the advent of democracy in 1994, the new government committed to redressing the injustices of the past. This journey within the mining

industry involved the formation of the Mineral Policy Process Steering Committee in 1995 which was mandated to "conduct an extensive consultative process to canvass stakeholder opinion for the preparation of a new minerals and mining policy for South Africa" (Heerden, 2015). The outcome was a White paper with proposals on minerals and mining policy for South Africa published as discussed in the literature review.

Following the Minerals and Petroleum Resources Development Act (MPRDA), policies such as the Mining Charter were introduced and implemented with the first version of the Mining Charter developed in 2002 and later amended in 2010. The aim of the charter was to drive transformation and inclusion within the industry. The Mining Charter was further amended and gazetted on 27 September 2018. The main context of the Mining Charter refers to specific targets and measurement criteria for the acceleration of transformation within the industry.

The latest charter, Mining Charter III (1 March 2019), was updated to address questions of regulatory uncertainty however questions and concerns from various stakeholders seek to suggest the objective of the charter may have not been fulfilled yet. Given the historical narrative of South Africa, legal and political themes cannot be separated. They are inter-related hence they have been analysed under the same theme. Applying this theme in the risk-adjusted framework, junior mining firms that may be favoured are those who comply with the strenuous regulatory requirements in South Africa, despite low compliance across the board.

***Sub-Theme 4: Community relations/Social license to operate***

The social license to operate does not follow a documented approach. It rather aims to follow a consultative process with various stakeholders, including host communities both pre-and post-operations. The South African mining industry has frequently been characterised by industrial action led by labour unions. These are usually over wages and salary increases, security of jobs and other contributing factors. If not resolved, these discussions or conflicts may manifest as strikes or go-slows and may lead to property damage and in the most extreme cases, losses of lives. A company that has healthy relations with host communities may be preferred as it can be seen as more stable than those that have a hostile relationship with communities.

### *5.1.5. Theme 5: Financial risks*

The analysis of narratives emerging as part of this theme revealed the inter-relatedness of this ability to access finance with the skills and experience of the management team. It was acknowledged and agreed that junior mining firms are technically astute, however, the majority lack business management experience. They are simply not entrepreneurial. As such, they struggle to position

themselves in an attractive manner to potential investors. Poor negotiating skills and experience hinders the prospects of a successful capital raising process and if they are successful in raising capital, it is usually not the most optimal funding structure for their business needs.

It is evident that junior miners are struggling to access capital and significant intervention is required to unlock investor potential. As such, following the risk-adjusted framework, a favourable junior mining company is one that has positive cashflows that can sustain its operations. The findings were that, generally, junior miners will struggle to raise funds from traditional investors such as banks who require between 40 – 70% of equity. A typical junior miner will simply not have the required equity. As such, until creative and sustainable ways of accessing finance are developed, the most preferred junior miners will be those with healthy and consistent cash flows.

#### *5.1.6. Theme 6: Operational risk*

The threat of operational risk in South Africa is driven by a poor administrative system which has not prioritised the junior mining sector. Access to infrastructure such as suitable roads, rail, port and water systems are part of the national agenda whose mandate should include proper development to address capacity constraints. Generally, major miners are prioritised with regards to the allocation of such facilities. Logistical risks pose a challenge with regards to the exportation of products. Access to reliable logistics is central in getting product to the customers.

In addition to infrastructural and logistical risks, junior mining processes are often rudimentary and un-mechanised. A junior miner that has embraced technology advancements and has adopted such technology within their production process is able to unlock much needed efficiencies. Both infrastructure & logistics and technology are key to effective operations

**General remarks**

The modified risk-adjusted framework was developed through the culmination of literature and observational data which was subsequently tested. The framework is robust and dynamic, as such, it has a universal application and will adjust accordingly based on each country's unique definitional factors which can all be classified under the identified mining risks types (grouped into themes). To this extent, the second and third objectives of the research have been fulfilled.

# CHAPTER 6

## 6. DISCUSSION

### *6.1. Objectives revisited*

This research sought to develop a framework for defining junior miners in South Africa from a mining risk perspective. The literature consulted for this research provided a grounded understanding of the current junior mining landscape in South Africa. Given the limited nature of literature with regards to the research topic, semi-structured interviews were conducted with professionals and experts within the mining industry sector. Literature together with data collected through interviews provided the basis for the development of such a framework.

The research conducted has deepened the understanding of the junior mining landscape in South Africa. It was guided by the following objectives:

(i) Develop an initial conceptual framework for the definition of junior miners
(j) Test the framework
(k) Propose a final revised framework

Critical review of literature revealed that there are different schools of thought on categorising and classifying junior miners. The various attempts at differentiating junior mining is an indication that scholars and industry bodies acknowledge that the junior mining sector is heterogenous. Literature review in conjunction with risk management theories formed the foundation for identifying the risk profile in the junior mining sector.

This study, through the observational realm, validated the definitional challenges presented in the literature review with regards to a lack of consensus in terms of a universal definition. This finding was expected and further validated the importance of this study in contributing to the understanding of junior miners in South Africa. While the initial framework believed that the definition of junior mining spans across all five main stages of the mining lifecycle, the study found that only the first three stages (exploration, development and production) were relevant in differentiating between different classes of junior miners. It was surprising to discover that South Africa, having once been a global leader in mining was in decline due to limited exploration activity.

The absence of an active mineral exploration project environment has contributed to the challenge of defining junior mining. A clear exploration sub-sector would provide clarity over the activities of operational and community producing junior miners. Until such a time that the exploration sub-

sector in South Africa is invigorated, the definition of junior mining will continue to encompass exploration activity.

Regulatory uncertainty was the most dominant theme that emerged in the study. This is consistent with literature and was expected given the 'newness' of the democracy in South Africa which is hailed for promoting a culture of transformation and inclusion in the mining sector which was once characterised by large-scale miners. It was clear the topic of regulation and policy is fundamental to the effectiveness of the sector. In a persistently weak economic environment currently experienced in South Africa, it is critical for government to commit to ensuring regulatory certainty so as to provide stability. It is this challenge that was identified as the main source for a lack of a clearly defined and understood junior mining sector. Given the role of the state as a custodian of mineral rights, most of the efforts rest on the government's formalisation policies that will guide the direction of the mining industry. It was surprising to discover the extent with which this factor weighs on the mining industry as a whole.

Second to the risk of regulatory stability in the mining industry was the threat identified in the research results of constrained access to capital. The global mining jurisdictions were examined and evaluated in detail, and it emerged that the junior mining sector relies heavily on raising capital on the stock exchange, compared with traditional investors such as banks. This finding was indicative as it helped to explain why junior miners in South Africa are struggling to raise project finance. The study revealed that South Africa does not have a strong investment culture in the junior mining sector. Where Australia and Canada will raise funds mostly from retail investors who are incentivised and are allowed to manage their individual annuities and retirement funds, South Africa lacks such legislation.

The 12J legislation that was implemented to achieve similar objectives to that of Canada and Australia has not materialised as expected. To this end, there are talks by the government to scrap the legislation. The findings with regards to raising capital have shed more light on the dominant investor profile in South Africa which is characterised by risk-averse institutions that are mostly local. Investors are divesting away from South Africa. This is a missed opportunity on the part of the government who should be stimulating a culture of investments through attractive and effective incentive structures within the junior mining sector.

From a technical or geological perspective, the study revealed that mineral deposits are perhaps the greatest determining factors in distinguishing between junior miners with high growth prospects against those who will always remain junior. It was found that the type, size, and quality of the

mineral deposit dictates the strategic options available to the miner. At any point in time, there are always strategic commodities that make a junior mining company attractive to investors. These commodities are driven by global supply and demand dynamics that are influenced by lifestyle changes and a growing population.

A relevant example is the innovation of electric vehicles that are aimed at reducing carbon emissions. The reason carbon emissions have soared is because of an increasing global population who are using more resources, i.e., electricity, cell phones (which have mineral components), production of chemicals, fertilisers, etc. It is surprising to find such a causal relationship between an area that can be considered as a social science (population) and a technical area, that is mining and minerals extraction and consumption.

Given the growing demand in mineral consumption and subsequently, production, the study found that South Africa has regressed from a culture of beneficiation to that of raw mineral exporter. Beneficiation was considered crucial in the South African environment by research participants which is characterised by high inequality levels and poor socio-economic standing. The topic of beneficiation was a subject not identified in literature.

While a discussion on the reliance of employment in the mining sector was discussed, the link with beneficiation as a means to supplement employment did not emerge from literature. This may have been because beneficiation is a secondary sector to the mining industry, however, there is a direct link as the mining industry provides input into beneficiation and processing of raw materials. This area requires further investigation as to the role the South African mining sector can play in increasing employment opportunities in the junior mining sector through supporting beneficiation and secondary industries.

Generally, the theoretical and observational realm did not deviate from each other but rather validated and complemented the phenomena under study. There were strong areas of overlap between the mining challenges identified and discussed in Chapter 2 and the mining risks identified through thematic analysis of interview data. This marked an important observation particularly with regards to the reliability and validity of the study.

The framework presented in this research considers the business of mining from a fundamental perspective, i.e. geology, commodity type, mining method, regulations and policy, supply and demand, infrastructure and logistics and other mining industry specific factors. The main challenge that was encountered with regards to the solution design was that the mining industry has global footprints, and each jurisdiction faces different challenges and environments. This challenge was

mitigated by dynamism and flexibility of the conceptual framework developed from this research in that it provides a blueprint for categorising junior miners by considering mining risk exposures in the specific context.

While it was initially designed to classify South African Junior miners in various tiers according to their risk profile, it was discovered to have a universal application due to the consistency of mining risk types across all jurisdictions. The main over-arching theme remains the same. To this extent, the risk-adjusted framework for the junior mining sector lends itself as a superior solution design characterised by robustness and pragmatism.

The drawback of the framework is that it lacks a risk quantification element to determine the level of significance of various risk factors. The model has been applied such that all definitional factors contribute equally to the classification of junior miners. However, a further investigation into an appropriate quantitative risk weighting method would further enhance the solution.

### *6.2. Reliability and Validity*

The results of this research were achieved through the adaptation and analysis of various sources which include literature reviews, interview respondents and the researchers professional experience. These sources revealed the congruency of the information and as such represent a triangulation approach.

The interview population consisted of 13 participants who represented different pillars of the mining industry such as mining engineers that work for Major Mining Companies, Junior Mining CEO, Junior Mining CFO, COO and board member of the Junior Mining association (institutional support initiative), geologist and exploration expert, mining law and policy consultant, former investment bankers in mining projects and project management specialists and pervious board member of a parastatal. The heterogeneity of participants provided rich data which validates the solution of the study through the congruency of the information shared by participants and the interrelatedness to the literature review.

The findings from the study have answered the research question and research objectives which was the development of a risk-adjusted framework for classifying South African junior miners into various classes as per their unique risk profiles.

## 7. CONCLUSION

The exploratory study sought to develop a risk-adjusted framework for defining junior miners in South Africa. The study was motivated by the lack of a single unanimous definition, both in the South Africa and globally. This study was important because the junior mining sector is a significant player in South African mining industry, however not much is known nor understood about them. Additionally, the mining industry in South Africa is said to be declining and heading towards its sunset years. Given this industry is the second largest employer after the agricultural sector, much government and private sector attention and effort should be dedicated to sustaining and reviving it so as to protect livelihoods of many people who depend on it for survival. Also, the economic contribution of the junior mining industry cannot be ignored and should be protected, even more so in a weak economic environment.

While the socio-economic motivations are clear and understood, it is not necessary for the mining industry in general (both junior and major) to continue declining when South Africa has rich mineral endowments, many which remain undiscovered and delineated. Much effort has to be concentrated so as to nurture and support junior miners starting with a clear understanding of the context in which they operate. Understanding the junior mining sector is necessary because most junior miners carry out the exploration work that is required for new mineral discovery without which the mining industry will not survive. This study takes us a step further towards understanding and defining the junior mining sector in South Africa so that we can best support it to ensure its development and growth.

Through this study, much has been learnt from matured mining jurisdictions such as Canada, Australia and The UK. The Junior mining sectors in these areas are booming and continue to support the fiscus. These countries have built their industries on the back of a successful junior mining sector. The key learnings relate to regulatory certainty and stability as well as investment as finance. Canada has a share-flow through model while Australia offers various tax incentives for investment in junior mining projects and companies

A thriving junior mining sector requires junior miners and investors to understand the importance of the risk-reward relationship. Such an understanding will drive much needed exploration activities that will lead to the discovery of new mineral deposits required to replace the rapid depletion of existing reserves. It is acknowledged that the business of mining is a tough school which requires long-term investment. And while there are no quick fixes, the success of the South African junior mining industry requires effective problem solving and partnership between government, business

and organised labour. When the regulatory and legislative environment is stable, predictable and competitive, then investments will follow suite.

The South African junior mining industry has massive potential owing to opportunities presented by large deposits of coal, chrome, platinum and manganese in addition to still having the largest gold reserves in the world.

The risk-adjusted framework for defining junior mining was aimed at providing a lens for understanding and evaluation of mining projects. Often times, potential investors met the South African junior mining sector with resistance, as such, the creation of an investor friendly environment is of paramount importance and should be prioritised as matter of urgency if junior miners are to unlock any prospects available to them.

### *7.1.1. Recommendations for Future Research*

The research revealed that one of the biggest risks to the South African mining industry was the regulatory landscape. This theme on the regulatory environment as emerged as the biggest challenge faced by junior miners through critical analysis of literature. This is no coincidence and requires specific attention. That is, the regulatory environment has become an inhibitor to the sustainability and success of an effective junior mining industry in South Africa.

In the advent of democracy in 1994, the government committed to transformation and inclusion however, almost three decades later, the junior miners are not better off. On the contrary, the regulatory environment has been described as unstable with a 'one-size-fit-all' approach. Junior miners have not received the necessary support and focus. The junior mining sector has been subjected to policies and legislation that were developed centuries ago with deep level gold mining in mind.

The global market dynamics have shifted, so should we. The South African mining industry needs to evolve and transform such that it is representative of the market demands and competitiveness. Given the nature of mining, it requires long-term investment since the process of exploration, development, extraction, and closure can take anything between 15 – 80 years. As such, for all mining (junior and major) companies to operate effectively, a stable and predictable regulatory and business environment is required to make such long-term investment decisions. It is for this reason the author suggests for other scholars to investigate and develop an effective roadmap for achieving regulatory stability specifically for junior mining in South Africa, as it pertains to the mining industry. The outcome of such a study should feed into the development of a clear strategy for nurturing and growing the junior mining sector in South Africa.

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# 9. APPENDICES

## *9.1. Appendix A: Participant information sheet*

*October 2020*

Re: Participation in Research relating to Risk Profiles of Junior Miners in the South African Context

Thank you for offering to participate in my research study interview.

I am a part-time MSc student in the School of Mechanical, Industrial and Aeronautical Engineering at the University of the Witwatersrand, under the supervision of Dr. Bernadette Sunjka. My MSc title is: ***A Conceptual Framework for Understanding the Risk Profile of Junior Miners in the South African Context***"

My belief is that the long-term sustainability of the Mining Industry in South Africa is threatened by the lack of investment in Junior Mining Projects due to the perceived high risk associated with Junior Mining Companies. The challenge faced by the investment community is that contrary to Major Miners, there is no real consensus in the definition of Junior Miners within the South African context.

It is the aim of this research to challenge the bucket classification of Junior Miners by means of developing a risk profiling framework to categorise Junior Miners into various risk profiles. The desired research outcome is for investors to better understand the Junior Mining landscape from a risk perspective.

As such, I would like to formally invite you to participate in this study; your knowledge and experience would contribute significantly to my research.

The study will be conducted between December 2020 to March 2021. Involvement in the study would entail a single face-to-face (or virtual) interview with you, at your convenience. During the interview I would like to understand your professional views on the South African and International Mining Landscape specifically related to risks within the mining industry.

Participation in the study is voluntary, and you may withdraw at any time. Anonymity and confidentiality of information provided will be assured and respected. I would like to record the interviews, so I can later transcribe them. Your consent at the time of the interview will be requested. If you do not wish the interviews to be recorded this will be respected.

The results of the study will form part of my MSc Research Report and may also be reported in academic papers and at conferences. A summary of the results of the research will be made available to you on request.

Please contact me if you have any questions regarding the research and participation in the study.

I look forward to hearing from you.

Yours faithfully,



.....

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## *9.2. Appendix B: Consent form*

Dear Participant,

Thank you for accepting to participate in this study. Please complete this consent form as you see appropriate. By signing this consent form, you are indicating that you have read and understood the description of this study and that you agree to the terms as described below:

| | Mark with X | |
|---|---|---|
| | YES | NO |
| I confirm that I have read and understood the information about this study as provided in the participant's information sheet. | | |
| I understand that my participation is voluntary and that I am free to withdraw at any time without any penalties or negative consequences against me. | | |
| I grant permission for the interview to be audio recorded. | | |
| I agree that the information I provide may be treated as strictly confidential and anonymous and only the research team will have access to the interview data. | | |
| I understand that the information acquired from the interview will not be recorded in excess of what is required for this study. | | |
| I agree that the results of this study may be recorded in academic journals and at conferences. | | |
| I have had the opportunity to ask any questions related to this study and I have had all my questions answered to my satisfaction. | | |
| I may request a report summary, which will come as a result of this study. | | |

With full knowledge of all above-mentioned terms, I agree to participate in this study.

| Participant | | Consent taken by (Researcher) | |
|---|---|---|---|
| Name | | Name | |
| Signature | | Signature | |
| Date | | Date | |

## *9.3. Appendix C: Interview questions.*

**Interview Questions for the Research Topic:** ***A Conceptual Framework for Understanding the Risk Profile of Junior Miners in the South African Context***

**Theme 1: Establish the Context**

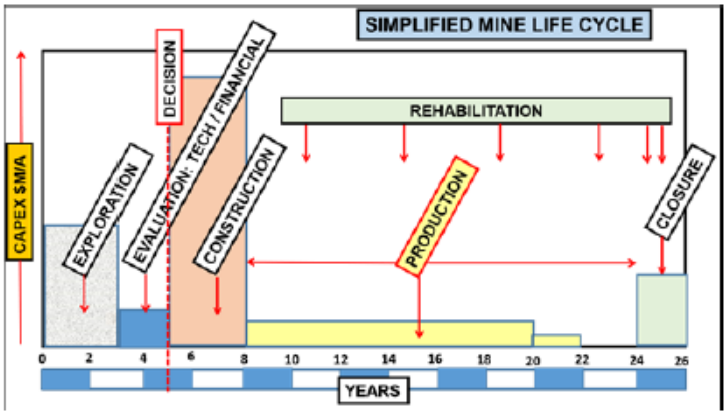
Q1: How would you describe the state of the mining industry in South Africa?"

This question is aimed at providing general insights into the overall state of the mining industry in South Africa following which the interview will narrow specifically into the state of the junior mining sector in South Africa and possible reasons of the absence of a single agreed definition for junior mining in SA.

Q2: How would you describe the distinction between 'Junior Mining' within the global context and Junior Mining within the South African context?

Q3: How would you describe the differences between Major Miner, Junior Miner, mid-tier miner, small-scale miner, and artisanal miner?

Q4: Given the five stages within the mining lifecycles (namely: 1) Exploration/Prospecting; 2) Feasibility; 3) Project Development; 4) Growth/Ramp-up production; and 5) Decline/Closure).




Source: University of Dundee – Centre for Energy, Petroleum and Mineral Law and Policy. Retrieved from https://www.extractiveshub.org/topic/view/id/21/chapterId/268

4.1. In your experience, what characterizes each stage of the mining cycle?

4.2. In which stage of the mining life cycle would you say non-major miners are situated?

**Theme 2: Understanding Risks within the Mining Industry**

Q5: What would you consider to be the biggest/main risks are present within the mining industry?

Q6: To what extent can the stated risks affect a mining business? For example, what is the likelihood that a commodity price crash will result in the closure of a mining business?
(This question is aimed at determining the resistance of a mining business against adverse effects)

Q7: Do you believe that there are there differences between risks that major miners and non-major miners experience? What would you consider to be the key differences?

Q8: Do you believe that risk management changes as we move through the mining lifecycle?
Let's go through each stage of the mining lifecycle and identify the key aspects of risk management for each stage? What is the difference in risk management for each stage of the mining life cycle?

**Theme 3: Understanding Definitional risk factors along the mining life cycle**

Q9: What commodities would you regard as risky for a mining business? Why?

Q10: Do you believe that the commodity risk changes through the mining lifecycle? If yes, then, how does the commodity risk change along the mining life cycle?

Q11: How does an orebody/geology impact on the success of a mining project?

Q12: Do you believe that there is a difference in the management teams of Junior Mining companies and Major Mining Company? If so, how does it compare?

Q13: Why do you think most junior miners are not listed on the JSE or other stock exchanges?

Q14: Do you think the lack of a clear definition is hindering Junior Mining Companies from listing on the stock exchange? If yes, how? If no, why not?

## *9.4. Appendix D: Interview Participant's Profiles*

**Participant 1**

Participant 1 is a founder and Managing Director of a multidisciplinary company which specialises in project management and consultancy. They are responsible for creating strategic plans and implementation roadmaps for transport and engineering projects. The participant boasts 21 years of working experience spanning across the public and private sector.

Through the various roles, she gained immense experience in designing municipal and provincial roads and other project management skills with a key highlight being her role in the implementation of the Bus Rapid Transit project in the City of Tshwane, a R4,6 billion project launched in November 2014.

**Participant 2**

Participant 2 in an electrical engineer by profession who started his career as a software developer before going on to complete a degree in electrical engineering. He currently works as a specialist Reliability Engineer at Anglo American. His experience within the mining and metals industry is focused on the management of physical assets. He is passionate about Technology, Innovation and Strategy and has recently completed a Master of Business Administration.

**Participant 3**

Participant 3 is an Industrial Engineer who currently works within the Integrated Planning and Operations Management at Anglo American as a Business Improvement personnel. Prior to that, she was a Scrum Master, operations manager where she was responsible for maintaining the team's agility using operations and agile management tools as well as general optimisation of business processes.

**Participant 4**

Participant 4 is a Drilling, Blasting & Technical Manager at Anglo American. She is an experienced specialist with a demonstrated history of working in the mining & metals industry. She is highly skilled in Mineral Exploration, Blast, Mining, Minerals, and Continuous Improvement. Upon completion of her degree on Mining and Mineral Engineering, she worked as a mining engineering professional in training and has risen up the ranks with notable roles being a Mine Overseer and Production Section Mining Manager. In 2018, she was voted as one of the Top 100 Global Women in Mining by the Women in Mining UK Chapter.

**Participant 5**

Participant 5 is an Australian lawyer and is a Subject Matter Expert on Libya's mining sector. She has led large-scale projects across countries and cultures. She has successfully navigated many unfamiliar territories with the most notable project being on the ground in post-Gaddafi Libya where she worked as a trusted advisor within the mining industry among Libyan government, industry, and corporate partners.

Some of her career highlights include managing an Australian government-funded initiative to build capacity in Ghana's mining sector, leading the establishment of an executive short course and LLM in mining law and policy for the University of Ghana, leading the production of a 200-article Annual Review publication, soliciting and editing best-of-the-best academic papers and incorporating all of study streams for the University of Dundee CEPMLP, establishing what was the largest indigenous land use agreement of its type in Australia at the time and successfully negotiating between 5 Native Title claimant groups and 3 levels of government.

She has worked hard to build strong networks and relationships especially within the mining industry. She is passionate about the power of domestic resource industries to drive economic change and empowerment within African countries. Her interest is in broadening economic development, elevating skills and delivering the support necessary to create thriving domestic mining industries. She currently works a s consultant on mining reform and is a lecturer at Murdoch University, Law School in Australia.

**Participant 6**

Participant 6 is a mine finder and developer and currently works as a managing director of Exploration Geological Consultancy. She specialises in Mineral Exploration and mine development, assessment, and investment strategies. She boasts more than 25 years' experience in assessing and developing mineral projects. Having developed and honed various skills over the years, her core skills include regional mineral targeting studies, due diligence and strategy, project management through to Concept and DFS mine studies, and mine license applications to government.

She has extensive experience in reviewing and managing geological data including geophysical, geochemical, regional and prospect scale mapping, mineralogical assessments, drill hole testing and resource range estimation. Through her training and experience, she has a remarkable ability to benchmark a project for its mineral exploration and mine development potential at all stages of the mine life investment cycle.

Her specific commodity experience is in Archean gold, porphyry copper-gold, sediment copper, uranium, BIF & itabirite iron ore, coal, brine potash, MVT lead and zinc, cobalt and graphite deposits. She has worked in many geographic jurisdictions including Australia, Chile, Argentina, USA, Liberia, Guinea, Gabon, Tanzania, Mozambique, Ethiopia, Malawi, South Africa, Nigeria and Zambia. Currently, her focus is on cost effective exploration assessment, project management and investment due diligence.

**Participant 7**

Participant 7 is the Chief Financial Officer (CFO) of a junior coal mine located in the Mpumalanga Province. He previously held various finance roles at Anglo American from shaft accountant, management accountant, and senior finance manager. The roles have largely focused on providing strategic and medium-to long-term planning decision support to various stakeholders including Senior Management. His core skills include financial Modelling, Enterprise Valuation (Alternative Business Cases), Long Term Planning Mining Project Portfolio Optimisation, Opex Modelling of Mining Concepts to Feasibility Study stage, Project reviews, Mine Extraction Strategy, Development of business plan optimisation (half level costing) tool.

**Participant 8**

Participant 8 is a co-founder and director at ABC* Investment Holdings, a resources and infrastructure advisory boutique firm. Prior to his current role, he worked as the head of resource finance at one of the largest banks in South Africa. Having started his career as a chemical engineer, he boasts sector experience of more than 20 years having held various roles from Domain manager at AngloGold Ashanti, Principal and process engineer at Hatch, Investment Office at IFC, and deal maker within the resources sector.

**Participant 9**

Participant 9 is a Mining Engineering lecturer at Wits University. She lectures undergraduate students on underground mining and surface mining drilling and blasting methods, Introduction to mining for Masters students in engineering as a bridging course, as well as Narrow Reef Mining to final year students. She is a qualified Mining Engineer who has worked at Impala Platinum in a development role where she was exposed to multiple departments such mine planning, finance and rock engineering.

**Participant 10**

Participant 10 is a CEO of a junior coal mining company in South Africa. She has worked for various organisations including Exxaro Resources. She has gained extensive experience in mineral

processing, coal mining and hard rock mining in various fields of engineering which includes but not limited to: project scope development, engineering design and specification, root cause failure analysis, equipment maintenance strategy development, energy management strategy development, project management, contractor management, risk management, quality management, cost management and compliance, governance and assurance management.

She is a professionally registered Electrical Engineer (Pr.Eng) by the Engineering Council of South Africa (ECSA) and also holds a Government Certificate of Competency for mines and works. She has executed a wide range of projects, from single discipline projects to large multi-disciplinary projects. She was the lead engineer for the Mine Closure Project with an overall budget of R2.6 billion.

**Participant 11**

Participant 11 is a director of a consulting firm. Previously, he was a managing director of the CCP 12J Fund Limited, a specialist, start-up, Section 12J Venture Capital Company which initially focused on investing in secondary mineral processing projects on existing mine sites. He trained in commercial studies and held roles such as investment banker at Nedbank within the Mining and Metals division. He was also the managing director of Keaton Energy Holdings, a Mineral exploration, mine development and production company.

He has led a team from start-up and first exploration borehole, through to listing on the Main Board of the JSE, raising project debt finance and then onto production. He also acquired a distressed ultra-narrow seam anthracite mine in Kwazulu-Natal and grew the business from 6 employees to 1400 in three years, hitting R1bn in annual revenues after 5-years.

**Participant 12**

Participant 12 is a new generation mining entrepreneur with a demonstrated history of working in the mining & metals industry. He is skilled in Deal Origination, Structuring, Strategic Planning, Business Strategy. As part of his various roles, he is involved in mergers and acquisition projects and transactions, beneficiation and rail logistics.

**Participant 13**

Participant 13 is a Chief Advisor on Mergers & Acquisitions, Business Exits, Capital Raising and Deployment and Communications at ABC* Associates. He has assisted several medium to large African businesses in raising capital and finance, selling their business and making the perfect business acquisitions/investments for more than 10 years now. He is also a board member of the Junior Mining Association of South Africa.

## *9.5. Appendix E: Interview Analysis Snapshot*

| Words or phrases extracted from transcripts | Code |
|---|---|
| Potential to grow based on rich mineral endowments | geology |
| Sunset industry | general |
| No exploration | lifecycle stage |
| Challenges with regards to coal and green energy | policy/legal |
| Coal is an important commodity | commodity type |
| Solar energy requires infrastructure | infrastructure |
| Gold and platinum | commodity type |
| Uranium as a source of nuclear energy | commodity type |
| Stagnation, entering a decline | general |
| negative outlook on the industry | general |
| There's a lot of opportunities for growth | general |
| Financing for coal by banks will continue but at a limited exposure | commodity type |
| Financing for coal by banks will continue but at a limited exposure | capital raising |
| Regulatory enviornment is unstable | regulatory uncertainty |
| Precious metals (platinum) will survive for a long time | commodity type |
| Base metals (zinc) is going to survive because of other competing energy sources | commodity type |
| Uranium | commodity type |
| various minerals mined in South Africa differ in exploitation and economic value | commodity price |
| Policy enviornment not stable | policy/legal |
| makes it very hard to invest | investment environment |
| Investing in technology | infrastructure |
| Investing in technology | investment environment |
| Africa was a pioneer in underground mining | general |
| technology advancements | production efficiecy |
| Processing operations have ceased | beneficiation |
| Mining ownership has remained in the same hands | transformation |
| Mining business is capital intensive | capital raising |
| you don't see a lot of black enterpreneurs coming in, or black mining engineers, starting their own mining companies | transformation |
| government has not prioritised mining | host country politics |
| our minerals are our strategic assets | commodity type |
| inequality gap | host country politics |
| sustainability | sustainabilty |
| listed on the JSE | investment environment |
| value of mine | economic value |
| mining license | legislation |
| funding access | capital raising |
| Different corporate structures | management team |
| Contract mining | contract mining |
| sophistication of mining method | mining method |

| Words or phrases extracted from transcripts | Code |
|---|---|
| JM mining and processing methods are mo sophisticated | mining method |
| majors are listed miners | listed on stock exchange |
| majors are listed miners | capital raising |
| JM's do not have access to huge land for mining compared to majors | mining land |
| corporate structure | strategic management |
| operation structure | tactical management |
| pre-colonial mining | host country politics |
| History | host country politics |
| transformation | host country politics |
| Mineral and Petroleum Resources Development Act (MPRDA) | legislation |
| explorers | lifecycle stage |
| developers | lifecycle stage |
| production company | lifecycle stage |
| mineral deposit | geology |
| stages of development | lifecycle stage |
| value curve - value of a deposit increases as you progress up from exploration | lifecycle stage |
| mining ownership has remained the same post 1994 | host country politics |
| little exploration taking place in South Africa | lifecycle stage |
| the mining environment is hostile | general |
| We don't have explorers in our country | lifecycle stage |
| iron ore, manganese, Chrome PGM | commodity type |
| Inheretited mineral commodities that were outcropping the surface | mining method |
| producing assets | lifecycle stage |
| most junior lack accounting and finance skills, non-technical knowledge | Personnel skills |
| The mandate of support structures is to lobby, look at legislation and support juniors | Support structures |
| Enterprise Development funding | capital raising |
| venture capital firms | investor profile |
| bankable budget | capital raising |
| multiple operations, multiple jurisdiction | mergers & acquisitions |
| majors are usually listed | investment environment |
| infrastructure and logistics challenges | infrastructure |
| capital raising in different jurisdiction | capital raising |
| we have one of the best regulated financial services industry | legislation |
| we have one of the best regulated financial services industry | investment environment |
| the economy is not conducive | investment environment |
| poor exploration culture | host country politics |
| poor exploration culture | lifecycle stage |
| due dilligence on projects | investment environment |
| junior miners do not have a great accountant theory and experienced financial manager | Personnel skills |
| junior miners do not have a great accountant theory and experienced financial manager | experience |
| the board consists out of skilled miners, not necessarily skilled corporates | governance |
| the board consists out of skilled miners, not necessarily skilled corporates | leadership & strategy |


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mining
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junior miners
big
challenges
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Mon, 04/12 · 13:01 52:13

SUMMARY KEYWORDS

junior miners | south africa | junior | absolutely | miner | majors | coal | terms | big | advisors | mining | challenges | countries | study | junior mining | exploration | raising | people | guess | regulations



Mon, 04/19 · 12:44 1:38:21

SUMMARY KEYWORDS

mining | junior | minerals | definition | absolutely | people | south africa | miners | companies | junior miners | junior mining | big | explorers | exploration | engineers | production | developing | discovered | mind | excluded



Tue, 04/20 · 19:02 10:00

SUMMARY KEYWORDS

mining | exposure | speak | commodity prices | battery | industrial engineering | mining company | sector | junior mining | manganese | study | mining industry | electric vehicle | number | logistics | excited | voice | junior miners | nmc | extremely



Fri, 04/09 · 19:12 1:23:11

SUMMARY KEYWORDS

junior miners | junior mining | south africa | people | banks | capital | big | money | mining | helpful | industry | capacity | raise | survive | oil | exposure | company | understand | coal | transactions

Show fewer




Tue, 04/20 · 19:09 57:56

SUMMARY KEYWORDS

mining | manganese | exploration | junior miners | industry | majors | big | mining industry | company | south africa | attract | business | investors | electric vehicle | concerned | called | mentioned | coal | put | money


majors
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electric vehicle
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money
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big
funding
junior
minerals
mining companies
people
starting
south africa
miner
develop
junior miners
mining
raw material
risks
company
government
exploration
sustainability

Fri, 04/09 · 19:12 1:01:03

SUMMARY KEYWORDS

mining | people | company | miner | exploration | south africa | government | mining companies | big | minerals | junior | africa | china | starting | develop | junior miners | risks | raw material | sustainability | funding

Wed, 04/07 · 10:09 55:52

SUMMARY KEYWORDS

people | mining | technology | sunset | perspective | absolutely | junior | funding | strategy | bank | inherited | south africa | junior mining | understand | decisions | big | context | junior miners | issue | find


big
south africa
perspective
technology
bank
absolutely
context
junior
decisions
people
inherited
sunset
issue
find
understand
mining
strategy
junior mining
junior miners
funding

**Word cloud**


junior miners
investors
commodity
exploration
miner
companies
mind
government
technology
absolutely
talking
leaving
diamond
risky
ensure
people
mining industry
mining
minerals
south africa


Sat, 04/10 · 21:13
1:02:34
SUMMARY KEYWORDS
people
mining
mining industry
south africa
junior miners
companies
minerals
miner
technology
commodity
diamond
exploration
risky
government
leaving
ensure
talking
absolutely
mind
investors


Sat, 2020/12/05 · 11:01
59:05
SUMMARY KEYWORDS
project
building
government
municipality
people
construction
money
manage
infrastructure
risk
bridge
company
road
timeline
mining
community
investor
area
case
pay




Thu, 02/25 · 15:47 49:02

SUMMARY KEYWORDS

commodities | mining industry | big | technology | mining | community | miners | risks | government | producing | junior miners | mind | operations | project | country | infrastructure | global | declining | problem | listed




Thu, 04/22 · 13:00 1:09:45

SUMMARY KEYWORDS

junior mining | big | junior | junior miners | miner | absolutely | mining | south africa | mauritius | bit | capital raising | people | business | services | membership | finance | company | funding | john | interesting




Sat, 2020/12/05 · 11:01 59:05

SUMMARY KEYWORDS

project | building | government | municipality | people | construction | money | manage | infrastructure | risk | bridge | company | road | timeline | mining | community | investor | area | case | pay