Junior mining as innovation entrepreneurship in minerals industry in South Africa

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Abstract

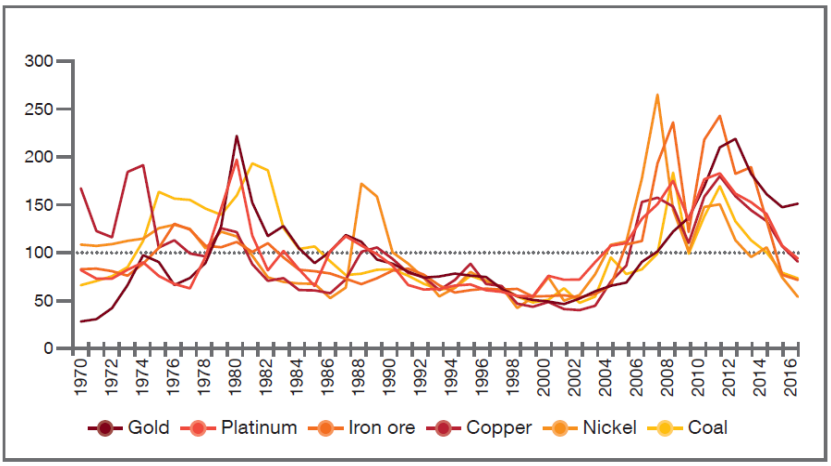
South Africa is well endowed with mineral resources which is estimated to be worth approximately US$2.5 trillion and is a leading producer of gold, platinum group metals, chromium, coal, iron ore, diamonds and vanadium. Junior mining companies or "Junior Mining" as it is known today are exploration companies that search for new mineral deposits that are believed to have significant potential for finding larger mineral deposits. The junior mining sector however faces a number of challenges. These include access to finance for capital intensive prospective green and brown field mining projects and also the very high economic and technical risks. With the changing political climate within the country and global trends in the supply and demand of minerals and metals, it is foreseen that Junior Mining has a major role to play in the future as there are many potential undiscovered deposits. It is hence a space where both Innovation and Entrepreneurship are critical in order for these Junior mining companies to not only achieve their medium to long terms goals but to also help attract much needed foreign investment into the country. This paper looks at the current status of Junior Mining in South Africa, the challenges/gaps faced by the sector, opportunities for development and the role of both Innovation and Entrepreneurship in order to succeed in this difficult industry which is dictated by fluctuating commodity prices. Recommendations will also be made on how this sector could be further improved and supported into the future.

Keywords: Entrepreneurship, innovation, investment, junior mining, minerals industry

1. Introduction

1.1 The Status of the Mining and Minerals Sector in South Africa

Mining and minerals is the backbone of the South African economy. South Africa is a leading producer of gold, platinum group metals, chromium and vanadium. It is also a leading producer of aluminium, diamonds, iron ore, manganese, coal, titanium, and zirconium. South Africa's mineral resources are estimated at a value of approximately US$2.5 trillion (Citi Bank, 2011). In the mining sector the term beneficiation is defined as the different processes used to extract valuable minerals from mined ore and separate it into mineral and gangue (waste), the former suitable for further processing or direct use (CTI Reviews, 2015). The term beneficiation is used very often in conjunction with the term value-addition. Based on the definition described above, the term beneficiation has been used within a context of economic development and corporate social responsibility (CSR) to describe the amount of value derived from the exploitation of mineral assets which remain in the country and benefits locals including communities (Citi Bank, 2011).



100 = Average real price since 1970
Source: *World Bank, PwC analysis*

Figure 1. Indexed real commodity prices in US$ from 1970 to 2016 (PwC, 2016)

According to (PwC, 2016) commodity prices shown in Figure 1 are cyclical and are influenced by supply and demand hence the decision to invest in mining operations is determined by the "life-of-mine price". Even though South Africa has a distinct advantage in terms of mineral endowments (it is predicted that there is still 30 more years of gold mining and production) there are a number of challenges facing the sector. These challenges need to be continually addressed in order for the country to remain competitive. Some of the challenges faced include increasing costs and the availability and utilization of labour. There has been several companies that have embarked on cost cutting exercises since as early as 2000's in order to have a competitive advantage (Neingo & Tholana, 2016). The challenges faced by the mining sector in South Africa is aptly summarized in Figure 2 below from a study done by (Deloitte & Touche, 2013).

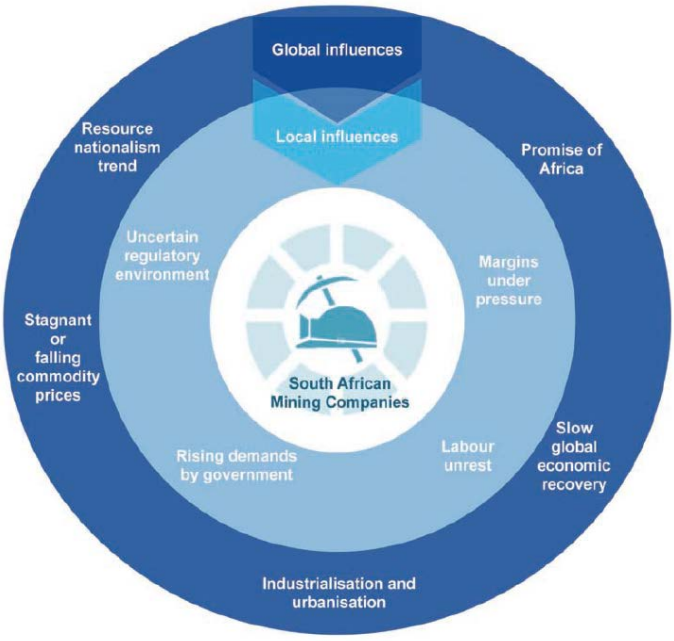


Figure 2. Local and Global challenges faced by the South African Mining Companies (Deloitte & Touche, 2013)

The above study also found that mining companies during challenging times either choose a "survival" or "leadership" strategy. In the survival strategy the objective is to cut costs as far as possible, adopting a risk-averse position and the focus is on defending their core business. The leadership strategy looks into identifying unusual

opportunities which would allow them to gain ground against their competition during the downturn (Deloitte & Touche, 2013).

According to (McGill & Theart, 2006) the junior and small scale mining sector have the potential to be very important role players in the mining sector within South Africa. In their view the country has taken a different approach to junior mining. Junior miners play a very key role in the BEE mining sector which is seen as a means to now benefit communities and the previously disadvantaged people of the country. This paper looks at the current status of Junior Mining in South Africa, the challenges/gaps faced by the sector, opportunities for development and the role of both Innovation and Entrepreneurship in order to succeed in this difficult industry which is dictated by fluctuating commodity prices. Recommendations will also be made on how this sector could be further improved and also supported into the future.

2. The Role of Junior Mining

Junior mining is usually acknowledged as an "exploration" company that searches for new opportunities and mineral deposits bearing gold, silver, uranium and other types of precious minerals. These areas are believed to have potential for finding larger mineral deposits and could in future become a large mining operation. There are also three categories of Junior Mining Companies namely: Exploration, Development and Mining. These correspond to the order within the mining value chain. For each of these categories of companies the type of people involved include prospectors, geologists, engineers and entrepreneurs. The main role of the junior mining company is seen as one that makes money for its shareholders by either selling or purchasing a larger mining company or share price appreciation. These teams of people that constitute a junior mining company in many cases use their own funds to start up a company, have highly skilled management teams but have lower overhead costs. Their main objective is to a make a return on investment. The risk taken however varies from low all the way to very high depending on the stage of the project being undertaken (Harwood, 2016).

Wesizwe Platinum Limited (Eksteen, 2006), in Figure 3 showed graphically the crossover from junior mining activity to major mining activity in terms of the mining value chain. The funding mechanisms utilised at various stages is also shown. It was at this stage in 2005/6 when South African institutions were starting to develop an "appetite" for junior mining in the country.

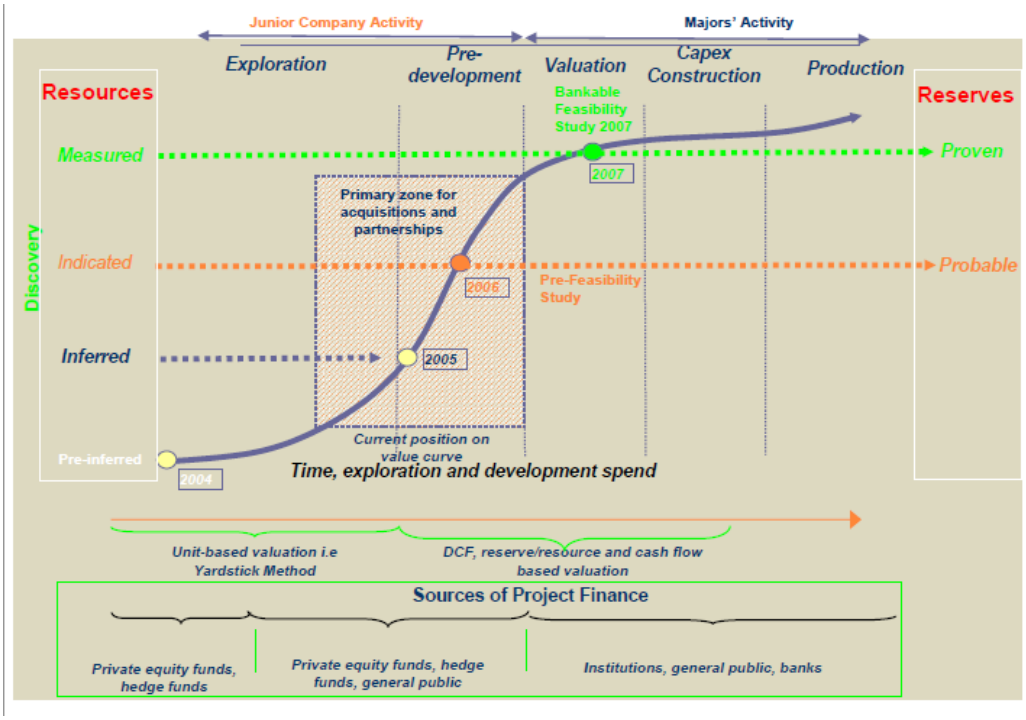


Figure 3. The Junior Mining investment value curve (Eksteen, 2006)

2.1 Challenges faced by the Junior Mining Sector

The first challenge faced is the threat of entry of competitors or other junior mining companies into the space. In certain countries e.g. Canada there are more junior mining exploration companies than major mining companies. The threat of entry of competitors is very high within the sector and those that enter are people already in the mining business with many years of experience under their belts. Companies are established to focus on specific mineral commodities rather than a number of them. Improvements in technology (innovation) has also made it easier to determine if exploration projects are likely to succeed and if there are high value minerals deposits available. There is competition amongst themselves for the land where exploration is to be done, financing and also the contractor to be used on projects (Forster, 2005).

Even though (Forster, 2005) indicated that the barrier for entry for junior mining companies is relatively low and that there are investors available, finance can still be a challenge. According to (Mothomogolo, 2012) in South Africa there are limited number of sources of mining investment funds. South Africa is seen as a developing country and hence has limitations in terms of GDP and the size of budgets and investments especially in the mining space. Funders or investors consider the following when evaluating a project and hence one has to have strong alignment to their requirements (Eksteen, 2006):

a) Choice of mineral commodity;
b) Position of the project;
c) State of the project;
d) Team leading the project i.e. the junior mining company

Contract mining and processing is a common alternative for junior mining companies. The mining company runs the business but allows contractors to manage the day to day operations of both mining and processing. One of the major difference found between junior and major mining companies is the availability of expertise. This availability determines whether one makes use of a contractor or to conduct the mining by themselves. Without the necessary expertise within the company, contract mining becomes the best alternative. Even though there are some benefits to this, the biggest risk and concern around contract mining is the increase of costs and also the loss of any intellectual property. One such example is geological knowledge and mine planning. This is crucial to the operation of a mine but can often be held by the contractors used. This can lead to the work performed being inefficient and may result in it being redone. If contractors are changed then the previous knowledge is also lost (Rupprecht, 2015).

3. Opportunities for Development

The first opportunity identified is improved access to funding. The research undertaken by (Mothomogolo, 2012) was aimed at developing and providing a framework that could be used by government, investors and entrepreneurs within the mining sector for the funding of junior mining start-ups. The funding framework is shown in Figure 4 below.

The framework indicates that there has to be an overlap between government (regulation), investors and the mining entrepreneur in order to have a conducive environment.

There are several areas for improvement under the “Mining Entrepreneur” component of the framework. Since the majority of junior mining companies do not have enough assets to be used a surety one suggestion is for government to issue bonds to projects that show promise. Banks should also be encouraged more to provide loans. Both the technical and financial skills of the entrepreneurs within the junior mining company are critical to the success of obtaining investment, hence government needs to enhance and develop mining related skills within the country. They also need to support local institutions to be able to provide the required training. Sending entrepreneurs overseas to enhance their skills is another option. South African banks use templates for business plans as part of their lending criteria and funding application. It is hence imperative for mining entrepreneurs to know and understand the requirements from the onset. There are also opportunities for funding from the IFC and Worldbank for mining related “feasibility” type projects (Mothomogolo, 2012).

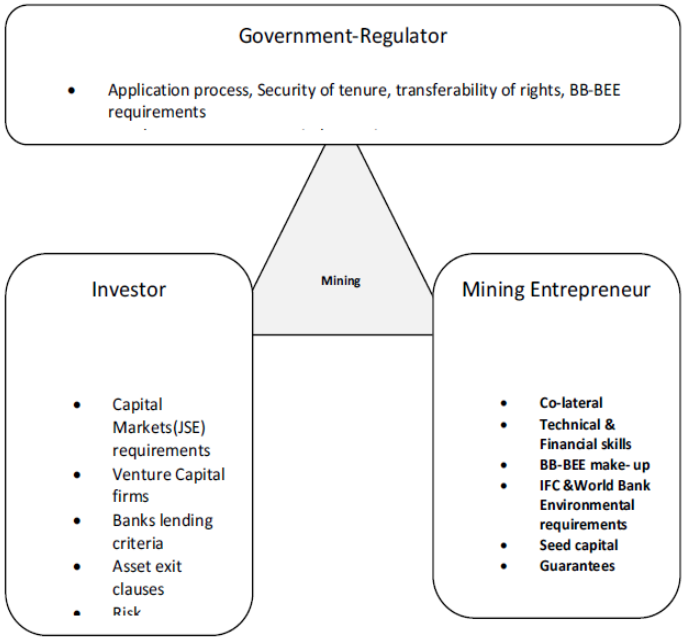


Figure 4. Example of an integrated funding framework developed by (Mothomogolo, 2012)

According to McGill & Theart (2006) in order for one to be effective, mineral resource management or MRM requires systems that will identify, quantify, and manage the risks associated with the deposits under assement. This is the core business of junior exploration companies. The person tasked to do this within the company needs to have the correct skills and competencies to undertake "quantitative risk management".

South Africa has been hosting the Junior Indaba for the past four years (www.juniorindaba.com) which brings together government, explorers, developers and investors in the junior mining sector of Africa. This allows the sector to network, engage and discuss on a yearly basis on the lessons learnt. The conference also looks at ways to further enhance investment into early stage mining projects and exploration. This type of platform is extremely beneficial for the sector and one hopes that it continues into the future.

4. Innovation and Entrepreneurship in Junior Mining

There are many ways to define what is meant by innovation. To some it is the process of taking a new idea or invention and converting this into a product or a service that has value in it (i.e. satisfies a need in the market) for which someone is willing to pay for it. Innovation in many instances requires great risk to be taken (Business Dictionary, 2018). An entrepreneur is seen as someone who is willing to take financial or other risks in order to set-up a business (mining operation) in order to generate profit or returns, the quantum of which is far greater than the risk taken. The junior miner in order to succeed hence has to be innovative and must possess entrepreneurial qualities. Both innovation and entrepreneurship however involve risk.

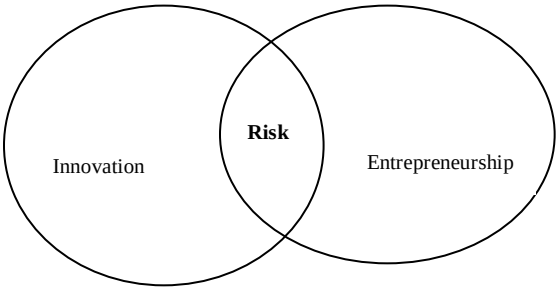


Figure 5. The overlap of Risk between Innovation and Entrepreneurship

According to (Bryant, 2015) some of the innovative approaches taken for optimising existing or new mining operations include:

- Use of continuous rather than batch operations
- Use of automation and increase in instrumentation to reduce labor costs
- Mine/Plant scalability
- Reduction of waste (to zero) and increasing energy efficiency
- Ability to mine lower grade mineral resources and a reduced cost

It must however be noted that the use of innovative approaches poses a much greater degree of risk to the junior mining companies but these companies can put "knowledge-based" strategies and plans in place to mitigate the risk. The use of technology to assist in improving the knowledge of junior miners and providing them with a platform to improve their mine planning and operational strategy cannot be underestimated. They need to make use of this available technology to acquire better knowledge of the mineral deposits to be explored which will assist in modelling and maximizing the mine design for better resource extraction (Bryant, 2015). This will inherently help in reducing the risk during the exploration phase of junior mining projects. One tool that can be used is a risk assessment chart (heat map) or matrix for the envisaged project. In many cases this is required by investors and an example is shown in Table 1 below.

Table 1: Example of typical risk categories used to identify problems in new mining projects (Source: Exploration Insights)

Source of information	Risk				
	Management - relevant experience - strategy - capital market	Technical - resource - mining - metallurgy	Execution - infrastructure - permitting - power/water/labor	Geopolitical - mining friendly - security	Financing - capex - working capital
Website	Good	Neutral	Neutral	Neutral	Neutral
Presentation	Good	Good	Neutral	Neutral-Good	Good
Financials/MD&A	Good	Neutral	Good	Good	Excellent
Technical reports	Neutral	Excellent	Good	Neutral-Good	Neutral
3rd party	Good	Good	Good	Good	Good
One on one	Excellent	Neutral-Good	Neutral	Neutral-Good	Excellent
Site visits	Excellent	Excellent	Excellent	Excellent	Neutral

The risks associated with junior mining projects come with the territory and can rarely be completely avoided. It is up to the management team to be innovative and utilise their entrepreneurial abilities to develop viable strategies to mitigate the risks which amongst others are technical, geopolitical and financial

5. Conclusion

With the country starting a "new dawn" there is much optimism within the mining sector even though there has been a decline over the last number of years. This however is seen as an opportunity of junior mining companies to play a major role in the identification of new mineral deposits. These companies however experience challenges. Lack of finance and investment is just one of them. They are also required to improve then technical and financial skills in order to stay ahead of the competition.

Support systems and frameworks are required by both government and private sector in order to provide the assistance required and to help streamline processes and also reduce the risk involved in these type of project investments. If these areas that are identified are developed and assistance is provided by both government and private sector junior mining could be seen as the savior of the mining industry going forward with South Africa.

The junior miner in order to succeed has to be innovative and must possess entrepreneurial qualities. Both innovation and entrepreneurship however involve risk. The use of innovative approaches poses a much greater

degree of risk to the junior mining companies but they can put "knowledge-based" strategies and plans in place to mitigate the risk and attract investor confidence.

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Biographies

Nirdesh Singh is currently a PhD (Engineering Management) student at the University of Johannesburg. He is a chemical engineer by profession with over 18 years' work experience in the fields of minerals processing, process control, small scale mining and small business development. He is currently employed as the Manager of the Small Scale Mining & Beneficiation Division of Mintek which is a South African based minerals research science council. His Master's degree focused on the use of engineering management concepts for sustainable productivity improvements in small scale mining and minerals processing operations in South Africa.

Antoine F. Mulaba-Bafubiandi is currently a Professor and the Head of School of Mining, Metallurgy and Chemical Engineering at the Faculty of Engineering and The Built Environment of the University of Johannesburg, South Africa. With more than 20 years in the industry and 25 years in academia he is the Head of the Mineral Processing and Technology Research Center. He is also leading the Artisanal and Small Scale Mining Interest group at the University of Johannesburg. A prolific research output producer, he has supervised and graduated 15 Doctorate students, more than 250 Masters degree holders (including engineering and business administration students) and numerous B-Tech and B.Eng (Hon). students. He is the chairperson of the Metal Casting Technology Station (MCTS) and of that of its Board. He has a PhD in Engineering, from KULEuven (Belgium), M.Eng., Lic. Physics and a MBA.