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MINE CLOSURE IN SMALL SCALE DIAMOND MINING IN SOUTH AFRICA: A REVIEW OF POLICIES AND PRACTICES

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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 Master of Science in Engineering.

24th July 2018

DECLARATION

"I ***JOSEE SORELLE NGUEKAM TAGNE,*** declare that the research report submitted for Master of Science in Engineering, at the University of the Witwatersrand is my own unique work and has not been previously submitted to any other institution of higher education. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references."

Signed: _____

This _____ day of _____ 2018

ABSTRACT

Mineral commodities are finite resources and their extraction can be understood using the mining life cycle which comprises of the following stages, namely: prospecting and exploration, development, extraction, and closure and reclamation. In the past, focus was largely directed to the first three stages of the mining value chain. This resulted in mine closure not receiving much attention. The increasing impacts of mining on the environment has forced government and mining companies to consider mine closure in policy and legislative frameworks as well as in the planning of mining operations. Over the years, several guidelines have been developed to serve as best practices for the mine closure. Moreover, mine closure has been included in mining policy and legislations for a majority of countries.

While considerable inroads have been made in terms of regulating mine closure; the focus of governments has been inclined towards large-scale mining operations. The majority of the mine closure guidelines and provisions within mining laws have been designed for large-scale operations. As a result, mine closure remains a gap in the small-scale mining (SSM) sector. The SSM sector continues to play a significant role in the socio-economic development in the remote areas. It is reported that the sector currently employs more than 40 million globally. Just like any mining activity, the SSM sector also had negative impacts on the environment. Unfortunately, if not conducted properly, the SSM activities can result in negative effects on the communities and the environment both during the operation and after a mine ceases its activities.

This study aimed to understand mine closure in SSM using South Africa as a case study. The study entailed reviewing the policy and legislative framework regulating this sector, determining the mine closure practice in the sector in order to assess whether there exists a gap between the policy and practices.

A combination of qualitative and quantitative methods was used to conduct the research and data was collected in the Northern Cape in South Africa. The research included a review of the literature and an assessment of mining

application and closure data. In addition, key informants were conducted with the practitioners from government Departments and the private consultancies to gain insights into mine closure practices in the SSM sector.

The research revealed that there is a gap between policies and practices within the SSM sector as it regards mine closure. Insufficient financial provision and the complexity of the legislation were the main hindrances to efficient mine closure. In addition, the lack of knowledge and skills, and the lack of enforcement and compliance were also identified as barriers in the sector.

The study concluded by proposing strategies that government, miners and institutions could follow to improve mine closure policies and practices in the SSM sector. As a starting point, a recommendation has been proposed towards the rehabilitation levy and its calculation. Government should reconsider the legislation and provide training and workshops on policies and technical issues; miners should integrate mitigations strategies in the closure plan. Furthermore, there is a need for supporting organization and institutions to provide support to miners particularly in the areas of technical education and funding assistance.

Keywords*:* SSM, Mine Closure policies, Financial Provision, Closure Certificates.

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DEDICATION

THIS STUDY IS DEDICATED

To my lovely parents ***Jacques and Micheline TAGNE***

For their support all the way through my studies and unconditional love

List of acronyms and abbreviations

Terms	Explanations
ASM	Artisanal and Small-Scale Mining
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
EMPr	Environmental Management Plan report
EMP	Environmental Management Plan
GDP	Gross Domestic Product
MPRDA	Mineral Petroleum and Resources Development Act
NEMA	National Environmental Management Act
NWA	National Water Act
SSM	Small-Scale Mining

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1 INTRODUCTION

1.1 Background

Mineral exploitation contributes significantly to economic growth and development in most countries around the world (Sorensen, 2012). The mining sector produces materials that are widely used in the world to meet human needs. While the sector has positive impacts, its processes are found to cause devastating environmental issues including land degradation, surface and groundwater pollution, as well as soil contamination (Zipper, et al., 2011).

Countries such as Western Australia, Brazil, Ghana and South Africa who have a long history of mining are experiencing the negative impacts of mining along the mining lifecycle. The consequences of mine closure has received less attention as compared to the other stages and thus countries such as South Africa have to deal with derelict and ownerless mine sites which pose significant concerns on the environment and the communities. This is largely due to past mining practices that had not planned and prepared for mine closure at the early stage of mine and/or lack of instruments to ensure that mines are closed properly.

With increasing concerns on the environmental impacts of mining particularly after operations have been closed, several countries have introduced and/or added mine closure provisions and requirements to their mining legislations. In most countries, mining companies are required to develop a mine closure plan that highlights actions to be taken to remediate issues posed by their operations before mining process commences. (Skousen & Zipper, 2014). In some countries, the granting of a mining license is dependent on meeting the requirements and/or provisions towards mine closure. The cornerstone of granting a mining license (including a mining permit) is to mitigate issues of water and land by the regulatory (Cheng & Skousen, 2017). In some countries, mining companies are required to make financial assurance as part of the application process. This financial assurance aims to carry out the environmental damage caused by mining operations.

Mining has a long history in South Africa and it can be traced back to the 1886s when diamonds were discovered in Kimberley in the Northern Cape Province (Sorensen, 2011). To date, the mining sector remains an important contributor to the economy of the country. According to the Chamber of Mines (2017), the mining industry contributes 7.2% to the Gross Domestic Product, 4.1% to the Fixed Investment and 3.2% to exports. The sector also employs a total of 498,396 people. Like many other countries, South Africa's prime focus during the pre-1994 period was on maximizing the economic gains of mining. Less attention was directed to managing and minimizing the environmental impacts of mining. The Minerals Act of 1991 which governed the mining industry prioritized the economic benefits of this sector rather the environmental and social benefits.

This limited attention subsequently led to poor mine closure practices by many mining companies. It is reported that there are over 6000 derelict and ownerless mines in South Africa (Van-Druten and Bekker, 2017). The impact of these mines has largely been associated with acid mine drainage, accumulation and pollution of waste material, land use, and contaminated aquatic sediments and soils (Mining, Minerals and Sustainable Development, 2002). To deal with the past legacies and to avoid future mistakes, the government enacted the Minerals Petroleum and Resources Development Act (MPRDA) in 2004.

One of the objectives of the Act is to "*give effect to section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development*". These environmental requirements and provisions were also included in several legislations within the National Environment Management Act (Act No.107) and National Water Act (Act No.36) working alongside the MPRDA. These instruments required mine owners to engage in the following processes: the submission of mining license application, the payment of financial provision, and the submission of environmental studies report.

The mining sector in South Africa can be broadly categorized into two groups namely large-scale mining (LSM) and small scale-mining (SSM). The latter group was officially recognized in 1994 and was promoted as an important economic development vehicle with the inclusion disadvantaged South Africans in the mining sector (Ledwaba and Nhlengetwa, 2016). Likewise, upon its recognition, the sector received attention from government and was included into mining policies and legislative frameworks (Scott, et al., 1998).

The South African government is commitment to the sector is envisioned in the White Paper on Minerals and Mining Policy for South Africa (1998, p25) which states that, "*government will encourage and facilitate the Sustainable Development of SSM in order to ensure an optimal exploitation of small mineral deposits and to enable the sector to make a positive contribution to the national, provincial and local economy*". The White Paper acknowledges that SSM sector has the potential to contribute economically where LSM is unable to operate and that this would contribute significantly to the national economy.

According to Ledwaba and Nhlengetwa (2016), the SSM sector plays a significant role in the development of any country through its provision of job creation opportunities, economic growth and social upliftment, especially in remote areas where unemployment and economic depression are prevalent. Unfortunately, its effective participation in the mainstream economy remains an elusive goal due to difficulties experienced by SSM operators (Mutemeri and Petersen, 2002). The SSM sector poses serious damage on the environment throughout its life cycle (Zvarivadza, 2014). There exists a lack of understanding of the mining lifecycle as it pertains to small-scale mining, which has to deal with the mine closure process and its associated effects on the environment and the communities.

During the life cycle of SSM, the closure phase is usually difficult for the operators to handle due to a plethora of reasons including inefficient exploitation of marginal deposits; poor equipment; limited or absent funds and skills; and inadequate environmental management practices. In addition, lack of financial assistance,

exploitation of women and children; as well as low levels of public health and safety are some of the difficulties and concerns met in SSM sector (Mutemeri, et al., 2010; Zvarivadza, 2014; Mutemeri and Petersen, 2002; Hoadley and Limpitlaw, 2004).

While there is no standard definition of SSM, it can best be described as a mining activity that is carried out by individual groups or cooperatives that operate with minimal or no mechanization and often in the informal sector of the market and mining operations, which involve the extraction and commercialization of the minerals (Hentschel, et al., 2003). Mutemeri et al (2016, p2) defines SSM as "*all the activities concerned with mining value chain including mineral searching, ore extracting, processing and trading of mineral product, and apply simple methods, low levels of capital and technology and are labour intensive*". In South Africa, SSM is defined as a "*mining activity employing less than 50 people, and has annual turnover of less than R 10 million with fixed and moveable assets of less than R 15 million*" (National Small Business Act, 2003, P 7).

1.2 Research rationale

As mentioned above, the limited attention to mine closure has resulted in poor mine closure practices by mining companies which has left the country with over 6000 derelict and ownerless mines. South Africa is forced to deal with the consequences of poor mine closure and to minimize the future impacts of mining. As envisaged in South Africa, mine closure has become a significant issue around the world. As a result, over the years, mine closure has received a lot attention (Cowan, et al., 2010). However, this attention is still concentrated in the LSM sector while the SSM sector has received less focus. This is seen in the number of publications and reports of mine closure in SSM specifically.

In 1999, the SSM sector employed an estimated 13 million people around the world. The number of people engaged in SSM activities has increased to an estimated 40 million in 2017 (Fritz, et al., 2018). This increase in the number of people involved in the sector has brought both positive and negative impacts to the environment and

communities. Some of the negative impacts of SSM mining include dust and noise pollution, sedimentation, river and channel erosion, and deforestation (Hoadley & Limpitlaw, 2004). With increasing concerns on the environmental footprint of SSM activities, there is a need to manage the impacts of the SSM sector. Recently, SSM activities were banned in Ghana because of their mounting impacts on the environment (Hilson, 2017).

Mine closure has become a reality if not properly done. Resultantly, any mining operation can cause consequences on the environment. More so, poor mine closure can have adverse social, health and economic implications. While several international institutions have developed some forms of guidelines and standards to ensure good practices, many of these are designed largely for LSM operations. Mine closure in SSM remains a gap both in South Africa and on the international platform. The focus of this research is on mine closure in SSM using South Africa as a case study. According to Alberts et al (2016), South Africa is amongst the countries with a well-regulated system for mine closure. Therefore, this research aims to determine the extent to which this system covers and caters for the SSM sector by reviewing policies and practices in SSM as they pertain to mine closure.

1.3 Aim and Research objectives

The aim of this research report is to understand mine closure in SSM by assessing policies and practices of small-scale mining around mine closure. The following specific objectives are to be addressed:

- To review the legislative frameworks regarding mine closure in SSM sector;
- To understand the practices of closure in SSM operations;
- To compare the legal requirements with practices on the ground to identify the level of compliance. This is determined by the level of rehabilitation which is measured in terms of financial provisions and the issuing of mine closure certificates;

As mentioned above, South Africa is used as a case study. As such, within the context and objectives of the study, SSM operations are defined as operations that are in possession of a valid mining permit. In South Africa, a mining permit is a mining license that is issued and/or granted by government through the Department of Mineral Resources (DMR) giving the mining company the permission to mine. The permit is valid for a period of 2 years and renewable three times for a period not exceeding one year. It is designed to cover an area extent of five hectares. While not explicitly stated, the mining permit has been designed for small-scale miners.

1.4 Research questions

In order to understand and analyze the concerns contained in the objectives of the study, the following research questions will be investigated:

- What are the legal requirements and provisions for mine closure in SSM sector?
- What is the current practice of SSM in South Africa around mine closure?
- Is there a gap between policy and practices of SSM around mine closure?

1.5 Study layout

The research report is organized as follows:

Chapter 1: presents an introductory background to SSM in South Africa and its potential to influence the environment after closure, the aim of the research report, the objectives of the study, the research rationale, the research questions, the significance of the study, and the scope and layout of the research.

Chapter 2: presents the literature review on mine closure in SSM. The following aspects are covered: an overview of SSM sector, mine closure and legislative frameworks regulating mine closure in SSM.

Chapter 3: provides the methodology used to conduct the research including the research approach, study area, ethical issues and limitations of the study.

Chapter 4: provides the findings of the research. This chapter is structured according to the three research questions: (1) what are the legal requirements and provisions for mine closure in SSM sector? (2) What is the current practice of SSM in South Africa around mine closure? And (3) is there a gap between policy and practices of small-scale mining around mine closure.

Chapter 5: highlights the key findings of the research in terms of the legislation provisions and mine closure practices in SSM.

Chapter 6: provides conclusion and recommendation towards efficient mine closure in the SSM sector.

1.6 Ethical considerations

The ethical clearance was obtained on 21 September 2017 with the protocol number H17/08/25. A semi-structured interview guide for key informants' interviewees was used during the research to obtain more insights into mine closure in SSM from practitioners working in the sector. The key informant interviews were conducted by telephone and /skype due to issues related to time, distance and accessibility.

2 LITERATURE REVIEW

This chapter reviews the various literatures on mine closure in the SSM sector. The chapter starts with a broad perspective of the mining life cycle and explains its different stages. An explanation of each stage, range of activities as well as the extent of environmental impacts experienced in each stage are described below. Particular attention is directed towards the last stage which is mine closure. The concept of mine closure process and its associated issues and consequences are described in the subsequent sections. The literature review also covers some of the international best practices and the legislations regulating mine closure and examples of different countries examples are given. The last section of the chapter discusses SSM activities and practices in South Africa and reviews the current legislation governing the SSM sector with specific focus on mine closure requirements and provisions in SSM.

2.1 The mining lifecycle

Robertson and Blackwell (2014) defined a mine's life cycle as a process which involves the development of a potential mine extraction operation from the start of the mining operations until the closure of the mine. Figure 2.1 shows an illustration of the mining lifecycle with the level of activity on the y-axis and time (in years) on the x-axis. The figure categorizes the mining lifecycle into five stages, namely: exploration and prospecting; site design and construction; mine operations; final closure and decommissioning and post-closure. The different stages are discussed below.

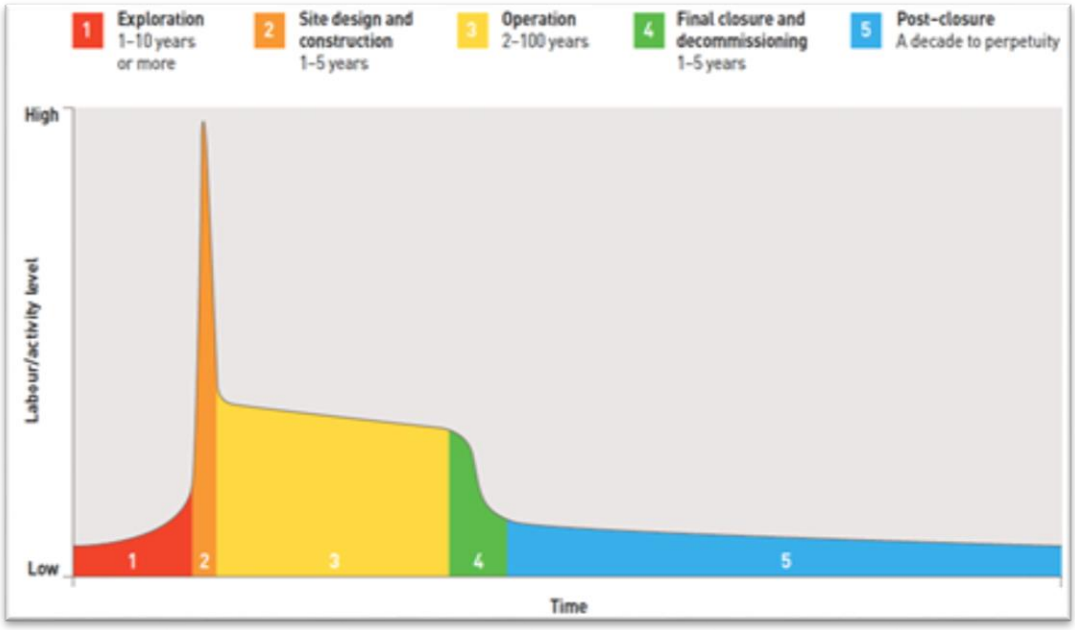


Figure 2-1: The mining life cycle (International Council on Mining and Metals, 2012).

2.1.1 Exploration and prospecting

The aim of prospecting is to search for the location of mineral deposits in order to determine whether the mineral deposit is economic to mine. Prospecting starts from reconnaissance to advanced stage (Watson, et al., 2018). In some countries, before someone can undertake a prospecting operation, reconnaissance and prospecting right must be applied (GlobalMine TM, 2015). This stage uses a range of geological techniques such as geophysics, geochemistry and photography surveys. While advanced stage may include feasibility study, typical activities include detailed sampling, drilling for samples, detailed mapping and geological surveys, as well as environmental and social studies (Fourie & Brent, 2006). The advanced stage enables one to decide whether the project will be abandoned or continued to the next stage (Watson, et al., 2018). Environmental and social studies assist with identifying, predicting and assessing the scale and the type of probable issues and opportunities associated with activities in this area. The length of these studies may vary from months and even up to years depending on the migration and seasonal issues. Impacts

are generally smaller over a wider geographic area (The University of the Arizona, n.d). As per figure 2.1, this stage can take typically between 1 and 10 years.

2.1.2 Site design and construction

Once a mineral deposit has been located and it has been proven to be financially and physically viable to mine, the next stage mainly involves the mine design and construction. Likewise, before this stage commences, the following legal authorizations may be required: mining licenses; Environmental Impact Assessment (EIA); Environmental Management Planning (EMP); the payment of financial guarantee; closure and rehabilitation plan (Watson, et al., 2018). Moreover, if the mining industry has obtained all the required licenses and agreements, and permission from local stakeholders and capital investments, then construction and mine design can start.

At this stage, elements such as mine planning, estimation of capital costs, risk assessments and organizational level asset management, geology and resources modelling, project engineering and metallurgical process planning are defined (The University of the Arizona, n.d). Site design and construction is an important phase as it allows for planning that would minimize and even mitigate some of the negative impacts that might be experienced in the future. Likewise the mine design process and the construction phase can have negative impacts on the environment and the community. Some of the environmental impacts include removal of vegetation, noise and dust pollution, and vibration. It often involves more labour and the greatest activity level (refer back to Figure 2.1). This phase may take 1-5 years before the commencement of extraction of mineral deposit (Intenational Council Mining and Metals, 2012).

2.1.3 Operation

The purpose of this phase is to start producing the ore in order to make profit. Once the resources are consumed, the waste is generated. Mine operation is the longest phase in the mining process and may take between 2-100 years depending on various

factor such as nature, and location of the orebody, the financial and technical viability, resource and its feasibility to mine (Intenational Council Mining and Metals, 2012).

These factors are also important in determining the type of mining method to be used and the equipment to be used. For example, depending on the type of the orebody, the mine can choose to use underground or surface mining methods. Generally, underground mining is complex and expensive, and requires more detailed planning for safety and convenience (McLellan, et al., 2009). The associated activities found during underground operations involve production facilities such as drilling, blasting, loading and haulage, plant and water storage, stockpiles, waste site, maintenance and office accommodation (Fourie & Brent, 2006). Surface mining methods include open pit mining, quarrying and stripping. This method intends to remove soil and rock overlying on the overburden. While in underground mines, the overlying rock remains in place and the removal of mineral is done by using the tunnels or shafts (Watson et al, 2018).

As noted above, this operation phase involves the process of excavating mineral resource from the ground by applying engineering principles and equipment (Hentschel, et al., 2003) and as such has negative impacts on the environment. These impacts can be categorized as direct, indirect and cumulative effects. Direct impacts can result from construction and other mining activities (e.g. water quality and land degradation) (Marais, et al., 2015); and indirect impacts can result from soil erosion and the increasing convenience to planned mining sites. In addition, cumulative impacts can result from the sum of all the impacts that have occurred (e.g. noise levels and air quality) (Watson, 2016).

The scale of operations differs for LSM and SSM operations. According to Patel et al. (2016), SSM operations usually target small deposits whereas LSM operations exploit large deposits. As such, the scale and extent of environmental impacts are different for the various categories of mining.

2.1.4 Final closure and decommissioning

Mine closure, which is the focus of this research, involves the decommissioning of the mine and restoring the environment close to its pre-mining state. The aim of this phase is to minimize the magnitude of the land disturbance which has been created in all stages of the mine lifecycle beginning with exploration activities (Mchaina, 2001). In addition, it aims to reclaim all distressed zones and to leverage facilities (e.g., roads and housing and other features) for their long-term benefit to communities around the mine site. This is important for social closure (e.g. a recent requirement added to legislation on mine closure) (Watson et al, 2018).

Laurence (2006) argued that sometimes closure might occur for unforeseen reasons and push a mine to close. Once a mining site is exhausted of reserves, the process of closing the site occurs, dismantling all facilities on the property, removal equipment and safe closure of all workings occur (Fourie & Brent, 2006). Largely, mine closure occurs once the mining process becomes uneconomical to continue mining.

During this stage, mining ceases and rehabilitation ramps up. Ideally, rehabilitation activities should commence during the operation phase and continue post-operations until closure objectives may be accomplished (International Council on Mining and Metals, 2008). Rehabilitation involves the removal of infrastructure such as the shaping of waste dumps, lying of topsoil and revegetation of waste rock disposal areas that will no longer be used.

The end result of closure and decommissioning is viewed in some countries as closure certificate or relinquishment. In cases of closure certificate, the holder of the mining license is no longer responsible for any environmental damage after the mine has closed. Digby (2016) posits that the granting of closure certificate allows the mine to *'walk away'* and move on to other projects. As such, closure certificates are seldom issued.

2.1.5 Post-closure

The post-closure stage aims to ensure that all rehabilitated mine lands, revegetation and water management structures are functioning as planned. Moreover, rehabilitation and long-term stabilization may involve ongoing monitoring and maintenance of latent and residual impacts (International Council on Mining and Metals, 2008). Some maintenance activities should be conducted to handle erosion, and monitoring is important to ensure that post-closure performance criteria are being met and intended land uses are being achieved. This phase may be extended for a long period. For example, long-term water management obligations require active water treatment and monitoring for decades.

It is during this stage that engagement activities with the local communities continue and emphasis is put on monitoring, land use and information about on-site activities. Furthermore, it is evident that communities are found to still interested in site activities and often participate in reviewing technical issues and decision-making.

2.2 Overview of mine closure

As noted above, ideally, mine closure should start at the early stage of the project evaluation and it should start before the construction of a mine site. In Canada, mine closure refers to "*when the ore minerals are completely depleted or when it is no longer economic*" (Environment Canada, 2013). As mentioned above, a myriad of reasons push a mine to close and these include depletion of the resources; low commodity prices; decline in the grade of the resources (geological factors); increasing production costs; technical reasons (geotechnical conditions, mechanical or equipment failure); and political constraints; lack of social license to operate as well as regulatory pressure and government policy (Laurence, 2006).

An example of an economic reason was observed in Australia in October 1985 when the commodity price of tin dropped dramatically and the mine was obliged to close

due to financial issues (Laurence, 2006). In some situations, mines may be shut down temporarily and be put in care maintenance (Environment Canada, 2013).

It is important for mining companies to ensure long-term environmental management and leave positive legacy for local communities. This entails developing an integrated mine closure plan which consider community interests. This process involves how the environment is managed, social consequences which may arise, as well as the manner in which rehabilitation of disturbed lands may be conducted in order to leave a suitable long-term beneficial land use after mines shut down (Spain, et al., 2006).

To date, countries such as Western Australia, Canada, the United States of America (USA), Australia, Ghana, and South Africa have integrated mine closure instruments and/or tools such as risk management, mine closure planning, and financial provisions in their mining laws in order to address the issues around closure.

2.2.1 Consequences of mine closure

In the past, issues around public health, safety and revenue loss were the major concerns for both government and mining companies (Roberts, et al., 2000). From a broader perspective of the international mine closure experience, the response to public pressure has directed discussion to the environment and social issues of the community around the mine sites (Roberts, et al., 2000).

The socio-economic consequences of mine closure usually depend on the depth and configuration of the mine, the attributes of the groundwater system and the features of human settlement on the surface (Ackermann, et al., 2018). Generally, the environmental issues of closure are significant and well known. Mine closure can intensify the environmental impacts caused by mining activities through the life cycle of the mine. These impacts include river systems issues; contamination of ground and surface water by heavy metals; radioactivity risks and acid mine drainage; damage to wetlands (Krause and Snyman, 2015). For example in Western Australia, the environmental issues observed at the time of closure included degradation of soil

quality, releasing of acid mine drainage and land use for agricultural purposes (Kabir, et al., 2015). In Ghana, the environmental issues met include land degradation, water and air pollution (Amponsah-Tawiah & Dartey-Baah, 2011).

Additional negative impacts of lack of proper mine closure are abandonment of land (Smith and Underwood, 2000); seismicity and re-watering; mining waste; as well as soil erosion (Krause and Snyman, 2015). The loss of jobs in the local communities is also a consequence of mine closure (Siegel & Veiga, 2009). Over the years, the environmental issues associated with mine closure have also resulted in severe impacts on the public health and safety which subsequently affect the economic status of local communities.

Tremblay and Hogan (2012) found that more than 10, 000 mine sites were abandoned in Canada. These abandoned mine sites pose severe concerns on the health of the local communities. In Latin America, the social issues observed at the end of the mine include loss of employment, and health concerns such as high blood pressure, cholesterol level, family violence (Warhurst, et al., 2000). In Australia, the consequences of mine closure included: substance abuse; heat exhaustion; myocardial infarction and nervous system disorders; dust breathing (Stephens & Ahern, 2002). Loss of community cohesion was another observation made. The consequences of mine closure in India led to the government assessing the effectiveness of regulation within the mining industry (Tripathy, 2012).

2.2.2 International best practices to manage mine closure

This section discusses the international best practices used to manage mine closure in the mining industry. According to Sheldon, et al. (2002), the guidelines of mine closure vary in terms of environmental and technical requirements, social consultation and integration. Best practices are simply described as the "*best way of doing things*" by using the actual technologies and knowledge present at a specific site and time (Department of Industry Tourism and Resources, 2006). Most of the international and national guidelines which have been developed are based on the

concept of Sustainable Development (SD) (Sheldon, et al., 2002) which emphasizes the need to "*meet the needs of the present without compromising the ability of future generations to meet their own needs*" (United Nations General Assembly, 1987, P43). The different standards and guidelines have a range of technical criteria and sustainable planning tools.

The following institutions have developed mine closure guidelines: International Financial council (IFC), International Council Mining and Metals (ICMM), and World Bank Group. Nationally, Australia has developed a guideline for mine closure titled: "*Guidelines for preparing mine closure plans".* At company level, Anglo American has a toolkit that deals with mine closure process which is titled "*Mine closure Toolbox".*

These guidelines and standards contain some of the main elements and instruments used to ensure a best practice of closure process. These include a closure plan, managing risks throughout the life cycle of the operation, financial provisions for closure, monitoring, and maintenance of post-closure (Department of Mines and Petroleum Environmental Protection Authority , 2015). These instruments are discussed below.

2.2.2.1 Planning for closure early in mining life cycle

Mine closure planning is implemented at the inception stage of the mining life cycle. The importance of planning for closure at the inception stage is to avoid, reduce and mitigate negative long-term social and environmental effects on the ecosystem. Unplanned closure poses serious effects on the environment and the communities (Nehring & Cheng, 2016). An efficient mine closure plan is perceived as an engine for the development of life beyond the mine's own life through a process that maximizes the benefits from long-term use, and reduces the negative effects (International Council on Mining and Metals, 2008).

During the establishment of the closure plan, the following obligations should be taken into consideration: closure objectives; environmental and social considerations;

health and safety hazards; closure assumptions; technical design criteria and relinquishment conditions (International Council on Mining and Metals, 2008). The toolkit developed by Anglo America (mentioned above) outlines some of the key closure principles and approaches that should be considered once the mine is preparing the closure plan (Anglo American, 2013). These elements include:

- Mine closure plan should demonstrate that the biological, physical, social, economic and institutional conditions of the surrounding mines can be achieved regularly with agreed target closure outcomes and goals;
- Mine closure plan should involve all the stakeholders; which summarizes the prerequisite for current concepts of consultation;
- Mining companies should conduct a Rapid Strategic Environmental Assessment which takes the form of scenario planning;
- Mining companies should identify and take in consideration all stakeholders views, expectations and aspirations in order to make proper decisions;
- Mining companies should ensure that the development of operations do not harm the company itself and result in the social, environment and the economic liabilities beyond closure. For example, mine closure must include best practice environmental compliance, health care and community development, and sustainable urban land use;
- Mining companies should plan for monitoring and evaluation programmes that take into account the environmental and socio-economic aspects. These programmes should be aligned with the legislations and Sustainable Development criteria;
- Mining companies should update the closure plans by referring to the results of all the above steps. For example in Columbia, the government requires the mining industry to revise and amend mine closure plan every five years (British Columbia, 2017).

2.2.2.2 Risk management across mining life cycle

Risk management has to be part of the short-term management method and integrated planning (Currey, 2003). During the elaboration of a closure plan, the risk assessment process allow mining companies to identify the potential issues that could pose risks to closure outcomes (International Council on Mining and Metals, 2008). One way of integrating risk assessment into the mine closure plan is to develop a risk register that could allow mitigating risks and applying control strategies (Laurence, 2003).

To manage the risks, it is important to insure, the level of acceptability regarding policies and guidelines. Therefore, the application of solutions has to employ the engineering assessment report, the application of innovation solutions that may include self-insurance financial guarantee (Anderson, 1999). Laurence (2006) postulates that risk management tools are useful in mitigating potential hazards during extraction and post-mineral extraction. These include risk management, project management and concurrent engineering.

2.2.2.3 Financial provision for closure

The mine closure costs vary over the mining life cycle and usually increase as the operation grows to its maturity until the mine closes. This is due to the size of operation, level of activity and a growing footprint. Under SD principles and in some legislative frameworks, mining companies are required to consider closure costs across the life cycle of a mine (Slight & Lacy, 2016). These closure costs are referred as financial assurance and/or guarantees in some countries. Financial guarantee can be defined as "disclosure used by regulators to determine the amount of an insurance, bonds, cash deposit, letter of credit and bank guarantee under a project's constitutional obligations (Peck & Sinding, 2009).

Usually, the closure cost estimates are regularly updated taking into account the changing circumstances and levels of risk (Department of Mines and Petroleum Environmental Protection Authority , 2015). This is to ensure that the closure costs

are accurate. Furthermore, this assists with the management and mitigation of high-risk impacts.

Kahn, et al. (2001) found out that some factors that could allow reducing closure costs include the use of improved material handling process and equipment, the timetable of monitoring process and the use of new bioremediation methods. In Western Australia, the amount of financial guarantee is integrated in the Mining Rehabilitation Fund Act 2012 and the Mining Rehabilitation Fund Regulations 2013. This amount of financial assurance is non-refundable and should be isolated from the internal accounting provisions for closure and rehabilitation. In addition, this amount should not be used to counterbalance the costs for rehabilitation (Department of Mines and Petroleum Environmental Protection Authority , 2015).

The regulatory authorities may also require the submission of the review of a complete detailed closure costing report, and/or an independent audit which should be clearly highlighted in the report in order to confirm that the company has sufficient funding to carry out mine closure issues (Department of Mines and Petroleum Environmental Protection Authority , 2015). If necessary, a costing report is also included into the agenda for financial assurance in terms of closure over the mining life cycle. In the case where the bond payment will be not be sufficient to cover the damage, mining companies are usually required to provide more funds to be able to cover the remedial works associated with closure.

For example, the Brazilian government requires mining companies to provide financial and economic incentives (Kahn, et al., 2001). These incentives involve the traditional performance bonds, flexible performance and insurance systems. Performance bonds focus on restoration of damage and the lowest level of environmental eminence. This incentive was used in Canada and United States to finance land restoration and it was a success. Flexible performance bond offer an incentive to mining company to close efficiently and minimize the extent of upcoming impacts. While insurance system generates incentive for an ongoing monitoring and maintenance of the closed mine sites.

2.2.2.4 Monitoring and maintenance

During the elaboration of mine closure plan, monitoring agendas are required to be in place and the verification of closure planning processes are assessed to determine if they meet the targeted goals. The monitoring programmes may need to establish baseline conditions, understand the changes that might result in social and environmental impacts, the measurement of progression towards predicted goals and the demonstration of the achievement goals (International Council on Mining and Metals, 2008).

From the review of the international best practices proposed by some institutions, the study noted that most developed countries like Columbia, Peru, Brazil, Australia, Ghana and South Africa have recognized the relevance of managing the environmental issues through the mining life cycle. This is as a result of the impacts of poor mine closure on the economic development of the respective countries. Over the years, these various countries have introduced closure provisions and requirements into their mining legislation in order to reduce environmental issues and manage closure issues in large-scale mining.

2.2.3 Mine closure in Small-Scale Mining (SSM)

As mentioned above, there is no universally accepted definition for SSM and hence its definition varies from country to country. Some countries refer to this group of activities as artisanal and small scale mining (ASM) and some as SSM. For the purpose of this research, these activities will be referred to as SSM.

Barreto, et al. (2018) argued that the definition of SSM sector could be seen both from a development and public policy perspective. According to Hentschel, et al. (2003), SSM refers to mining by individual groups or cooperatives with minimal or no mechanization, often in the informal sector of the market and mining operations, which involve the extraction and commercialization of the minerals. Mutemeri et al (2016) defines SSM as "*all the activities concerned with mining value chain*

including mineral searching, ore extracting, processing and trading of mineral product, and apply simple methods, low levels of capital and technology and are labour intensive".

The most recent publications point out an estimated number of people who rely in ASM. This figure is between 40 million and about 150 million people who depend on this sector across 80 countries (Persaud, et al., 2017). SSM activities are widespread in developing countries particularly in Latin America, Asia and Africa. The sector employed an estimated 10 million people in Asia, 9 million Africa and 1.4 million people Latin America (Fritz, et al., 2018). In some countries, SSM activities employ more people than the LSM sector. Barreto et al. (2018) posits that the SSM sector employed five times more people than the LSM sector. The literature reports that 40 to 50% of women are involved in SSM in Africa (Fritz, et al., 2018).

This sector is both complex and important to the economies of at least 23 countries in sub-Saharan Africa, especially in the rural location (Fritz, et al., 2018). In 2003, women in SSM represented 50 per cent in Mali of the total mining population (Hentschel, 2003; Hinton et al., 2003). However, many countries face challenges to regulate SSM sector because of the informal nature of the sector. Despite attempts to formalize SSM sector, many SSM activities still operate outside the regulatory frameworks. Literature has attributed this to the burden for some legislative requirements costs associated with the application processes and many other factors (Crawford, 2015). For example, in Madagascar and Dominican, Crawford (2015) argued that miners said that the license fees, transaction costs and taxes miners have to pay are higher than the benefits of mining. In Uganda, SSM represents 90 per cent of all mining but only 5 percent of these miners have licenses (Crawford, 2015).

The SSM sector plays a significant role in the economy and the development of rural areas around the world. Unfortunately, although it presents benefits to the population, it also poses serious concerns on the environment, economic, public health and safety, as well as social at the time of closure. For example, the environmental issues met during SSM activities in Brazil include soil water and fauna alteration, air

quality, water contamination and deforestation (Veiga & Hinton, 2002). In Ghana, the health issues found are mental illness, neurological damage, chronic bronchitis, asthma or lung disease, incidence of tuberculosis, and gastrointestinal diseases (Bansah, et al., 2016). There is usually lack of clear mitigation measures and funding from the governments to assist the sector to deal with the environmental challenges it faces and/or creates. This challenge continues to escalate social and environmental impacts in SSM sector (Crawford, 2015).

Mine closure is a new phenomenon in SSM sector and mine closure planning is a more recent realization. The topic has not received much attention in SSM compared to LSM. There is limited academic publication and journals on mine closure in SSM (Andrews-Speed, et al., 2003). While a number of guidelines have been developed over the years on mine closure, the majority of these guidelines and standards are designed towards managing the environmental impacts of the LSM sector. The SSM sector has in many countries been neglected and not considered important until recently. While most countries have officially recognized SSM activities, it still remains in the shadows and without resources, skills and technology. In many countries, the sector is not well regulated and a high percentage of its activities take place in the shadows to avoid regulators.

While the environmental impacts of SSM are well documented and known, there is still a lack of detailed assessments of environmental issues and consideration for closure requirements as compared to large mining activities. Closure is not well done, if done at all. There are some countries that have put in place standards and legislation to manage mine closure in SSM. Some of the examples from these countries are discussed below.

In Madagascar, post-mining rehabilitation requirements involve the elaboration of Environmental Impact Assessment process (EIA), risk mitigation; payment of financial provision and an elaboration of mine closure plan (Cook & Healy, 2012). This situation is different when it comes to SSM activities. For SSM operators, EIA is found to be unaffordable and *unnecessary* (Fluctuation, n.d.). Many scholars have

criticized the mine closure planning requirements for SSM under Madagascar's regulations (Cook & Healy, 2012). It is required for the SSM sector to undertake an EIA or a simplified version known as an Environmental Engagement Plan (EEP) before starting any activity (Cook & Healy, 2012). Consultants who assist miners with the application process and produce reports (Fluctuation, n.d.). usually do this. The environmental baseline studies and the elaboration of required plans cost in time and resources.

Barreto, et al. (2018) found that the national and local SSM organizations play a significant role in the mediation between SSM sector and government. In addition, these organizations provide training through campaigns and assist SSM operators to minimize concerns on the environment and the community.

In Ghana, once a mine ceases its activities, it needs to close and rehabilitate. The rehabilitation of land costs a lot of money. Recently, financial assurance policies have been introduced for post-mining land rehabilitation (Twum, 2013). The implementation of financial assurance is only applicable where SSM operations are legalized. The literature shown that SSM sector faces some difficulties and lack of funds is one of them. This issue does not allow miners to make sufficient financial provisions to carry out the environmental issues.

Ghana, Zimbabwe, and Western Australia have introduced a new concept that allows responsible government departments to handle the issue of rehabilitation in SSM sector. These countries have introduced a rehabilitation levy into legislation framework. The Ghanaian government defines the rehabilitation levy as the percentage of weighing scale of compensation amount taken into a fund to help clear-out environmental issues (Arkorful, et al., n.d). In South Africa, the rehabilitation levy would be equivalent to financial provision which is the amount that the government may retain from buying commodities to miners or the amount that regulator authority make use to carry out the environmental damage in case miners will not do it.

The Western Australia has implemented the Mining Rehabilitation Fund Act 33 of 2012 in order to ensure that funds are available to clean up environment issues that may occur at the time of closure. This Act requires that all holders of mining license to pay annual amount of the total estimated mine closure liability (Department of Mines and Petroleum and Environmental Protection Authority, 2013). SSM operators are required to pay smaller than AUS$50000 for rehabilitation levy per year (Department of Mines and Petroleum , 2014a). The rehabilitation levy is recalculated annually in Western Australia.

In Zimbabwe, at the time of closure small-scale miners are expected to pay $15 per ton of all commodity for rehabilitation levy. The required amount of levy depends on the level of output from miners (Dlamini, 2014). Prior to 2014, the amount of rehabilitation levy was $500 per year. With the majority of the miners struggling to pay the levy, the government reduced the levy amount by 60%. According to Dlamini (2014) the decision to reduce the rehabilitation amount was government's attempt to formalize the sector. In 2016, the Minister of Mines in Zimbabwe argued that *one stop shop* concept would allow miners and millers to pay registration process and rehabilitation costs easily. This concept creates an investment conducive environment by reducing costs and time of processing documents. In his submission, the Minister of Mines proposed that $1200 per annum for levy charges (Kasha, 2015). This is higher than the levy that was charged pre-2014.

2.3 Mining closure in South Africa

The mining sector is amongst the sectors contribute significantly into the economy of the country especially in South Africa. As mentioned above, the sector contributes considerably to the foreign exchange earnings and local employment (Statistics South Africa, 2016). The large reserves of important minerals found in South Africa include diamonds, gold, phosphate, cobalt, coal, uranium, and the platinum group metals (Chamber of Mines, 2013). These minerals are mined using both small-scale and large scale mining methods.

The following factors are usually used to distinguish between LSM and SSM activities in South Africa: the number of employees, the profit generated, the motivation, the technology used, the level of skills and competences (Nhlengetwa and Hein, 2015). For instance, the LSM sector is driven by profit and it is technologically advanced. LSM refers to "*any formal company that complies with international performance standards*" (World Bank, 2009). On the other hand, SSM operations are largely poverty driven and are conducted as a livelihood and survival activity (Hoadley & Limpitlaw, 2004)**.**

2.3.1 Small-Scale Mining in South Africa

The National Small Business Amendment Act (2003, p 7) defines SSM as "*a mining activity employing less than 50 people and having annual income of less than R10 million, with fixed and movable assets of less than R10 million*". According to Ledwaba and Mutemeri (2017), SSM activities are characterized by mechanized and limited scale of equipment; high production input; large extent of operation; and registered form of organization (See figure 2.2).

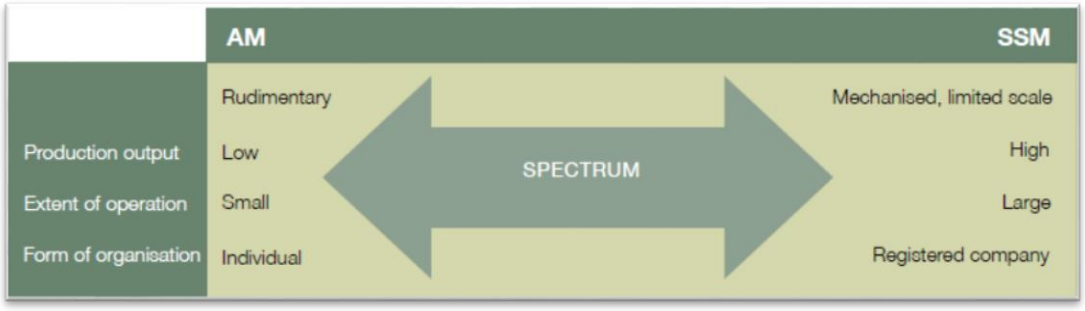


Figure 2-2: Difference between artisanal and small-scale mining (Ledwaba and Mutemeri, 2017)

Small-scale mining operations exploit a wide range of commodities and these include precious minerals, construction materials such as clay, stone and sand, as well as industrial minerals (Mutemeri, et al., 2010). In South Africa, small-scale miners are found in nine provinces. However, the largest number of SSM operators is found in Northern Cape, North West, and KwaZulu Provinces (Ledwaba and Mutemeri, 2017).

The spatial distribution of the SSM commodities depends on the geography, geology and transportation system of the area (Mutemeri, et al., 2010).

According to the Department of Minerals and Energy (now Department of Mineral Resources) (2007), there were about 6000 legal SSM in South Africa in 2007, but currently, the number of registered SSM is unknown. Many reports estimated the number of SSM operators to vary from 10,000 to 30,000 (Buxton, 2013). A study done by the Mine Health and Safety Council (MHSEC) (2011) referenced by Ledwaba and Nhlengethwa (2016) estimated the number of legal operations to be 1030.

The primary legal tools that govern SSM sector in South Africa is MPRDA in conjunction with other laws including National Small Business Amendment Act, National Environmental Management Act (NEMA), National Water Act (NWA) and Mine Heath Safety Act and others (Ledwaba and Mutemeri, 2017). As in other countries, historically, SSM sector did not receive much attention in South Africa until the enactment of the MPRDA and the introduction of mining permits which were "meant". The mining permit is granted for 2 years and for an area extent not exceeding 5 hectares (section 27 (8) of MPRDA (2008). Section 27 (8) (a) covers the renewability of the mining permit which is for three periods and each may not exceed one year at a time (MPRDA, 2008). Table 2.1 shows the summary of the provisions for mining permit. The Department of Mineral Resources (DMR) is the competent and responsible authority for granting mining permits.

Table 2-1: Summary of SSM legal procedures (Debrah, et al., 2014)

Provisions	**South Africa**
Law	MPRDA
Category of licenses	Mining Permit (cover all SSM activities)
ligibility by nationality	No restriction
Where permit can be issued	No restrictions, can mine any area where licensed
Validity	2 years, renewable 3 times for a period of 1 year each time
Area extent	≤ 5ha
Depth restriction	None
Number of licenses allowed	Not limited
Number of employees	Not specified
Transferability	Transferable, can be leased

The SSM sector in South Africa is categorized into two, namely the legal and illegal SSM. Figure 2.3 provides an illustration of the two categories of SSM. This research focuses on the legal SSM and this includes miners that operate with mining permit required in terms of the provisions and requirements of the MPRDA. Some SSM operations are legal but struggle to fully comply with all the required legislations. Therefore, to be considered compliant, SSM activity should meet requirements under MPRDA, NEMA and NWA.

The legal requirements are a challenge for SSM operators because it is difficult for them to afford the professional services required to put together the required documentation. Obtaining the mining permit can take six months or more, which depends with the SSM operators' ability to provide the required documentation (Ledwaba and Mutemeri, 2017). The application process of mining permit is a time consuming and arduous. More so, the application should be completed online and this is an issue for miners because they are located in remote areas where access to internet or computer is a challenge (Ledwaba and Mutemeri, 2017).

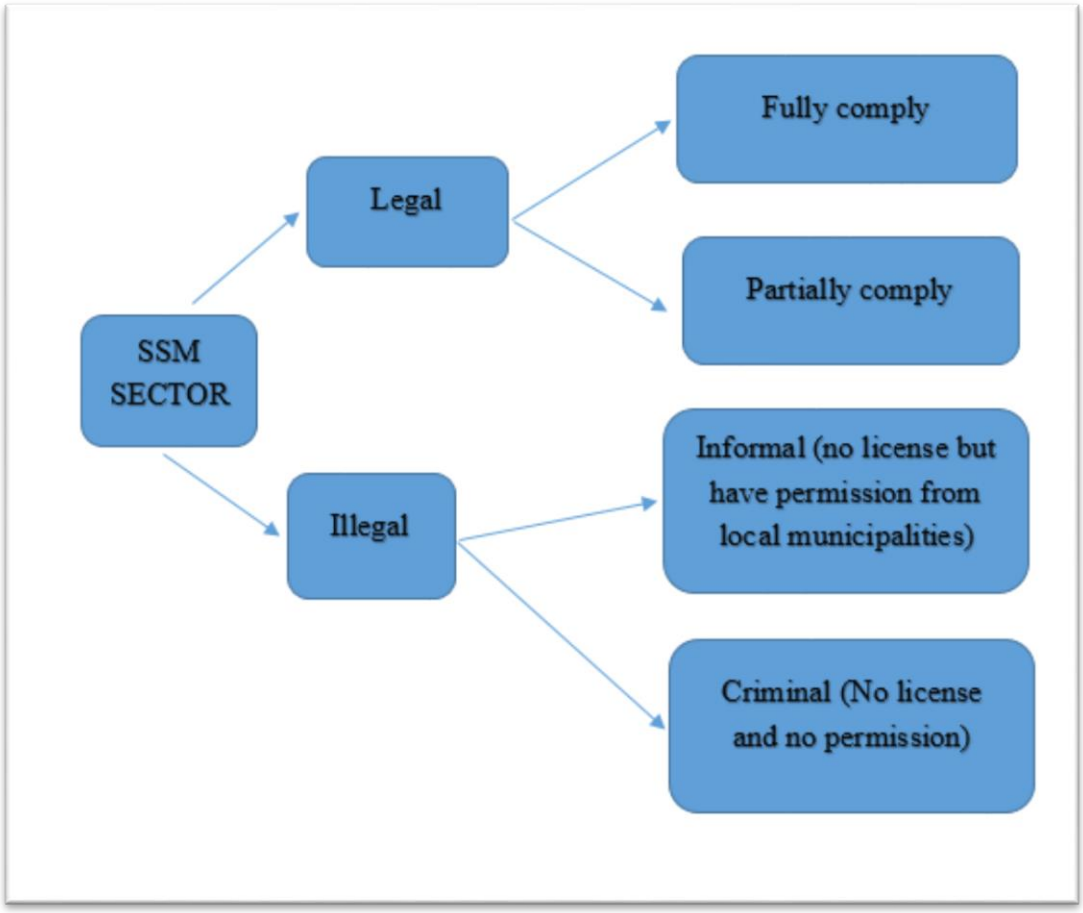


Figure 2-3: Description of SSM sector in the context of Law (Ledwaba and Mutemeri, 2017)

In understanding challenges facing the sector Mkubukeri and Tengeh (2016) identified "push" and "pull" factors. The "push" factors include poverty, natural

disasters, conflicts and economic crises, while "pull" factors include the potential for high incomes or gold-rush type situations (Mkubukeli and Tengeh, 2016). Unfortunately, there is no actual statistical data with regard to exact contribution of SSM sector to the economy. However, SSM activities are perceived having potential to alleviate poverty in remote rural areas, contribute to economic growth and development and create job opportunities in remote areas (Ledwaba and Nhlengetwa, 2016). Statistics South Africa (2016) has shown that agriculture is no longer the main economic activity in remote areas and has been replaced by SSM.

Despite the advantage of this sector, during the life cycle of mine of SSM activities, these activities have negative impacts on the environment and these include: water and air pollution, land use change, soil pollution and degradation, lack of rehabilitation, landscape change, ground instability and landslides (Heath, et al., 2004). These impacts have been found to have a long-term effect on the mine surroundings and communities (Heath, et al., 2004). The environmental issues that occur in SSM sector worldwide and especially mercury emissions from gold mining are also similar to the South Africa context (Heath, et al., 2004).

2.3.2 Difficulties facing the Small-Scale Mining sector in South Africa

As the case in many countries, SSM sector is perceived as having a multitude of challenges on its operations, the environment, social and economy (Zvarivadza, 2014). Some of the challenges faced by SSM operators are the lack of basic operational conditions including lack access to finance, limited access to appropriate equipment and technical capacity, limited market opportunities, inadequate legislative framework and policy, lack of insufficient government capacity and information, as well as insufficient training opportunities (Mutemeri, et al., 2016). These challenges are discussed below.

- Lack of legal requirements: SSM sectors struggle to comply with legislative framework. This is due to some limiting factors such as skills, finance and resources.

- Inadequate or lack of geological information as a challenge on its own can lead to negative effects on the environment, a lack of planning and the consequent failure to integrate mine closure planning at an early stage of the mining life cycle, which in turn results in the creation of negative environmental consequences or poor rehabilitation procedures (Alberts, et al., 2016).
- Lack of finance: financial institutions view SSM sector as a risky business and hence they are hesitant to finance and/or lend money to small-scale miners. Currently in South Africa, the SSM sector depends on the limited government assistance and several programmes that provided technical and financial assistance have been disbanded. Currently, there are a few institutions that provide assistance to small-scale miners (Ledwaba and Mutemeri, 2017).
- Lack of adequate equipment and skills: There also exists a lack of knowledge and appropriate technology in the sector. The majority of miners lack formal education which leads to low level of skills in the sector. In addition, the use of second-handed machines and equipment also affects the nature of their operations Furthermore, the low level of skills in the sector leads to poor techniques and practices, lack of understanding and compliance of legislative framework, poor understanding of environmental issues (Mutemeri, et al., 2016).
- Institutional support: as noted above, the SSM sector currently receives very little institutional support. The majority of the structures and/or initiatives that have been established to support the sector have been dismantled (Ledwaba and Mutemeri, 2017).

In order to overcome the above difficulties faced by miners during their operations, Bristow (2017) proposes that support from government, LSM operations and other institutions could assist with some strategic policy options by adopting measures such as regulatory initiatives, provision of technical and educational support to promote SSM sector in South Africa.

2.4 Legislation regulating mine closure in South Africa

The expected outcomes of mine closure are assessed against the closure objectives and actions at the individual mine site (Stacey, et al., 2010). Closure objectives are mostly focused on the compliance statutory obligations. Mine closure involves the management of latent and residual impacts to ensure a safe and productive post-mining land.

According to Pope el al. (2013), the sustainable closure should be done according to the legislation that require the holder of a mining permit to conceptualize a closure by integrating the closure vision, objectives, EIA and all the environmental reports. The best practices principles are based on the planning, implementation and monitoring of closure (Heikkinen, et al., 2008). These instruments should be able to contribute and strengthen sustainability in mine closure.

After the apartheid era, South African government designed a comprehensive environmental legislation to protect the environment and promote sustainable development in the mining industry. The new legislative framework was introduced not only to manage environmental impacts of mining but also to provide incentives that would encourage the mining sector to set out environmental targets that reflect best practices.

South Africa has introduced policies and legislation that provide direct or indirect requirements for mine closure. The legal framework and the regulations of mine closure and mine rehabilitation in the mining industry has undergone transformation since the promulgation of the various laws.

Previously the Mineral Act No. 50 of 1991 was the first legislation regulating closure in South Africa and its purpose was to regulate the prospecting for the adequate exploitation, processing as well as the rehabilitation of surface land after mining ceases its activities (Mineral Act, 1991). The MPRDA replaced the Mineral Act No.50 of 1991. The main legislation governing mine closure include Mineral and

Petroleum Resources Development Act 28 of 2002 Gazette No. 23922, Notice No. 1273, and the National Environmental Management Act 107 of 1998. Government Notice R617. Vol 401Government Gazette No. 19519 and the National Water Act 36 of 1998 Gazette No. 19182, Notice No. 1091 and its accompanied Regulations.

These three main legislations are discussed below. Table 2.2, Table 2.3 and Table 2.4 present the summary of requirements of MPRDA, NEMA and NWA and Regulations pertaining to mine closure.

2.4.1 Mineral and Petroleum Resources Development Act (MPRDA)

According to Morrison-Saunders, et al. (2016) the MPRDA was designed to address the weakness of inadequate closure and mine site rehabilitation found in the Minerals Act No. 50 of 1991. Table 2.2 provides the summary of the requirements of MPRDA, broadly, mine closure requirements in the MPRDA include the application of closure certificate and a prescribed amount of financial provision for rehabilitation. Before being issued a closure certificate, the MPRDA requires that some activities be undertaken and these include Basic Assessment process, elaboration of Basic Assessment Report, Environmental Management Plan report (EMPr) and closure plan. The MPRDA requires the applicant of a mining license (including mining permit) to make financial provision before the closure certificate can be issued. As such, the applicant is required to follow EIA Regulations of 2014 in order to make financial provision.

The Department of Mineral Resources (DMR) remains the relevant authority despite the fact that NEMA rules should also be applied. Section 38 of MPRDA requires to the holder of a mining license (including mining permit) to be responsible for any damage on the environment in terms of the environmental principles under NEMA. The main section regulating closure for mining license holders is Section 43 of MPRDA and it outlines the requirements for issuing closure certificate. It emphasizes that the holder of a mining license remains liable for any environmental damage and management until the Minister grants the closure certificate. For instance, the holder

of a mining permit is expected to close and rehabilitate the site at the end of the life cycle of mine and leave the site in a usable and sustainable condition. Only with the closure requirements are met then the closure certificate can be granted.

Table 2.2: Summary of requirements of MPRDA and Regulations pertaining to closure

Legislation	**Requirements**
Mineral and Petroleum Resources Development **Act** 28 of 2002.	The holder of a mining permit must apply for water license, integrate environmental management, make financial provision and apply for closure certificate
Mineral and Petroleum Resources Development **Amendment Act** 49 of 2008.	S39, 40, 41, and 42 of the MPRDA No. 28 of 2002 was repealed. S43 of the Act 28 of 2002 was amended by S34 of MPRDA No. 49 of 2008. S34 of the MPRDANo.49 of 2008 makes requirements for the issue of closure certificate.
Mineral and Petroleum Resources Development Amendment Bill of 2013. This legislation is still in the parliament.	S43 (1) substituted by S34(a) of Act of 2008;
Mineral and Petroleum Resources Development **Regulations** 2004	This regulation covers the methods of financial provisions; monitoring and the performance of EMP; Principles for mine closure and closure plan; The holder of a MP must submit the closure objectives as part of the draft of EMP or EMPr;

2.4.2 National Environmental Management Act (NEMA)

The NEMA is a legislative framework which provides general standards, principles and procedures for environmental management. The NEMA supports sustainability reporting regarding environmental issues (Marais, et al., 2015). Table 2.3 provides a summary of the requirements of NEMA and Regulations pertaining to closure process. The relevant provisions of NEMA for mining permits holders include basic assessment process, make financial provisions and submit an Environmental Management Plan report (EMPr). Regulation 11 of the New Financial Provisions 2015 GN1147 requires that an independent auditor assess, review and adjust the amount of financial provision. It is also required that the regulatory body maintain the amount of financial provision until the issue of closure certificate by the Minister (NEMA, 2017). In the DMR guidelines of 2005, the amount of financial provision was calculated using the environmental sensitivity of mine area and the following factors were considered:

- The minimum rate per hectare for closure should be determined by identifying the rate per hectare for closure through collected information on the environmental sensitivity of mine location;
- The overall area of mining activities should be determined in order to recognize the suitable scaled topographical maps and mine site visit;

The calculation of closure costs based on the minimum rate per hectare and the overall size of the mining activities (Department of Minerals Resources, 2005). In the DMR guidelines of 2005, the minimum amount of financial provision was calculated as ZAR10,000 and this was based for rehabilitation.

Table 2.3: Summary of requirements of NEMA and Regulations pertaining to closure process

Legislation	**Requirements**
National Environmental Management **Act** 107 of 1998.	S24 requires the integration of environmental management, the potential impact on the environment, as well as socio-economic and cultural heritage.
National Environmental Management **Amendment Act** 62 of 2008	It covers mine financial provision, Environmental Authorizations and mine closure authorizations.
National Environmental Management Act of 2010. **Environmental Impact Assessment Regulations of 2010**. This legislation is no longer applicable	Reg 22 stipulates that the holder of a mining permit should conduct a Basic assessment process and submit a basic assessment report in accordance in Regulation 58 of MPRDA Regulations, 2004.
National Environmental Management Act 2014. **Environmental Impact Assessment Regulations of 2014**. Current Regulations	Same requirements as NEMA, 2010. But some changing was made during basic assessment process
National Environmental Management Act 2017. Environmental **Impact Assessment Regulations of 2017.** Current Regulations	Same requirements as NEMA, 2014. But some changing was made during basic assessment process
National Environmental Management Act **Financial provisioning regulations**, 2015.	This Regulation covers the methods of calculating financial provision, the forms of financial provision and the requirements applicable for financial provision.

2.4.3 National Water Act (NWA)

The NWA presents a fundamental reform of the laws with regard to water resources. The NWA is a framework intended to ensure the sustainable use of water resources (King & Reddell, 2016). It is also the main legislative framework used for controlling and managing the country's water resources. Table 2.4 shows the summary of the requirements of NWA and Regulations pertaining mine closure process. The NWA encompasses the rules to protect the national water resource from pollution (King & Reddell, 2016). Given the fact that mining activities and its nature can cause negative impacts on water resources the holder of a mining permit is required to be in possession of a water license which obliges him or her to take into account the impact of mining on water resources during the mining life cycle. Section 19 of NWA covers the prevention and remedying effects of pollution. The competent authority for a water license is the Department of Water Affairs (DWA) (Department of Water Affairs Forestry, 2006).

Table 2.4: Summary of requirements of NWA and Regulations pertaining to closure process

Legislation	**Requirements**
National Water **Act** 36 of 1998	The holder of a mining permit must apply a license in terms of Act 36 of 1998.
National Water **Amendment Act** 45 of 1999	S27 requires to the holder of a mining permit to consider all the water issues before applying for licenses.
National Water **Amendment Act** 27 of 2014.	This Regulation covers the establishment of national water strategy. Some subsections related to mining were amended.

2.4.4 A review of gaps and challenges

A lot of progress has been observed in terms of environmental management since introduction of new legislation. However, there are some issues remain to be addressed (Morrison-Saunders, et al., 2016). As shown in table 2.5, the three legislative frameworks that regulate mining, environment and water provisions have different competent authorities with different pieces of legislations that govern the mine closure in the country. As such, the regulation governing mine closure is fragmented making it difficult for small-scale mining operations to comprehend and comply.

Table 2.5: Responsible departments governing closure in South Africa (Source: Author's own)

Legislation	**MPRDA**	**NEMA**	**NWA**
Responsible Agency	DMR	DMR and DEA	DWA

The provisions and/or requirements for mine closure changed regularly making it difficult for SSM operators to keep up to date with what is happening. The closure requirements have three main points that emerge from the legislation which are; basic assessment, financial provisions and mine closure certificate. SSM operators are required like LSM operations to comply with all these requirements before a closure certificate can be issued. The competent authority responsible for granting the closure is the Minister of the Mineral Resources. The key instruments used and their requirements are discussed below.

a. Basic Assessment Process in terms of NEMA, EIA Regulations

The objectives of the basic assessment process is to conduct a consultative process, undertake a risk assessment process inclusive of environmental impacts, describe the alternative measures and determine the legislative and policy complex of the location

(NEMA, 2017). Basic assessment process involves the description of the activity, the public participation process, the impact assessment, the elaboration of basic assessment report and the recommendations of the Environmental Assessment Practitioner (NEMA, 2014). In addition, basic assessment must include the extent and nature of the proposed project in more detail.

The holder of a mining permit must submit the application of basic assessment within 90 days of receipt to the competent authority (Reg 19 (1) of NEMA, 2014). All the information contained in the basic assessment report, EMPr and the closure plan are set out respectively in Appendix 1, 4 and 5 of EIA Regulations (2014). Appendix 1, 4 and 4 include respectively the basis assessment process, the content of environmental management programme report and the content of closure plan. The holder of a mining permit must include a specialist report, EMPr and applicable closure plan into the basic assessment report.

b. Financial provisions in terms of NEMA, Financial Provisioning Regulations 2015

MPRDA Regulation of 2004 was used to regulate financial provisions and currently this responsibility has been transferred to the Financial Provisioning Regulations, 2015 (referred to as GN R 1147) promulgated in Government Notice Regulations 1228 on 10 November 2017.

The Financial Provisioning Regulations of 2015 do not give the exact amount of financial provisions that a holder of a mining permit must make but it describes the steps that the holder of a mining permit should undertake in order to make financial provision. The timeframe of financial provision application is equal to the costs of implementing the activities identified in the final rehabilitation decommissioning and closure plan, as well as residual risk assessment report and making financial provisions (NEMA, 2017). The existing financial provision methods remain unchanged and these are cash deposit, bank guarantee and trust fund. The determination of financial provision and data review can be undertaken either by a

specialist or by a holder of a mining permit. The requirements of annual assessment, review and adjustments of financial provision have been found to have serious costs implications for the mining sector. It is required that either auditing firms or external firms undertake data review and that it should include audited financial statements (Koeslag, et al., 2018). An auditor is required to sign off the estimation of the financial provision. All the documentation should be submitted to the DMR for approval within 30 days. After submitting the documentation, the holder of a mining permit should publish the financial statements for public interest (NEMA, 2017). The period of the financial provision application process varies from two to eight weeks (Koeslag, et al., 2018). According to Koeslag et al. (2018) during the annual review, assessment and adjustments of financial provision, no distinction is made between the mining rights or mining permits. In the context of South Africa, mining right is a type of a mining license issued to large-scale mining companies and it is valid for 30 years and renewable.

In the DMR Guidelines of 2005, the minimum amount of financial provisions was R10, 000. In the DMR Guidelines of 2005, the amount of financial provision calculation was based on the calculation of the minimum rate per hectare and the overall size of the mining activities. This guideline is currently outdated and not in use.

c. Mine closure certificate in terms of MPRDA 2008

The purpose of the closure certificate is to ensure that the holder of a mining permit will not abandon the mine site without remediating harm caused on the environment. The granting of a closure certificate marks the end of the entity's obligations to maintain the financial guarantee (Krause and Snyman, 2015).

Section 43 (1) of MPRDA covered the responsibility of the holder for any damage, environmental liability and the management until the Minister has granted a closure certificate (MPRDA, 2008). The holder of a mining permit is required to submit a closure plan which must contain closure objectives, the results of environmental

risks, description of decommissioning methods, mitigations measures. In addition, the mitigations strategies should be integrated into the closure plan associated with a proposed closure costs for monitoring, maintenance and post-closure management. The Chief Inspector of Mines; the DWA, DEA must grant the application of a closure certificate and hence the holder of the Mining permit is required to meet the standards on health, safety and environment (Section 43 of MPRDA, 2008).

2.5 Summary

Mine closure has become a reality and as such it has become important for government and mining companies to work together in order to achieve target closure goals and outcomes. The lack of appropriate mine closure has severe consequences on communities, environment, health and economic. To address the gaps and consequences of mine closure, several institutions have developed standards and guidelines to assist mining countries to deal with issues of mine closure. Some of these guidelines have been incorporated in country's legislative frameworks in order to manage environmental issues and enable mining operations to achieve a sustainable mine closure. Unfortunately, the majority of the guidelines and standards have been inclined towards large-scale mining activities and very limited attention is directed to SSM operations.

In South Africa, SSM activities are governed by MPRDA, NEMA and NWA. Despite the recent improvement in the legislative framework concerning mine closure, there remains some gaps and challenges. As mentioned above, there currently exist a lack of integration between the three pieces of legislations. Morrison-Saunders, et al. (2016) pointed out the fragmentation between the different legislative frameworks regulating closure in South Africa. This was attributed to the lack of experience and capacity, finance and technical expertise to response to closure requirements and its environmental risks.

According to Van Zyl, et al. (2012) it is necessary to integrate the authorization of Environmental Management Plans by multiple authorities. Botham (2011) argued that

the DMR is constrained by the lack of necessary capabilities and skills. Alberts, et al. (2016) note that the challenges as listed above faced by the DMR weaken the current enforcement of legislative environmental requirements.

Morrison-Saunders, et al. (2016) observed that these issues concerning the regulatory regime in South Africa are also observed in other jurisdictions in the African region, and even around the world. Pope, et al. (2013) have pointed out that the scope and objectives of closure and rehabilitation are usually not well or properly designed in the initial Environmental Management Plan. The review of the closure plan is mostly focused on the review of financial provisions which should be adjusted in accordance with the changing circumstances. The lack of requirements with regard to a formal and periodic review, as well as a lack of assessment procedures with respect to closure plans was observed (Krause and Snyman, 2015). More so, Van Zyl, et al. (2012) have pointed out inadequate considerations regarding long-term water quality issues. Laurence (2006) has also noted the lack of technical experience of mining companies in the area of mine closure planning. According to DMR (2005) the lack of data does not allow them to make appropriate evaluation of impacts during mine closure.

In view of these challenges, improved best practices would require the identification of specific factors and concerns that have a posture on the improvement of the SSM sector to ensure efficient mine closure.

3 RESEARCH METHODOLOGY

This chapter elaborates on the methodology employed during the research. The chapter outlines the research approach, study area, methodology and limitations.

3.1 Research approach

The approach used for the research comprised a combination of quantitative and qualitative methods. The main characteristics of the qualitative research method were the use of multiple sources of data and research methods to understand a specific event (Creswell and Creswell, 2009). The rationale behind qualitative procedures was to understand government approaches and interventions through interactions with key informants who understand mine closure in SSM. While the quantitative approaches was used to understand the phenomenon of mine closure in SSM sector from a nearer observation by using a survey method.

A case study was chosen as the appropriate approach. According to Yin (2009) a case study technique allows the application of logic that either contradicts or confirms a conceptual understanding. The case study approach relies on the use of multiple sources of evidence and the need for data to converge in a triangular approach. The benefit of using a case study includes the ability to guide the researcher during the data collection and data analysis. Bradley, et al. (2007) found that the best way to assess and have a clear understanding of philosophical issues under investigation of the use of case studies. The shortcomings of case studies include the difficulty to draw a precise picture of effects or cause from the case study, data cannot be generalized for the entire population, and bias in data collection.

Various sources of data including legislation, existing database published and collected by Oxpeckers Investigative Environmental Journalism (2016) and semi-structured questionnaires were used to collect the relevant information for the research. In addition, key informant interviews were conducted with five specialists from government, Civil Society Organization and academia.

3.2 Case study- Northern Cape

The Northern Cape is the largest province in South Africa with an area of 361.830 km2. It occupies one-third of the total national territory, specifically 29.7%. This province has very poor communities and it experienced a high rate of unemployment of 40.5% (Statistics South Africa, 2016). Figure 3.1 presents the map of Northern Cape Province. As mentioned above, the bulk of SSM activities are concentrated in areas with higher levels of poverty and unemployment. The province has the majority of SSM operators who mine diamonds compared to the other provinces. According to Ledwaba and Mutemeri (2017), SSM operators exploited the following minerals in the Northern Cape 88%, 2% mine sand, the remaining 6% mine semi-precious stones and 4% mine other commodities.

For the purpose of this research, diamond small-scale mining is used. Diamond mining process involves digging and washing which results can have negative impacts on water and the environment. The case study focused on two areas in the province and these are Springbok and Kimberley areas. The study focused on the legal SSM who registered and hold a mining permit.

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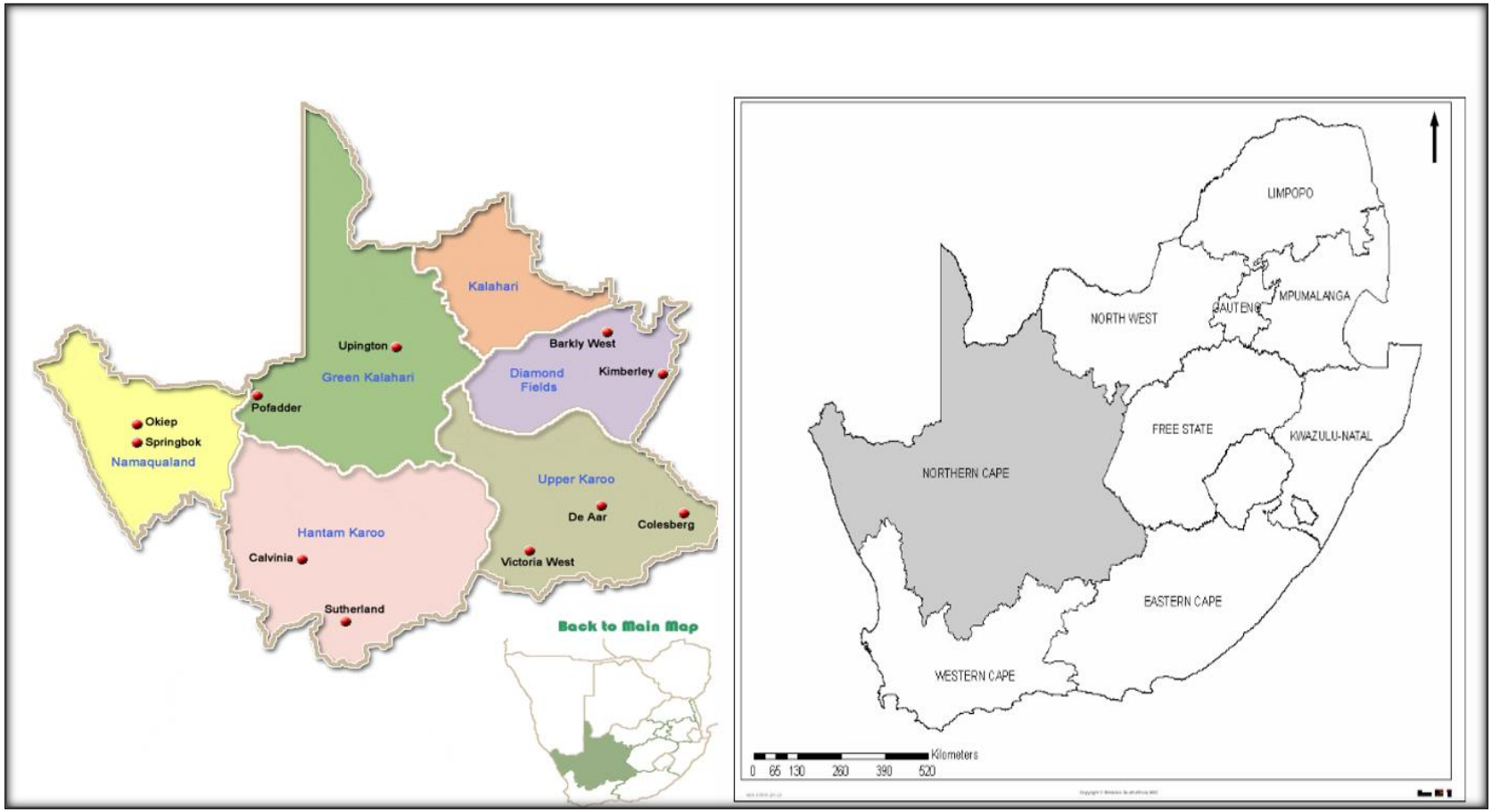


Figure 3-1: Map of Northern Cape Province (Statistics South Africa, 2016)

3.3 Methodology

The various sources of data and how it was analyzed are described below. This is in accordance with the objectives of the research.

3.3.1 Research question 1: What is the legal requirements and provisions for mine closure in Small-Scale Mining?

The sources of data included government documentation, peer-reviewed articles and publicly available reports. The following legislation was reviewed:

- Mineral and Petroleum Resources Development Act 28 of 2002 Gazette No. 23922, Notice No. 1273 (MPRDA);
- National Environmental Management Act 107 of 1998. Government Notice R617. Vol 401 Government Gazette No. 19519 (NEMA);
- National Water Act 36 of 1998 Gazette No. 19182, Notice No. 1091 (NWA).
- Regulations to the MPRDA and NEMA, related to SSM, mine closure and financial provision, and well as amendments to these, were also reviewed.

The different pieces of legislations were reviewed by assessing the legal requirements of closure such as closure certificate, basic assessment requirements and financial provision. The outcomes of the first question are represented using flowchart and tables. These were drawn and plotted by using Excel.

3.3.2 Research Question 2: What is the current practice of Small-Scale Mining in South Africa around mine closure?

To answer the second research question, the researcher used a database on mine closure certificates and financial provision which was compiled by Oxpeckers Investigative Environmental Journalism in 2016. The data was compiled by journalist Mark Olalde through the Promotion of Access to Information Act of 2000 (PAIA). The data base contains the following information of closure certificates granted between 2005 and 2016, and financial provisions held for rehabilitation under both

NEMA and the MPRDA across the country. The data was sorted in order to answer the following sub-questions:

- How many mining permits were granted?
- How many closure certificates were issued?
- How long does it take a closure certificate to be issued?
- How much financial provision been made?
- In what forms are the financial provisions made?

The researcher processed the data in the spreadsheet by identifying the amount, form and the average of financial provision made; the number of closure certificate applied and granted in Springbok and Kimberley Regions between 2005 and 2016. The outcomes were plotted on graphs, and tables.

In addition, semi-structured interviews were conducted with various practitioners working in the SSM sector. Initially, the researcher intended to interview both miners and specialists. Unfortunately, miners refused to be interviewed. A total of five interviews were conducted with practitioner from government and institutions working in mining. During the interview, each participant was asked a set of open-ended questions, and the session lasted between 30-50 minutes. The questions asked during the interviews are presented in Appendix 2. These interviews were critical in gaining better insights into the practices on mine closure in SSM. At the end of each interview, the conversations were transcribed and sorted to be analyzed according to themes.

3.3.3 Research Question 3: Is there a gap between policy and practices of Small-Scale Mining around mine closure?

Following an analysis of the data, a comparison between the policies (answers to question 1) and practices (answers to question 2) was done in order to identify keys findings from the review of the legislative frameworks and what is being practiced in

SSM. This was done in order to determine whether there exists a gap between the policies and practices of SSM in mine closure.

3.4 Ethical issues

According to the ethics guideline before conducting an interview, an ethics clearance has to be applied and the researcher was granted by an ethic clearance code R14/49 on 21 September 2017.

The participation of all respondents was voluntary and they consented to be interviewed. During the interviews, no participants were exposed to any risk or harm either psychological or physical. Before collecting information, the participants were assured that their contributions would remain and be treated with confidentiality and anonymity. Before starting the interviews, the participants consented to record that the information collected could be used for the research study. Each participant was advised of the purpose of the research, and the data collected was used only for this purpose.

3.5 Limitations of the study

The following were the limitations to the research:

- Interview response rate was low. The database obtained from the DMR was outdated. Of the ninety-three contacts in the database, thirty did not exist, two were duplicated, ten were not mining companies, and the remaining did not want to take part in the study.

- The efforts to conduct interview with specialists were proved to be a difficult task with a number of practitioners not responding to the requests.

- Missing information in the gathered data from Oxpeckers Investigative Environmental Journalism (2016). There were not all usable especially the Kimberley Region that did not include relevant variables that are crucial for

the research, which therefore made the study focus more on the Springbok Region.

- Literature review: there is insufficient literature on SSM and mine closure in South Africa. It was difficult to find relevant materials regarding this topic in South Africa.

4 RESULTS

The findings of this research are presented in terms of the three research questions.

4.1 Question 1: What is the legal requirements and provisions for mine closure in small-scale mining sector?

A review of South African legislative framework was explained in section 2.4. As noted above, there are various pieces of legislations regulating mine closure in South Africa and so this becomes difficult for SSM operators to comply with all of them. Over the years, several provisions and requirements were introduced and making it difficult to keep up to date and even comply. More so, the changes which have been made are found to make the legislative frameworks complex. Some of the closure requirements have been moved to other Acts, Bill and Regulations. While the MPRDA remains the main legislation to apply for a mining permit and closure certificate, there are different Departments that regulate mine closure legislation as shown in Table 2.5.

Figure 4.1 and 4.2 provide a detailed overview of the legal process to be followed when applying for a mining permit and a process to be followed to be issued with a closure certificate. Typically, a SSM operator is expected to conduct a basic assessment study, submit an environmental management plan report, apply for an environmental authorization and make the payment of financial provision before the regulatory authority can issue the mining permit. To obtain a closure certificate, a SSM operator would have to review data from basic assessment process, elaborate a closure plan, and determine the nature and the extent of environmental damage. In addition, environmental risk analysis, plan compilation and financial provisions calculations and auditor sign off the review of financial provisions report. As seen in the two figures, these processes are looked in different Departments.

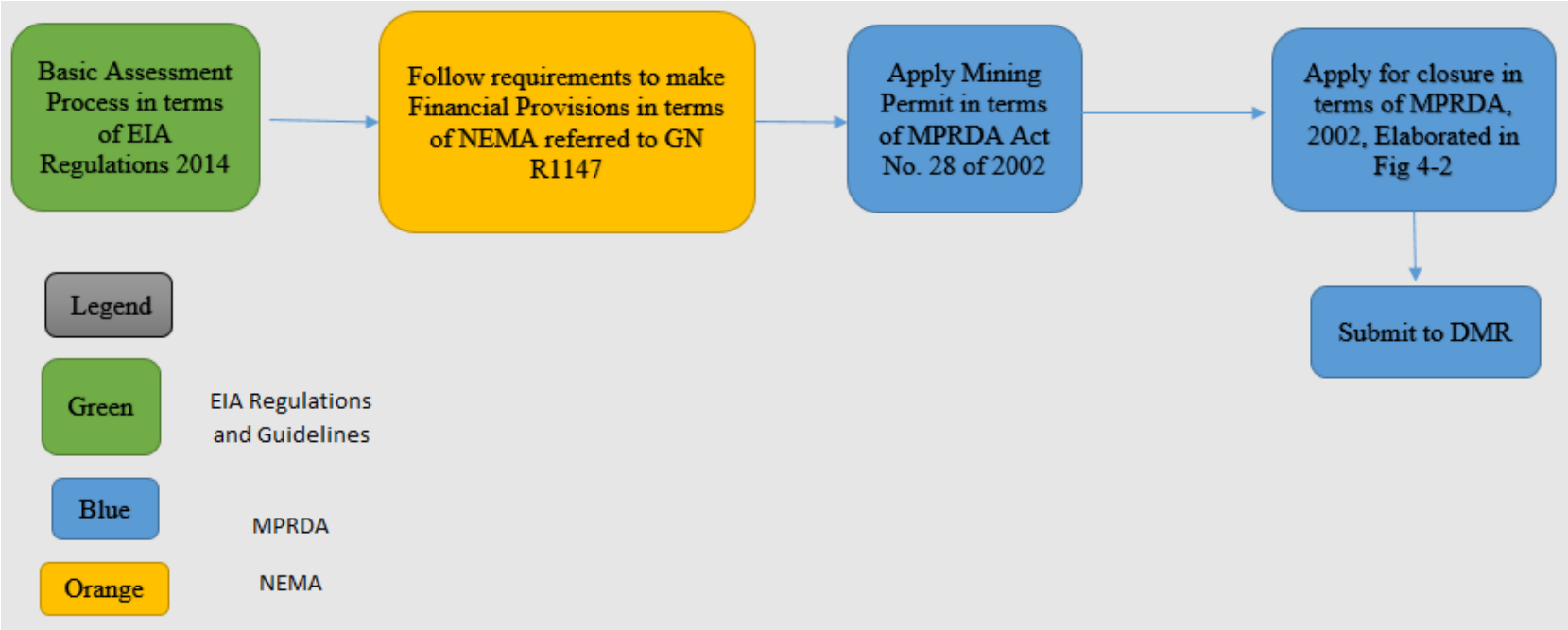


Figure 4-1: Authorization of mining permits for SSM (Source: Author's own)

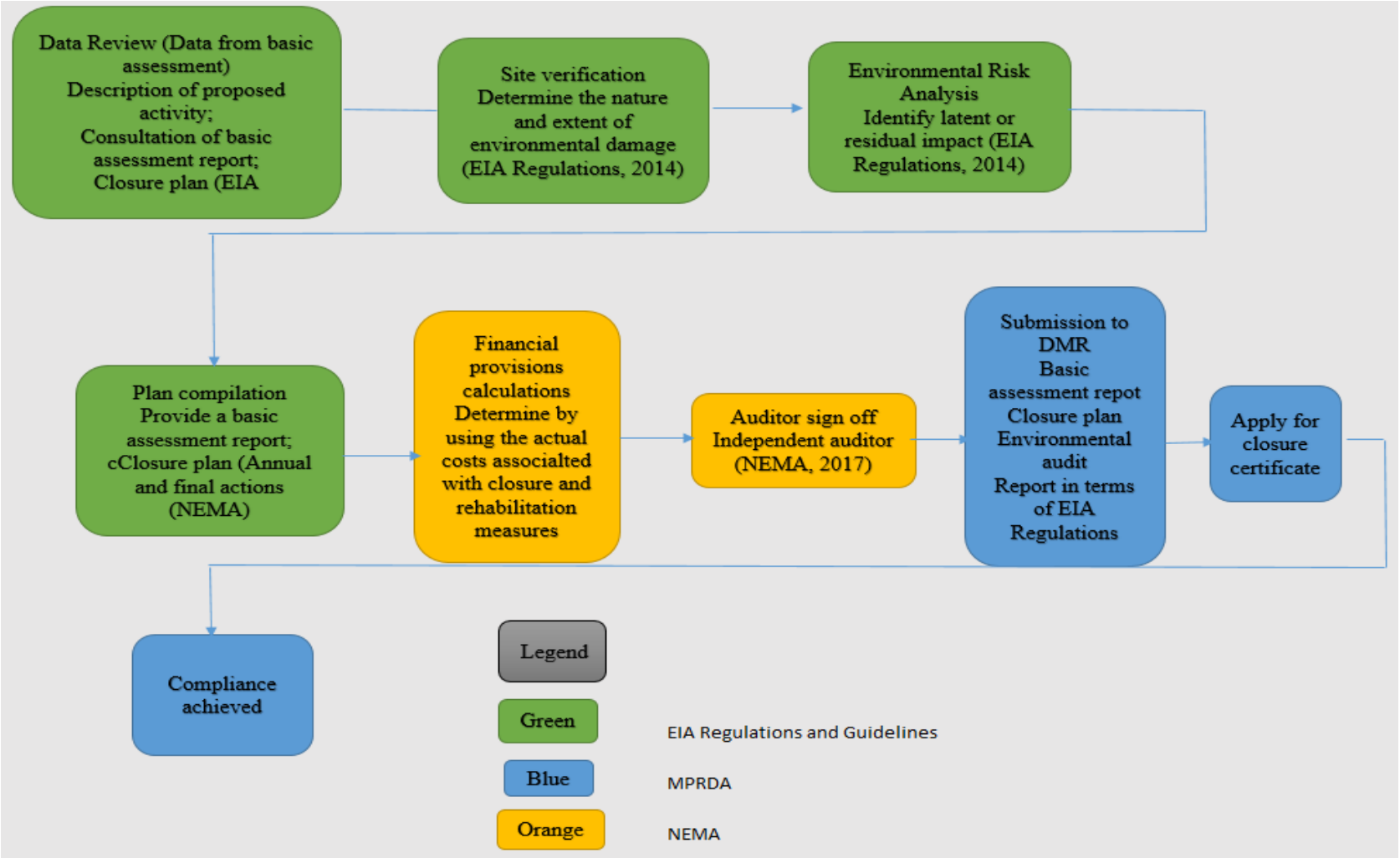


Figure 4-2: Steps in the mine closure process for SSM in terms of NEMA (Source: Author's own)

4.2 Question 2: What is the practice?

This section determines what is happening in practice and it reviews: the number of mining permit granted; closure certificates issued and the length of time between the application and the issue of closure certificate; the amount of financial provision made; and the forms of financial provisions used.

4.2.1 Number of Mining permits granted

As discussed above, before the mining permit can be issued, the applicants of the mining permit must make a financial provision towards rehabilitation. In essence, the number of mining permits issued must be equal to the number of financial provisions made in a particular period. Figure 4.3 shows the number of mining permits which have been issued in the Northern Cape Province. The study period for the assessment is between 2005 and 2016. A total of 110 mining permits were granted in Northern Cape Province during the study period. As seen in the figure, the number of mining permits issued increased considerably in 2010 reaching a peak in 2013. However, a drop was experienced between 2014 and 2016. Only eight mining permits were issued in 2015.

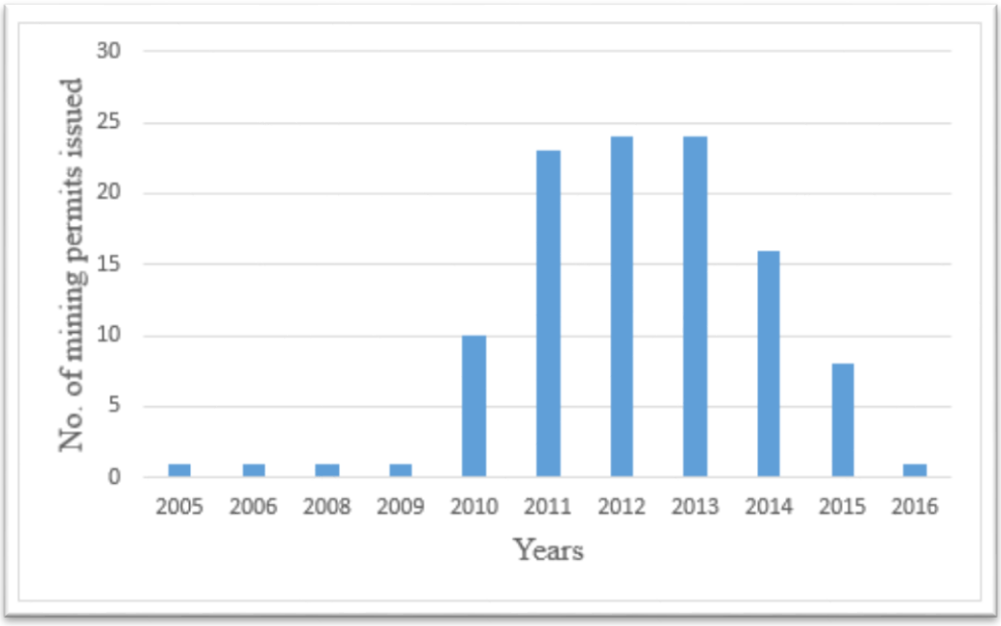


Figure 4-3: Mining Permit issued between 2005 and 2016 (Source: compiled from Oxpeckers Investigative database)

The Minister of the Mineral Resources has attributed this decline to internal challenges and delays within the DMR. The Minister also pointed out to the acts of corruption in DMR office as being the reason for this decline. As a result, there is currently a backlog of mining license applications. According to the Minister, some applications have been siting since 2010 and 2012 without being processed (Mantashe, 2018).

4.2.2 Number of closure certificate applied and granted

Figure 4.4 shows the number of closure certificates which the Department issued between 2005 and 2016 in the Northern Cape. A total of 110 applications for closure certificates were received by the Department and only seventy four (74) were issued. Of those issued, fifty-seven (57) were issued in Springbok region while seventeen were granted in Kimberley region. The success rate calculated from the total closure certificate applications and issued is 67.27 percent.

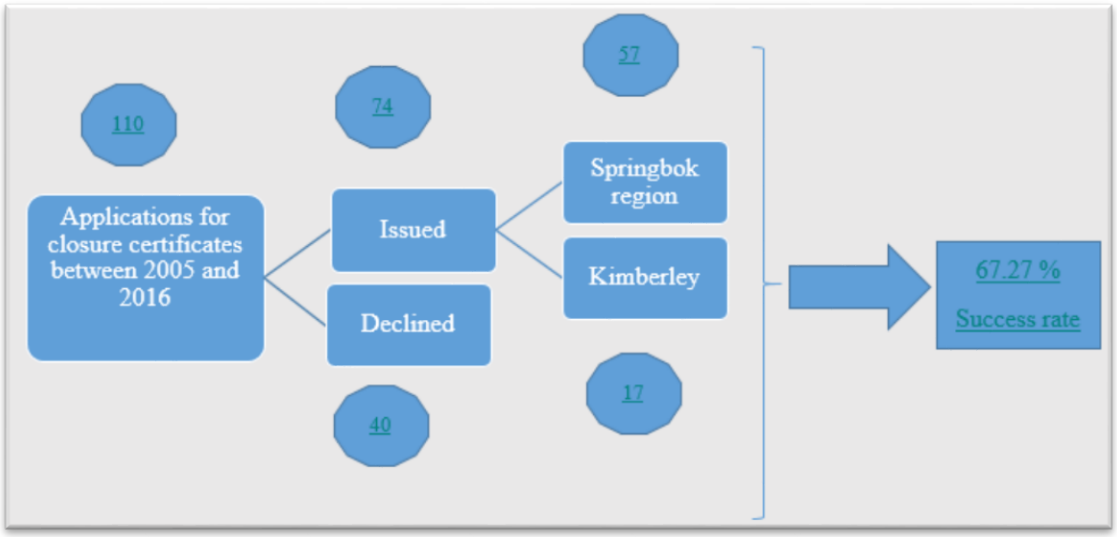


Figure 4-4: Percentage of closure certificate issued between 2005 and 2016 (Source: Author's own)

According to World Economic Forum (2014), the South African legislation has made significant inroads in as far as environmental management is concerned. This may explain the increasing number of closure certificates after 2009. Figure 4.5 shows the number of mining permits and closure certificates issued between 2005 and 2016. As noted above, the mining permit is valid for a period of two years but can be renewed three times for a period not exceeding one year. In essence, a mining permit is valid for a maximum of five years.

As seen in the figure, the closure certificates declined in 2012 and 2013. An increase was observed in 2014. The largest number of closure certificates were issued in 2014. Nineteen (19) closure certificates were issued.

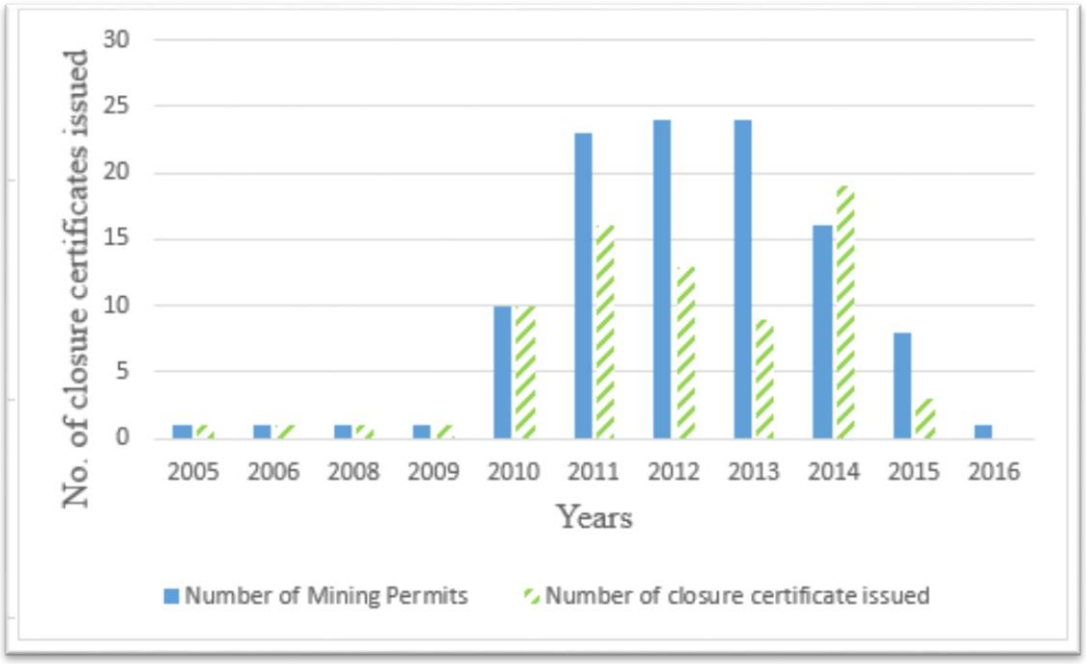


Figure 4-5: Number of closure certificates issued between 2005 and 2016 (Source: compiled from Oxpeckers Investigative database)

4.2.3 Length between the application and the issue of closure certificate

Figure 4.6 presents the duration between the application and the issuing of the closure certificates for operations in the only Springbok area. The data for Kimberley was incomplete and hence could not be included in the report. There were ninety-seven closure (97) certificates applied in Springbok region and fifty-seven (57) closure certificates were issued during the study period. It can be seen in figure 4.6 that generally most closure certificates were granted in less than five years. The longest time so far has been 11 years.

Between 0 to 2 years, a total of seventeen (17) closure certificates were issued. Over 20 certificates were issued between 2 and 4 years. The implications of delaying the issuing of certificates could result in operators giving up and leaving the mining sites as is and this will become the liability of government. The complete dataset for Springbok is included in appendix 3. As will be seen in the appendix, before 2009, the closure certificates were taking long before being issued. Over the years, the

length of time has decreased considerably. This may be because of increased in both capacity and understanding of the legislation in relation to closure requirements. Furthermore, it might be because increasing awareness regarding closure policies and the compliance on the side of the miners.

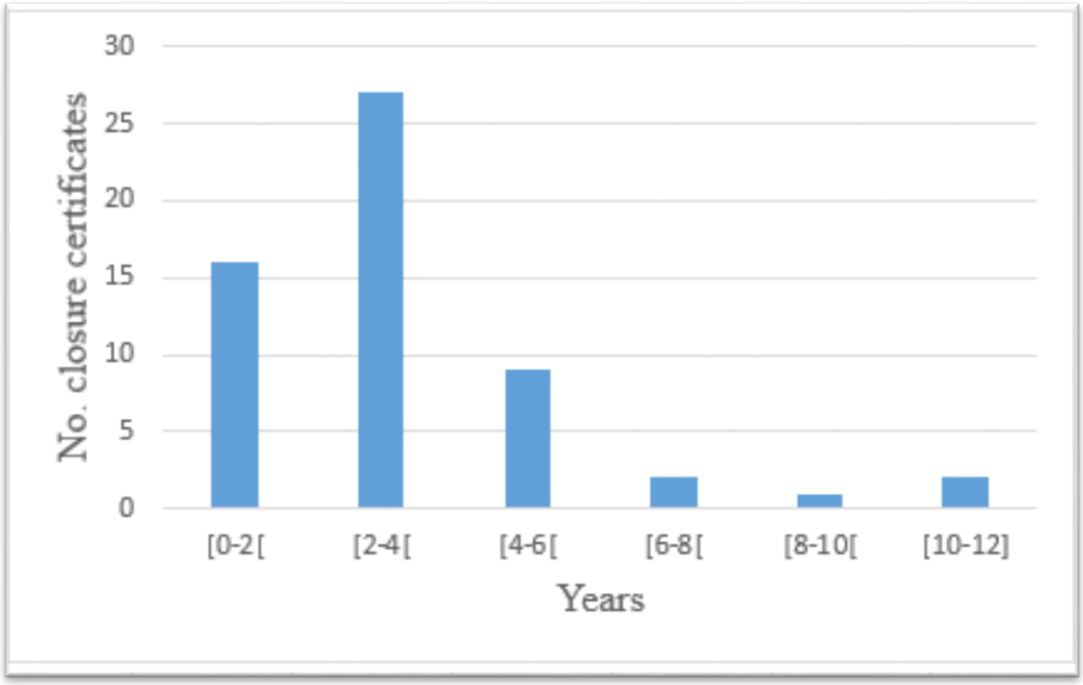


Figure 4-6: Length of time between the application and the issuing of closure certificate in Springbok Region between 2005 and 2016 (Source: compiled from Oxpeckers Investigative database).

4.2.4 Amount of financial provisions

A total amount of R 2,414,825 for financial provision was collected in Northern Cape Province between 2005 and 2016 for rehabilitation. The Kimberly area region received an amount of R569,300 for rehabilitation for mining permits. The largest financial provision to be made by SSM operation was R 187,111. The lowest amount made towards financial provision for rehabilitation in Kimberly Region was R14, 075.65. The data does not capture the type of mineral commodities for the financial provision.

A total of R1,845,525 amount was paid to the Springbok region and this amount was acquired from nineteen -seven (97) number of mining permits. While, the smallest amount of financial provision made by a SSM operator was R3000 in Springbok Region. The largest amount of financial provision made by a SSM operator in Springbok region was R240, 000. This study considered SSM operators who paid the amount of financial provision from R3, 000 to R240, 000.

As seen in figure 4.7, the amounts paid towards financial provision has been increasing. These large amounts can be due to the increasing the extent area from 1.5 hectares to 5 hectares. Figure 4.7 shows that the average amount paid by SSM operators.

It is also observed from the data that thirty-six (36) SSM operators have not increased the amount of financial provision while seventy-four (74) SSM operators increased the amount of financial provision made. The increase in the amount of financial provision made could be due to a number of factors such as extending of mining area, mineral commodity being mined. It may be concluded that the SSM operators are moving from non-compliance towards compliance that explains the increase in payment of financial provision even though there is a colossal variation between the amounts of financial provision. The green line shows the required amount of R10, 000 asked to SSM operators as the minimum amount of financial provision.

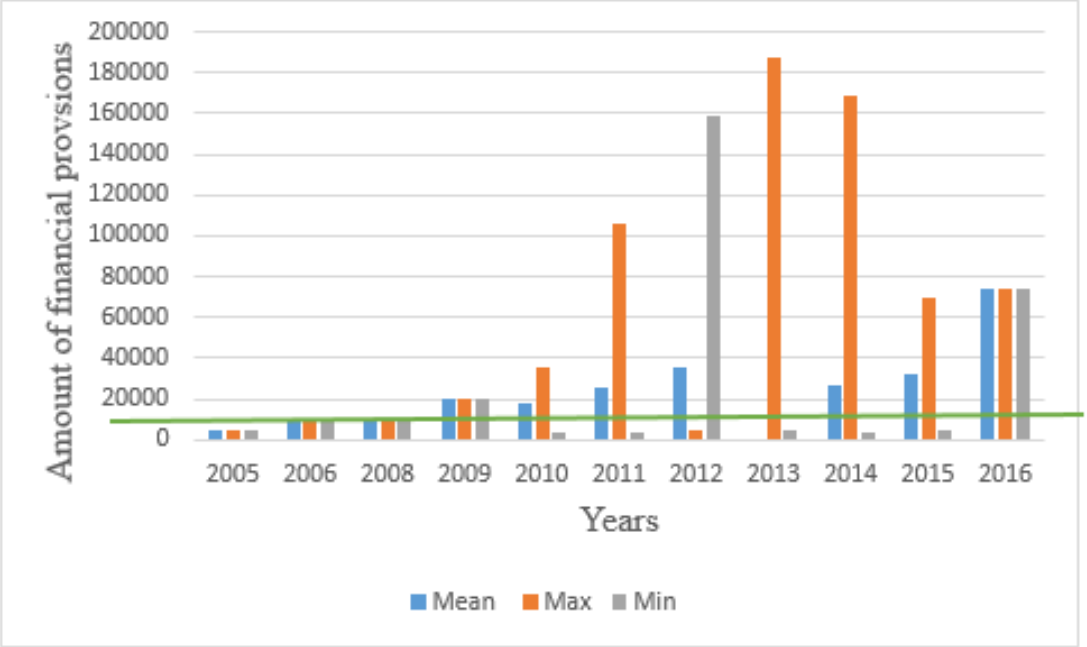


Figure 4-7: Amount of financial Provisions made between 2005 and 2016 (Source: compiled from Oxpeckers Investigative database)

Figure 4.8 shows the amount of financial provision and the percentage of mining permits. As seen in the figure, 33 per cent of the mining permits made financial provisions of between R3000 and R10000. Over 60 per cent of the mining permits made financial provisions of more than the prescribed amount of R10, 000.

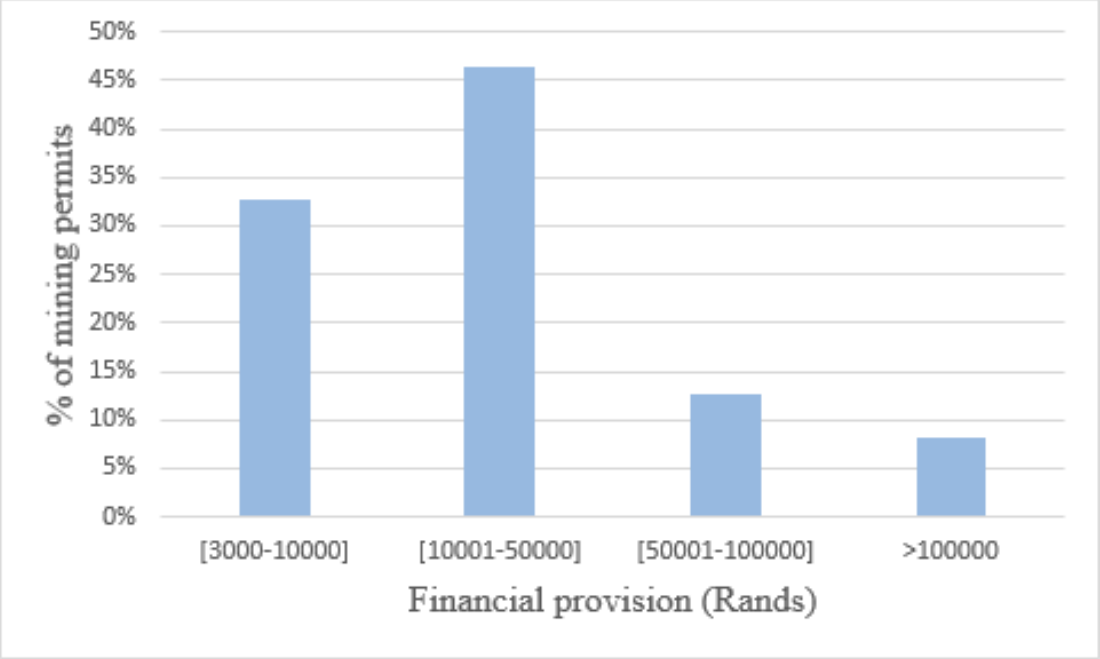


Figure 4-8: Range of financial provision made (Source: compiled from Oxpeckers Investigative database)

4.2.5 Forms of financial provisions

Table 4.1 provides the form of financial provision used by miners. From the findings, it is observed that the majority of the operators are making financial provision using cash deposits. This is considered to be an easier way because they do not need to have a bank account to make the payment. The cash deposit is made directly to the DMR. The bank guarantee method requires the miners to fill out an application form that identifies the reasons and the amount for guarantee and it is valid for a specific period. This method is considered to be complicated and hence prove to be difficult to most SSM operators. As seen in Table 4.1, eighty miners made financial provision using cash deposits, and thirty miners made the financial provision using bank guarantee. No trust fund was used as method of payment for financial provision.

Table 4.1: Forms of financial provisions

Years	2005	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Cash Deposit	1	1	3	1	9	18	17	15	12	3	0	80
Bank Guarant	0	0	0	0	1	3	6	9	6	5	1	30
Trust Funds	0	0	0	0	0	0	0	0	0	0	0	0

4.2.6 Experience of specialists

As mentioned above, five participants took part in the key informant interviews and they are labelled P1, P2, P3, P4 and P5. Interviews were transcribed and analyzed according to four themes. The Interco consisted of a series of open-ended questions and these are included in the appendix 2. These responses are captured below.

Theme 1: Financial provisions

There was a total agreement that the amount of financial provision made by SSM operators is mostly insufficient. According to the majority of respondents, most of the operators do not properly address the environmental impacts at the time of closure. Not all respondents had an idea about the exact amount of financial provision made by miners but they know that as mentioned in the DMR Guidelines of 2004, the minimum amount should be R10, 000.00 and later the holder of a mining permit should add the remaining amount from the calculated financial provision.

The amount of financial provision depends of the amount of damage caused by mining activities on the environment. This means that the more the damage is

present, more amount of financial provision should be made. Participant P1 mentioned that, "*Financial provision required by the ministry is not enough, it is very insignificant*".

The majority of the respondents agreed that the variation for rehabilitation costs is due to the methods of calculation. Unfortunately, there is no updated method of calculation but the DMR guidelines of 2005 presents some estimations. The respondents also pointed out to some factors that are a barrier for effective calculation of financial provisions and these include inadequate skills and competencies, lack of auditing; assessment and reviews from specialists are the causes of lack of the proper amount of financial provision.

Theme 2: Lack of enforcement and compliance

The majority of the respondents agreed that miners struggled to comply with closure legislation. There was unanimous agreement that South African legislation on mine closure has improved over the years but it became more complex and difficult to comprehend due to its fragmentation.

The participants reasoned that these complexities of the legislation, lack of knowledge, skills and finance makes it a challenge for the small-scale miners to comply. There was a total agreement that the process is time consuming and has serious cost implications to meet closure requirements. Some of the interview participants suggested that a presence of specialist who would help miners to prepare the required documents and conduct basic assessment would improve the process, but SSM operators usually faced financial challenges; it is difficult for them to afford a specialist.

Participant 4 noted that the legislation is not designed for small-scale mines but for large-scale mining. The respondent emphasized that by saying, "*South African environmental legislation is strong enough to address environmental issues at the end of mine closure. This legislation was largely designed for LSM which make it difficult*

for SSM to comply. However, the framework should be re-designed to enable SSM to be able to comply with closure requirements".

Participant 5 echoed similar views stating that "*The South African legislative framework regulating mine closure is similar to the Australian and Peru framework. It is believed that South African legal requirement is one of the best mine closure legislation within the African Continent*". In addition, the legislative framework is good compared to the African counterparts, however the government still lacks capacity in enforcing the legislation as said by Participant 1, "*Government department does not enforce and implement environmental legislation as it should be*"

The majority of the respondents agreed that miners do not fully comply with environmental legislation regarding closure requirements. This non-compliance has led to unsuccessful rehabilitation. There were total agreements that miners will eventually comply with closure legislation despite the fact that some take longer than others do. This could be observed during the length time of closure certificate issued.

The respondents suggested that the length from application of a closure certificate to the time it is granted depends on the level of compliance and how fast the miners can take to comply and the time taken by the DMR to process the certificates. A few respondents affirmed that in practice most of the miners do not follow the mitigation measures included in the closure plan submitted in order to apply for closure certificate. There were total agreements by the respondents regarding the main requirements of closure certificates issued. They said that SSM should conduct a basic assessment process, make financial provision and elaborate a closure plan before applying for closure certificate. This should be under the legislation for NEMA and MPRDA.

There was a total agreement that small-scale miners do not fully comply as they should which will be a liability to DMR if they grant a closure certificate. One

respondent said, "*Actually, DMR hesitates to grant closure certificate because DMR is afraid to take the liability if SSM operators do not make a proper clean-up*".

Theme 3: Lack of knowledge

There was a total agreement regarding the lack of education and training of miners around legal requirements, tools and the information around mining methods. This could be due to the fact that miners faced lack of training opportunities and workshops, which will enable them to know what they should do in order to work in a sustainable miner. One respondent said, *"SSM operators really face lack of knowledge. This can be observed during the application of closure certificate or the basic assessment process."*

Theme 4: Lack of support

There was agreement amongst interviewees regarding the support from the government and/ or the institutions. The majority of respondents mentioned that the support system should be from government through the DMR, MINTEK, Council for Scientific and Industrial Research (CSIR) and Water Research Commission. The respondents argued that even with the presence of support system it remains inefficient for these institutions to provide resources to SSM operators. All the respondents argued that financial institutions do not help small-scale miners with finance. One respondent said, *"In South Africa there exists so much institutions that [should] bring their support to SSM unfortunately these institutions do not help small-scale miners".*

Practices are not clear and the level of support required by the small-scale miners is not clear. Unfortunately, efforts to interview the small-scale miners were fruitless. It is also important to obtain their contributions towards their issues on mine closure. The findings from the respondents were quite helpful, insightful but not conclusive enough. Most respondents did not give a straight answer and indicated that there exist a gap of knowledge, problem of insufficient financial provision, lack of enforcement and lack of support in SSM sector.

Mostly, there was a lot of disagreement about mine closure practices in SSM. There was a general agreement regarding the issues of insufficient amount of financial provisions, lack of support from the government departments and lack of knowledge by the small miners. There was further general agreement that there was lack of data regarding mine closure in SSM. Each of the respondents had their own perception regarding environmental legislation.

Interviewees mentioned Tablas's farm and Ibhubesi Ore exploration in the North West as examples of two small-scale mines that were effectively closed. Respondents concurred that generally, the environmental issues observed include the land degradation and water pollution. The respondents agreed that the environmental damage is mostly due to lack of knowledge, inadequate equipment, lack of support from the government and Non-Governmental Organization (NGOs) and lack of finance faced by SSM operators. The environmental disturbance is often related to the technology used during mine operations.

4.3 Question 3: Is there a gap between policies and practices in Small-Scale Mining sector around mine closure?

The research was constraint by the lack of participation by the SSM operators themselves; there are positives and negatives in the current legislation on mine closure in SSM and the implementation thereof. The current legislations governing the mining sector in South Africa recognises all forms for mining including SSM. As such, the provisions and requirements within these pieces of legislations extend to SSM operations. Essentially, the mine closure requirements in MPRDA, NEMA and NWA extends to SSM operations.

With that being the case, it was observed that the SSM operations are required to follow and adhere to the same regulations and requirements of mine closure as their counterparts. This is a challenge given the nature of SSM activities as described in literature. The mine closure process is found to be complicated and complex for typical SSM operators. Several scholars have also pointed to the fragmentation of the

various pieces of legislations. It has been argued that these makes it difficult for SSM operators to close their sites properly.

One of the instrument that the DMR is using for rehabilitation are financial provisions. Contrast to the literature, holders of mining permits are making adequate financial provisions towards rehabilitation in comparison to the required amount of R10,000. As shown above, the amount of financial provision sets aside for the financial provision is more than the minimum amount required for complete rehabilitation. This raises the question that are these people the 'typical' SSM operators or 'entrepreneurs' who opt for mining permits because of the ease of obtaining them compared to mining rights? This question is raised because of the confliction between the data presented above and the views and opinions of practitioners working in the SSM in mine closure.

The researcher noted that SSM operators do not incorporate mine closure activities through the mining life cycle or implementing mine closure activities during mining operations. That is why it seems like SSM operators are not complying in practices.

5 DISCUSSION

5.1 Legislative framework of closure in Small-Scale Mining sector

The first objective of the research was to review the legislative framework regulating mine closure in the SSM sector. A number of conclusions were drawn from the review of the three main legislative frameworks.

The findings of the study indicate that despite the improvement of the South African legislative framework on mine closure post-apartheid regime, there are still some gaps and challenges that still exist as it pertains to the legislative provisions. The presence of multiple legislative provisions on mine closure has contributed to the challenges with regard to enforcement and implementation.

As seen in Table 2.2, 2.3, and 2.4 there still exists fragmentation, which plays a significant role in the weakness of the South African regulatory framework. These different pieces of legislation and their requirements lead to the inability of different departments to perform efficiently and to act appropriately during the time of decision-making.

The findings also revealed that lack of compliance and implementation of environmental legislation which reduces the efficacy of South African legislation that is supposed to provide a sound environmental sustainability in the mining industry. The inadequacy is brought by the numerous changes and amendments to the provisions on mine closure. These changes have introduced confusion in the industry. For example, in the past, the requirements of financial provisions and mine closure requirements were in the MPRDA and NEMA was there to explain the process involved in the MPRDA. The financial provision and EIA requirements have now been moved to different pieces of legislations.

The lack of implementation is also linked to government capacities in terms of the lack of experience, technical and financial resources present for the implementation of closure policies in accordance with the provisions of the Act. The time taken to be

issued with closure certificate and mining permits to miners are long and this results in SSM operators abandoning and not rehabilitating their sites.

From the research findings, several discrepancies were found. The data provided by the Department on mining permits and the number of closured certificates did not tally up. This could be attributed to the presence of backlogs, corruption and delays in the issue of authorization licenses in South African mining industry.

The guidelines listed (see section 2.2.2) are mainly designed for mining, with specific focus on large-scale mining. Some guidelines are also applicable for SSM. For example, elements such as planning and managing the risks during mining operations. However, the challenges remain the lack of skills and knowledge, inadequate legislative requirements and the implementation measures.

The respondents postulated that the environmental issues related to SSM could be well handled if the operators conducted the required basic assessment process and followed the EMPr process proposed in the closure plan. For a sustainable closure, SSM operators are required to design a proper scope and objectives of the rehabilitation in the EMPr. The lack of skills and knowledge of the legislative frameworks remains a barrier for the majority of the miners to comply with the required regulation governing mine closure.

Broadly , the main findings for objective 1 relate to: the fragmentation of the three main legislation governing mine closure; the lack of government enforcement and legislative controls, lack of competency in implementing closure policies, fragmentation and uncertainties around financial provisions, inadequate legislative framework, as well as outdated guidelines for the evaluation of closure related to financial provision. There is no other form of calculation and /or incentives afforded to miners in terms of guidelines documents for the preparation of mine closure plans.

The issues that emerged from South African regulatory and legislation were observed in other regions as discussed in the literature review. Broadly, the guidelines and legislation managing mine closure are inclined towards large-scale mining.

5.2 Current practice of Small-Scale Mining sector in South Africa around mine closure

The second objective of the research was based on understanding the practice and its current nature and status. The information for this objective was collected through key informant interviews with practitioners working in the SSM sector and in mine closure. The main findings from the key informant interviews are organized into four themes. Figure 5.1 summarizes the key points raised from the practices of mine closure in SSM.

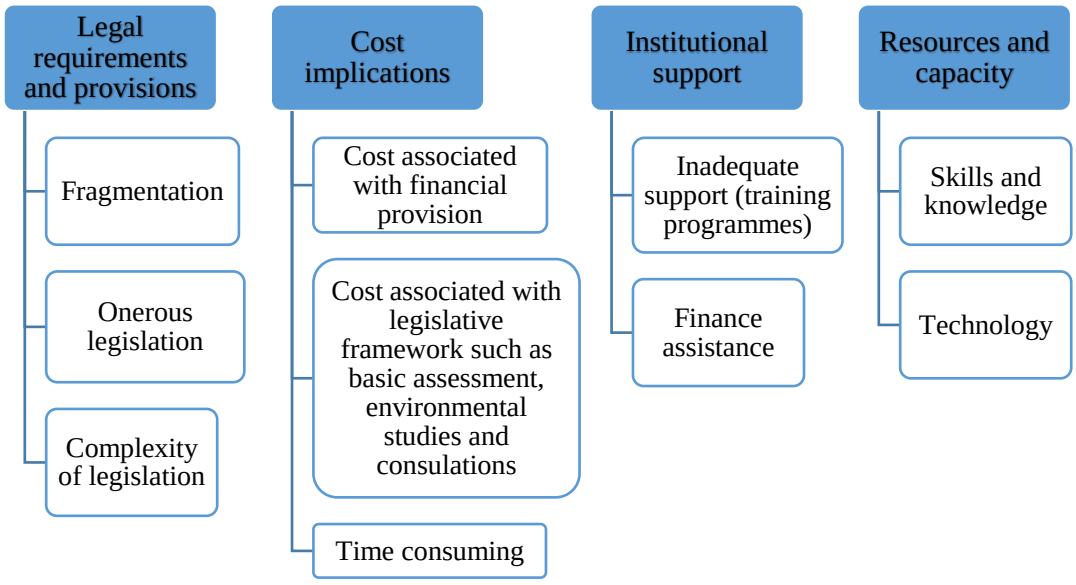


Figure 5-1: Main themes emerging from the results (Source: Author's own)

a) Legal requirements and provisions

South African legislative framework pertaining to mine closure in the mining industry is one of the best in Africa but its legislation and regulations are inappropriate for SSM. From the findings collected from semi-structured interviews with key informants and analysis of data collected from the Journalist Mark Olalde,

the research noticed that the legal requirements and provisions are fragmented, onerous and complex. This becomes problematic for SSM operators. Respondents mentioned that miners do not comply with mine closure requirements and the issues regarding the legislative framework and regulations do not allow SSM operators to understand and comply with the policies.

The research revealed that there is a lack of proper engagement by the government in matters pertaining to investments and/or financial and enforcement in the sector. While it appears that, miners do not want to comply with the required provisions; most do not have the means to comply. The presence of many pieces of legislation tends to confuse miners as well.

b) Costs implications

The costs required meeting the legislative requirements, and application of mining permits, and to hire consultants assistance may be a barrier for miners to comply with requirements. The majority of miners usually cannot afford and as a result they find them unnecessary. As mentioned above, miners are required to compile Basic Assessments as part of the application process. Consultants who charge exorbitant fees do these documents.

Of five respondents, four of them mentioned the insufficient financial provision provided by SSM operators to carry out environmental damage and they pointed out the lack of appropriate methods of calculation, lack of monitoring and auditing from the DMR authorities as the reason of the presence of variation in the amount of financial provision.

c) Institutional support, and resources and capacity

The bulk of the issues and risks associated with mine closure in SSM activities are linked to poverty. Mining is quite a complex operation and it requires a presence of knowledge and skills. The lack of training to the miners by government and institutions contributes to lack of appropriate mine closure. More so, there is a lack of

comprehensive and understanding of the factors driving mine closure by SSM operators. This is a starting point of nurturing sustainable mine closure.

5.3 A gap between policy and practices of small-scale mining around mine closure

The research findings revealed that there exists a misalignment between the policy and the practices of the SSM sector in South Africa (section 5.1 and 5.2).

In terms of mine closure requirements, SSM operators comply with basic assessment, EMPr, closure plan and financial provision. Unfortunately, SSM operators do not comply in terms of the implementation of the closure plan activities during mining operations. It appears as miners do not incorporate planning and risk management in the operations. A consequence of not incorporating the closure activities during SSM operations may delay the issue of closure certificate and the rehabilitation process as seen by the practitioners on the ground. This is because SSM operators have gone through a rigorous process of application of mining permit without including closure activities.

Brought by the lack of enforcement and implementation in the part of the different government, and the lack of knowledge and understanding of the legal requirements and provisions by SSM operators.

Table 5.1: Summary of misalignment between the policy and the practices of SSM sector in South Africa (Source: author's own)

Legislative framework	Practices	Gaps
Basic assessment requirements	Yes, miners conduct basic assessment study	No gap
Elaboration of EMPr	Yes	No gap
Closure plan	Yes	Lack of appropriate closure plan, lack of identification of mitigation measures, lack of basis review of closure plan
Financial provision	Yes	Lack of sufficient amount of financial provision; Lack of update amount of financial provision
Assistance with the basic assessment or an EMPR	No	Lack of training and support, lack of consultation and sharing information
Application of closure certificate	Yes, but not all were granted	Lack of compliance, understanding and enforcement of legal requirements

As highlighted in table 5.1, SSM operators try to comply with legislative framework but unfortunately not all of them fully comply. The first condition to be issued by a mining permit is that miners are required to conduct a basic assessment and elaborate an EMPR. At the time of application of closure certificate, miners are required to

submit a closure plan which integrates the closure objectives, focus, description of the activities and the closure costs. The findings revealed that not all miners comply with closure requirements and this is seen through the low percentage 37.23% of closure certificates issued in Springbok. Miners struggle to understand and comply with the different pieces of legislation. Government does not enforce legislative framework as it ought to be.

As mentioned earlier, some countries are using rehabilitation levy, which is the same as financial provision. This may work in the South African context if there is quite a change in the legislation and consideration of the difficulties to this sector.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The aim of the research was to understand mine closure in small-scale mining using South Africa as a case study. The research objective was achieved through understanding the policy and legislative frameworks governing mine closure in South Africa and obtaining insights into closure practices from specialists who work in the sector. Using the mining lifecycle to explain mine closure, the concept of mine closure is defined as the decommissioning of the mine and restoring the environment close to its pre-mining state.

Mine closure is therefore regarded as a process and not an event and thus its success remains difficult to achieve because of poor planning early in the mine lifecycle. The consequences of poor mine closure include environmental impacts such as land degradation, acid mine drainage, water and air pollution, mining waste and others. There are also socio-economic impacts such as job losses from retrenchments and health and safety issues.

Over the years, more attention has been paid to mine closure and its importance. Several guidelines and legislations have been introduced to manage and prepare for closure. Institutions such as the IFC, ICMM and World Bank have published guidelines on mine closure. At country level, several countries have included closure requirements and provisions in their mining and environmental frameworks. Instruments such as planning for closure early in mining, risk management, financial assurance, and monitoring and maintenance are used to ensure that the objectives of closure are met. These instruments are seen as useful tools in achieving an effective closure after mine operations cease its activities. Unfortunately, the majority of these standards and legislation are designed for large-scale mining.

South Africa also has progressive legislative frameworks that take into account mine closure requirements. Like in other countries, these frameworks do recognize all forms of mining including SSM operations however; it is argued that they are

inclined towards LSM. The SSM operators are required to follow the same legislative requirements in order to get mining permits and closure certificates.

The findings from the legislation review found that South African legislation is complex, difficult and fragmented. This was assessed in terms of the challenges faced by the SSM operators. In terms of the mine closure practice in SSM, it was found out that there are challenges that miners are faced with which makes it difficult for them to adhere to the requirements and provisions of the law. It was found that while SSM operators are generally making financial provisions above threshold.

There is a gap in terms of the lack of adequate closure, lack of knowledge and skills, and the complexity of the legislation. These factors were found to lead to poor performances. The lack of enforcement and implementation of the regulatory body was also identified as a challenge.

The challenges and shortfalls found within the South African legislation is a common phenomenon in other countries. As discussed in the literature review, countries like Western Australia, Ghana, India and Brazil that are characterized with high percentages of SSM activities which also face several issues relating to mine closure policies. One of the instruments used to plan and cater for mine closure is the rehabilitation levy which is the percentage of weighing scale of compensation amount taken into a fund to help clear-out environmental issues. The rehabilitation levy is a new concept that may come in handy in helping some governments to deal with environmental issues in the SSM sector.

6.2 Recommendations

Based on the above findings, it is recommended that South Africa consider the use of rehabilitation levy as a mechanism and/or incentives to increase compliance with closure requirements he study would like to make the following recommendations.

6.2.1 Recommendations for Government

The following factors should be considered during the design of the method of rehabilitation levy calculation: low capital, lack or inadequate technology and skills, and inadequate knowledge. From the calculation, the minimum amount prescribed in the outdated guidelines for evaluation of financial provision may be used as the basis of the calculation and be perceived as financial protection to government in case of abandoning mines by SSM operators. The following activities should be considered: listed activities needed, discounts, disturbance areas, the rehabilitation associated with risks and costing estimation. This method is described below.

- Step1: the regulatory authority needs to calculate the total of rehabilitation liability with respect to the disturbed land. This amount must be a prerequisite for applying a mining permit.
- Step2: In recognition of low risk associated with SSM activities and the regulatory authority may introduce the incentives to reward small-scale miners who comply with legal requirements pertaining mine closure process. For example, discount schemes may be used as incentives. This would push SSM operators to reduce the amount of rehabilitation levy to an amount below the total rehabilitation levy as would be calculated by the Department;
- Step 3: the proposal amount of rehabilitation should be equal to the total 100% of rehabilitation liability amount deducts from the discount amount.

Payment calculator need to be developed and should include calculation model for estimation of mine closure cost for rehabilitation levy. Regulatory authority needs to put in place regular reporting, monitoring and maintenance measures. In addition, the following recommendations are made to the different stakeholders.

- There is a need to address the existing fragmentation between the different Departments by assigning one Department to deal with all issues. The DMR already has a Directorate for Small-Scale Mining that can to deal with all issues related to SSM. Currently, each Directorate per province has one

person that assists SSM operators. It is recommended that the DMR increase the capacity of this Directorate to increase policy awareness and education, and its legislation implementation thereof.

- The DMR should also keep up to date the lists of SSM operators. Given the capacity constraints in the government, the DMR should collaborate with relevant institutions to provide regular training and workshops on technical aspects and policies.
- DMR in collaboration with DEA and DWA should work towards developing a framework for mine closure in SSM. A conceptual framework for the strategy for mine closure in SSM is illustrated in figure 6.1. The improvement of mine closure legislation and controls requires best practices and principles of mine closure, as well as the identification of mine closure objectives. A set of adequate procedures and standards of mine closure should form the basis of the mine closure guidelines for SSM operators.

6.2.2 Recommendations for miners

- It is important for SSM operators to familiarise themselves with the Basic Assessment and EMPr conducted during the application of mining permits. This will increase the probability of them integrating the mine closure plan at the early stage of the mine and identifying mitigation measures during the mining lifecycle. Small-scale miners should on a continuous basis review the closure plan in order to make sure that the plan is up to date and review the financial provision accordingly.
- During the closure planning process, there should be continuous sharing of information, consultation and transparency between all involved stakeholders. Any changes in legislations should be communicated to the miners. The DMR in collaboration with the miners should consider putting in place a representative structure that will ensure that the SSM operators are up-to date with the requirements and provisions of the legislation.

6.2.3 Recommendations for institutional and financial support

- Technical training and education are essential for the success of SSM sector and hence this should be in place in order to allow miners to carry out their operations. Institutional support is necessary to provide technical education and training capacity which would allow miners to acquire more knowledge about legal requirements and environmental issues. These structures should assist government with monitoring and checking if appropriate processes and procedures are correctly followed by small-scale miners and are in accordance with the law;
- There are limited studies conducted on mine closure practices in SSM sector around the world, and these institutions may help government to do more research in this sector.

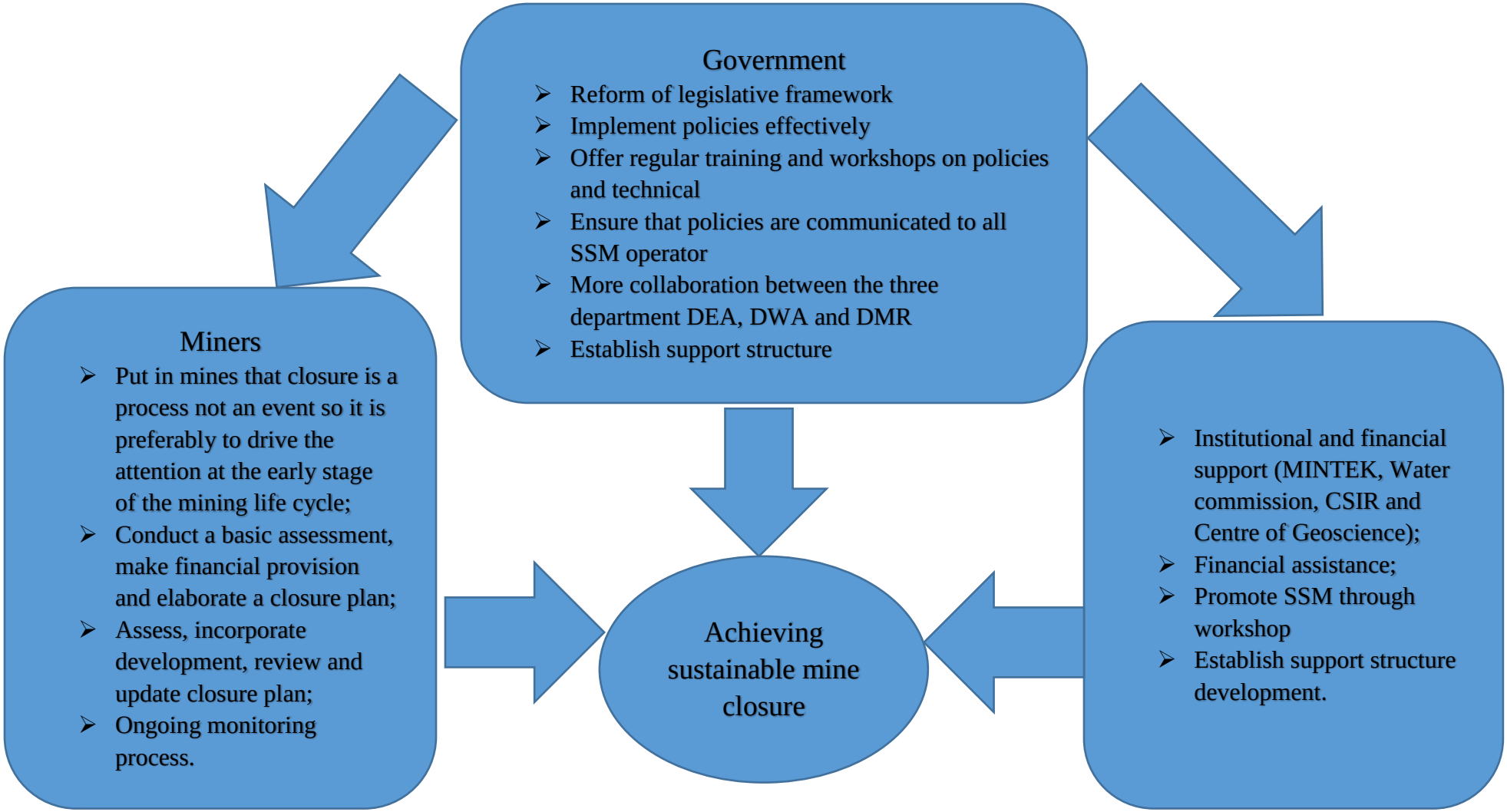


Figure 6-1: A conceptual framework for SSM sector towards sustainable closure (Source: Author's own)

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APPENDICES

Appendix 1: Ethics Clearance for the study

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Nguekam Tagne

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H17/08/25**
PROJECT TITLE	Mine closure in small-scale mining in South Africa: A review of policies and practices
INVESTIGATOR(S)	Miss J Nguekam Tagne
SCHOOL/DEPARTMENT	School of Mining Engineering/
DATE CONSIDERED	18 August 2017
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	20 September 2020

DATE 21 September 2017 **CHAIRPERSON** J-Knight
(Professor J Knight)

cc: Supervisor : Mrs I Watson

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____
Signature **Date**

Appendix 2: Specialist interviews

1. What is your role and experience in small-scale diamond mining?
2. Are you aware of any small-scale diamond mines that have closed? Could you give me an example? What process did they follow? Did they do rehabilitation? In your opinion, is this effective?
3. Do small-scale diamond mines comply with the closure legislation? Why? Why not?
4. Do you think that the SA's government enforces SSM legislation during mine closure?
5. Are you aware of the amounts of financial provision made by small-scale mine diamond operations? Do you think that it is enough?
6. Why is there a variation in amounts paid for rehabilitation by small-scale mining operations?
7. If you have to recommend to Minister around closure in small-scale mining, what are you going to recommend?
8. What are the most environmental effects faced by SSM during closure? In your point, which approaches could you propose to mitigate that?
9. What are the some challenges faced by small-scale diamond mining during mine closure in SA?
10. Are you aware of any support given by government or other institutions to help small-scale diamond miners with closure? Please provide examples. Are these effective?

Appendix 3: Length of time between the application and the issuing of closure certificate in Springbok Region

Reference	Applied years	Issued years	Length of Time	Reference	Applied years	Issued years	Length of time
MP 536	2005	2016	11	MP 521	2012	2016	4
MP 514	2006	2016	10	MP540	2012	2015	3
MP 513	2008	2016	8	MP 541	2012	2015	3
MP 519	2009	2016	7	MP 542	2012	2016	4
MP 500	2010	2012	2	MP 543	2012	2015	3
MP 501	2010	2013	3	MP 544	2012	2015	3
MP 596	2010	2012	2	MP 546	2012	2015	3
MP 637	2010	2012	2	MP 683	2012	2015	3
MP 687	2010	2012	0	MP 737	2012	2016	4
MP 698	2010	2016	6	MP 738	2012	2013	1
MP 699	2010	2016	6	MP 818	2012	2013	1
MP 753	2010	2011	1	MP 819	2012	2013	1
MP 754	2010	2011	1	MP 867	2012	2013	1
MP 769	2010	2011	1	MP 633	2013	2016	3
MP 532	2011	2016	5	MP 736	2013	2013	1
MP 534	2011	2016	5	MP562	2013	2016	3
MP 555	2011	2013	2	MP 667	2014	2016	2
MP 558	2011	2013	2	MP 689	2014	2013	1
MP	2011	2013	2	MP 723	2014	2016	2

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MP 579	2011	2012	1	MP 724	2014	2016	2
MP 580	2011	2012	1	MP 733	2014	2015	1
MP 651	2011	2012	1	MP 734	2014	2015	1
MP 731	2011	2015	4	MP 743	2014	2016	2
MP 742	2011	2013	2	MP 824	2014	2016	2
MP 798	2011	2016	5	MP 854	2014	2015	1
MP 799	2011	2016	5	MP826	2014	2016	2
MP 806	2011	2014	3	MP 10054	2015	2016	1
MP 811	2011	2013	2				