

https://dspace.org/

A comparative analysis of mining environmental management programme reports following a change to the one environmental system

Mathe, Lebogang

2022
University of the Witwatersrand, Johannesburg
https://hdl.handle.net/10539/36998
Mathe, Lebogang. (2023). A comparative analysis of mining environmental management programme reports following a change to the one environmental system [Master's dissertation, University of the Witwatersrand, Johannesburg]. WireDSpace.https://hdl.handle.net/10539/36998

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



A MINI RESEARCH REPORT SUBMITTED TO THE FACULTY OF SCIENCE,

UNIVERSITY OF THE WITWATERSRAND

COURSE CODE: GEOL7007A

A COMPARATIVE ANALYSIS OF MINING ENVIRONMENTAL MANAGEMENT PROGRAMME REPORTS FOLLOWING A CHANGE TO THE ONE ENVIRONMENTAL SYSTEM

LEBOGANG MATHE, STUDENT NO: 585974

MSC ENVIRONMENTAL SCIENCES (COURSEWORK AND RESEARCH)

SCHOOL OF ANIMAL, PLANT AND ENVIRONMENTAL SCIENCES

SUPERVISOR: I. WATSON

DECLARATION

I declare that this report is my own unaided work. It is being submitted in partial fulfilment of the degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

LEBOGANG MATHE .....

DATE November 2022

Abstract

The mining fraternity has recently seen a shift in terms of environmental requirements under the ambit of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) to the National Environmental Management Act 107 of 1998 (NEMA). The objective was to ensure a streamlined environmental compliance and to put emphasis on integrated environmental management. The One Environmental System (OES) was introduced which denotes that all environmental related projects or activities, including mining, are regulated through an ambit of one system. NEMA is recognised as an overarching law which provides for co-operative environmental governance; therefore, all environmental related activities are regulated under its ambit and EIA regulations.

In this research report, the Environmental Management Programme (EMP) reports and Environmental Authorisations that were issued under the MPRDA and the 2014 NEMA regulations respectively, were analysed using the respective regulations to compare the environmental management measures outlined in the reports to achieve better environmental results. The aim of the research was to assess whether the Environmental Authorisations granted in terms of NEMA reflect better environmental results as compared to those issued under the MPRDA. Better environmental results mean improved management plans with clearer assessment of impacts, more detailed mitigation measures with specific, achievable, relevant and time bound actions that do not pose harmful effects on the environment and communities. A mixed method of analysis was implemented which included a review and comparison of legislation, evaluation and scoring of 20 EMPs (10 submitted under MPRDA and 10 submitted under NEMA) and interviews with key informants, namely competent authorities and the Environmental Assessment Practitioners (EAPs) were conducted to support the findings of the reports.

In conclusion, the reports analysed presented a significant improvement and better environmental results under NEMA. The interviews conducted with authorities and the EAPs have also substantiated the observations made in terms of Environmental Management Programme reports and Environmental Authorisations submitted. The findings indicated that there were similarities in the MPRDA and NEMA regulations as

regards some environmental requirements. However, the MPRDA lacked to outline a detailed description of environmental requirements needed to manage environmental impacts. Thus, applicants provided limited information in terms of the management of impacts. NEMA has provided additional requirements, including baseline environmental information, specialist reports and public participation amongst others; these contributed to improved environmental results. The study revealed that the reports submitted under NEMA provided better environmental management measures as compared to the reports submitted under MPRDA.

Table of Contents

CHAPTER 1: INTRODUCTION 8
1.1. Problem Statement 11
1.2. Aim of the Research 13
1.3. Research Questions 13
1.4 Structure of the Report 13
CHAPTER 2: LITERATURE REVIEW 15
2.1 Introduction 15
2.2 Mining and the environment 15
2.3 Impacts of mining 16
2.3.1 Managing environmental impacts 20
2.3.2 Environmental impacts from mining in South Africa 20
2.4 Environmental Management Plans / Programmes 22
2.4.1 Legislation in relation to EMP in South Africa 24
2.5 Environmental Impact Assessment 25
2.5.1 EIA in the South African context 26
2.6 The One Environmental Management System 30
2.7 Quality of environmental reports 31
2.8 Concluding remarks on literature 35
CHAPTER 3: METHODOLOGY 36
3.1 Introduction 36
3.2 Research design 36
3.3 Research Methods 38
3.4 Research limitation 45
3.5 Ethical considerations 45
CHAPTER 4: RESULTS AND DISCUSSION 46
(a) PRESENTATION OF RESULTS 46
4.1 Question 1 46
4.1.1 Comparison of clauses derived from MPRDA versus NEMA regulations 48
4. 2 Question 2 56
4.3 Question 3 62
4.3.1 Authorities' feedback 62
4.3.3 Environmental Assessment Practitioners feedback 65
(b) DISCUSSION OF RESULTS 66

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS 70
5.1 CONCLUSIONS 70
5.2 RECOMMENDATIONS 71
References 72
ANNEXURE A: INTERVIEW QUESTIONS 79
ANNEXURE B: ETHICS CLEARANCE CERTIFICATE 81

List of tables

Table 1: List of Environmental Management Programme Reports analysed 39
Table 2: List of participants (Regulators) 41
Table 3: List of participants (Environmental Assessment Practitioners) 42
Table 4: MPRDA versus NEMA Application process 46
Table 5: Brief comparison of elements derived from legislative requirements in terms of MPRDA and NEMA regulations 50
Table 6: Scoring in terms of environmental requirements: Information as provided in the MPRDA EMP reports 57
Table 7: Scoring in terms of environmental requirements: Information as provided in the NEMA EMP reports 60
Table 8: Summary of Authorities feedback 63
Table 9: Summary of Environmental Assessment Practitioners feedback 65

LIST OF ACRONYMS

AEL – Atmospheric Emission License

DEA – Department of Environmental Affairs

DMR – Department of Mineral Resources

DWS – Department of Water and Sanitation

EA – Environmental Authorisation

EAPs – Environmental Assessment Practitioners

EIA – Environmental Impact Assessment

EMP – Environmental Management Plans / Programme

EMPR – Environmental Management Programme Report

HDSA – Historically Disadvantaged South Africans

IEM – Integrated Environmental Management

MPRDA – Mineral and Petroleum Resources Development Act, 2002 (Act no. 28 of 2002

NEMA – National Environmental Management Act, 1998 (Act No. 107 of 1998)

OES – One Environmental System

SIA – Social Impact Assessment

WUL – Water Use License

CHAPTER 1: INTRODUCTION

The mining industry is a source of goods and services to many supplies that human beings depend on including energy, agriculture (fertilisers), building infrastructures to name a few (Carvalho, 2017). However, mining also presents substantial disturbance to the environment and impacts on the society (Carvalho, 2017). Mining is continuously associated with intrusion and impact on the environment, mainly the landscape, water and the atmosphere (Pietrzyk-Sokulska et al., 2015). The legacy of mining has been there for many centuries, but the impacts caused to humans and the environment have only been recognised during the last quarter of the 20th century (Carvalho, 2017).

Before 1994, the economy of South Africa grew rapidly due to mineral extraction, without any intervention from government with regard to the mining methods and destruction that markets had (Rogerson, 2011). The new government took a careful approach to the changes in policies in relation to the mining sector (Rogerson, 2011). South Africa followed in the footsteps of other countries to adopt a more active involvement in mining projects (Rogerson, 2011).

The realisation of impacts caused by mining has led to progress on development of legislation for environmental protection and in some instances clean up and rehabilitation projects were implemented (Carvalho, 2017). The increasing demand and requirements of environmental legislation assist to influence the measures taken by the mining industry to reduce the impacts caused by mining activities (Pietrzyk-Sokulska et al., 2015). Since developing countries are now hosts to mining projects, they are now adjusting and updating legislation to implement environmental management measures (Carvalho, 2017). Thus, the future of mining is reliant on observing good practices in order to safeguard the environment and positively contribute to the quality of life of communities (Carvalho, 2017).

The initial point for environmental compliance and management in mines is to conduct an Environmental Impact Assessment (EIA), prepare and submit the EIA report (Sinding, 1999). The EIA report remains a very critical step, not only in the environmental management process but also the general design of a mine (Sinding,

1999). Over the years, efforts and legislative procedures have been effected to try alleviate the environmental consequences resulting from the active and closed mines (One Environmental System Colloquium, 2018). The Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) together with the regulations provided administration of environmental requirements for mining activities (Humby, 2015). Applicants were required to incorporate the principles of the National Environmental Management Act 107 of 1998 (NEMA) as set out in schedule 2 (Humby, 2015).

The Environmental Management Programme (EMP), Environmental Impact Assessment (EIA) and rehabilitation were introduced as legislative and policy measures that the mines should use in order to ensure that environmental hazards are reduced (Odeku, 2017). The purpose of the EMP is to make sure that rehabilitation takes place and is sustainable in a way that will benefit communities. Thus, it is critical that the EMP is in place at all times (Odeku, 2017).

Odeku (2017) indicates that nowadays, government as well as companies are moving towards sustainable mining as opposed to irresponsible activities that cause harm to the environment. Any mining company that does not incorporate sustainability into their vision, mission and day to day operations is considered to be unsustainable (Odeku, 2017). The major critical tool that can ensure that mining is undertaken sustainably is the maintenance of the EMP, which encompasses measures to protect the environment and rehabilitation of the environment to a productive state (Odeku, 2017).

The Environmental Management Programme (EMP) is used as one of the measures to ensure that the holder of a mining right or the project applicant has fully committed to manage and guard or protect the environment (DEAT, 2004a). When preparing an EMP, it is required that the applicant follows the environmental impact assessment methodology (Humby, 2015). Section 39 of the MPRDA states that an applicant of a mining right must conduct an EIA and produce an EMP.

Since 2014, the mining fraternity has seen a change with regard to environmental requirements from the MPRDA to NEMA in order to ensure a streamlined environmental compliance places more stringent emphasis on an integrated environmental management (One Environmental System Colloquium, 2018). The OES was introduced which denotes that all environmental related projects or activities are regulated through an ambit of one system (One Environmental System Colloquium, 2018).

The reason for the OES was that there have been many concerns raised over the years, with regard to environmental regulation of mining in South Africa (Mpinga, 2017). Investors raised that the regulatory framework was complex and over regulated, due to the different fragments of legislation including the MPRDA and NEMA (Mpinga, 2017). Mining companies needed to obtain authorisations from both DMR and DEA. These included the EMP developed in terms of MPRDA and the mining right from DMR in terms of MPRDA. Furthermore, DEA also required Environmental Management Plans /Programmes (EMP) to be developed in terms of NEMA, in order to obtain environmental authorisation (Mpinga, 2017).

Obtaining the mining right from DMR constituted the environmental authorisation from DEA in order to conduct mining. In light of this, it was evident that there was a repetition of procedures (Mpinga, 2017). Furthermore, the OS was established to deal with the inefficiency of EIA related aspects in the reports submitted by the mining industry. The mitigation actions as described in the EMP reports were not substantial and complied with (One Environmental System Colloquium, 2018). In this regard the One Environmental System was introduced (Mpinga, 2017).

During the year 2008, an agreement to implement the OES was signed by the Ministers of Mineral Resources and Environmental Affairs that all mining and related environmental activities also be conducted and regulated according to NEMA (One Environmental System Colloquium, 2018). The purpose of the O ES was to streamline the licensing processes for mining, environmental authorisations and water use license as well as to prevent the legacy of impacts on the environment (One Environmental System Colloquium, 2018).

To implement the agreement, the two Departments amended both the MPRDA and NEMA (One Environmental System Colloquium, 2018). The OES necessitated those amendments of both the MPRDA and NEMA be carried out and all environmental requirements in terms of MPRDA to be repealed (One Environmental System Colloquium, 2018).

Implementation of the OES commenced on the 08th of December 2014. It is therefore emphasised that one of the outcomes of the OES is that environmental impact assessments for mining are now conducted in terms of NEMA and not the MPRDA. In essence, under the OES, the Minister of Mineral Resources issues environmental authorisations in terms of NEMA.

This research sought to compare the contents and extent of environmental management measures outlined to reduce the impact on the environment in reports developed under MPRDA with those of NEMA. In addition, the analysis determined whether the legislative requirements have been followed or not. The comparison was based on the EMP reports granted during the MPRDA regime against those granted in the NEMA regime (post 2014). The aim of comparison was to determine whether the Environmental Authorisations granted in terms of NEMA reflect better environmental results as compared to the previous MPRDA regime. Better environmental results mean improved management plans with clearer assessment of impacts, more detailed mitigation measures with specific, achievable, relevant and time bound actions that do not pose harmful effects on the environment and communities. The better environmental results reflected through NEMA will provide an initial step towards achieving one of the objectives of OES, which is to prevent the legacy of impacts on the environment. A study to determine whether the management measures are indeed implemented would need to be conducted separately.

1.1. Problem Statement

With effect from the 8th of December 2014, the Department of Mineral Resources (DMR) started to implement Environmental Impact Assessment (EIA) for mining applications, and the administration of the applications are according to the new NEMA EIA regulations. The DMR issues Environmental Authorisations (EA) and mine waste

licenses, whereas the air quality licenses, or Atmospheric Emission Licences (AEL) are issued by Department of Environmental Affairs (DEA), and the Department of Water and Sanitation (DWS) are responsible for issuing the Water Use License (WUL) (One Environmental System Colloquium, 2018).

The OES was introduced to deal with concerns regarding the efficiency of EIA related aspects in the reports submitted by the mining industry, in particular the requirements for numerous authorisations related to water, mining and the environment, as well different timeframes relevant to these. Furthermore, there was a concern that the mitigation procedures outlined in the MPRDA EMP reports were not substantial or complied with (One Environmental System Colloquium, 2018). The OES set out to address these concerns.

It has been 8 years since the implementation of the OES commenced to coordinate environmental related applications that has impacts on the environment. It is thus opportune to assess, whether the NEMA EIA requirements reflect better environmental results and compliance to the prescripts of the regulations, as compared to the MPRDA regime. The environmental management measures made in the EMP will provide potential for better environmental results. In this research, better environmental results mean improved environmental management action plans with clearer assessment of impacts, more detailed mitigation measures with specific, achievable, relevant and time bound actions that do not pose harmful threats to the environment and communities.

A well written quality report as per the NEMA requirements will serve as a base point towards positive environmental results. It is critical that any applicant, including mining companies, complies with the requirements of NEMA. Since the approved Environmental Management Programme is legally binding, environmental management measures (with specific reference on Chapter 5 of NEMA) need to be clearly outlined and distinguished from the old MPRDA regime.

1.2. Aim of the Research

The research sought to assess whether the Environmental Authorisations granted in terms of NEMA reflect better environmental results as compared to the MPRDA regime.

1.3. Research Questions

Question 1

What are the changes in requirements for mining Environmental Management Programme reports compiled in terms of NEMA versus the previous MPRDA requirements?

Question 2

Do these changes in legislative requirements result in improved Environmental Management Programme reports with better environmental results that do not pose a threat to the environment?

Question 3

How do practitioners who develop and approve Environmental Management Programme reports experience the change in legislation?

1.4 Structure of the Report

This report has been structured according to the following chapters:

Chapter 1: Introduction

This chapter provides a brief introduction of the study and includes the problem statement, aim of the research and research questions.

Chapter 2: Literature review

This chapter provides an overview of existing research on reports or articles relating to mining and the environment, environmental impact assessment, environmental management programmes and One Environmental System.

Chapter 3: Methodology

This chapter outlines the methodology that was applied or implemented to obtain the necessary data for the research.

Chapter 4: Results

In this chapter, the results are presented in relation to the research aim and questions.

Chapter 5: Discussions and Conclusion

This chapter discusses the overall findings of the research and how it relates to existing literature. The conclusion is also drawn from the research results and suggestions, and recommendations are made for further improvement in terms of better environmental results that do not pose a threat to the environment.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

A brief synopsis on the impacts of mining and the progression of legislation in order to address environmental challenges was provided in Chapter 1. The OES serves as the latest endeavour to ensure protection of environmental resources from development activities including mining. In order to recognise the environmental progression of mining, the literature review focused on the brief history of mining impacts, the management of impacts, tools that have been used including the EIA and EMP and the quality of environmental reports. The review assists to determine if there has been an improvement over time with regard to the legislation and management measures by the mining industry.

2.2 Mining and the environment

Mining is one of the activities that has been in existence for centuries and has played a significant role in the growth of economies. It is considered to have brought transformation worldwide (Bell et al., 2006). Over the years, the demand for mineral production has increased due to its value, rendering dependency by society to a certain extent. Mining has therefore become essential to the society due to continuous economic growth in developed countries and alleviation of poverty in developing countries (Bell et al., 2006).

Mining activities conducted during in each phase of a mine, including prospecting, exploration, construction, operation, maintenance and decommissioning, have the ability to cause negative and positive impacts to societal and environmental systems through direct and indirect ways (Haddaway et al., 2019). Mining can also offer different benefits to societies, but it may also cause conflict regarding above ground and sub-surface land use. Similarly, mining has the ability to modify environments, but remediation and mitigation can re-establish some of the systems (Haddaway et al., 2019).

The main methods used in extracting a mineral are surface and underground mining. More often, surface mining is considered the primary mining method. Surface rocks are removed through blasting which in turn disturbs the land significantly. Underground mining is usually accessed through tunnels and shafts which penetrate down into the ground (Hudson et al., 1999).

There are various mining activities with different ecological footprints on the environment. Amongst others, the two major issues include mine tailings dams and acid mine drainage (Carvalho, 2017). The legacy of mining activities has accumulated over centuries. The impacts were only realised during the last quarter of the 20th century. Since then, there has been a major change with regard to the development of legislation and environmental protection. Some activities involved industry clean up, remediation and projects that involved rehabilitation (Carvalho, 2017).

2.3 Impacts of mining

Sameh et al. (2011) state that the impacts are created during the various phases of a mine which directly disturb the environment. These impacts are complicated and unsettling on both the environmental and social aspects (Barve et al., 2011). The activities that result from removal and processing of ores contribute to major environmental challenges (Bell et al., 2006). The following are some of the impacts caused by mining:

- Air Pollution

Air pollution including dust; aerosols remain one of the pollution problems associated with mining impacts due to the ingress of particulate matter in the atmosphere, thereby contributing to the change in climate (Bridge, 2004). During each stage of a mine's life, airborne emissions are produced. Waste piles for example can contain small particles that are easily blown by wind (Norgate et al., 2000). The sources of pollution include excavations, tailings facilities, haul roads, transportation and blasting which contains particulate matter. Vehicular traffic including haul trucks on haul roads also contribute to air pollution through fugitive dust (Chaulya et al, 2011). Pollutants caused by mining

activities cause a major impact on the wellbeing of adjacent communities and the environment (Norgate et al., 2000). Dust generated through mining activities do not only impact on air quality but also create health hazards to human beings. While underground mining affects mostly the workers in the vicinity, opencast mining extends to a wider area due to gaseous and dust pollutants dispersing (Singh, 2009).

Opencast mining methods have been identified as one of the major sources of dust generation. In the case of coal mining, concentration of coal particulates is usually visible during the winter season when it is dry and reduced during rainy seasons (Chaulya et al, 2011).

In addition, mining activities have the potential to change global carbon in many ways, including carbon dioxide uptake by forests and vegetation, as forests, vegetation or tropical regions play an imperative role in the uptake or absorption of carbon dioxide. The removal of forests and vegetation will hinder the absorption of carbon dioxide (Sengupta, 2021).

- Water pollution

Impacts of mining on watercourses are mainly due to various chemicals used during mining processes and extraction of ore from surface (Jhariya et al, 2016). According to Norgate et al. (2000), the impact of mining on water resources is seen as the most substantial factor in the affected mining area. The crucial aspects to look at are the ability of ground and surface water to suffice and remain safe for human consumption as well as aquatic species. Watercourses contaminated by acid mine drainage have a pH value of 4 and lower which is detrimental to aquatic life with a minimal chance of survival. In addition, acid mine drainage has the ability to dissolve toxic metals, which in turn, if carried by water, can travel a long distance, thereby settling at the bottom of the streams (Norgate et al., 2000).

Contamination of soil and water due acid mine drainage is a major threat in other parts of the world, especially in highly populated areas and developing countries where mines are in close proximity to human settlements (Ochieng et al, 2010). The water from coal and other base metals often has sulfuric acid as well as heavy metals with

a volume content that can pollute the streams and agricultural land. High levels of heavy metals in soils or streams are easily absorbed by plants and human beings, which poses a high risk to consumers (Ochieng et al, 2010).

There are also chemical pollution problems that are caused by the reagents used during the mineral processing process and ultimately released into the environment. Exposure of some of the ore to the air, can also lead to oxidation which results in chemical pollution (Bridge, 2004). Most of the metal ores that occur as sulphides, when exposed to oxygen and water, will oxidise to create sulphuric acid and create acid mine drainage if not managed properly. It is considered one of the major environmental concerns (more specifically to water pollution) in the mining industry (Bridge, 2004).

Surface watercourses including streams, lakes and rivers are often polluted due to spillage of toxic chemicals, erosion of waste materials into streams or discharge of used mine water (Jhariya et al, 2016). Toxic chemicals are stored and used in processing plants or facilities. These poses a potential concern for accidental spillage whenever they are used (Jhariya et al, 2016). Erosion is also one of the factors which causes impact on surface water. Sources of erosion include open pit areas, dumps, overburden piles, haul roads and ore stockpiles (Jhariya et al, 2016). When erosion happens, sediments are deposited in layers into flood plains which ultimately impact on surface waters. Minerals are also carried with sediments, which in turn change the pH of surface waters (Jhariya et al, 2016).

During mining, groundwater is extracted for use in mine activities. The water table is therefore lowered and the way in which groundwater migrates is altered (Karmakar et al, 2012). In addition, mining activities have the potential to disturb drainage systems and surface contours by extracting groundwater (Karmakar et al, 2012). In some cases, mine excavations have the ability to cause subsidence. As a result, subsidence causes the change in the movement of underground water and changes the groundwater level and catchment area (Jhariya et al, 2016).

- Soil and vegetation

The physical landscape intrusion is the first point of impact that results in all other forms of effects caused by mining activities. There are several kinds of landscape intrusion aspects which include construction of building structures and creation of pits (Bridge, 2004). The impacts include deforestation, removal of vegetation, erosion due to removal of vegetation, sedimentation in surface water resources and instability of rocks and soil (Žibret et al., 2017)

Clearing of vegetation and removal of topsoil contributes to the impact on the environment and loss of habitat as well as the displacement of fauna and flora. Most of the habitats provide vegetation as a source of food, cover from predators as well as nesting sites. The removal of vegetation therefore reduces the chances of survival for wildlife (Norgate et al., 2000). When preparing for a mine, vegetation and topsoil are removed for construction purposes. Through this process, animal and plant species are destroyed or displaced and severely affected (Sengupta, 2021). The impact includes shortage of food as some species depend on vegetation as their source of food supply. Some animals do not adjust to the changes as they require special kinds of habitats for survival (Sengupta, 2021).

Existence and construction of mine facilities changes the landscape of the surrounding area and the quality of soil by exposing undisturbed and fertile materials. As a result, potential for agricultural activities will also be affected. Furthermore, soil can be contaminated through oil and chemical spills, contaminated windblown dust, chemicals from tailings dumps and waste rocks (Sengupta, 2021). Due to a significant or high content of copper, lead, arsenic or cadmium, tailings dams are considered to be one of the primary contributing sources of pollution. The failure of some of the tailings dams has raised concerns about the stability and pollution consequences relating to tailings dams (Bridge, 2004).

2.3.1 Managing environmental impacts

The environmental damage related to a long history of poor regulation has sparked a realisation that a sense of balance is required for development and a healthy environment (Barve et al., 2011). Cleaner technologies have been developed to reduce the impacts on the environment, however these do not eliminate the challenges completely (Barve et al., 2011). Furthermore, the evolution of national and international agreements relating to the protection of the environment, has also raised requirements for banks and other finance institutions to provide credit based on certain environmental conditions (Bridge, 2004). The financial institutions now attach environmental performance as a condition to their lending and insurance agreements. The agreements do not only provide influence on environmental performance but improved social conditions as well (Bridge, 2004).

The mitigation hierarchy is also a decision-making tool intended to prevent and remediate environmental impacts. The first stage is to avoid the impact where possible (Phalan et al., 2017); if the impact cannot be avoided, the developer should attempt to minimise the impact, restore the area and offset as a last stage. Impact avoidance denotes developers to foresee and prevent any action that could cause impact. Impact avoidance is therefore considered to be the most critical stage such that it reduces the need for remediation (Phalan et al., 2017).

The past two decades have seen great pressure on the mining industry to work towards an improvement not only on the environment but towards the developmental and societal performance as well (Bridge, 2004). It is broadly accepted that a complete legal compliance with environmental laws is required, however, inadequate societal expectation on environmental aspects is not met (Bridge, 2004).

2.3.2 Environmental impacts from mining in South Africa

Mining in South Africa has happened since the 19th century; however, protection of the environment was not regarded as a priority (Makua et al., 2017). It is in this regard that South Africa now faces serious environmental challenges due to the damages and degradation caused by mine operations (Makua et al., 2017). Furthermore,

accountability and directives of the industry are lacking. Surrounding communities and the affected ecosystems continue to be affected daily (Makua et al., 2017). Poor environmental laws of the past resulted in the legacy of pollution which government is still trying to address today. Hence, Swart (2003) states that in the past, old mined out areas were left unrehabilitated and environmental protection was not practised as an aspect of critical importance, until such time that the Minerals Act, 1991 was promulgated (Swart, 2003). Compliance in terms of environmental management was practiced at a low standard. In this regard, the legacy of mining contributed to be a harmful impact not only on the environment but to the social wellbeing (Swart, 2003).

It is to be noted that the different kinds of mineral resources that SA possesses serve as the main driver of social and economic growth and development (Makua et al., 2017). Mining provides jobs and is a major contributor to the economy and is important in building relations with other countries (Makua et al., 2017). Nevertheless, irresponsible practices create a major impact on the environment that ultimately not only diminishes the natural assets or resources but affects the health and wellbeing of individuals (Makua et al., 2017). In parts of the country such as Emalahleni which is situated in Mpumalanga Province, mining of coal has been conducted for over a century (Mbedzi et al., 2020). The impact has gone as far as sterilisation of land due to spontaneous combustion and subsidence of land in the area (Mbedzi et al., 2020).

One of the major concerns in South Africa is the impact of Acid Mine Drainage (AMD) which is primarily linked with sulphide rich metalliferous ore deposits which include but are not limited to gold, coal and copper deposits which are extracted in South Africa (Morodi et al., 2018). Acid mine drainage has been identified as the most severe risk to the public wellbeing and the environment (Morodi et al., 2018). Due to the interconnectedness of most of the mines in Gauteng, contaminated groundwater from the old gold mines decanted from one mine area to another, therefore exacerbating the problem (Morodi et al., 2018).

The problematic issue is that, as this contaminated water flows from one mine area to the other, it also goes through other waterways whereby it also permeates into the soil and ultimately reaches the water table causing contamination to far reaching areas (Morodi et al., 2018). The impact of AMD is not only linked with ground and surface

water pollution, but it also degrades the soil quality, and causes harm to both flora and fauna (Morodi et al., 2018). Another major issue with regard to AMD is its impact on diminishing infrastructure, which also influences economic activities and can displace people and affect their livelihoods (Feris et al., 2014).

The other significant causes of pollution include the Tailing Storage Facilities (TSF) that are mainly associated with gold mines (Mpanza et al., 2020). A major number of these TSFs are unlined and not rehabilitated, therefore creating a challenge in terms of water pollution (since TSFs contain a lot of toxic heavy metals), air pollution due to dust and particulate matter (Mpanza et al., 2020). Fugitive dust from the TSFs affect the life health and socio-economic status of surrounding communities due to the medical costs incurred (Mpanza et al., 2020). In addition, due to dry climatic conditions in South Africa, windblown dust if often very prevalent which in turn causes air pollution (Mpanza et al., 2020).

2.4 Environmental Management Plans / Programmes

The Minerals Act, no.59 of 1991 required that all mining operations must submit a rehabilitation plan or programme for approval (ILRMD, 1994). However, during that time the members of the Chamber of Mines in South Africa raised that the requirement focused on restoring land surface only rather than including the management of environmental impacts as well (ILRMD, 1994). The industry saw it fit that it had to implement Integrated Environmental Management (IEM) to resolve the conflict. In light of this, the concept of the Environmental Management Programme (EMP) came into effect (ILRMD, 1994).

An Aide Memoire was recommended by the industry to assist in the preparation of EMPs for mining and to facilitate the implementation (ILRMD, 1994). A committee to compile the Aide Memoire was formed in this regard and incorporated all affected parties, regulatory bodies and industry (ILRMD, 1994). The Aide Memoire acted as a guideline which reflected the information required by different departments (ILRMD, 1994). It was decided that the EMP report should include the details of environmental impact assessments conducted as well as the environmental management

programmes (ILRMD,1994). The overall objective of the EMP was to provide an all-encompassing document that will be approved by various authorities concerned with the regulation of the environment, to provide for the needs and benefit of the project and to meet environmental requirements (ILRMD, 1994).

An EMP is therefore described as a tool that can give assurance that the project applicant has committed to appropriate provisions for mitigation measures in relation to the impacts that are likely to be caused by the development (DEAT, 2004a). The EMP outlines all the foreseeable environmental impacts, the planned mitigation and monitoring measures, the person responsible for the mitigation, the budget and the time frames (DEAT, 2004a). It outlines an overview of the systems, methods and actions that will be employed to lessen and monitor environmental impacts caused during the mining process. Furthermore, the EMP is a live document that is used throughout the life cycle of a project and amended as and when the project is modified (DEAT, 2004a). The EMP also encourages awareness and implementation of best environmental management practices (Baby, 2011). The EMP document is used through the entire of a project and should be regularly updated to align to the project progress (DEAT, 2004a).

Broderick et al. (2006) state that in the US, the EIA process is complemented through the incorporation of environmental management plans into the environmental statements. The purpose of the EMP is to provide a working guide for implementing suitable environmental systems and monitoring procedures throughout the project (Broderick et al., 2006). In addition, it alleviates potential pollution forms through monitoring, avoids degradation of land, trains and capacitates employees with regard to environmental compliance, reduces risks posed to the environment. It provides a plan to answer the questions on what; where; when; how; by who, (Baby, 2011). It ensures that the project complies with license conditions and adopts good practice measures to mitigate the impacts (Broderick et al., 2006). It is a practical and attainable plan with management actions to ensure minimisation of impacts and direction towards sustainable development (Baby, 2011). A well-designed EMP must be followed by compliance and implementation. The regulatory authorities must also play a role to ensure compliance to legislation and regulations (Odeku, 2017).

2.4.1 Legislation in relation to EMP in South Africa

The Environment Conservation Act of 1989 regulations provided a list of activities that required environmental authorisation; however, mining activities were not included in the list (Sandham et al., 2008a). Since the enactment of the EIA process, the then Department of Environmental Affairs and Tourism was the competent authority for EIA authorisation, while the Department of Mineral and Energy became the competent authority for mining activities. This resulted in a double process for environmental authorisation (Sandham et al., 2008a). The Department of Mineral and Energy developed its environmental regulations and guidelines and introduced the Aide Memoire which required the Environmental Management Programme Reports to be submitted during the application process (Sandham et al., 2008a). The EMPR was derived from the EIA requirements, however, at the time the legal requirement was not strict (Sandham et al., 2008a).

The Minerals Act 50 of 1991 came into effect on 1 January 1992, with the aim to regulate the minerals and produce a system for authorisation (Makua et al., 2017). It also made it easy to solve the complicated variety of prospecting and mining rights that existed, as well as to align the rules on mineral rights and health and safety standards (Makua et al., 2017). Furthermore, it also dealt with rehabilitation of land and payment of compensation with regard to open cast and underground mining (Makua et al., 2017). All the mineral classifications that existed prior to the Minerals Act were no longer relevant and the focus was now on best utilisation of mineral resources, mining in a safe and health way and rehabilitation (Makua et al., 2017). Prospecting permits, mining permits and mining rights were the only three different forms of licenses (Makua et al., 2017). The applicant had to prove that environmental requirement pertaining to the rehabilitation are complied with and show capabilities to mine in a healthy and safe manner. Rehabilitation was an important factor. Therefore, emphasis was placed on environmental regulation. Failure to rehabilitate resulted in suspension of a permit or authorisation (Makua et al., 2017). The Minerals Act introduced that an Environmental Management Programme be submitted and approved officially (Swart, 2003).

The legislation was amended in the year 2002, with the introduction of the MPRDA (Sandham et al., 2008a). The MPRDA became a breakthrough in the transformation of the mining fraternity and provides for internalisation of economic, social and environmental costs. The MPRDA regulations were further introduced during 2004, with addition of environmental requirements. The Aide Memoire was therefore no longer used (Sandham et al., 2008a). The EMP was then based on the environmental impact assessment conducted (Swart, 2003).

2.5 Environmental Impact Assessment

An EIA is a tool used for planning purposes to outline and predict environmental impacts that might arise due to a development (Makmor et al., 2015). It is further described as a process to evaluate impacts that are likely to be caused by an activity in the future. The EIA process involves the combination of social, economic and environmental aspect throughout the entire life of the activity. It is therefore regarded as the crucial tool to alleviate or manage the impacts that may arise as well as ensuring sustainable development (DEA, 2018). According to the “DEAT (2010) Sector Guidelines for the EIA Regulations”; the main aim of the EIA process is to understand and measure the negative and positive effects that will be caused due to existence of an activity. It is therefore critical that the EIA reflect on the whole spectrum including the biophysical environment, society as well as the economy.

The initial establishment of the EIA was in the United States of America in 1969, through the National Environmental Policy Act of 1969 (Sandham et al., 2005). It was introduced in California in the 1970s and advanced to other States. Australia also followed suite in 1972 and Canada in 1973 (Sandham et al., 2005). Many other countries including Thailand, New Zealand, France, Columbia and Netherlands etc also introduced their EIA policies during the mid-70s. The European countries adopted the example of the United States to enact the EIA legislation in all major projects (Sandham et al., 2005). In developing countries, the EIA practice was adopted much later. Major projects took place without EIAs. In some African countries, these projects were conducted by donor agencies until the EIA legislation was adopted in the 1980s (Sandham et al., 2005).

2.5.1 EIA in the South African context

The legal requirements and EIA procedures in Africa have changed significantly over the past decade. Countries including Kenya, Tanzania, Mozambique, South Africa as well as Angola are implementing EIA regulation. However, the environmental deterioration encompassed through poverty, lack of development and infrastructure is still a challenge (Rebelo et al., 2017). EIA is deemed to be one of the significant processes and systems required to achieve sustainable development. Although there are different opinions that the Strategic Environmental Assessment (SEA) explores the sustainability of strategies and policies which takes into account the socio economic and environmental aspects, the perspective and method used in South Africa has effectively synchronised the two procedures. In principle, one of the objectives of EIA is the achievement of sustainable development (Murombo, 2008).

The principles set out in section 2 of NEMA requires that a person must take reasonable steps to prevent pollution. The objectives and corrective measure of the Integrated Environmental Management (IEM) also give effect to the principles. The objectives of the IEM are to assess impacts, conduct awareness, control and remove pollution sources (Retief et al., 2011).

During the 1970s, the EIA process was introduced in South Africa, however it was not an obligation and therefore implemented on a voluntary basis (Sandham et al., 2013). In 1997, the EIA regulations were promulgated in terms of the Environment Conservation Act of 1989 (ECA). It therefore became a compulsory requirement for any development to go through an EIA (Sandham et al., 2013).

In South Africa, the EIA process is an all-encompassing system which simultaneously addresses the social, economic and environmental problems (Murombo, 2008). It is noted that the process has its weaknesses and strengths. Its key strength is its ability to achieve incorporation of all aspects which forms the foundation of sustainable development. EIA is also considered to be one of the systems critical for public participation and decision making (Murombo, 2008). The weakness, however, is the difficulty of ensuring that all aspects of a project are sufficiently considered (Murombo, 2008).

Social Impact Assessment (SIA) has grown as one type of impact assessment. At first, SIA predicted the impacts only and proposed the mitigation measures (Hildebrandt et al, 2014). This rendered the SIA not to be a planning tool but to deliver an overview of the social environment. As a consequence, a debate was triggered with regard to the role the SIA play, and its place in the assessment process (Hildebrandt et al, 2014). In South Africa, SIA was considered to be a fundamental part of EIA, however not as an assessment on its own (Hildebrandt et al, 2014). It is recognised that NEMA has a solid social focus with regard to participation and empowerment of disadvantaged communities, however, the EIA system focuses more on the biophysical environment. It was therefore concluded that there is a lack of SIA within EIA. There is also a lack of legislation and guidance (Hildebrandt et al, 2014).

The National Environmental Management Act (NEMA) was the first primary legislation which included a full range of environmental aspects, promulgated in 1998 (Sandham et al., 2013). Some of the requirements of the ECA were repealed, however the EIA requirements were not. The EIA requirements therefore continued until the promulgation of the new EIA regulations in 2006 in terms of NEMA (Sandham et al., 2013).

Over the years, the EIA process has gone through a number of reviews with the intention to advance performance of activities (Sandham et al., 2013). Many of the said reviews lead to the amendment of the legislation and regulations (Sandham et al., 2013). The EIA regulations were amended in the year 2006 in order to improve the use of EIA (Sandham et al., 2013). The revision of the 2006 EIA procedure was to address the shortfalls within the ECA EIA regulations as well as to consider the advances made in sustainable development and participation (Murombo, 2008).

Subsequent to the 2006 amendments, the EIA regulations were further reviewed and amended in June 2010 (Sandham et al., 2013). The 2010 regulation required that the applicant of an activity must appoint an independent environmental assessment practitioner in order to oversee the EIA process (Sandham et al., 2013). Furthermore, the EIA was subdivided into small scale projects which require a basic assessment process, and a scoping and environmental impact assessment (S&EIA) process for bigger or large-scale projects (Sandham et al., 2013).

The stages of EIA include screening and application, scoping, impact assessment including suggestion of alternatives, submission for decision making, environmental authorisation. The next step after a decision has been made is follow-up and monitoring. Public participation is always regarded as a key aspect and therefore encouraged throughout the stages (Sandham et al., 2019).

Screening is regarded as the first and foremost phase to determine to what extent will the EIA be required for the proposed project. Screening is well recognised internationally as the most effective and critical component of the EIA system (Retief et al., 2011). It is recognised that EIA systems that do not have strong screening mechanisms are often characterised by a large number of EIA applications for developments with low impacts (Retief et al., 2011). An internal review conducted by DEA revealed that one of the criticisms received was the failure of screening mechanisms during the ECA regime. As a result, too many EIAs that were not necessary were triggered, which in turn placed pressure on government (Retief et al., 2011).

Screening has the potential to lessen environmental impacts by bringing ideas for modification. Screening methods include checklists, decision support systems and consultations (Retief et al., 2011). Screening is therefore required to fast-track the flow of applications in order to ensure that resources are used for projects with significant impacts. Projects that do not have impacts or have few impacts should not be screened (Retief et al., 2011).

Prior to the amendment of the 2010 regulations, a significant number of non-conforming application activities were received. The list of activities therefore became the main focus of the amendment process, and ultimately resulted in developing three listing notices. Authorities were also obliged to comply with a specified time frame. Other amendments included amongst others the improvement of the public participation process through the publishing of decision made by authorities (South African Government media statements, 2010).

The EIA process requires that the applicant must appoint an Environmental Assessment Practitioner in order to conduct the EIA and submit the report to the

competent authorities. Prior to the submission of the report, a full consultation which include all the affected and interested stakeholders must be conducted (Lee et al., 1991). An environmental impact report is produced for evaluation by the competent authority to determine the completeness and adequacy of the application. The information that is provided plays a pivotal role in decision making by authorities (Sandham et al., 2008).

In terms of the 2017 EIA regulations, it is required that an applicant submit an environmental impact assessment report inclusive of the environmental management programme. The environmental management programme contains the process of public participation undertaken and the incorporation of comments received and the management thereof. The South African EIA regulations outline the process to be followed when conducting assessments as well as the listed activities required to implement Chapter 5 of the National Environmental Management Act. The listed activities cannot commence without the issuance of an environmental authorisation (DEA, 2018).

The EIA regulations provide a list of activities that require an EIA process and furthermore provide the process and phases that should be followed, including screening, scoping, consultation, impact prediction, alternatives, mitigation, review and decision making (Sandham et al., 2005). The scoping process and report should cover a description of the project and impact on the environment, detailing all environmental issues that were identified, the project alternatives that have been identified and the process of public participation conducted (Sandham et al., 2005). The scoping report is considered by the competent authority who may then issue authorisation if the information provided is sufficient (Sandham et al., 2005). It is noted that in South Africa, the EIA process has grown to the point where much of the EIA requirements form part of the scoping report. This includes information relating to impact identification and mitigation and an all-embracing public participation process and management measures. In this regard, the scoping report is considered to be a mini-EIA report (Sandham et al., 2005).

In the past, the effectiveness of EIA in South Africa was investigated by reviewing the report quality alongside the report quality of Strategic Environmental Assessment and

Environmental Management Framework (Hildebrandt et al., 2014). The investigations focused on the reports submitted during the 1997 and 2006 EIA regime. The results revealed that the quality was generally satisfactory (Hildebrandt et al., 2014). A slight decline in report quality was noticed in reports after 2006, possibly due to excessive regulation of impact assessment (Hildebrandt et al., 2014).

Studies in relation to the effectiveness of EIA incorporated the analysis in terms of the quality of EIA reports as one of the aspects for consideration. The analysis of the quality of these reports has pointed out that public participation is normally well conducted as specified in the EIA reports (Sandham et al., 2019). Nevertheless, not too many studies have been undertaken on the real effectiveness of public participation in EIA, with particular emphasis on disadvantaged communities (Sandham et al., 2019). Studies conducted in Ghana have indicated that public participation in disadvantaged communities is not effective. It is assumed to be the case in South Africa as well, however the evidence is unreliable (Sandham et al., 2019). It is evident that better strategies for public participation need to be investigated (Sandham et al., 2019).

The review stage in EIA is regarded as an important process for quality control, as it ensures that information on environmental impacts is acceptable before a decision can be made. It is therefore vital to ensure that this stage is conducted effectively (Rebelo et al., 2017).

2.6 The One Environmental Management System

Prior to the OES, mining did not form part of the scope of NEMA, therefore environmental related aspects were carried out in terms of MPRDA (One Environmental System Colloquium, 2018). However, some related mining activities triggered the EIA listed activities in terms of NEMA (One Environmental System Colloquium, 2018). During this era, there were different departments mandated with the management and execution of environmental legislation, which had to be conformed to by the mining companies (Le Roux, 2012). This included obtaining approvals from these department. The split in the environmental governing bodies

therefore created a disgruntlement due to lack of accountability by affected departments (Le Roux, 2012).

The Departments of Mineral Resources and Environmental Affairs came to an agreement that a single system should be implemented to ensure an efficient operation of systems. To achieve such system, it was agreed that environmental management requirements relating to mining be enacted through NEMA (Mpinga, 2017). Environmental management requirements were therefore deleted from the MPRDA and inserted in NEMA (Mpinga, 2017). A single environmental governance allocates responsibilities and jurisdictions and presents sustainable results (Kotze, 2006). The DMR now receives EIA mining applications, the administration of the applications will be according to the new NEMA EIA regulations (Mpinga, 2011). The DMR will issue Environmental Authorisations (EA) and mine waste licenses, DEA (currently Department of Forestry, Fisheries and Environment) issues air quality licenses and is the Appeal authority, while Department of Water and Sanitation (DWS) will issue Water Use License (WUL). The Departments have agreed on the timeframes for processing and issuing of licenses (Mpinga, 2017).

The evolution of legislation is therefore critical in order to give direction to the activities conducted by the mining industry (Sutton et al., 2007). The MPRDA and its regulations were enacted to make sure that the mineral resources are extracted and processed in a sustainable manner, ensure that the benefits are equitably balanced as well as to safeguard the environment (Sutton et al., 2007). However, over the years it was realised that there are gaps in the protection of the environment in the MPRDA, including the EIA process, and mine closure (Sutton et al., 2007). Hence, there has now been a shift of regulation of the mining industry in terms of NEMA in order to cover the whole spectrum of EIA requirements.

2.7 Quality of environmental reports

Globally, the legacy and environmental impact that has been left due to development needs to be attended to as a matter of high importance (Harman, 2005). In addition,

protection and improvement of the environment will happen through a good quality structure of authority and adherence to legislation (Harman, 2005).

An EIA system can be well defined through a combination of legislative frameworks, ability and capacity of all stakeholders to conduct duties to achieve EIA objectives (Mubangaa et al., 2020). A governing or regulatory framework is critical to an EIA system as it gives direction on how the EIA should be conducted, including the steps and activities (Mubangaa et al., 2020). An executable EIA legislation is therefore the step in achieving positive environmental management (Mubangaa et al., 2020). In addition, the skills and capacities of the stakeholders also affect the effectiveness of the legislation (Mubangaa et al., 2020).

Historically, implementation and monitoring of projects were based on instructions set out by authorities through different legislations in order for business to comply. A step-by-step procedure or guide assists to determine whether a development is compliant or not (Harman, 2005). Through this old method, an improvement in terms of the environmental authorisations has been realised. Nevertheless, this method may not be effective for business or development does not take cognisance of its part in governance (Harman, 2005). Globally, there is more focus on inspiring industries to accomplish the desired goals through self-compliance and environmental commitment (Harman, 2005).

The EIA quality studies conducted widely have indicated that the overall quality of EIA reports has improved with time (Jalava et al., 2010). An EIA report is considered the final document of an EIA process which should include all the required information related to the project and aid in decision making (Jalava et al., 2010). Nadeem et al. (2008) state that the success of the EIA process depends on a well prepared and good quality report. However, in the case of Pakistan, the studies conducted revealed that there are still shortfalls in the proper identification, assessment and mitigation of impacts with regard to the reports reviewed. A well prepared and high-quality report is considered one of the elements for the successful implementation of EIA law (Nadeem et al., 2008).

EIA is more efficient where there are specific regulatory requirements designed specifically for it, with environmental impact assessment reports prepared thoroughly, and accountable authorities to make informed decisions (Wood, 2003). Nevertheless, EIA legislation is not considered the only contributing factor to produce a good quality report (Nadeem et al., 2006). It is critical that EIA be incorporated in the project planning process (Wood, 2003). There are several factors which also need to be considered to achieve best quality in EIA, including: affording opportunities for public participation, methods undertaken to assess the impacts, the quality of information presented to authorities (Nadeem et al., 2008). In addition, procedures for screening, scoping, external review and public participation need to be incorporated in the EIA process (Wood, 2003). The stages of the EIA process therefore include project design, screening, scoping, consideration of alternatives, consultation or public participation, mitigation, decision making, report preparation, review and monitoring of impacts (Wood, 2003).

Public participation plays a critical role in the EIA process. Prior to the existence of EIAs there were no regulatory requirements to consider the impacts made by activities on the environment (Sharma, 2006). EIA therefore takes into account the concerns of the public regarding potential impacts (Sharma, 2006). The involvement of the public helps to achieve an objective decision, as members of the public are the ones with indigenous knowledge. Information provided by the public is therefore used by government in making a decision (Sharma, 2006).

A report on potential impacts is described and all the possible measures to avoid or reduce environmental impacts also need to be described. The mitigation measures for all the identified alternatives are also considered. Alternatives can vary from site selection, technical measures, or any different way to achieve the same activity goal (Sharma, 2006).

Scoping is conducted to study the information essential to the EIA report. Its purpose is to identify crucial issues at an initial phase in the preparation process, involving all interested and affected parties (Sharma, 2006). The feedback will determine the scope

and complexity of work to be conducted. Scoping remains ongoing throughout the course of the project (Sharma, 2006).
In terms of the mitigation measures, the report details out the actions to be taken to prevent, minimise or avoid potential impacts (Sharma, 2006). The measures could include the use of best available technologies or various pollution control techniques (Sharma, 2006).

Jalava et al. (2020) further state that the quality of a good EIA report is determined amongst others by the following:

- A clear structure with arranged categories and issues (including the baseline data, predicted impacts, mitigation, significance of impacts);
- Clear description of the project;
- Clear description of development proposals;
- Use of diagrams, maps, pictures;
- Clear description of methods conducted for the studies;
- Evidence or proof of consultations conducted;
- Clear descriptions of alternatives;
- Commitment to mitigation and monitoring programmes.

In addition, commitment to management measures by applicants, experience of involved participants, communication between various participants as well as availability of guidelines also contribute as factors (Nadeem et al., 2008). A report with better environmental results is dependent on collaborative approaches to help better understand all the different spheres. The link should be identified, starting from the legislation and incorporation into the reports and involvement of all affected and interested parties (Nadeem et al., 2008).

Better environmental results mean improved management plans with clearer assessment of impacts, more detailed mitigation measures with specific, achievable, relevant and time bound actions that do not pose harmful effects on the environment and communities. Once all the environmental requirements have been met and management measures implemented accordingly, the development will provide a positive and non-detrimental results to both the environment and communities. The better environmental results reflected through NEMA will provide an initial step

towards achieving one of the objectives of OES, which is to prevent the legacy of impacts on the environment. The engagements and involvement of interested and affected parties at an initial stage, will also provide an informed decision making to help achieve better results and sustainability.

The EIA report is usually written by a consultant on behalf of the applicant (Sharma, 2006). It can be broken into different sections, including a comprehensive report which is brief and non-technical and a detailed report with detailed assessment of significant issues (Sharma, 2006). Review is the last step to assess quality control of the information provided (Sharma, 2006).

2.8 Concluding remarks on literature

As pointed out in the literature section, mining is unquestionably one of the major sources of impact on the environment, and yet continues to enhance the economy. However, it is well agreed that economic development cannot be advanced at the expense of the natural environment and communities. Over the years legislations have been enacted to try to alleviate the impact caused on the environment. EIA is recognised as one of the significant processes in every project development to assess and plan the mitigation of environmental impacts. The EIA studies conducted indicate that the advancement of legislation and EIA reports have improved over time. In South Africa, the OES was introduced to have an integrated EIA process where all development activities will be managed under the NEMA / EIA umbrella. It is therefore expected that there will be a noticeable change under the new regime.

CHAPTER 3: METHODOLOGY

3.1 Introduction

As pointed out in Chapter 1, it has been eight years since the implementation of the OES. The aim of this research was to assess whether the environmental authorisations granted in terms of NEMA reflect better environmental results that do not cause a harmful effect to the environment and communities, as compared to the MPRDA regime. Both the MPRDA and NEMA legislation and regulations provided a good basis of departure for evaluating the quality of the reports granted under MPRDA and NEMA. Since the contents of the regulations are very comprehensive, a summary of the key elements required in the EIA process was developed. EMPs were evaluated through a checklist of key elements and scored. Interview were also conducted to corroborate the results. The sections below provide more information on the research design and data collection methods used.

3.2 Research design

In order to achieve the aim of the research, a mixed method of analysis was implemented which included a review and comparison of legislation, evaluation of EMPs and interviews with key informants. Mixed methods refer to a study that combines qualitative and quantitative data in one study and links the data to address the research problem (Halcomb et al., 2015). This method was used in order to obtain more in-depth information through several spectra. In addition, the results of one method can be easily validated with the results of the other (Chaparro et al., 2019).

A comparison of MPRDA and NEMA regulations was carried out to find the similarities and outline additional environmental requirements added to NEMA regulations. The comparison also determined if the additional clauses or requirements provided information that help achieve better environmental results. The research focus was given to the environmental reports (scoping report, environmental impact assessment report and environmental management programme report) that are required for an application for a mining right.

The Environmental Management Programmes or environmental authorisation granted in terms of MPRDA and NEMA respectively, were also scrutinised with reference to the requirements outlined as per the MPRDA and NEMA regulations. The purpose was to distinguish the significant improvements or differences on how environmental impacts are managed.

A checklist was used as one of the methods to help achieve the results by ticking off the information provided. A checklist is a list of factors, tasks or items recorded in a consistent way which allows the assessor to note whether the listed item is present or not (Chaparro et al., 2019). According to DEAT's (2004b) Review in Environmental Impact Assessment, the modest and efficient way to review a document is through a checklist which encompasses the guiding questions. It is further stated that checklists are intended to scrutinise the appropriateness of reports in terms of legal compliance. Checklists are therefore efficient in checking the comprehensiveness of an EIA report DEAT (2004b).

Lohani et al. (1997) further state that there are 4 types of checklists as follows:
1. simple checklist – this provides a list of environmental factors without any guidelines on how to measure and interpret them;
2. descriptive checklist – it identifies environmental factors and procedures on how to measure data;
3. scaling checklist – same as the descriptive checklist but has extra information on particular scaling of parameters;
4. scale weighting checklist – same as scaling checklist but has additional data for subjective calculation of each factor.

Lohani et al., (1997) further provides reasons for using checklists, these include that they are beneficial to summarise information and make it accessible to specialists or decision makers; that scaling checklists give an initial level of analysis; and that weighting checklist incorporates information about ecosystem functions. In this research, a simple checklist created from both MPRDA and NEMA regulations has been used.

A set of different interview questions was developed for the Environmental Assessment Practitioners as well as the regulatory officials from the Department of Mineral Resources. The purpose of the interviews was to try to gain a personal opinion with regard to the use of EIA/EMP Reports compiled in terms of NEMA Regulations as compared to MPRDA Regulations, to achieve better environmental results.

3.3 Research Methods

To deliver the objective of the research, data were collected and analysed for each question as follows:

3.3.1 Data collection procedures

Question 1
What are the changes in requirements of mining Environmental Management Programmes reports compiled in terms of NEMA versus the previous MPRDA requirements?

Data collection
The MPRDA and NEMA regulations were obtained online to outline the legislative requirements in terms of Environmental Management Programme Reports.

Question 2
Do these changes in legislative requirements result in improved Environmental Management Programme reports with better environmental result that do not pose a threat to the environment?

Data collection
Twenty Environmental Management Programmes Reports or Environmental Authorisations which are publicly available and have been approved during MPRDA and NEMA regime respectively, were randomly selected online and reviewed in order to distinguish the differences in reports. As indicated in table 1, these comprised of 10 reports under MPRDA and 10 NEMA reports. The MPRDA reports denotes the mining

applications that were made prior to the year 2014, whereas the NEMA reports were made after the year 2014. A desktop study was conducted in this regard. The study focused on one province (Limpopo) and one commodity (coal) in order to limit the variables. The rationale was that the reports differ from province-to-province due to geology and landscape. In addition, different commodities have different environmental impacts.

The evaluation of EMPRs presented the critical part which sought to determine if the shift to NEMA presented a different system in terms of the compilation of EMPs and environmental management measures. The following reports were evaluated as part of the study (Table 1):

Table 1: List of Environmental Management Programme Reports analysed

LIST OF EMPRs (MPRDA)			
COMPANY	**DATE**	**LOCATION**	**COMMODITY**
Grootegeluk Coal Mine	July 2014	Limpopo	Coal
Chapudi Coal (Pty) Ltd	December 2013	Limpopo	Coal
Paardeplaats Coal Mine	March 2013	Limpopo	Coal
Exxarro Resources	June2010	Limpopo	Coal
Generaal and Mount Stuart Collieries	December 2013	Limpopo	Coal
Brakfontein Coal Mine	December 2012	Limpopo	Coal
Mopane Coal Project	November 2013	Limpopo	Coal
Tshikondeni mine	June 2006	Limpopo	Coal
Vele colliery	May 2009	Limpopo	Coal
Sekoko Waterberg colliery	July 2014	Limpopo	Coal
LIST OF EMPRs (NEMA)			
COMPANY	**DATE**	**LOCATION**	**COMMODITY**
Berenice coal mine	July 2016	Limpopo	Coal
Grootegeluk Coal Mine	March 2020	Limpopo	Coal
Universal Coal Development (V) Pty Ltd	October 2019	Limpopo	Coal
Dalyshope Coal Mining	August 2020	Limpopo	Coal
Universal Coal Development II (Pty) Ltd	September 2016	Limpopo	Coal
Assmang Dwarsrivier Expansion Project	April 2018	Limpopo	Coal
Kubu coal mine	August 2016	Limpopo	Coal
Makhado colliery	June 2021	Limpopo	Coal

COMPANY	DATE	LOCATION	COMMODITY
Boikarabelo coal mine	June 2015	Limpopo	Coal
Ledjadja	February 2018	Limpopo	Coal

Question 3

How do practitioners who develop and approve Environmental Management Programme reports experience the change in legislation?

Data collection

Additional information to corroborate the results presented in the reports as well as to understand decision making was also obtained through interviews with officials and consultants who are directly working with the compilation and review of Environmental Management Programme reports.

A set of interview questions was developed for the Environmental Assessment Practitioners (EAP) as well as the regulatory officials from the Department of Mineral Resources. As indicated in Tables 2 and 3, both the regulatory officials and the EAPs were allocated different questions in line with their mandate (Annexure A). 20 participants (10 regulators and 10 Environmental Assessment Practitioners), with an experience of more than 2 years in the compilation or reviewing of mining EIA reports were interviewed. Though the OES commenced during the year 2014, application that were received and approved prior to the implementation of OES were still processed in terms of the MPRDA. The officials with more than 2 years experience will also have the opportunity to process and monitor the MPRDA reports.

Interviews were conducted during the year 2020 to gather opinions of regulatory officials and EAPs as well as to determine if the information provided on the EMPs can be corroborated with the feedback received from the interviews. The aim of the interviews was to gain a personal opinion with regard to the contents of EIA/EMP Reports compiled in terms of NEMA Regulations as compared to that of MPRDA Regulations, to achieve better environmental results. The following participants were interviewed (Table 2):

Table 2: List of participants (Regulators)

PARTICIPANTS	DEPARTMENT / SECTION	POSITION	YEARS OF EXPERIENCE
No.1	Mine Environmental Management regulation	Senior management	>5 years
No.2	Compliance and enforcement	Middle management	>2 years
No.3	Compliance and enforcement	Middle management	>7 years
No.4	Mine Environmental Management regulation	Middle management	>5 years
No.5	Mine Environmental Management regulation	Middle management	>6 years
No.6	Mine Environmental Management regulation	Middle management	>2 years
No.7	Mine Environmental Management regulation	Senior management	>6 years
No.8	Mine Environmental Management regulation	Middle management	>5 years
No.9	Mine Environmental Management regulation	Middle management	>5 years
No.10	Mine Environmental Management regulation	Middle management	>5 years

The selected participants had a work experience of more than 2 years, working within the environmental compliance and regulation section in the Department of Mineral Resources. The environmental compliance section was formed during the year 2018 as part of the implementation of the OES to improve capacity and address non-compliance of EIA requirements. However, reports received prior to 2014 were managed in terms of the MPRDA, providing opportunity for monitoring in terms of MPRDA. The years of experience was critical in that officials would be in a position to provide an experienced opinion with regard to NEMA application process, whereas official with more than 5 years can differentiate on a broader scale between the MPRDA applications and the NEMA applications. The positions of selected participants included those in middle and senior management due to the fact that they are the first point of reference to administer and evaluate the EMP / EIA mining applications.

Table 3: List of participants (Environmental Assessment Practitioners)

PARTICIPANTS	AREA OF EXPERTISE	YEARS OF EXPERIENCE
No.1	- Water Use Licence (WUL) - Environmental Authorisation for mining activities or other developments - Waste Management Licence - compliance audit and financial provision assessment - monitoring programme (quality and quantity) of wastewater discharges and or diffuse pollution. - Developing remediation and rehabilitation plans	>8 years
No.2	- EIA - Air quality monitoring - Geology - Mining	>2 years
No.3	- EIA - Compliance audit - water use licence - soil management	>5 years
No.4	- EIA - Water quality monitoring - Public participation	>6 years
No.5	- Tailings dam management - Compilation of EMP - Water use license	>7 years
No.6	- EIA - Mine closure plans, Compilation of EMP - Public participation - Compilation of financial provision	>5 years
No.7	- Waste management - EIA - Water quality monitoring - Mine residue deposits	>5 years
No.8	- EIA, Environmental authorisation - Air quality monitoring - Project management	>6 years
No.9	- EIA - EMP compilation - Tailings management	>5 years

PARTICIPANTS	AREA OF EXPERTISE	YEARS OF EXPERIENCE
	- Water quality monitoring, Storm water controls	
No.10	- EIA - Air quality monitoring - Tailings dam management	>5 years

The EAPs were also selected based on the experience of more than 2 years (Table 3). The motive used for the regulatory authorities in terms of the years of experience was also applied with the EAPs in that the consultants would be in a position to provide an experienced opinion with regard to MPRDA and NEMA application process,

3.3.2 Data analysis and interpretation

Question 1

The contents of both the MPRDA and NEMA regulations were compared and analysed. Specific focus was given to the environmental reports requirements (scoping report, environmental impact assessment report and environmental management programme report) that are required for an application of a mining right. The aim of the analysis was to determine the similarities and differences in terms of the legislative requirements. A summary of the key elements that form part of legislative requirements in terms of both MPRDA and NEMA was developed and presented in table 5 below. The additional or differing clauses in terms of MPRDA and NEMA were also explained.

Question 2

Qualitative analysis of mining Environmental Management Programmes Reports was conducted to assess the environmental management measures and positive environmental results of EMPs compiled in terms of MPRDA and NEMA. The aim of the comparison was to determine whether there are significant differences in the EMPs as well as which ones result in better environmental management measures.

According to DEAT, (2004b), the modest and efficient way to review a document is through a checklist which encompasses the guiding questions. Checklists are intended to scrutinise the appropriateness of reports in terms of legal compliance. Checklists are therefore efficient in checking the comprehensiveness of an EIA report (DEAT, 2004 b). The Southern African Institute for Environmental Assessment (SAIEA) has also developed a checklist which also has been utilised to assess the comprehensiveness of EIA reports. The requirements of both the MPRDA and NEMA regulations, as well as the SAIEA checklist were used as review techniques in this research.

The reports were analysed using the key elements developed and derived from the MPRDA, NEMA Regulations as well as the SAIEA checklist. The key elements were scored on a scale of 1 to 3, with the numbers representing the following:
(1): represents inadequate information or omission of information;
(2): represents adequate information that can still be used to make a decision, unless the Regional Manager issues a request for more information;
(3): represents comprehensive information for informed decision making.

Calculating the scores:
There are 11 key elements that were obtained from both the MPRDA and NEMA regulations and have been used to compare the detailed requirements of both regulations, namely:

1. Description of the project
2. Baseline environment
3. Environmental attributes
4. Alternatives
5. Public participation process
6. Impacts identification and assessment
7. Risks identification and assessment
8. Ranking of impacts and risks
9. Specialist studies
10. Mitigation measures
11. Impact management outcomes

The scores were calculated as follows:
Maximum score (3) x number of elements (11) = 33
33 x 10 reports = 330

The scores for all the reports were combined to find the total weight, which was divided by 330, and the quotient multiplied by 100 in order to get the percentage. Observations were made whether the reports do follow the requirements prescribed in the contents of the regulations. A summary of the review result was also presented in a table and feedback provided regarding the information that is missing or not addressed properly.

Question 3

Feedback from the interviews was compiled in a form of a table. Analysis was made based on the answers as to which legislation regime provides better environmental results. Questions that presented similar answers from more than 5 participants provided positive feedback towards answering the research question. The feedback from the interviews as well as the results from the review checklist were then collated to present the overall results.

3.4 Research limitation

Interviews were scheduled to be conducted during the course of the year 2020. Due to the Covid 19 restrictions and lockdown, the interviews could not be conducted face to face and therefore telephone was used. However, the method of communication (telephone) did not change or have an impact on the research results in any manner. The information provided has been captured on a questionnaire form.

3.5 Ethical considerations

Approval to conduct interviews was granted by the Ethics Committee at the University of the Witwatersrand. An ethics clearance certificate (Protocol number:1914) was also received in this regard (Annexure B).

CHAPTER 4: RESULTS AND DISCUSSION

As discussed in Chapter 3, an assessment of legal provisions, requirements in terms of EMP reports as well as interviews with key informants was conducted. The findings presented some similarities in terms of legal requirements and environmental management measures made in the reports analysed. The interviews substantiated the results in terms of MPRDA and NEMA reports. The sections to follow provide detailed findings for each question asked in Chapter 1.

(a) PRESENTATION OF RESULTS

4.1 Question 1

Legal provisions of MPRDA and NEMA

An assessment of legal provisions and processes which are included in both the MPRDA and NEMA was conducted and a brief summary of the comparison the legislative requirements in terms of MPRDA and NEMA was also developed.

Table 4: MPRDA versus NEMA Application process

MPRDA			**NEMA**	
STEP BY STEP SCOPING/EIA	**PROCESS TIME FRAMES**		**STEP BY STEP SCOPING/EIA**	**PROCESS TIME FRAMES**
Application Lodgment	Within **14 days**		Application Lodgment	within 10 days
Acknowledge			Acknowledge	
Regional Manager (RM) to accept or reject			Regional Manager to accept or reject	Within 14 days
Scoping Report Submitted ✓ Public participation conducted and issues raised	Within **30 days** from the date of notification by RM		Scoping Report Submitted ✓ Public participation conducted and issues raised ✓ site selection matrix	Within 44 days from the date of Lodgment
Consultation with state departments	**30 days to comment from the day of the request**		**Scoping Report Acknowledgement**	**Acknowledgement and Consultation within 10 days of receiving the report**
			Consultation with state departments	

STEP BY STEP SCOPING/EIA	PROCESS TIME FRAMES		STEP BY STEP SCOPING/EIA	PROCESS TIME FRAMES
			Evaluation	Within 42 days of receipt of a scooping report
			Scoping report Accepted	Within 42 days of receipt of a scooping report Applicant must submit within 107 days after acceptance of Scooping report
Scoping report Accepted and comments collated to form part of EIA	(forms part of the EIA and EMP submission below)		Submission of EIA and EMP ✓ Public participation ✓ specialist reports ✓ a map of the proposed activity and its associated structures and infrastructure on the environmental sensitivities motivation for not considering alternative development footprint	
Submission of EIA and EMP ✓ Public participation ✓ Financial provision ✓ Implementation programme	180 days		✓ EIA and EMP Acknowledgement	Acknowledgement and Consultation within 10 days of receiving the report
Evaluation Decision making (Grant or reject) by competent authority	120 days		Evaluation Decision making (Grant or reject) by competent authority	Within 107 days. With Extension-50 days. 157 DAYS
			Decision Sent to Applicant	Within 5 days
Decision Sent to Applicant	n/a		Decision lodges appeal to DEA	Appeals must be lodged within 20 days
Decision lodges appeal to RMDEC	n/a		Appeal decision made	Between 60 - 90 days appeal must be finalized.
Appeal decision made	n/a			

In terms of section 22 of the MPRDA, the applicant applies for a mining right with the relevant Regional Manager, who must then reject or accept the application within 14 days. If the application is accepted, the Regional Manager informs the applicant to

submit a scoping report within 30 days which provides the methodology applied to conduct scoping and matters raised by the public. Subsequent to acceptance of the scoping report, an applicant conducts an EIA and consults the public, after which the EIA report is submitted together with an Environmental Management Plan (EMP) as per the findings of the EIA conducted, within 180 days. The EMP report forms part of the EIA in which all the impacts are investigated and assessed. This includes the impacts on the environment, social aspects and the economy.

In terms of the NEMA process, an application for a mining right is submitted to the office of the competent authority (DMR). Subsequently, an application for an environmental authorisation together with a report created through a web-based screening tool system is also submitted once the mining right application has been accepted. All applications and assessments are undertaken by a qualified and registered Environmental Assessment Practitioner (EAP).

Once the competent authority accepts the application, the applicant must, within 44 days, submit a scoping report which has undergone a public participation process inclusive of comments received. The competent authority must within 43 days accept or refuse the scoping report. Subsequent to acceptance of the scoping report, the applicant submits an EIA report (also subjected to public consultation) together with the specialist reports and the Environmental Management Programme Report within 106 days. The competent authority must within 107 days of receipt of the reports make a decision to grant or refuse the environmental authorisation.

The EMP is a final live and legally standing document which provides all the required baseline information regarding the affected environment and the contemplated remedial or mitigation measures. Furthermore, it provides specific goals for the management of impacts and mine closure. The programme of action to achieve the set goals is also outlined as well as the financing mechanism.

4.1.1 Comparison of clauses derived from MPRDA versus NEMA regulations

A comprehensive comparison of the requirements of MPRDA versus NEMA regulations, has been developed as part of Table 5 below. Several new sections have

been added to the 2017 NEMA regulations. The table below summarises some of important elements represented in the regulations.

Table 5: Brief comparison of elements derived from legislative requirements in terms of MPRDA and NEMA regulations

ELEMENTS	MPRDA REGULATIONS	NEMA REGULATIONS
1. Description of the project	The applicant must provide a plan showing the land and mine area as well as the mineral to be mined	Over and above the mine plan, it is required that all listed and specified activities that will be generated and that are applied for; and a description of the associated structures and infrastructure related to the development be fully identified.
2. Baseline environment	An applicant must describe the existing status of the environmental prior to the mining operation	An overall explanation of the process followed to decide on the proposed preferred activity, site and location of the development footprint within the site.
3. Environmental attributes	MPRDA makes mention of environmental, cultural and social impacts to be assessed. However, no specific mention on the environmental attributes	A map at a proper scale which overlays the proposed activity, including its associated structures, and infrastructure on the environmental sensitivities of the preferred site.
4. Alternatives	An assessment must be conducted for the environment that is likely to be affected by the identified alternative land use method or developments, including cumulative environmental impacts	All preferred alternatives, including location alternatives must be mentioned, as well as the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment
5. Public participation process	Provide details of the engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed	The person who undertakes a public participation process must take into account the applicable guidelines for public participation as outlined in section 24J of the Act. In cases where a person is interested to attend but unable to participate in the process because of illiteracy; incapacity or disability; or any other disadvantage written notice is given to registered interested and affected parties regarding where the revised basic assessment report or, empr or closure plan, revised environmental impact assessment report are. All the comments provided by interested and affected parties must be recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority

ELEMENTS	MPRDA REGULATIONS	NEMA REGULATIONS
6. Impacts identification and assessment	An evaluation of the nature, degree, period, likelihood and consequence of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts;	A full description of the process conducted to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site. An evaluation of each identified and possibly substantial impact and hazard that includes • The impacts that are considered cumulative • The nature, implication and consequences of the impact and risk • The degree and period of the impact and risk • The likelihood of the impact and risk happening • The degree to which the impact and risk can be reversed • The degree to which the impact and risk may cause irreplaceable loss of resources; and • The degree to which the impact and risk can be alleviated
7. Risks identification and assessment	A risk report required only during the application for a closure certificate	An assessment of each identified potentially significant impact and risk, An explanation of all environmental problems and hazards that were identified during the environmental impact assessment process; and an assessment of the implication of each problem and hazard and an indication of the degree to which the problem and hazard could be avoided or addressed by the implementation of mitigation actions Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects
8. Ranking of impacts and risks	An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including the cumulative environmental impacts. However, there is no specific mention of ranking the impacts	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint

ELEMENTS	MPRDA REGULATIONS	NEMA REGULATIONS
9. Specialist studies	The specialists report together with supporting information must be attached as appendices	A brief of the results and recommendations of with regard to the report done by specialist and how these results and recommendations have been incorporated in the final assessment report
10. Mitigation measures	Determine the appropriate mitigatory measures for each significant impact of the proposed mining operation Action strategies to attain the objectives and specific goals which must incorporate a schedule of activities that will be undertaken to implement mitigative actions for the prevention, management and remediation of each environmental impact	An explanation of suggested impact management measures, identifying the method in which the impact management outcomes will be accomplished, and must also incorporate actions to • Avoid, change, remedy, control or halt any action, activity or process which causes pollution or environmental degradation The likely mitigation procedures that could be applied and level of residual risk;
11. Impact management outcomes	A description of the appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspects	A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development A record of planned impact management outcomes for the development and inclusion in the empr as well as for inclusion as conditions of authorisation A description of suggested impact management activities, and identifying the means in which the impact management outcomes will be accomplished

4.1.2 Summary of findings

The summary of elements has been further explained below.

From the analysis, there are similarities in terms of the environmental requirements, however, the MPRDA regulations were not detailed enough to outline some of the specific requirements. Additional clauses have also been added as part of the 2017 NEMA application and requirements process, as follows:

Listed activities – NEMA provides for a list of activities that have the potential to cause an impact on the environment and require that they be identified, investigated and assessed prior to an environmental authorisation.

Appointment of an EAP - NEMA requires that all assessments be conducted by a qualified and experienced Environmental Assessment Practitioner (EAP).

Property description - The exact and proper digit survey (21digit Surveyor General code of each cadastral land parcel) of the site and its alternatives must be provided. The locality map which shows the distance to the nearest town, as well as the linear activity route map information, including overland conveyors, power lines, pipelines, roads, rail to siding must be provided.

Baseline Environment - Previously (MPRDA), the onus was on applicants to describe the existing status of the environment prior to development, and any other information that may be requested by the Regional Manager. In terms of the current regime (NEMA), an application will not be considered unless a screening tool report which outlines the proposed area and geographical attributes or sensitive features in the area (if any), has been produced. This will eliminate the risk of development in protected areas and ensure adherence to strict management controls in areas that are considered as protected environments.

Furthermore, the assessment is required to describe the current condition of the environment on site as well as the surrounding areas and its current land uses,

including the magnitude and scale of the land uses. The purpose is to identify the type of environment that may be affected, including the surroundings, with regard to its current geographical, physical, biological, social, economic, and cultural character. This will assist to determine specific features which may require protection, remediation or proper management measures.

Public participation - EIA is now subjected to a full public consultation process to incorporate all the comments received and how they have been addressed. Should comments not be addressed, a proper motivation needs to be outlined. In cases where there have been amendments to the reports or any new information has been added (which was not part of the consulted document), the revised document is required to undergo another process of public participation.

Alternatives – The MPRDA required that land use or development alternatives be described, including alternative means of undertaking the proposed activity. Furthermore, a comparative analysis of the development and its alternatives in terms of the environmental, social and cultural impacts was also required. In terms of NEMA, not only does it require the impacts identified, but it is also requires a full description of the process followed in identifying and assessing the development alternatives. Not only does it require the impacts to be identified but the proposed mitigation measures, avoidance and impact management in relation to the alternatives must be indicated.

Specialist report – In terms NEMA, an application must include specialist reports which have also been subjected to public consultation and comments must be addressed. The report must also reflect the recommendations or any condition that must be included as part of the environmental authorisation.

Impacts and risks identification – the impacts are identified and assessed in both the MPRDA and NEMA. However, NEMA also requires that the risks be included as well. The impacts are not only identified and ranked for the proposed activity only, but the impacts that will be imposed on the development footprint due to associated structures and infrastructures also need to be described.

The procedure used in determining the implication of possible environmental impacts must be provided and describe (a) the degree as well interval of the impact, (b) the possibility of the impact happening, (c) the extent to which the impact can be reversed, (d) the extent to which the impact may cause irreplaceable damage of resources; and (e) the degree to which the impact can be alleviated. Furthermore, the methodology for assessing cumulative impacts must also be provided. The assessment of significant impacts must be related to the source activity in order for that activity to be considered for authorisation. The impacts and risks must also include the degree to which they can be reversed or cause an irreversible damage.

Impact management - in terms of NEMA, the impact and risk management outcomes must be defined for the phases of the development from the planning and design phase until the post closure phase. The impact management actions must also be defined as to how the management outcomes will be achieved, including the method in which the impact management action will be monitored. All the areas, including environmentally sensitive areas and buffers that must be avoided, should be indicated on a map. All related policies, legislation, standards, tools, frameworks and guidelines which the activity must comply with are to be outlined.

From the observations, the MPRDA regulations did outline the requirements for an applicant to conduct an environmental impact assessment and provide a report in that regard. However, the requirements were general and did not go into specific details as required in the current NEMA legislation. Information such as the specialist reports was not too much of a prerequisite unless directed or requested by the Regional Manager. In this regard, there was a potential to have an information gap if the applicant did not conduct a proper assessment or study. The additional requirements as provided for by NEMA, including a broad public participation and a web-based screening tool, affords a better opportunity for improved decision-making.

4. 2 Question 2

Do these changes in legislative requirements result in improved Environmental Management Programme reports with better environmental results that do not pose a threat to the environment

As indicated in Chapter 3, the Environmental Management Programme reports were scored based on the requirements derived from both MPRDA and NEMA regulations. The results were then summarised and graded. It is considered whether the information is complete or not and it is scored from 1 to 3.

4.2.1 Summary of findings (MPRDA)

The observation is that 62% of the EMP reports as compiled in terms of the MPRDA did follow the requirements as per the regulations (Table 6). In some reports, the EIA methodology followed the requirements as stipulated in the NEMA regulations. However, one specific issue related to the inclusion of the alternatives was noted. In terms of regulation 50 of the MPRDA, it requires that an assessment be conducted on the environment in terms of the identified alternatives. The analysis presented that most of the EMPRs did make mention of alternatives, but assessments in terms of viability and impact of alternatives were not conducted. The focus remained only on the proposed operation.

The MPRDA regulations also require a description of the environment and the likelihood of the impacts occurring. The limitation is that it does not require a detailed scope of the activities. As a result, this was dependant on the applicant to address all of the activities anticipated, their impacts and management measures. Some of the reports provided general details in relation to environmental impacts and their management measures. Furthermore, specialist studies are not a prerequisite unless directed by a Regional Manager. This renders a limitation of information related to species data and the management thereof. The objectives for mine closure are not clearly presented, with 7 of the 10 reports that did not outline the monitoring procedures post mine closure. The mitigation measures are also set out but do not provide clear goals and objectives.

Table 6: Scoring in terms of environmental requirements: Information as provided in the MPRDA EMP reports

ELEMENTS	REPORT 1	REPORT 2	REPORT 3	REPORT 4	REPORT 5	REPORT 6	REPORT 7	REPORT 8	REPORT 9	REPORT 10	SCORE
	SCORING (1-3)										
1. Description of the project	3	2	3	2	3	2	3	3	3	3	**27**
2. Baseline environment	2	2	3	1	2	2	2	2	2	2	**20**
a.											
3. Environmental attributes	2	2	2	2	1	1	1	2	1	1	**15**
4. Alternatives	1	1	3	1	1	2	1	1	1	1	**13**
5. Public participation process	1	2	2	2	2	2	2	2	2	2	**19**
6. impacts identification and assessment	2	2	3	3	2	3	2	2	2	2	**23**
7. Risks identification and assessment	2	1	3	1	1	2	2	2	2	2	**18**
8. Ranking of impacts and risks	1	1	3	1	2	2	2	2	2	2	**18**
9. Specialist studies	1	1	1	1	2	1	1	1	2	2	**13**
10. Mitigation measures	2	3	3	2	2	2	2	2	2	2	**22**

11. Impact management outcomes	1	2	3	1	1	2	1	1	2	2	**16**
	18	**19**	**29**	**17**	**19**	**21**	**19**	**20**	**21**	**21**	
TOTAL SCORE											**204**
PERCENTAGE (total score divided by 330)											**62%**

4.2.2 Summary of findings (NEMA)

On average 85% of the reports compiled in terms of the 2014 NEMA requirements presented much clearer information with regard to the processes undertaken to identify and measure the impacts as well as how the impacts will be managed (Table 7). However, some of the reports did not provide a full description of the associated structures and infrastructure related to the development. Also, reports submitted prior to the promulgation of the 2017 EIA Regulations did not provide detailed information on environmental sensitivities.

NEMA requires the involvement of interested and affected parties from the initial stage of application which presents a much more informed decision-making process as local knowledge is acquired. Furthermore, the reports and recommendation submitted through the specialist studies assist to focus on some of the hotspot areas that require attention. Eight of 10 reports did not clearly mention the process followed to reach the proposed development, whereas some of the reports did not mention information regarding responsible persons and time periods for management of impacts.

Table 7: Scoring in terms of environmental requirements: Information as provided in the NEMA EMP reports

Element	REPORT 1	REPORT 2	REPORT 3	REPORT 4	REPORT 5	REPORT6	REPORT7	REPORT8	REPORT9	REPORT10	SCORE
SCORING (1 – 3)											
1. Description of the project	3	3	2	3	2	2	3	3	3	3	**27**
2. Baseline environment	2	3	3	2	2	3	3	3	3	3	**27**
3. Environmental attributes	2	1	2	3	3	3	2	2	2	1	**21**
4. Alternatives	2	2	2	2	2	2	2	2	2	2	**20**
5. Public participation process	3	3	3	3	2	3	2	3	3	2	**27**
6. impacts identification and assessment	3	3	3	2	3	3	3	2	3	3	**28**
7. Risks identification and assessment	3	2	1	3	3	2	2	2	3	3	**24**
8. Ranking of impacts and risks	3	2	1	3	3	2	2	2	3	3	**24**
9. Specialist studies	3	3	2	2	3	3	3	3	3	3	**28**

10. mitigation measures	3	3	2	3	2	3	3	2	3	3	**27**
11. impact management outcomes	3	2	2	3	3	3	3	2	3	3	**27**
	30	**27**	**23**	**29**	**28**	**29**	**28**	**26**	**31**	**29**	
TOTAL											**280**
PERCENTAGE (total score divided by 330)											**85%**

4.3 Question 3

How do practitioners who develop and approve Environmental Management Programme reports experience the change in legislation?

4.3.1 Authorities' feedback

The table 8 below summarises the feedback provided by Authorities / Regulators officials from the Department of Mineral Resources.

4.3.2 Summary of findings (Regulators)

Of the 10 interviewees, only 2 participants had a working experience of less than five years in the mining regulation aspects. Through the interviews conducted, all the interviewees expressed a positive response towards the change in legislation from MPRDA to NEMA. However, 2 participants expressed that the change has also brought confusion and unfairness towards Historically Disadvantaged South Africans as the process requires an Environmental Assessment Practitioner to be appointed.

Authorities alluded to the fact that they are now in a better position to make an informed decision based on the information submitted. Previously, issues including specialist reports were not much of a prerequisite information required. The information provided through specialist reports currently provide a better opportunity to understand the sensitivities of the site. It also provides an opportunity for easier monitoring and compliance checking.

The reports are submitted as per the requirements of NEMA regulations which provide a clear explanation on impact management measures and environmental results. In cases where the requirements of the regulations are not complied with or incomplete reports were submitted, applications are rejected. Two of the major issues that often lead to rejection of application include inadequate public participation and financial provision, which are considered critical factors towards a positive decision and management of impacts.

Table 8: Summary of Authorities feedback

QUESTIONS	FEEDBACK SUMMARY
How has the change in legislation (One Environmental System) impacted on the mining industry?	Positive impact: • Elimination of duplication whereby EIA authorisations/ EMP were processed by both DMRE and DEA, with different authorisations issued with different conditions placing a burden on the mining sector. During MPRDA mining industry were supposed to acquire Mining right; prospecting right or mining permit from DMR and environmental authorisation from DEA, now the right or permit and environmental authorisation are acquired on one competent authority. • Elimination of financial burden for lodging applications and submissions to different competent authorities; and duplication on public participation processes. • Elimination of monitoring and enforcement actions being done by different organs of state on EIA (e.g., DEA monitoring EA issued by DEA in terms of NEMA DMRE monitoring approved EMP in terms of the MPRDA), as well as issuance of different compliance notices with different instructions and timelines on the same aspects which frustrates/ confuses the industry (mining companies) leaving them not knowing which legislation or requirement or notice to comply with. • The appeals were adjudicating by the competent authority (DMR) during MPRDA, however during NEMA, the appeals were centralised and adjudicated by DEA). Negative impact: • Change in legislation impacted on the mining industries because it brought confusions and applications started to be late. The lodgement date of the EA and accepting date of the application where not clear to the applicant, because they were not sure when do they start counting their 90 days period to submit Basic Assessment or 44 days for submitting scoping Report, so the application ends up lapsing. • NEMA does not adequately take into account Historically Disadvantaged South Africans (HDSA). Process is expensive to HDSAs.
Have you noticed a change in the EMPs submitted since the introduction of the one environment system? If so, in what way? In your option is this a positive or negative change?	• Better description of environmental attributes. Impact identification: More tools for impact assessment/ identification of potential environmental impacts, and understanding of the environmental attributes (description of the environment) now required, including the use of the web-based screening tool • Mainly the requirement for EAP's details and declaration of independence, which is a positive change • Yes, the EMP is currently extensive, and it is compiled using the Environmental Impact Assessment Regulations • No significant changes in content. The MPRDA EMPs followed the same requirements as NEMA EMPs.
	•

Do the EMPs submitted provide the required information as per the Act /Regulations? E.g., Description of the development, local environment and baseline conditions	• Yes, also the full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity. • Yes, it clearly describes the local and baseline information of the area development will be taking place.
Has there been any EMPs rejected since the implementation of the one environmental system? If so, what were the reasons for rejection?	Yes, mainly the following: • Failure to meet the requirements for public participation; • failure to provide financial provision in terms of Section 24 P; • Applications lodged in protected areas that are declared • Failure to address comments raised by official on the submitted BAR/EMP; • Fraudulent submission of BAR/EMP (applicants using another EAPs details fraudulently); copy and paste (BAR/EMP for project A being submitted for project B) • Failure to Adherence to NEMA timeframe • Failure to carry-out the specialists' study as its warrant by the proposed mining • Unavailability of the locality map; details of public participations, clear mitigation measure; rehabilitation plans and closure objectives.
In your opinion, does the current legislation result in better environmental outcomes?	Yes, • the current legislation makes it non-compliance if a holder fails to comply with the conditions of the Environmental Authorisation. • Previously Most of the EMPs had insufficient information as all were using standard EMP to assess the impacts of the area, it does not matter the difference of the area and mineral • It makes easy for the officials (Competence Authority) to enforce and monitor the negative or positive of the mining activities on the proposed location. • Cultivates a good space for a fruitful interaction between the applicants and the affected parties. • Well balanced environmental assessment reports which helps the officials to make even an informed decision and better advice going forward • The screening tool also assist with identification of applicable technical studies to be conducted or technical reports to be submitted as part of the BAR/ EMP which further assist with impact assessment, establishment of mitigation measures and informed decision making. • EAs issued by DMRE appealed to the DEA minister. This allows for unbiased decisions on the appeals lodged and effectiveness in terms of environmental considerations in both impact assessment and decision making. .

4.3.3 Environmental Assessment Practitioners feedback

Table 9 below summarises feedback provided by Environmental Assessment Practitioners who compiles EMP reports:

4.3.4 Summary of findings (EAPs)

Of the 10 participants, only one had less than 5 years' experience. The experience includes working in the mining sector as well as other EIA related projects. The Environmental Assessment Practitioners also expressed the same positivity towards the change in legislation. Seven of the 10 participants expressed that most of the mining rights applications followed the NEMA regulations requirements during the MPRDA regime. Thus, the move from MPRDA to NEMA did not present a major challenge in terms of the compilation of documents. However, one major challenge is that the period to issue a license takes too long. The water use license also still remains an obstacle in terms of authorisation as it takes years to be issued, resulting in noncompliance by most of the operations.

Table 9: Summary of Environmental Assessment Practitioners feedback

QUESTIONS	FEEDBACK
What are the changes in requirements of mining Environmental Management Programmes reports compiled in terms of NEMA versus the previous MPRDA requirements?	• Inclusion of listed activities • Submission of a web-based screening report. This is a positive aspect as it assists to make an informed decision. • Duplication of processes by different departments (not a requirement in terms of NEMA or MPRDA), however, it eases the burden and financial costs. • NEMA does not present much of a difference as most of the requirements were taken from the MPRDA regulations.
Has the current regime (NEMA) presented any major challenges with regard to the compilation of EMPs?	• Time frames – the NEMA process takes too long (over a year) • The comments and approval process in terms of the water use license hinders the progress with regard to the compilation of the EMP as one is not certain of the outcome of the application. • Specialist studies required in areas that are not regarded as sensitive
In your opinion, does the current legislation result in better environmental outcomes?	• Yes, the introduction of a screening tool assists to address unforeseeable impacts that can be caused by an operation. It also helps in terms of environmental offsetting. • NEMA is more stringent in terms of environmental objectives and outcomes

(b) DISCUSSION OF RESULTS

This research endeavoured to compare whether the Environmental Authorisations granted since 2014 in terms of NEMA reflected better environmental results as compared to reports granted during the MPRDA regime. The OES was introduced in an effort to remove overregulation and duplication of legislative systems, inefficiency of EIA related aspects in the reports submitted by the mining industry as well as to strive towards cooperative governance (One Environmental System Colloquium, 2018). The research was based in one province and also focused on one commodity in order to limit the variables from different commodities and provinces.

An assessment was required to determine, amongst others, the quality of environmental reports, in order to understand whether the NEMA EIA requirements reflect better environmental results as compared to the MPRDA regime, an objective of the OES. A well written quality report with environmental management measures as per the NEMA requirements will serve as a base point towards positive environmental results.

The literature review conducted did not reveal any specific studies in relation to comparison of EMPs between MPRDA and NEMA regulations. However, comparison studies were made on EIA reports submitted between 1997 and 2006 in terms of NEMA only. These studies were used as base points to compare with the current study. The results indicated that the quality of the reports was generally satisfactory (Hildebrandt et al, 2014). Jalava et al. (2010) also supports that the quality of reports has improved over time. Though, Hildebrandt et al. (2014) alluded that a slight decline in report quality was noticed in reports submitted after 2006, possibly due to more stringent regulation of impact assessment.

In an effort to achieve better and more informed results, the research focused on a range of methods that corroborated each other on the findings. This entailed the analysis of the legislation requirements in NEMA and MPRDA, compliance of EMP reports in terms of legislative requirements and interviews with Environmental Assessment Practitioners as well as Authorities.

Since NEMA is the overarching or principal legislation with stringent clauses in terms of environmental requirements, the expectation was that there will be improvement in terms of environmental management measures in the management of pollution by the mines. With the move from MPRDA to NEMA (OES), it was expected that EMPRs should now reflect clear environmental management measures with better environmental results.

Both the NEMA and MPRDA regulations were used as a point of reference to outline the environmental requirements and reports that are mandatory when applying for a mining right. A regulatory framework is important to the EIA system as it provides guidance on the steps required to conduct an EIA (Mubangaa et al., 2020). The process of environmental impact assessment is a very critical aspect in any project development (DEAT, 2010). It gives an applicant an opportunity to outline all related aspects of a development including baseline data, existing environment, alternatives, predicted impacts, risk identification and management outcomes (Sandham et al., 2005).

Investigations were conducted to determine if there are differences between the EMP reports submitted during the MPRDA and NEMA legislative regime. The reports were scrutinised based on components or elements derived from the EIA requirements. The results clarified which reports presented better environmental results. The EMPR is a critical document in achieving a better and improved environmental outcome (DEAT, 2004). The EMPR allows for an applicant to develop a plan of action (including time frames and responsible persons) to be undertaken in managing the impacts identified during the EIA process (Baby, 2011). It also guarantees that the project follows the license conditions and implements good practise measures for the mitigation of impacts (Broderick et al., 2006). The EMP is amended as and when there are changes or additional features encompassed in the development (DEAT, 2004). The interviews presented an important component to support the findings with regard to outcome of the reports as well as to find other important points that might have been missed in the report.

The findings indicated that both the MPRDA and NEMA regulations provided similarities in some of environmental requirements. However, MPRDA lacked to

outline a detailed description of requirements that will not limit the information provided by applicants. NEMA has further provided additional requirements, including baseline information, specialist reports and public participation amongst others.

As per the analysis, all the EMP reports followed the requirements outlined by both regulations. However, due to the limited requirements in the MPRDA regulations, the MPRDA reports presented a gap in information as compared to NEMA reports. The data or findings supports the theory as indicated (One Environmental System Colloquium, 2018), that there were inefficiencies with regard to EIA related aspects in reports compiled through MPRDA. The interviews also confirmed that some of the critical information required for decision making were not a prerequisite during the MPRDA era. In this regard, the shift to NEMA was a step in the right direction as it presents clear objectives and aspects for informed decision making. A well prepared and quality report promotes the success of the EIA (Nadeem et al., 2006).

The results did indeed meet the expectation and showed that the EMPRs developed through the NEMA regime promise a far better chance of achieving improved environmental management. The shift to the One Environmental System reflects better environmental results and environmental management measures. The assessment of EMPR documents as well as the interviews conducted, substantiated each other. Literature also validated that Sutton et al. (2007) state that MPRDA and its regulations were promulgated to safeguard the environment and mineral resources and to ensure they are developed in a sustainable manner. However, it has been realised that the MPRDA presents gaps with regard to management of the environment, including the EIA process (Sutton et al., 2007). The shift to the One Environmental System under the auspices of NEMA was to include all the requirements of EIA. A well-defined legislative framework is critical in the EIA process as it gives direction on how the EIA should be carried out, the steps, activities to be carried out in the process. An executable EIA legislation is therefore the step in achieving a positive environmental management. In addition, the skills and capacities of the stakeholders also affect the effectiveness of the legislation (Mubangaa. et al 2020).

Although the reports submitted under NEMA, indicated much improved environmental management measures, it should be noted that a well-designed report does not translate to good implementation and compliance. Odeku (2017) indicates a well-structured EMP that meets both internal and national standards is a critical regulatory tool that present mining that is sustainable in communities and areas where the mine operates. However, simply developing a well-designed EMP is not enough as it must be followed by compliance and implementation. The regulatory authorities must also play a role to ensure compliance to legislation and regulations (Odeku, 2017).
On the other hand, the interviews revealed an issue that was not highlighted as environmental requirements but could affect the quality of a report. This includes the following:

- Appointment of EAP, in terms of NEMA regulations, section 12 (1), *A proponent or applicant must appoint an EAP at own cost to manage the application.* The interviewee raised that this creates unfairness on emerging mines and Historically Disadvantaged Individuals due to the lack of funds. In an effort to reduce the costs, the applicants will ultimately appoint EAPs who are not skilled to perform or conduct an EIA. In return the quality of the report will be comprised and will not consist of a true reflection of the issues in consideration, thereby attracting possible conflict with affected individuals.

The matter as raised above will need to be assessed and find mechanisms to avoid submission of reports that have insufficient information. Currently, the NEMA does not state the number of years experience required for an EAP to conduct EIA. It would therefore be of importance for regulators to look at the number of years as well as the previous projects conducted by EAPs in order to weigh their expertise.

Since the research did not involve any site visits, the question that remains is whether does good processes and reports result in good practices or implementation? This is an area that will still need further research to find if the environmental management measures as stipulated on the reports are adhered to. A good quality report does not automatically translate to good environmental practices. Evidence on the ground will provide a much clearer picture to determine if environmental result and the objective of the OES are met.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Challenges remain with regard to the legacy left behind by previous mining operations. The introduction of the MPRDA played a significant role to try and eliminate the adverse impacts caused by mining. However, the shift to the OES under the auspices of NEMA promises a much better and positive environmental reflection.

It is noted that often a good quality report yields better environmental results. This is dependent on several factors which should be taken into consideration when applying for a project. Public participation from the initial set of the project, proper identification of impacts, the manner in which the impacts will be dealt with, mitigation measure and education play a pivotal role in achieving the best results.

The study undertaken has revealed that the Environmental Management Programme reports submitted as per the 2014 NEMA regulations presented an enormous difference in terms of the processes undertaken and environmental impact management measures as compared to the MPRDA regime. The information provided through NEMA presented a far better understanding and were easy to follow or monitoring process by the competent authority.

The change in legislation to OES brought different opinions from different stakeholders, with some referring to as a positive move to alleviate further damage on the environment and the disintegration of the licensing processing, while others believed the system to be a time-consuming process. Interviews have also confirmed that the change in the system has created a much improved and positive outcome towards the management of the environment by the mining industry. In this regard, it is concluded that the OES was a constructive change, with the industry working towards improved actions. The change to NEMA has provided improved compilation of EMPR. This will provide a better platform towards the implementation of management measures of negative impacts caused by the mining industry and contribute to improved and better environmental results.

5.2 RECOMMENDATIONS

It is well acknowledged that the EMPR developed in terms of NEMA presented better results with regard to environmental results. However, it is yet to be known if the environmental management measures outlined on the reports are implemented on the ground or not. Are the mines conforming to the mitigation measures outlined in the reports? Has there been a reduction in the number of environmental pollution cases? Failure to implement the measures committed to would mean failure of the OES. The following are therefore recommended for implementation:

- A study should be conducted to measure the implementation of actions as stipulated in the EMPR. The study will assist to determine if the OES or the shift to NEMA application process shows any improvement or success.
- Although public participation is now recognised as a critical aspect in the EIA process, it can be valuable to include active participation (which include inspections) in the development of the reports produced by the mine. One such report is the environmental audit report which outlines compliance to environmental authorisation.
- An analysis should be conducted to determine the number of environmental complaints received before and after 2014. It will serve as one of the measures to determine the reduction in pollution cases. Regular consultation with communities will also indicate the level of compliance by the mines.
- Promote regular joint inspection with the relevant and affected departments (including Department of Water and Sanitation)
- Establishment of a monitoring and evaluation agency that will assist government to ensure compliance in terms of environmental management measures.

References

Baby, S. (2011). 'Approach in developing environmental management plan (EMP)'. *2nd International Conference on Environmental Engineering and Applications*, IPCBEE vol.17 (2011), Singapore. Available at: <http://www.ipcbee.com/vol17/48-L40000.pdf>

Barve, A. and Muduli, K. (2011). 'Challenges to environmental management practices in Indian mining object industries', *2011 International conference on innovation, management and service*, IPEDR vol.14 (2011), Singapore. Available at: <http://www.ipedr.com/vol14/53-ICIMS2011S20008.pdf>

Bell, F.G. and Donnelly, L.J. (2006), *Mining and its Impact on the Environment,* 1st edition, Taylor & Francis, London. Available at:<https://doi.org/10.1201/9781482288230>

Bridge, G. (2004), 'Contested terrain: mining and the environment'. *Annual Review of Environment and Resources*, vol.29(1), p. 205-259. Available at: <https://doi.org/10.1146/annurev.energy.28.011503.163434>

Broderick, M. A. and Durning, B. (2006). 'Environmental impact assessment and environmental management plans: an example of an integrated process from the UK'. *WIT Transactions on Ecology and the Environment*, 89, p. 10. Available at: <https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/89/16208>

Carvalho, F.P. (2017). 'Mining industry and sustainable development: time for change', *Food and Security*, vol.6(2):61-77. Available at: <https://doi.org/10.1002/fes3.109>

Chaparro, A., Keebler, J.R., Lazzara, E.H. and Diamond, A. (2019). 'Checklists: a review of their origins, benefits, and current uses as a cognitive aid in medicine'. *Ergonomics in Design the Quarterly of Human Factors Applications*, 27 (8). Available at: <https://doi.org/10.1177/1064804618819181>

Chaulya, S.K., Kumar, A.K., Tripath, M.N., Singh, R.S., Mishra, P.K. and Bandyopadhyay, L.K. (2011). 'Assessment of coal mine road dust properties for controlling air pollution', *International Journal of Environmental Protection*, 1 (2), available at: <https://d1wqtxts1xzle7.cloudfront.net/47832082/Assessment_of_Coal_Mine_Road_Dust_Proper20160805-27591>

Department of Environmental Affairs (2017) National Environmental Management Act, 1998, Environmental Impact Assessment Regulations (2017). Pretoria. Government printer

Department of Environmental Affairs (DEA) (2018). '20 Years of environment impact assessment in South Africa', EIA booklet, Department of Environmental Affairs, Pretoria. Available at: EIAbooklet.pdf (www.dffe.gov.za)

Department of Environmental Affairs and Tourism (DEAT) (2004a). 'Environmental management plans, integrated environmental management', Information Series 12, Department of Environmental Affairs and Tourism, Pretoria

Department of Environmental Affairs and Tourism (DEAT) (2004b). 'Review in environmental impact assessment, integrated environmental management', Information Series 13, Department of Environmental Affairs and Tourism, Pretoria.

Department of Environmental Affairs and Tourism (DEAT) (2010). 'Sector guidelines for environmental impact assessment regulations', Notice 654, Department of Environmental Affairs and Tourism, Pretoria

Department of Forestry, Fisheries and Environment (2018). One environmental system colloquium (meeting report), 2018. Cape Town <https://pmg.org.za/committee-meeting/27570/> (accessed: 25 October 2019)

Department of Mineral Resources (2010). Stakeholders' declaration on strategy for the sustainable growth and meaningful transformation of South Africa's mining industry; 2010; Mining stakeholders, as represented by the Department of Mineral Resources (DMR); National Union of Mine Workers; Solidarity and UASA, Chamber of Mines and South African Mining Development Association,

Feris, L. and Kotzé, L.J (2014). 'The regulation of acid mine drainage in South Africa: law and governance perspectives', *Potchefstroom Electronic Law Journal*, 17 (5). Available at: <http://dx.doi.org/10.4314/pelj.v17i5.07>

Haddaway, N.R., Cooke, S.J., and Lesser, P. (2019). 'Evidence of the impacts of metal mining and the effectiveness of mining mitigation measures on social–ecological systems in Arctic and boreal regions: a systematic map protocol', *Environmental Evidence* 8 (1): 9. Available at: <https://doi.org/10.1186/s13750-019-0152-8>

Halcomb, E.J. and Hickman, L. (2015), 'Mixed methods research', *Nursing Standard: promoting excellence in nursing care*, 29 (32), 41-47., Available at: https://ro.uow.edu.au/smhpapers/2656

Harman, J. (2005), 'The relationship between good governance and environmental compliance and enforcement', Seventh International Conference on Environmental Compliance and Enforcement, 9-15 April 2005; Page 5-13, Cape Town, South Africa. available at:

<https://old.inece.org/conference/7/vol1/04_Harman.pdf >

Hildebrandt, L. and Sandham, L.A. (2014). 'Social impact assessment: the lesser sibling in the South African EIA process?'. *Environmental Impact Assessment Review* 48 (2014: 20–26

Hudson, T.L., Fox, F.D. and Plumlee, G.S. (1999). 'Metal mining and the environment.' American Geological Institute, Alexandria,VA. Available at:
< http://www.agiweb.org/environment/publications/metalsfull>

Humby, T. (2015). 'One environmental system': aligning the laws on the environmental management of mining in South Africa', *Journal of Energy & Natural Resources Law,* 33(2):110-130. Available at:
< http//doi.org/10.1080/02646811.2015.1022432>

Jalava, K., Pasanen, S., Saalasti, M. and Kuitunen, M. (2010), 'Quality of Environmental Impact Assessment: Finnish EISs and the opinions of EIA professionals. *Impact Assessment and Project Appraisal*, 28:15-27, Available at: <https://doi.org/10.3152/146155110X488826>

Jhariya, D., Khan, R. and Thakur G.S (2016). 'Impact of Mining Activity on Water Resource: An Overview study', National Seminar on Recent Practices & Innovations in Mining Industry (2016), Raipur. Available at:
<https://www.researchgate.net/publication/301522857_Impact_of_Mining_Activity_on_Water_Resource_An_Overview_study >

Karmakar, H.N. and Das, P.K. (2012), 'Impact of mining on ground and surface waters', 4th international mineral water association congress (2012). Available at:
<http://mwen.info/docs/imwa_1991/IMWA1991_Karmakar_187.pdf> (accessed August 2022)

Kotzél, L.J. (2006). 'Improving unsustainable environmental governance in South Africa: the case for holistic governance'. *Potchefstroom Electronic Law Journal*, Vol 9, Available at:
<https://www.ajol.info/index.php/pelj/article/view/43452>

Lee, N. and Colley, R. (1991). 'Reviewing the quality of environmental statements: review methods and findings. *The Town planning review*, 62 (2):239-248. Available at <https://www.jstor.org/stable/i40003772:>

Le Roux, N. (2012). Environmental governance, fragmentation and sustainability in the mining industry, Doctoral dissertation, North-West University. Available at:
<https://repository.nwu.ac.za/bitstream/handle/10394/7398/LeRoux_N.pdf?sequence=1&isAllowed=y

Lohani, B., Evans, J.W., Ludwig, H., Everitt, R.R., Carpenter, R.A. and Tu, S.L. (1997). Environmental Impact Assessment for Developing Countries in Asia. Volume 1. Available at:

<https://www.adb.org/sites/default/files/publication/29779/eia-developing-countries-asia.pdf>

Makmor, M. and Ismail, Z. (2015). 'Improving Environmental Impact Assessment (EIA) process in Malaysia'. *Jurnal Teknologi*, 78(1). Available at: https://doi.org/10.11113/jt.v78.4489

Makua, M.P. and Kola O.O. (2017). 'Harmful mining activities, environmental impacts and effects in the mining communities in South Africa: a critical perspective'. *Environmental Economics*, 8 (4):14-24. Available at: < http://dx.doi.org/10.21511/ee.08(4).2017.02>

Mbedzi, M.D., Van der Poll, H.M. and Van der Poll, J.A (2020) 'Enhancing a Decision-Making Framework to Address Environmental Impacts of the South African Coalmining Industry', *Energies*, 13 (18):4397. Available at: <https://www.mdpi.com/1996-1073/13/18/4897>

Morodi, T.J. and Mpofu, C. (2018). 'Environmental Decision Making on Acid Mine Drainage Issues in South Africa: An Argument for the Precautionary Principle', *Science & Engineering Ethics*, 24:1181-1199. Available at: <https://link.springer.com/article/10.1007/s11948-017-9933-z>

Mpanza, M., Elhadi, A. and Moolla, R. (2020). 'Dust Deposition Impacts at a Liquidated Gold Mine Village: Gauteng Province in South Africa', *International Journal of Environmental Research and Public Health*, 17(14). Available at: <http://dx.doi.org/10.3390/ijerph17144929>

Mpinga, S. (2017). 'The One Environmental System for the mining industry: Has it given rise to intra-governmental conflict of interest?' *Mineral Law in Africa*. Available at: http://www.mlia.uct.ac.za/news/one-environmental-system-mining-industry-has-it-given-rise-intra-governmental-conflict-interest (accessed 15 May 2018)

Mubanga, R.O. and Kwarteng, K. (2020). 'A comparative evaluation of the environmental impact assessment legislation of South Africa and Zambia'. *Environmental Impact Assessment Review,* 83:106401.

Murombo, T. (2008). 'Beyond Public Participation: The disjuncture between South Africa's Environmental Impact Assessment (EIA) Law and Sustainable Development', *Potchefstroom Electronic Law Journal.* Available at: <https://www.ajol.info/index.php/pelj/article/view/42238>

Nadeem, O. and Hameed, R. (2006). 'A Critical Review of the Adequacy of EIA Reports-Evidence from Pakistan'. World Academy of Science, Engineering and Technology, *International Journal of Environmental and Ecological Engineering*, 2. Available at:
< https://doi.org/10.5281/zenodo.1074425>

Norgate, T.E. and Rankin, W.J. (2000). 'Life Cycle Assessment of Copper and Nickel Production'. Published in Proceedings, Minprex 2000, International Conference on Minerals Processing and Extractive Metallurgy, pp133-138. Available at: <https://publications.csiro.au/rpr/pub?list=BRO&pid=procite:a2169a6f-cc94-4784-96fc-82453c96a3a9>

Ochieng, G .M., Seanego, E.S. and Nkwonta, O.I (2010). 'Impacts of mining on water resources in South Africa'. *Scientific Research and Essays*, 5(22), pp. 3351-3357. Available at: <https://academicjournals.org/journal/SRE/article-full-text-pdf/E1F28F718891>

Odeku. K.O. (2017). Effective implementation of Environmental Management Plan for sustainable mining. *Environmental Economics*, 8(1): 26-35. Available at:<http://dx.doi.org/10.21511/ee.08(1).2017.03>

Phalan, B., Hayes, G., Brooks, S., Marsh, D., Howard, P., Costelloe, B., Vira, B., Kowalska, A. and Whitaker, S. (2017). 'Avoiding impacts on biodiversity through strengthening the first stage of the mitigation hierarchy', Published online by Cambridge University Press. Available at: <mitigation hierarchy/DDBA2EA1D468985A9CE5D089ABC5FAD5>

Pietrzyk-Sokulska, E., Uberman, R. and Kulczycka, J. (2015). 'The Impact Of mining on the environment in Poland – myths and reality'. Gospodarka Surowcami Mineralnymi – Mineral Resources Management, 31. Available at: < http://dx.doi.org/10.1515/gospo-2015-0009 >

Proceedings of International Land Reclamation and Mine Drainage Conference and Third International Conference on the abatement of acidic drainage, 1994, volume 4 of 4, Pittsburgh, PA, 24 – 29 April 1994, Available at: <https://www.osti.gov/biblio/6637388>

Rebelo, C. and Guerreiro, J. (2017). 'Comparative Evaluation of the EIA Systems in Kenya, Tanzania, Mozambique, South Africa, Angola, and the European Union', *Journal of Environmental Protection*. 8(5):603-636. Available at: <https://doi.org/10.4236/jep.2017.85040>

Republic of South Africa. 2002. Mineral and Petroleum Resources Development Act 28 of 2002. Pretoria. Government printer

Retief, F., Welman, C.N.J. and Sandham, L. (2011). 'Performance of environmental impact assessment (EIA) screening in South Africa: a comparative analysis between the 1997 and 2006 EIA regimes. *South African Geographical Journal*, 93(2):154-171. Available at: <https://doi.org/10.1080/03736245.2011.592263 >

Rogerson, C.M. (2011). 'Mining enterprise, regulatory frameworks and local economic development in South Africa'. *African Journal of Business Management*, 5. Available at: <http://dx.doi.org/10.5897/AJBMX11.013>

Sameh, S. and Tahlawi, M. (2011). Environmental Impacts of Mining Operations, A Case Study: Monitoring the Impacts at Abu Tartour Phosphate Mine, Egypt, *International Journal of Environmental Protection,* 1(4). Available at: <http://www.ijep.org/>

Sandham, L.A., Chabalala, J.J. and Spaling, H.H. (2019). 'Participatory rural appraisal approaches for public participation in EIA: Lessons from South Africa'. *Land,* 8(10). Available at: https://doi.org/10.3390/land8100150

Sandham, L.A., Hoffmann, A.R. and Retief, F.P. (2008). 'Reflections on the quality of mining EIA reports in South Africa'. *The Journal of The Southern African Institute of Mining and Metallurgy*; 108:701-706. Available at: <http://www.scielo.org.za/pdf/jsaimm/v108n11/05.pdf>

Sandham, L.A., Moloto, M.J. and Retief, F.P. (2008). 'The quality of environmental impact reports for projects with the potential of affecting wetlands in South Africa'. *Water SA,* 34 (2). Available at:

<http://www.scielo.org.za/pdf/wsa/v34n2/03.pdf>

Sandham, L.A., Siphugu, M.V. and Tshivhandekano, T.R. (2005). 'Aspects of Environmental Impact Assessment (EIA) practice in the Limpopo Province - South Africa'. *African Journal of Environmental Assessment and Management*, volume 10. Available at: <https://www.researchgate.net/publication/45256272_Aspects_of_Environmental_Impact_Assessment_Practice_in_the_Limpopo_Province--South_Africa>

Sandham, L.A., Van Heerden, A.J., Jones, C.E,. Retief, F.P. and Morrison-Saunders, A.N. (2013). 'Does enhanced regulation improve EIA report quality? Lessons from South Africa'. *Environmental Impact Assessment Review*; 38:155-162. Available at: < https://doi.org/10.1016/j.eiar.2012.08.001>

Sharma, D. (2006). 'Environmental Impact Assessment: Basic Principles & Overview Key Steps'. All India Seminar on Environmental Impact Assessment, 18 – 19 August 2006. Available at: <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.103.2150&rep=rep1&type=pdf#page=119> (accessed 13 October 2021)

Sinding, K. (1999). 'Environmental impact assessment and management in the mining industry'. *Natural Resources Forum*, 23(1):57-63. Available at: <http://dx.doi.org/10.1111/j.1477-8947.1999.tb00238.x>

Sengupta, M. (2021). Environmental Impacts of Mining: Monitoring, Restoration and Control (2nd ed.). available at: < https://doi.org/10.1201/9781003164012>

Singh, G., Pal, A. and Khoiyanbam, R.S. (2009). 'Impact of mining on human health in and around Jhansi, Bundelkhand region of Uttar Pradesh, India', Journal-of-Ecophysiology-and-Occupational-Health, vol.9, p47-54. Available at: <https://www.researchgate.net/publication/289196567_Impact_of_mining_on_human_health_in_and_around_Jhansi_Bundelkhand_region_of_Uttar_Pradesh_India> (accessed: 2 June 2022)

South Africa. Department of Environmental Affairs (2010). Media statement: New Environmental Impact Assessment (EIA) regulations come into effect today, 2 Aug 2010. Available at: <https:// www.gov.za/new-environemtal-impact-assessment > (Accessed: 20 May 2018)

Sutton, M.W. and Weiersbye, I.M. (2007). 'South African Legislation Pertinent to Gold Mine Closure and Residual Risk', Australian Centre for Geomechanics. Available at: https://wiredspace.wits.ac.za/server/api/core/bitstreams/2b9fe9d4-3653-4a0c-a7ca-fc7b5a149c8c/content > (accessed: 01 June 2019)

Swart, E. (2003). 'The South African legislative framework for mine closure'. *The Journal of The South African Institute of Mining and Metallurgy*, 103:489-492. Available at: <https://www.saimm.co.za/Journal/v103n08p489.pdf>

Wood, C. (2003). 'Environmental Impact Assessment in Developing Countries: An Overview'. Conference on New Directions in Impact Assessment for Development: Methods and Practice, 24-25 November 2003. Available at: https://d1wqtxts1xzle7.cloudfront.net/31196405/Wood-with-cover-page (accessed 2 June 2022)

Žibret, G., Gosar, M., Miler, M. and Alijagić, J. (2018). 'Impacts of mining and smelting activities on environment and landscape degradation—Slovenian case studies', *Land Degrad Dev*, 29:4457–4470. Available at: <https://onlinelibrary.wiley.com/doi/pdfdirect/10.1002/ldr.3198>

ANNEXURE A: INTERVIEW QUESTIONS

AUTHORITIES

1. How many years have you worked as an environmental official for mining related applications?

< 2years; 2 years to 5 years; >5 years Could you please explain to me what your job entails

2. How has the change in legislation (from the MPRDA environmental assessment to the one environmental system under NEMA) impacted on the mining industry? [with regards to what?]

3. Have you noticed a change in the EMPs submitted since the introduction of the one environment system? If so, in what way? In your option is this a positive or negative change?]

4. Do the EMPs submitted in terms of NEMA provide the required information as per the Act and its Regulations? E.g., Description of the development, local environment and baseline conditions

5. Has there been any EMPs rejected since the implementation of the one environmental system? If so, what were the reasons for rejection?

6. In your opinion, does the current legislation result in better environmental outcomes? could you please give me some examples?

ENVIRONMENTAL ASSESSMENT PRACTITIONERS

1. How many years have you worked as an Environmental Assessment Practitioner?

< 2years; 2 years to 5 years; >5 years Could you please briefly tell me what your job involves

2. What are the changes in requirements of mining Environmental Management Programmes reports compiled in terms of NEMA versus the previous MPRDA requirements?

3. Has the current regime (NEMA) presented any major challenges with regard to the compilation of EMPs for mining applications? could you please give me examples

4. In your opinion, does the current legislation result in better environmental outcomes? How/in what way? Please provide examples

ANNEXURE B: ETHICS CLEARANCE CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

SCHOOL OF ANIMAL, PLANT AND ENVIRONMENTAL SCIENCES ETHICS COMMITTEE CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: 1914**
PROJECT TITLE	A comparative analysis of miming environmental management programme reports following a change to the one environmental system.
INVESTIGATOR	Lebogang Mathe
SCHOOL/DEPARTMENT OF INVESTIGATOR	Animal, Plant and Environmental Sciences
DATE CONSIDERED	18 October 2019
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	Date of submission of the project report
ISSUE DATE OF CERTIFICATE	**CHAIRPERSON** _____ (Dr Shalini Dukhan)

cc: Supervisor/s : Dr Ingrid Watson

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I 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.

_____ Signature

23/10/2019 Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES