

An appraisal of the quality of mining EIA reports

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Abstract

Environmental Impact Assessment (EIA) is one of the tools used by relevant authorities all over the world in an attempt to ensure that the principles of sustainable development are achieved. Since EIA became mandatory in South Africa, many EIAs have been conducted. As one of the principle industries contributing to the South African economy, the mining sector is no exception. It is also true that the mining industry is one of the largest contributors to environmental impacts.

In order to ensure that EIA achieves its goal, it is necessary to test the quality of EIA systems and reports. There are various methods to achieve this, one being the use of Environmental Impact Assessment Report quality review packages to test the quality of the EIRs produced in terms of the National Environmental Management Act, Act 107 of 1998, and the Mineral and Petroleum Resources Development Act, Act 28 of 2002, both of which require that EIA be conducted.

In order to conduct a quality review, the Lee and Colley review model was adapted for use in the South African mining sector.

This model was used to assess the quality of 20 approved EIRs submitted to the relevant authority, i.e. the Department of Minerals and Energy (DME). Results derived from the use of this model indicate that the majority of EIA reports in the in the mining sector are of an acceptable standard. However, the results also indicate a number of weaknesses. Several key areas of EIA do not receive sufficient attention, specifically the identification of impacts and the consideration of alternatives. This could undermine the effectiveness of the whole EIA process.

Opsomming

Omgewingsimpakbepaling (OIB) is een van die hulpmiddels wat gebruik word om volhoubare benutting te verseker. Sedert OIB verpligtend geword het is vele impak bepalings gedoen en die mynbou sektor is geen uitsondering nie. Die mynbou sektor dra tot 'n groot mate by tot die ekonomie van Suid-Afrika. Dit is ook een van die sektore wat die grootste impak het op die omgewing.

Wetgewing is ingestel om die beginsels van volhoubare benutting te implementeer. Die twee staatsdepartemente wat bemoeid is met omgewingsaangeleenthede, die Departement van Omgewingsake en Toerisme (DOST) en die Departement van Mineraal en Energiesake (DME), het elk hul eie wetgewing, die Nasionale Wet op Omgewingsbestuur, 107 van 1998, en die Nasionale Wet op Mineraal en Petroleum Ontwikkeling, 28 van 2002 (NWMPO). Albei stelde wetgewing vereis dat OIB gedoen word.

Die wêreldwye implementering van OIB het baie belangstelling gelok en vele studies is gedoen oor die effektiwiteit van OIB stelsels. Een metode is die gebruik van kwaliteitevalueringmodelle om die kwaliteit van omgewingsimpakverslae (OIV) te bepaal. 'n Studie van die spesifieke regulasies wat op die NWMPO van toepassing is, het dit moontlik gemaak om die Lee en Colley model aan te pas vir gebruik in die Suid-Afrikaanse mynbousektor. Die gebruik van die model het die volgende resultate aan die lig gebring: die oorgrote meerderheid van OIB verslae wat deur die DME goedgekeur is, is van 'n aanvaarbare standaard. In die lig van die studie kan sekere aspekte van die wetgewing ook bevraagteken word in terme van die toepaslikheid daarvan. Die resultate het ook getoon dat sekere aspekte van die OIB stelsel nie die nodige aandag ontvang wat dit verdien nie. Sleutel areas word afgeskeep en dit kan die effektiwiteit van die hele OIB stelsel ondermyn.

List of acronyms and abbreviations

CEC - Commission of European Communities

DEAT - Department of Environmental Affairs and Tourism

DME - Department of Minerals and Energy/Departement van Minerale en
Energieë

DWAF - Department of Water Affairs and Forestry

ECA - Environment Conservation Act

EIA - Environmental Impact Assessment

EIR - Environmental Impact Assessment Report

IEM - Integrated Environmental Management

EMP - Environmental Management Programme

EMPR - Environmental Management Programme Report

MPRDA - Minerals and Petroleum Resources Development Act

NEMA - National Environmental Management Act

NEPA - National Environmental Policy Act

NGO - Non Government Organisation

NWU - North West University

PRPMI - Potchefstroom Review Package for the Mining Industry

RA1 - Review Area 1; Description of the Environment

RA2 - Review Area 2; Identification and Evaluation of Impacts

RA3 - Review Area 3; Alternatives and Mitigation

RA4 - Review Area 4; Communication of Results

SEA - Strategic Environmental Assessment

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Preface

For this dissertation, the article format was used. The dissertation contains the following:

- Chapter 1: Introduction

This chapter is an introduction to the study as conducted in Chapters 2 and 3. The legal position of Environmental Impact Assessment (EIA) in South Africa and a brief exploration of the relevant legislation are included in this chapter, as well as some problems that have been pointed out regarding the South African EIA system.

The aim of the study is to conduct a quality review of environmental impact assessment reports (EIRs) submitted to the Department of Minerals and Energy (DME) by the mining industry after the Minerals and Petroleum Resources Development Act (MPRDA) came into force in 2004. To this end, some specific objectives have been set, including: a careful scrutiny of the relevant legislation in order to determine the specific requirements laid down by the relevant authority (the DME) and using these for the development of a new EIR quality review package for use within the South African mining industry based on the generic Lee and Colley review package.

- Chapter 2: Literature review and methodology.

The literature review explores the history and process of EIA, why it is such an important tool in the context of Sustainable Development as well as some of the research conducted both within South Africa and abroad. This will serve as background and context for the adaptation and implementation of an EIR quality review package for specific use within the South African mining industry. The methodology explores the materials and methods utilised in the development of the EIR quality review package and its application.

- Chapter 3: An appraisal of the quality of mining EIA reports (article manuscript).

Chapter 3 contains the results generated from the use of the newly developed EIR review package. These indicate that while the EIRs generated by the South African EIA system are of a generally acceptable standard, there is still room for improvement, especially with regards to the evaluation and identification of key impacts, and the consideration of alternatives and mitigation. These results are in line with international findings.

The article is aimed at journal publication, specifically the South African Geographical Journal, and will be submitted after examination of the dissertation is complete. The supervisor and student will be cited as co-authors. For improved reader friendliness, tables and figures have been placed in the text at appropriate locations, rather than in appendices as required for manuscript submissions.

References are cited at the end of Chapters 1, 2 and 3, in accordance with the requirements of the North West University (NWU).

- Chapter 4: Conclusion.

Chapter 4 contains a summary of the main points raised within the dissertation and a brief discussion of what the results indicate.

- Appendices

The appendices contain material that could not be included in the main text but is nevertheless necessary for the purposes of the dissertation.

Appendix A: The Potchefstroom review package for the mining industry

Appendix B: Collation sheet

Appendix C: Guidelines for authors

Appendix D: Additional figures

1. Introduction and problem statement

Environmental Impact Assessment (EIA) has been implemented in most countries around the world since its initial introduction in the United States of America in 1969 (Sowman *et al.*, 1995) and its benefits and uses have been widely documented (Azapagic, 2003; Glasson *et al.*, 2005). Similarly, there are numerous criteria for evaluating EIA systems (Wood, 2003), as well as guidelines for determining the quality of EIA reports (DEAT, 2004).

EIA was introduced in South Africa in 1997 in terms of the Environment Conservation Act, Act 73 of 1989 (ECA) (South Africa, 1989), nominally under the supervision of the Department of Environmental Affairs and Tourism (DEAT). Under the ECA, many activities that would require EIA were identified, and specific regulations pertaining to EIA were introduced. In 1998, the ECA was superseded by the National Environmental Management Act, Act 107 of 1998 (NEMA). However, certain sections of the ECA such as Section 21, Section 22 and Section 26, as well as the regulations pertaining to EIA – R.1182 and R.1183 – were not repealed until 2006, when EIA under NEMA came into effect. (South Africa, 1998).

Although mining was one of the activities identified as requiring an EIA (South Africa, 1997a; South Africa, 1997b) the mining industry was separated from all other activities that required an EIA under a separate set of legislation, the Minerals Act, Act 50 of 1991 (South Africa, 1991) and supervised by the Department of Minerals and Energy (DME). Like the ECA, the Minerals Act has since been repealed and replaced by a new set of legislation, the Minerals and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA), the

environmental sections of which came into force in 2004 with the introduction of a set of regulations (R.527) (South Africa, 2004).

The fragmentary nature of the South African legislation with regards to environmental affairs has been widely criticised by scholars and environmentalists alike on the grounds of causing confusion (Wood, 1999). Others were of the opinion that a department with a vested interest in mineral resource development should not also administer and evaluate the impacts these activities have on the environment (Otto Dale, 1997). Although the current legislation (NEMA and MPRDA) are similar in aim, content and execution regarding EIA, the criticism is still valid, seeing as nothing has changed with regards to departmental supervision of environmental affairs.

Both sets of current legislation (NEMA and MPRDA) provide specific guidelines as to the contents of Environmental Impact Assessment Reports (EIR) and are very closely tied to the principles of sustainable development. These principles are codified into both the NEMA and the MPRDA (South Africa, 1998; South Africa, 2002).

As one of the acknowledged tools to reach the goal of sustainability, the quality of both the EIA system and that of the reports produced by the EIA system (EIR) must be evaluated (Wood, 1992). In the international context, EIA quality has been extensively reviewed by means of quality review packages such as that developed by Lee and Colley (Glasson, *et al.*, 2005; Lee *et al.*, 1999).

Most studies that have thus far been conducted in South Africa regarding quality of EIRs have focussed on EIRs produced in terms of the requirements of ECA (Moloto, 2005; Pretorius, 2006; Sandham *et al.*, 2005).

No studies have thus far been published to test the quality of EIR in the mining sector. It is the purpose of this study to fill this gap in the literature.

2. Aims and objectives

The aim of this study is two-fold: to develop a review package suitable for use in the South African mining sector, and to use this review package to assess the quality of EIR in the mining sector.

To reach these aims, the following research objectives have been set:

- To conduct a review of current, relevant legislation pertaining to EIA in the South African mining context.
- To use this review as a basis to adapt a generic review model to suit the mining industry in South Africa.
- To conduct a quality review of a sample of EIRs submitted and approved by the DME in the North West Province using the newly developed model.

A careful study of the relevant legislation and regulations was conducted, and using an add-and-subtract method, the differences between the generic Lee and Colley model and the relevant South African legislation were resolved. The model was tested on a sub-sample of four EIRs and re-evaluated before being used on a larger sample of 20 EIRs, all obtained from the DME in Klerkdrorp. The results gained from this study are the main subject of the research, and are presented in Chapter 3.

3. Format of study and research methodology

The article format has been used for this study. It consists of four separate chapters as follows:

The introduction serves to identify the knowledge gap addressed by this study, and the literature review in Chapter 2 provides the theoretical basis for the creation and use of a quality review package for the mining industry in South Africa. The package serves as basis for the empirical study of the quality of EIR in the mining industry, which is presented in Chapter 3. The conclusion in Chapter 4 reflects on findings and serves to identify future research potential.

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Chapter 2 Literature review and methodology

2.1 Introduction to EIA

2.1.1 The global environmental movement

Over the last number of decades, various historical events and scientific discoveries brought environmental concerns to public attention. One such philosophy is that the earth is essentially a closed system with only the energy of the sun serving as an external factor. This model is called the 'spaceship' model. One of its implications is that all the resources of earth are finite, and are therefore subject to depletion through overuse. More importantly, it also implies that the environment that serves as the source for all the resources is also the sole recipient, or sink, of all the waste produced by the extraction and use of those resources (Corning, 2003). Furthermore, the irresponsible use of the resources had led to some very serious problems such as global warming (Houghton, 2005) and global dimming (Stanhill & Cohen, 2001).

Pressure from public and various non-government organisations (NGO's), fuelled by popular reports such as Rachel Carson's 'Silent spring', published in the late 1960's (Kroll, 2001), and ecological disasters such as the Exxon Valdez oil spill in Alaska in the late 1980's (Anderson, 2002) have forced governments and commercial entities alike to behave more responsibly toward the environment. Also, the development of the 'global community' and easy access to information have heightened public awareness of environmental impacts (Jenkins & Yakovleva, 2004; Rondinelli & Berry, 2002).

All of this led to some groundbreaking international commissions and conventions, most notably the World Commission on Environment and Development of 1987, and the Rio Conference of Sustainable Development in 1992, the outcome of which led to the development of the principles of sustainable development, as codified in Agenda 21. These have been incorporated into environmental legislation all over the world (Interparliamentary Union, 1997; Wood, 2003).

2.1.2 EIA - historical roots

EIA as a process had its beginnings in the USA in 1969 under the National Environmental Policy Act (NEPA), and was formally introduced in 1970. In spite of occasionally hostile presidential administrations the process of EIA and its core components remained intact with minimal changes to the core legislation for over 30 years. Through litigation and congressional as well as public participation, many of the initial weaknesses in the US EIA system were eliminated. Following the successful implementation of EIA in the USA, the EIA process spread to Europe. In 1975, the Commission of the European Communities (CEC) initiated EIA research and issued a first draft EIA directive in 1977, but the process was not adopted until 1985. By 2007, even developing countries such as Thailand and Columbia have EIA systems in place (Glasson *et al.*, 2005; Muttamara, 1996; Wood, 2003).

The process of EIA is closely linked to the principles of sustainable development, even though it predates the formal adoption of sustainable development internationally (Bray, 1998; Gilpin, 1996). For the purpose of this study, sustainable development is defined as 'development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987). It is impossible to directly determine what the needs

of future generations will or might be, but it is generally accepted that future generations will require an environment that can sustain them (Glasson *et al.*, 2005).

2.2 Introduction to generic EIA

In order to understand the nature of EIA, it is necessary to define what the environment is. For the purpose of this study, 'environment' will be defined according to the definition provided in the definitions section on the National Environmental Management Act (South Africa, 1998: 8) as:

"The surroundings within which humans exist and that are made up of

- i. The land, water and atmosphere of the earth*
- ii. The micro-organisms, plant and animal life*
- iii. Any part or combination of (i) and (ii) and the relationship among and between them*
- iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence health and well-being."*

There are numerous definitions of EIA, but according to Glasson *et al.* (2005), it is in essence a process that attempts to predict the possible negative consequences that any development may have on the environment, with the emphasis being in prevention of these impacts. The data contained in an EIA report (EIR) are intended to provide decision-makers with the relevant information needed to prevent undue negative impacts from occurring (Sadler, 1996; Tarr, 2003).

To place EIA into the proper perspective of its utilisation and function, a different, more encompassing definition is offered:

EIA is *“a technique for drawing together, in a systematic manner, expert qualitative assessments of a project’s environmental effects and presenting the results in a way which enables the importance of the predicted effects, and the scope for modifying or mitigating them, to be properly evaluated by the relevant decision-making body before a decision is given. Environmental assessment techniques can help both developers and public authorities with environmental responsibilities to identify likely effects at an early stage and thus to improve the quality of both project planning and decision-making”* (Wood, 2003: 1).

Wood (2003) goes on to state that the process is systematic and integrative with participation of all interested and affected parties an essential part of the process (South Africa, 1998).

From this definition the following conclusions about the nature and purpose of EIA can be drawn:

- It is a pro-active process.
- It draws together knowledge about the environment likely to be affected in a systematic, scientific manner, from many different disciplines.
- It offers conclusions about what the impacts on the environment are likely to be, as well as offering possible ways to prevent and/or mitigate the impacts.
- It offers this information to the relevant authorities to improve decision-making in an easily assimilated format.
- The process offers potential benefits to three parties: the project initiator/developer, the relevant authorities and the environment itself.

EIA as a process finds application at the project level. As such, it is important to distinguish it from Strategic Environmental Assessment (SEA), a process that operates on the level of policies, plans and programmes. To illustrate the difference, a formal definition of SEA is offered:

SEA is a process during which policies, plans and programmes are systematically evaluated for its potential environmental impacts (Glasson *et al.*, 2005). SEA is thus a process that should be conducted before the advent of a project.

2.3 EIA effectiveness and the need for EIR quality review

EIA as a system has been in operation in many countries around the world for over 35 years. During that time, it had attracted the attention of environmental scientists from many parts of the world; questions were raised whether or not the EIA systems that have been implemented were actually working (Delicaet, 1995; Glasson & Salvador, 1999; Sadler, 1996; Wood, 2003).

Several methods have been used over the years to assess the quality of EIA systems. Criteria and principles to evaluate an EIA system as a whole have been developed by Gibson (1993), Sadler (1996) and Wood (1999, 2003) and used to evaluate EIA systems.

Christensen *et al* (2006: 396) summarised the aspects to which evaluation of EIA can relate as follows: "*...the procedures and how they relate to provisions and principles; the substantive content, e.g. how the EIA impacts decision-making or improve environmental protection; and third, to be more transactive in nature by looking at the efficiency of the EIA process.*"

Another method that is used is to evaluate the quality of the Environmental Impact Assessment Reports (EIR) that the particular EIA system produces. These reports are subjected to a set of specially developed criteria, referred to as a quality review model, often presented in the form of a quality review package such as that developed by Lee and Colley. Several such models have been developed (Lee *et al.*, 1999; Leu *et al.*, 1996; Glasson *et al.*, 2005; Simpson, 2000).

Numerous studies of the quality of EIR have also been conducted, some of individual countries, and others comparative (Androulidakis & Karakassis, 2005; Barker & Wood, 1999; Canelas *et al.*, 2004; Christensen *et al.*, 2006). The results of these indicate that EIA as a system improved markedly over the years in some countries. The main problems encountered in most countries were a lack of political will to implement the system as well as a lack of qualified practitioners and under-qualified personnel in government offices. In spite of these factors, the majority of EIA reports were found to be of satisfactory to good quality, although this did depend strongly on the budget expended to obtain the data (Androulidakis & Karakassis, 2005; Baker & McLelland, 2003; Barker & Wood, 1999; Canelas *et al.*, 2004; Christensen *et al.*, 2006).

2.4 EIA in South Africa

2.4.1 Historical perspective and development

The history of EIA in South Africa is a long one. Starting in 1974, where it was discussed at professional gatherings; numerous academic and professional papers and books have been published, calling for its formal implementation. In 1983, the EIA Committee for the Council for the Environment initiated research and invited comment on the implementation of EIA. Since that time, many voluntary EIAs were conducted (Peckham, 1997; Wood, 2003). This led

to the introduction of Integrated Environmental Management (IEM) in 1989. Further consultation led to a revised IEM procedure in the form of six guideline documents, published by the Department of Environmental Affairs (DEA) in 1992. Meanwhile, in 1989, EIA was formally recognised in the legislation with the advent of the Environment Conservation Act (ECA), which made provision for the minister to promulgate EIA regulations.

In 1997, a set of regulations was duly promulgated in terms of the ECA. These regulations (R. 1182, R. 1193 and R. 1184) formalised EIA and also listed projects for which EIA would be compulsory. These regulations ushered in the first era of mandatory EIA in South Africa and remained in effect until 2006. As part of a comprehensive law reform process following the first democratic political dispensation in South Africa in 1994, the National Environmental Management Act (NEMA) was promulgated in 1998, and much of the old ECA was repealed, except for the above-mentioned regulations in terms of Sections 21, 22 and 26 of the ECA. Although NEMA also made provision for EIA, it did not come into effect until 2006. However, mining was still excluded from activities that required an EIA, in spite of the various impacts it has on the environment (Kitula, 2004; Naicker *et al.*, 2003; Tarras-Wahlber *et al.*, 2001).

2.4.2 EIA in the mining sector

Prior to 1991, when the Minerals Act, Act 50 of 1991 came into force, the mining industry had no formal set of legislation governing the environmental aspects of its activities. However, due to growing environmental concern, the Department of Minerals and Energy (DME) provided its own set of legislation, the Minerals Act of 1991, as well as its own set of guidelines in the form of the Aide Memoire. In terms of the Minerals Act, every mine had to produce an Environmental Management Plan (EMP) and submit an

Environmental Management Programme Report (EMPR) to the DME. The EMPR was the mining industry's equivalent of an EIR, and though the contents of the EMPR were similar to that of an EIR, the Minerals Act did not require than an EIA be conducted. The Aide Memoire was a generic guideline template intended to aid Environmental Managers within the mining sector to produce an EMPR. The reasoning (which still prevails in 2007) behind the separation of the mining industry from other activities that by law required EIA was that since the mining industry provided so much of the country's income, it required a set of regulations specific to its needs (Fourie & Brent, 2006).

The Minerals Act, Act 50 of 1991 was replaced in 2002 by the Minerals and Petroleum Resources Development Act, Act 28 of 2002, the environmental aspects of which came into force on 1 May 2004 with the promulgation of R.527, the set of regulations dealing with EIA in the mining sector. Since then, all EIAs conducted in the mining sector had to be conducted in accordance with the requirements of the current legislation.

The Minerals and Petroleum Resources Development Act, Act 28 of 2002, utilised the principles of sustainability as presented in NEMA Chapter 5 as a basis for EIA practice. These principles include:

- A cradle to grave approach to environmental impacts.
- Due consideration of alternatives, including amendments to the project, as well as the alternatives to the projects itself (the 'take no action' option).
- Public participation in the form of all interested and affected parties.
- The polluter pays principle.
- The introduction of the precautionary principle.

- Decision-making at the level of the Minister, or the Minister's duly appointed delegate (South Africa, 1998).

The EIA process laid out in the regulations closely follow the best practice generic guidelines, a much better approach than the feeble EMPR it replaced. With the process now very similar to what was originally envisioned in the ECA, the only remaining criticism that remains is the split between the competent authorities that administer EIA.

A possible point of concern regarding the competent authority for the mining sector (the DME) is the relative inexperience of the environmental officers and the understaffing experienced by the department, revealed by personal informal interviews with personnel who wished to remain anonymous.

Figure 1 shows the procedural framework within which EIA operates in the mining industry.

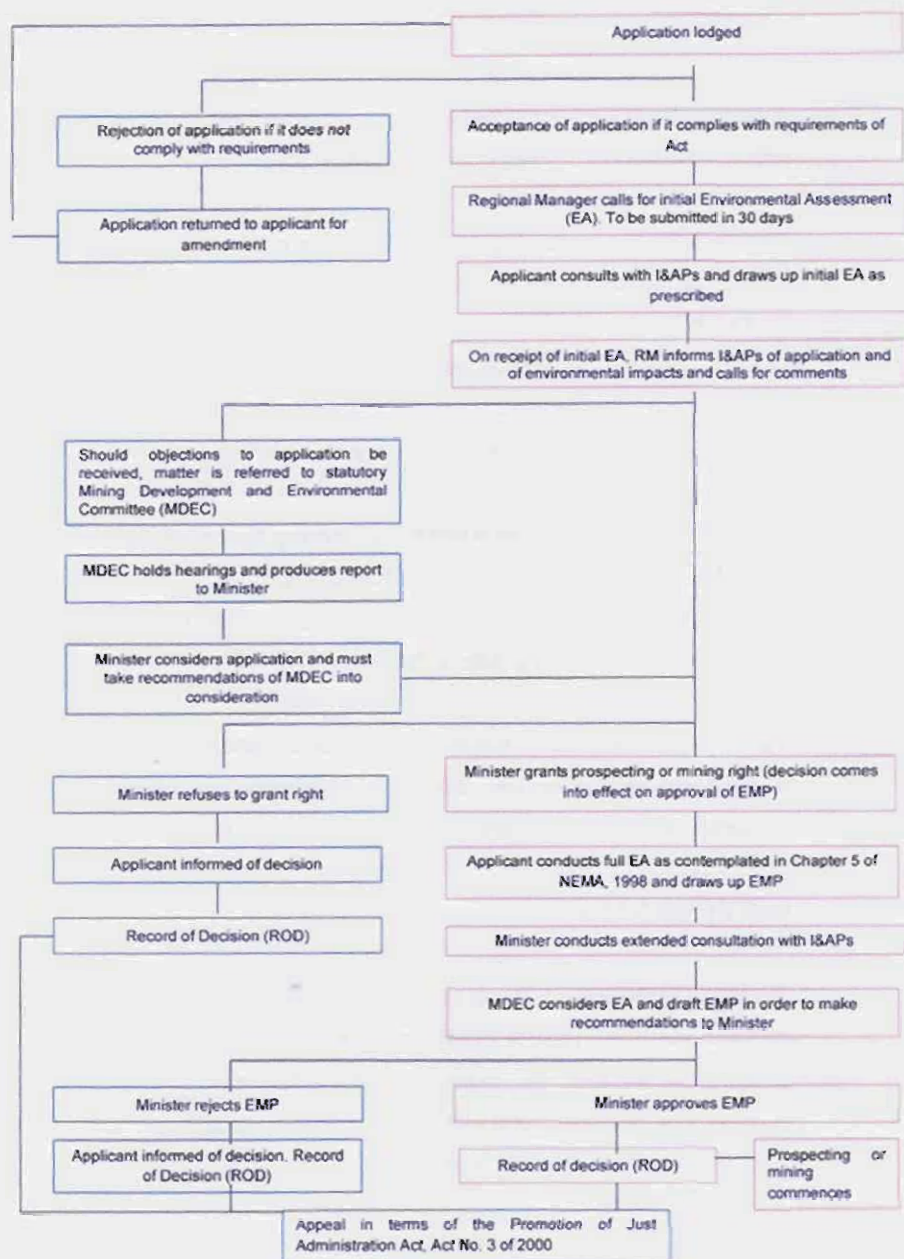


Figure 1: The legal position of EIA within the overall process as set out by the MPRDA. (Source: Swart, 2004)

The DME, unlike DEAT, is not divided into autonomous provincial departments, where final authority for EIA within provincial jurisdiction lies with an MEC. Rather, the final authority for all mines in all the provinces lies

with the minister. DME operates only at the national level, and therefore there is no provincial competency in approving EIA.

Since the Minerals Act, Act No. 50 of 1991 was repealed, the guideline document for the mining industry, the Aide Memoire, was not carried over or updated. There is therefore no guideline except the specific regulation (R. 527), which might lead to differing interpretation of the requirements.

Although some work has been done to assess the quality of EIR in terms of ECA and a review model adapted to South African conditions has been developed (Moloto, 2005; Sandham & Pretorius, 2007), thus far, no research has been done to assess the quality of EIRs in the mining industry, and no model exists to test its quality.

2.5 Methodology

2.5.1 The Lee and Colley review package

Although there are other review packages available, such as the Dutch and Canadian review packages (Harrop & Nixon, 1999), the Lee and Colley package remains one of the most widely used (Glasson *et al.*, 2005; Lee & George, 2000).

The Lee and Colley review package was first developed in 1989 for use in EIR quality review in the United Kingdom, but has since then undergone numerous revisions and refinements for use in EIA and other applications such as SEA (Simpson, 2000). The package was designed to be used not only by academics, but also by the relevant authorities, consultancies and NGO's to assess the quality of EIR in a consistent and methodical manner (Lee & George, 2000).

The review package is arranged into four tiers, in a hierarchical structure as shown in Figure 2:



Figure 2: The hierarchical structure of the Lee and Colley review package (Adapted from: Lee *et al.*, 1999).

The package is arranged into four review areas (Level 3), each of which contains several Review Categories (Level 2). The base of the pyramid (Level 1) contains the most specific criteria to which the EIR must conform. Scores are assigned in the form of symbols that range from A to F, as indicated in Figure 3. These rather than numbers, are used to prevent reviewers from using 'average' to arrive at the overall score for a higher level (Lee *et al.*, 1999).

Scoring	
A	Relevant tasks well performed, no important tasks left incomplete
B	Generally satisfactory and complete, only minor omissions and inadequacies
C	Can be considered just satisfactory despite omissions and/or inadequacies
D	Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies
E	Not satisfactory, significant omissions or inadequacies
F	Very unsatisfactory, important task(s) poorly done or not attempted
NA	Not applicable. The review topic is not applicable or it is irrelevant in the context of this statement
<p>Results are recorded on a collation sheet. Not all criteria are of equal weight, so it cannot be added together, or an average taken. The reviewer must decide which omissions are significant and which not.</p>	

Figure 3: The Lee and Colley review package scoring system (Adapted from: Lee *et al.*, 1999).

2.5.2 Use of the review package

A review is started at the first level, i.e. at the sub-category level. Lee and Colley recommended that at least two independent reviewers work together, each reviewing every EIR. After review, scores should be discussed between them in order to arrive at a consensus score (Lee *et al.*, 1999). The scores for each of the four levels are recorded on a collation sheet (see Figure 4). It is also recommended that observations about each EIR's particular strengths and weaknesses be recorded by the reviewers.

COLLATION SHEET						
Overall assessment						
1	2	3	4			
1.1	2.1	3.1	4.1			
1.1.1	2.1.1	3.1.1	4.1.1			
1.1.2	2.1.2	3.1.2	4.1.2			
1.1.3	2.1.3	3.1.3	4.1.3			
1.1.4	2.1.4		4.1.4			
1.1.5						
1.2	2.2	3.2	4.2			
1.2.1	2.2.1	3.2.1	4.2.1			
1.2.2	2.2.2	3.2.2	4.2.2			
1.2.3		3.2.3	4.2.3			
1.2.4						
1.2.5						
1.3	2.3	3.3	4.3			
1.3.1	2.3.1	3.3.1	4.3.1			
1.3.2	2.3.2	3.3.2	4.3.2			
1.4	2.4		4.4			
1.4.1	2.4.1		4.4.1			
1.4.2	2.4.2		4.4.2			
	2.4.3					
1.5	2.5					
1.5.1	2.5.1					
1.5.2	2.5.2					
1.5.3	2.5.3					

Figure 4: Example of the collation sheet (Source: Lee et al., Colley, 1992).

2.5.3 Adaptation of the Lee-Colley review package for the South African mining EIRs

The Lee and Colley review package was chosen as basis for the Potchefstroom Review Package for the Mining Industry (PRPMI) because it has been extensively used since 1989 (Lee *et al.*, 1999), and because its adaptability, ease of use and consistency is well documented (Barker & Wood, 1999; Moloto, 2005; Rzeszot, 1999; Sandham & Pretorius, 2007; Simpson, 2000).

Level 1 (review sub-categories) contain the detailed criteria that are used to assess the quality of EIR. The Lee and Colley sub-category criteria were compared to the requirements of the South African legislation as presented in R.527 (South Africa, 2004). Using the structure of the legislation as a base, the

review package was adapted and each criterion reassessed for its applicability using the following criteria as indicated in Table 1.

Table 1: Applicability criteria for all levels of the original Lee and Colley model in comparison with South African legislation.

NC	No changes necessary
UWC	Applicable with changes made
NA	Not applicable

Table 2 indicates the applicability of the original criteria as contained in Lee and Colley to South African mining EIA legislation. The collation sheet was adapted to match the newly adapted review package.

Table 2: Applicability review of the review topics in Lee and Colley to South African legislation.

NC = No Change Necessary. UWC = Used With Changes. NA = Not Applicable.

Review area	Review category	Lee and Colley review Package	Applicability assessment
1 Description Of Development, Local Environment And Baseline Conditions	1.1 Description of the development	1.1.1: Purpose and objective	NA
		1.1.2: Design and size	UWC
		1.1.3: Appearance	NA
		1.1.4: Production process	UWC
		1.1.5: Construction materials	NA
	1.2 Site description	1.2.1: Land area mapped	UWC
		1.2.2: Land use demarcated	UWC
		1.2.3: Duration of phases given	UWC
		1.2.4: Number of workers, visitors	NA
		1.2.5: Transport of materials	UWC
	1.3 Waste: types, quantities and disposal	1.3.1: Quantity of waste, energy	NA
		1.3.2: Treatment, handling of waste	UWC
		1.3.3: How waste was obtained	NA

	1.4 Environmental description	1.4.1: Environment mapped	NC
		1.4.2: Environment broadly defined	NC
	1.5 Baseline conditions	1.5.1: Components of environment identified and described. Methodology, uncertainty indicated.	UWC
1.5.2: Existing data used		UWC	
1.5.3: Local land use policies		UWC	
2 Identification And Evaluation Of Impacts	2.1 Definition of impacts	2.1.1: All possible effects described	UWC
		2.1.2: Above describes in terms of humans, life, assets, physical environment and cultural aspects	UWC
		2.1.3: Impacts from non-standard operation considered	UWC
		2.1.4: Deviation from baseline	NC
	2.2 Identification of impacts	2.2.1: Systematic methodology	UWC
		2.2.2: Indication of impact identification methods	UWC
	2.3 Scoping	2.3.1: Inform public and special interest groups	UWC
		2.3.2: Collection of opinions	UWC
		2.3.3: Key impacts identified and investigated	UWC
	2.4 Impact magnitude	2.4.1: Data sufficient for task. Gaps identified.	UWC
		2.4.2: Methods used must be described and be appropriate	UWC
		2.4.3: Predictions quantified	UWC
	2.5 Assessment of impact significance	2.5.1: Significance to community and society distinguished from magnitude	NC
		2.5.2: Significance assessed	UWC
		2.5.3: Choice of standard, assumptions, value systems justified.	NA
3 Alternatives And Mitigation	3.1 Alternatives	3.1.1: Alternative sites: advantages and disadvantages	UWC
		3.1.2: Alternative process	UWC
		3.1.3: If impact is severe, rejected alternative used	NC
	3.2 Mitigation	3.2.1: Mitigation considered for severe impact	NC
		3.2.2: Mitigation include alteration of project	NC
		3.2.3: Effectiveness of mitigation	NC
3.3 Commitment	3.3.1: Record of commitment	NA	
	3.3.2: Monitoring	UWC	
4 Communication Of Results	4.1 Layout	4.1.1: Introduction	NC
		4.1.2: Information logically arranged	NC
		4.1.3: Chapter summaries	NC
		4.1.4: Original sources acknowledged	NC
	4.2 Presentation	4.2.1: Comprehensible to non-specialist	NC
		4.2.2: Technical terms, acronyms defined	NC
		4.2.3: Presented as integrated whole	NC
	4.3 Emphasis	4.3.1: Emphasis given to severe impacts	NC
		4.3.2: Unbiased	NC
	4.4 Summary	4.4.1: Non-technical summary	NC
4.4.2: Summary cover all issues		NC	

No changes were made to the overall structure of the model, although several criteria were moved to other review categories, and several were added,

particularly with regards to public participation. Appendix A contains the complete Potchefstroom Review Package for the Mining Industry (PRPMI) as used in this research.

2.6 Data gathering

Access to information was requested of the DME in terms of the Promotion of Access to Information Act, Act No. 2 of 2000, on the 10th of August 2006. The request was granted on the 29th of August, although notification was only sent in late September.

Access was granted, with limitations; these being that no correspondence between the minister and her delegates would be provided, and that no other person other than the applicant would be given access. Due to these restraints, it was only possible to conduct a limited test of the PRPMI with another competent person present. However, it was deemed sufficient for the purpose. The PRPMI was tested on a sub-sample of four EIRs and slightly modified before being applied to the full sample of 20 EIRs.

The sample of 20 EIRs had all been submitted in accordance with the requirements of the MPRDA, i.e., they were all conducted or amended during 2004. The sample was randomly drawn from the available EIRs and represents a wide selection of mines in the North West Province, including small scale mining of alluvial diamonds, marble and granite quarries of various sized and underground platinum mines. It also represents a relatively large proportion of the approved EIRs in the North West Province. The total of approved EIRs is estimated at 50 to 60 and according to the DME officials, the number pending is close to 300.

The results of the review are presented in Chapter 3.

2.7 Conclusion

EIA is one of the tools used to achieve sustainable development, a concept that is present throughout South African environmental legislation. Although its history is occasionally turbulent, it has emerged as one of the most powerful tools in the quest for sustainable development. As such, numerous systems have been put forward to ensure its effectiveness and to test its quality. One such method is to evaluate the quality of the EIR. In the South African context, some work has been published with regards to the effectiveness of EIA, but thus far nothing has been published concerning the quality of EIRs within the mining sector, and given that the mining sector has its own legislation and is administered by its own dedicated authority, such research is urgently needed. To this end, an EIR quality review package based upon the generic Lee-Colley review package was developed, tested and applied to a sample of 20 approved EIRs. The results generated from the use of this review package are presented in Chapter 3.

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Chapter 3

An appraisal of the quality of mining EIA reports in South-Africa

Article Manuscript

An appraisal of the quality of mining EIA reports

Abstract

In South Africa, matters pertaining to environmental impact assessment are administered by two separate government departments, each with its own set of legislation, regulations and guidelines. Thus far, most research has focussed on the Environmental Impact Assessment (EIA) process under the auspices of the Department of Environmental Affairs and Tourism (DEAT), but none has focussed on the EIA process of the South African mining industry, overseen by the Department of Minerals and Energy (DME). Using the Lee and Colley review package as a basis, a review model specifically tailored to the needs of the mining industry was applied to review the quality of a sample of 20 EIRs. Results reveal that 85% of the sample of EIRs approved by the DME are of an acceptable standard. Review areas 1 and 4 generally scored higher than review areas 2 and 3, which is in line with international norms. It also raised some questions as to the applicability of some aspects of the legislation.

Keywords: EIA, EIR, mining, quality assessment

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In South Africa, matters pertaining to environmental impact assessment are administered by two separate government departments, each with its own set of legislation, regulations and guidelines. Thus far, most research has focussed on the Environmental Impact Assessment (EIA) process under the auspices of the Department of Environmental Affairs and Tourism (DEAT), but none has focussed on the EIA process of the South African mining industry, overseen by the Department of Minerals and Energy (DME). Using the Lee and Colley review package as a basis, a review model specifically tailored to the needs of the mining industry was applied to review the quality of a sample of 20 EIRs. Results reveal that 85% of the sample of EIRs approved by the DME are of an acceptable standard. Review areas 1 and 4 generally scored higher than review areas 2 and 3, which is in line with international norms. It also raised some questions as to the applicability of some aspects of the legislation.

Keywords: EIA, EIR, mining, quality assessment

Introduction

Environmental Impact Assessment (EIA) was first introduced in the USA in 1969 and has since then spread to all corners of the world (Glasson *et al.*, 2005). As one of the most important and well publicised tools to achieve sustainability, EIA has been made mandatory in many countries, from the developed to developing nations (Inter-parliamentary Union, 1997; Wood, 2003). The effectiveness of EIA has also been well documented in various studies (Barker & Wood, 1999; Christensen *et al.*, 2006).

In 1989, the Environment Conservation Act, Act No. 73 of 1989 (ECA), made provision for EIA in South Africa, but it was not until 1997 that a set of regulations was promulgated to govern it - R.1182, R.1183 and R.1184 - and it was not made mandatory until 1998. These regulations contained a list of activities for which EIA was mandatory. Mining activities were excluded from this list. In 1998, the ECA was partially repealed in favour of the National Environmental Management Act, Act No. 107 of 1998 (NEMA) (South Africa, 1998); only sections 21, 22 and 26, together with the regulations promulgated in 1997, remained in force. These were only repealed in 2006 when EIA regulations in terms of NEMA came fully into effect after a lengthy revision process. The NEMA is effectively the umbrella legislation: specific departments may and do have separate sets of legislation such as the Department of Minerals and Energy (DME) and the Department of Water Affairs and Forestry (DWAF).

South Africa has a unique system with regards to environmental legislation. In spite of the fact that strong environmental legislation exists, backed by a

powerful governmental department i.e. the Department of Environmental Affairs and Tourism (DEAT), there is nevertheless disunity with regards to certain aspects of environmental management. In 1991, DME introduced their own set of environmental legislation (the Minerals Act, Act 50 of 1991), and published a set of guidelines (the Aide Memoire) for the creation of the so called Environmental Management Programme Reports (EMPR) (South Africa, 1991). The EMPR was a form of EIA, but was largely ineffective because the legal requirements at the time were less stringent than is currently the case, and were rarely enforced (Fourie & Brent, 2006). This legislation was superseded in 2002 with the introduction of the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) of which the section dealing with environmental concerns came into force in 2004 with the introduction of a set of regulations (R. 527) that provide specific guidelines regarding the practise of EIA in the mining industry (South Africa, 2002; South Africa, 2004) and as a consequence the old Aide Memoire became obsolete and was not updated. The new EIA system was a much improved and comprehensive process than the EMPR, but the DME remained as the competent authority.

Since EIA become mandatory in South Africa in 1998, some research has been conducted regarding both the effectiveness of the EIA system and the quality of the reports produced by the EIA system (the EIR) (Moloto, 2005; Sandham & Pretorius, 2007; Wood, 1999). Results so far indicate that, generally speaking, the reports produced by the South African EIA system are of an acceptable standard. This is in line with international findings (Barker & Wood, 1999; Canelas *et al.*, 2004; Geraghty, 1996; Lee & George, 2000).

Thus far, no research could be found regarding the quality of EIR in the South African mining industry. This is a critical gap in the literature, which is the subject of this study. Using the well-established Lee and Colley review package

(Lee & George, 2000; Simpson, 2000), a review package specifically tailored to the South African mining industry was created. This model was then applied to a sample of 20 approved EIRs that had been submitted to the DME after the MPRDA regulations came into effect in 2004.

Materials and methods

1. Package adaptation

The Lee and Colley review package was chosen to serve as basis for the Potchefstroom Review Package for the Mining Industry as it has been in use since 1989 (Lee *et al.*, 1999), and its adaptability, ease of use and consistency is well documented (Barker & Wood, 1999; Moloto, 2005; Pretorius, 2006; Rzeszot, 1999; Simpson, 2000).

Using the structure of the regulations (R.527) as a base, the generic Lee and Colley review package was compared to the regulations and adapted to suit the South African system and the collation sheet was adapted from the original Lee and Colley collation sheet to match the newly developed review package.

(Appendix A contains the complete Potchefstroom Review Package for the Mining Industry).

2. Package use

The Lee and Colley review package is hierarchically arranged with the review subcategories contained in the lowest level. Upon examination of an EIR, a score is awarded ranging from A to F, depending on how well a specific task was performed. The symbols are indicated in Figure 1.

Scoring	
A	– Relevant tasks well performed, no important tasks left incomplete
B	– Generally satisfactory and complete, only minor omissions and inadequacies
C	– Can be considered just satisfactory despite omissions and/or inadequacies
D	– Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies
E	– Not satisfactory, significant omissions or inadequacies
F	– Very unsatisfactory, important task(s) poorly done or not attempted
NA	– Not applicable. The review topic is not applicable or it is irrelevant in the context of this statement
Results are recorded on a collation sheet. Not all criteria are of equal weight, so it cannot be added together, or an average taken. The reviewer must decide which omissions are significant and which not.	

Figure 1: The Lee and Colley review package scoring system (Adapted from: Lee *et al.*, 1999).

The results are then recorded on a collation sheet (see Appendix B).

3. Access to information and review sample

Access to information was requested of the DME in terms of the Promotion of Access to Information Act, Act No. 2 of 2000. Upon receiving permission to access the EIRs, the PRPMI was tested on a sub-sample of four EIRs before the full review of 20 EIRs was conducted.

The 20 selected EIRs had all been submitted in accordance with the requirements of the MRDPA and represent a large proportion of the approved EIRs in the North West Province. The total of approved EIRs is estimated at 50-60, at the time the data was extracted, although according to DME officials, the number pending is close to 300. The review sample covers a wide variety of mines including small scale open cast mining and underground platinum mines.

4. Review methodology

Since it was impossible to obtain sufficient personnel to follow the recommendation of Lee *et al* (1999) that at least two reviewers review every EIR,

the author was initially accompanied by an experienced reviewer to calibrate the reviewer's judgement and to assess the performance of the review package. The reports were reviewed separately and then a consensus discussion was held. While there were some small differences between the two reviewers' allocated scores at the level of sub-categories, these were eliminated as the review moved up the hierarchy, and there were no differences at the level of review areas or overall scores. This was deemed as sufficient to allow further reviews to be conducted by a single reviewer.

Results were recorded on the collation sheet (see Appendix B). A full summary of scores at each of the four levels appears in Table 1. A series of graphs was derived from the tabulated data, indicating the number of EIRs that correspond to each quality level (see Figure 2 in the results and discussion section), for the overall score, each review area and each review category.

Results and discussion

Comparison of national and international data

The results obtained from the use of the new review package are similar to other South African studies concerning EIA (Moloto, 2005; Pretorius, 2006) which show similar patterns of distribution as well as results from outside South Africa, although the uniquely South African practice of having separate governmental departments administer the practise of EIA complicates direct comparison with international results because the separate sets of legislation could be perceived to be in conflict.

A score of C or higher indicates that the EIRs in question are of an acceptable standard. A score of B or higher (see Table 1) indicates that the EIRs are of better than acceptable standard with regards to the Review Area (RA), Review Category or Review Sub-Category. A score of C within a review area, review

category or review sub-category indicates that a certain criterion is just satisfactory. A score of B indicates that a higher standard have been achieved for the particular review area, review category or review sub-category. A large difference between the percentage of EIRs scoring C or better and the percentage of EIRs scoring B or better indicates that a particular review area, review category or review sub-category does not receive due attention. Figure 2 summarises the percentage of EIRs scoring C or higher. A high percentage of EIRs scoring as acceptable or better implies that the relevant authority has been properly equipped to facilitate proper decision-making, which in turn implies that the process of EIA is effective in achieving its goals (Sadler, 1996; Wood, 2003).

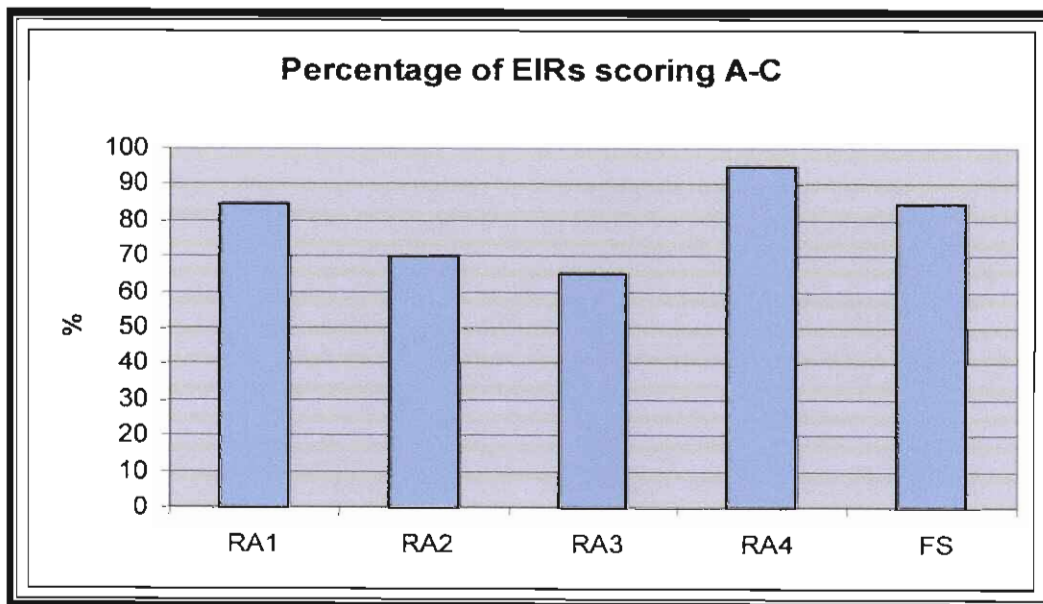


Figure 2: Scores per review area (percentage of EIR scoring C or above). RA1 – Review area 1; RA2 – Review area 2; RA3 – Review area 3; RA4 – Review area 4; FS – Final score.

It was found that EIRs in the mining industry tended to score higher in Review Areas 1 and 4, and lower in Review Areas 2 and 3 (Figure 2), which was also

the case in a comparative study (Barker & Wood, 1999) as well as other international studies (Canelas *et al.*, 2004; Christensen *et al.*, 2006).

Review Area 3 (RA3), concerning alternatives and mitigation, received the lowest overall score of 65% in the range of percentage of EIR scoring C or better while Review Area 2 (RA2), identification and evaluation of key impacts, scored 70%. Although these results are in line with international findings, especially with regards to other emerging economies with recent introduction of EIA (Androulidakis & Karakassis, 2005; Canelas *et al.*, 2004), it is still relatively low in comparison to countries in which EIA has been practised longer.

The relatively poorer performance of RA2 and RA3 in comparison to RA1 and RA4 could be due to the comparative complexities of RA2 and RA3, both of which require not only the study of the environment, but also to make predictions based on scientific data as well as experience on the part of the consultant. Due to this, differences of opinion or skill may begin to play a role in how well an EIR is compiled. The lower number of EIRs receiving a score of C or better could be explained by the legislation which mentions only alternative sites and not alternative processes. This could lead to inconsistent interpretations of the legislation on the part of the consultants. Some reports mentioned alternatives only in terms of location, stating that no alternatives are possible due to the relevant material to be mined only being present on the location under consideration. None mentioned alternative mining methods, and in only three cases were process alternatives considered.

Although the majority of EIRs (85%) are of an acceptable standard, the picture changes when the levels of "acceptable" are broken into A, B and C components.

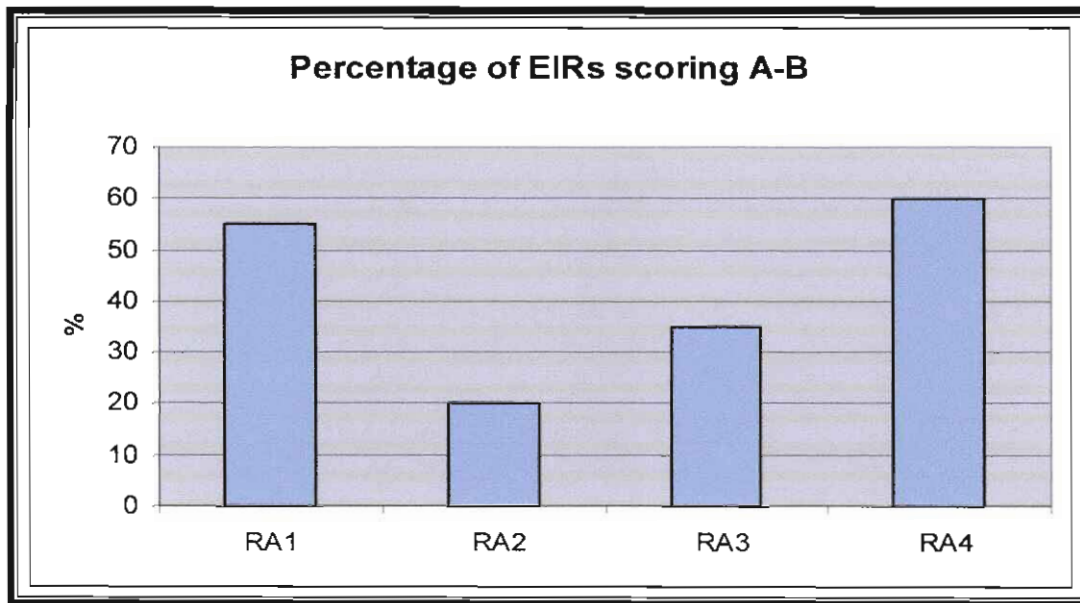


Figure 3: Scores per review area (percentage of EIRs scoring B or better). RA1 – Review area 1; RA2 – Review area 2; RA3 – Review area 3; RA4 – Review area 4.

Figure 3 shows the percentage of EIRs that score B or better. In Review Area 1 and Review Area 4 (RA1 and RA4), more than half the EIRs scored B or better, but in the case of Review Area 2 and Review Area 3 (RA2 and RA3) the percentage drops from 70% and 65% respectively to 20% and 35% respectively, indicating that just enough is being done to satisfy the regulations instead of an intensive effort being made to gather relevant information. These results are further supported in Figure 4. Although 85% of the EIRs subjected to the review package were of an acceptable standard, 45% of them scored a C and only 40% scored B, while none scored an A.

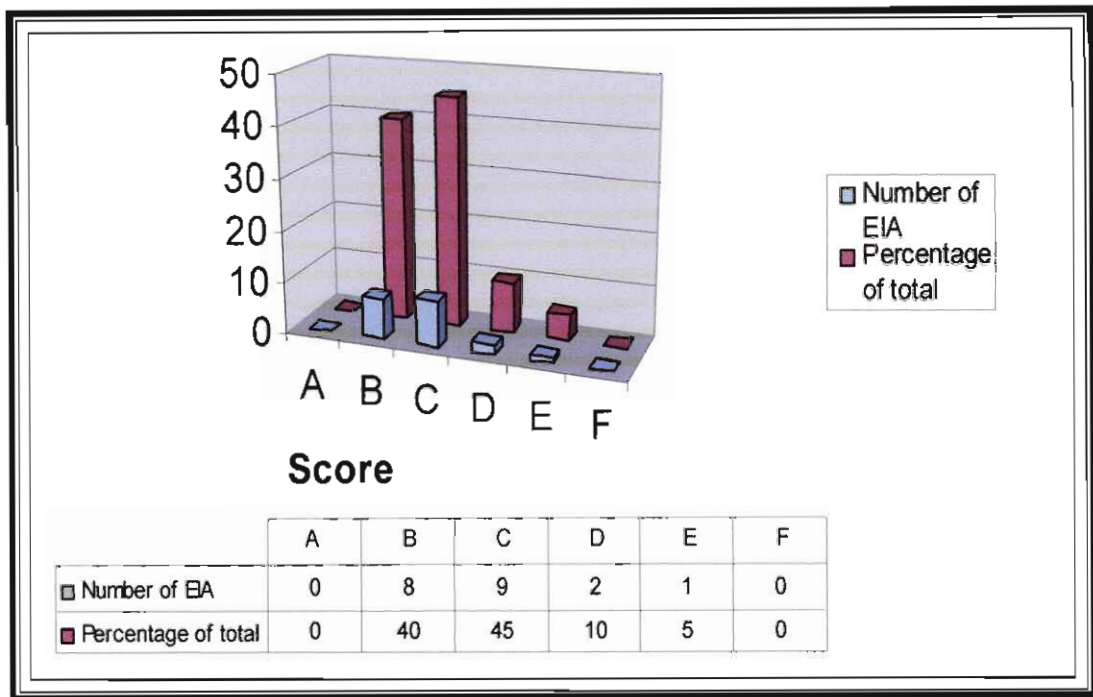


Figure 4: Overall scores. A - Excellent, B - Generally satisfactory, C - acceptable, D - Unsatisfactory, E - Poor, F - did not attempt.

A score of C indicates that an EIR is only just acceptable, i.e. it can therefore be regarded as a marginal score, and could possibly have been scored a D. If the C scores were converted to scores of D, the percentage of acceptable reports changes significantly. Only 40% of EIRs conducted would then be acceptable. A score of D is also marginal, however there are far fewer EIRs that scored a D, and therefore would not significantly alter the percentage of EIRs scoring C or above.

Would the EIA system be considered effective if only 40% of all EIRs conducted were acceptable? EIRs are meant to aid the decision-making process of the relevant authority. If marginal EIRs are produced by the consultants, and accepted by the relevant authority, it underlines the implication that EIRs within the mining industry are produced with the specific intent to satisfy procedure, which is not what the process of EIA has been put in place to

achieve. Informal interviews with officials within the DME revealed that few environmental officers remain with the DME for longer than a year, and that therefore most of the staff evaluating the EIRs are inexperienced. The interviews also revealed a general feeling of overwork due to staff shortages.

Table 1 summarises the complete results gathered, including Review Areas, Review Categories and Review Sub-categories and also indicates the number of EIRs per review area receiving a score of B or better. A decrease in the percentage of EIRs scoring C or above can be observed in all the review areas, but again it is RA2 and RA3 that show the greatest decline.

Table 1: Summary of results: Number of EIRs per review area, review category and review subcategory.

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
RA1	Description of the environment	1	10	6	1	2	0	85	55
1.1	Site description: The on-site land requirements of the development should be described and the duration of each land use indicated.	2	11	4	0	3	0	85	65
1.1.1	The land area taken up by the development site should be defined and its location clearly shown on a map.	12	3	3	1	0	1	90	75
1.1.2	The uses to which this land will be put should be described and the different land use areas demarcated.	15	2	2	0	0	1	95	85
1.1.3	The estimated duration of the construction, operational and where applicable the decommissioning phase should be given.	3	3	7	0	6	1	60	30
1.1.4	The means of transporting raw materials to and from the site should be described.	4	9	3	0	3	1	80	65

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
1.2	Environmental description: The area and location of the environment likely to be affected by the development proposals should be described.	3	7	7	3	0	0	85	50
1.2.1	The environment expected to be affected by the development should be indicated with the aid of a suitable map of the area.	7	6	4	2	0	1	85	65
1.2.2	The affected environment should be defined broadly enough to include any potentially significant effects occurring away from the immediate construction site. These may be caused by, for example, the dispersion of pollutants, infrastructural requirements of the project, traffic, ect.	3	8	7	2	0	0	90	55
1.3	Baseline conditions: A description of the affected environment as it is currently, and as it could be expected to develop if the projects were not to proceed, should be presented.	6	6	5	0	3	0	85	60
1.3.1	The environment should be described in terms of the following: geotechnical aspects, ground water investigation, land use, topography and surface drainage, infrastructure and other man-made features (including sites of potential archaeological value), climate, fauna, flora, soils, surface water, noise and air quality.	10	3	4	1	2	0	85	65
1.3.2	Existing data sources should have been searched and, where relevant, utilised. These should include local authority records and studies carried out by, on behalf of conservation agencies and/or special interest groups.	11	6	1	0	1	1	85	80

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
1.3.3	All other data should be collected as necessary to assist in the determination of the "baseline" conditions, i.e. the probable future state of the environment, in the absence of the project, taking into account natural fluctuations and human activities (often called the "do nothing" scenario).	6	5	5	1	2	1	80	55
RA2	Identification and evaluation of key impacts	0	4	10	5	1	0	70	20
2.1	Identification of impacts: Potential impacts of the development on the environment should be investigated and described. Impacts should be broadly defined to cover all potential effects on the environment and should be determined as the predicted deviation from the baseline state.	0	5	9	5	1	0	70	25
2.1.1	A description should be given of the nature, extent and duration of the identified impacts.	6	7	4	2	1	0	85	65
2.1.2	The above types of effects should be investigated and assessed with regards to impacts on the environment, social impacts and cultural impacts, including cumulative impacts.	0	2	9	5	3	0	55	10
2.1.3	The probability of any impacts occurring should be assessed.	3	5	10	1	1	0	90	40
2.1.4	The impacts should be determined as the deviation from baseline conditions, i.e. the difference between the conditions which would prevail if the development were not to proceed and those predicted to prevail as a consequence of it.	0	5	12	2	1	0	85	25
2.2	Identification of impacts: Methods should be used which are capable of identifying all significant impacts.	2	7	8	1	0	2	85	45
2.2.1	Impacts should be identified by an independent consultant and any lab testing should be carried out by a competent person.	7	7	3	1	0	2	85	70

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
2.2.2	A brief description of the impact identification methods should be given.	3	3	8	4	0	2	70	30
2.3	Scoping: not all impacts should be studied in equal depth. Key impacts should be identified, taking into account the views of interested and affected parties, and the main investigation centred on these.	5	10	2	2	1	0	85	75
Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
2.3.1	There should be genuine attempts to inform interested and affected parties of the proposed development.	15	2	2	1	0	0	90	85
2.3.2	Arrangements should be made to both inform the interested and affected parties and to allow them to participate.	14	3	1	1	1	0	90	85
2.3.3	Participation should take the form of notification in the relevant provincial gazette and/or a local gazette and/or notice in the local magistrate's court as well as in the local office of the DME.	17	0	2	0	0	1	95	85
2.3.4	Public meetings should be held and advertised in the local gazette to allow the public to participate.	9	3	4	1	1	2	80	60
2.3.5	The public participation campaign should be conducted by an independent consultant.	9	8	0	1	0	2	85	85
2.3.6	Key impacts should be identified and selected for more intense investigation. Impact areas not selected for thorough study should nevertheless be identified and the reasons they require less detailed investigation should be given.	8	3	7	2	0	0	90	55
2.4	Prediction of impact magnitude: The likely impacts of the development on the environment should be described in exact terms wherever possible.	0	2	5	6	3	4	35	10

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
2.4.1	Any gaps in the required data should be indicated.	2	0	6	5	0	7	40	10
2.4.2	The methods used to predict the impact magnitude should be described, and its adequacy reported.	0	1	9	5	1	4	50	5
2.4.3	Underlying assumptions and uncertainties encountered in compiling the required information should be noted.	1	3	6	5	0	5	50	20
2.5	Assessment of impact significance: The expected significance that the projected impacts will have for society should be estimated. The rationale, assumptions and value judgements used in assessing significance, should be fully described.	0	10	7	3	0	0	85	50
2.5.1	The significance to the affected community and to society in general should be described and clearly distinguished from impact magnitude. Where mitigating measures are proposed, the significance of any impact remaining after mitigation should also be described.	4	7	7	2	0	0	90	55
2.5.2	Account should also be taken of the magnitude, location and duration of the impact with the principles of sustainability in mind.	1	7	8	3	1	0	80	40
2.6	Wastes: The types and quantities of wastes which might be produced should be estimated, and the proposed disposal routes to the environment described.	6	6	8	0	0	0	100	60
2.6.1	A description of impacts relating to the disposal of waste materials, air pollution, noise management, blasting, vibration and shock - control, soil pollution and erosion and management of stockpiles and deposits should be included where appropriate.	6	6	8	0	0	0	100	60

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
RA3	Alternatives and mitigation	1	6	6	5	2	0	65	35
3.1	Alternatives: Feasible alternatives to the proposed project should have been considered. These should be outlined in the EIR, the environmental implications of each presented, and the reasons for their rejection briefly discussed, particularly where the preferred project is likely to have significant, adverse environmental impacts.	4	5	4	3	2	2	65	45
3.1.1	Alternative sites should have been considered where these are practicable and available to the developer. The main environmental advantages and disadvantages of these should be discussed and the reasons for the final choice given.	5	4	4	3	1	3	65	45
3.1.2	Where available, alternative land use or development and their impacts should be considered.	6	3	5	2	2	2	70	45
3.1.3	Comparative assessments of the identified land use and development alternatives should be conducted.	4	5	4	2	3	2	65	45
3.1.4	If unexpectedly severe adverse impacts are identified during the course of the investigation, which are difficult to mitigate, alternatives rejected in the earlier planning phases should be re-appraised.	3	4	6	2	3	2	65	35
3.2	Scope and effectiveness of mitigation measures: All significant adverse impacts should be considered for mitigation. Evidence should be presented to show that proposed mitigation measures will be effective when implemented.	0	8	8	4	0	0	80	40
3.2.1	The mitigation of all significant adverse impacts should be considered and, where practicable, specific mitigation measures should be put forward. Any residual or unmitigated impacts should be mitigated.	6	9	4	1	0	0	95	80

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
3.2.2	Mitigation methods considered should include modification of the project, compensation and the provision of alternative facilities as well as pollution control.	3	4	8	5	0	0	75	35
3.2.3	It should be clear to what extent the mitigation methods will be effective when implemented. Where the effectiveness is uncertain or depends on assumptions about operating procedures, climatic conditions, etc., data should be introduced to justify the acceptance of these assumptions.	1	4	11	4	0	0	80	25
3.3	Monitoring: A monitoring program must be in place.	6	2	7	4	0	1	75	40
3.3.1	Monitoring arrangements should be proposed to check the environmental impacts resulting from the implementation of the project and their conformity with the predictions within the EIR. Provision should be made to adjust mitigating measures where unexpected adverse impacts occur. The scale of these monitoring arrangements should correspond to the likely scale and significance of deviations from expected impacts.	6	2	7	4	0	1	75	40
RA4	Communication of results	1	11	7	1	0	0	95	60
4.1	Layout: The layout of the EIR should enable the reader to find and assimilate data easily and quickly. External data sources should be acknowledged.	6	8	5	1	0	0	95	70
4.1.1	There should be an introduction briefly describing the project, the aims of the environmental assessment and how those aims are to be achieved.	9	6	4	1	0	0	95	80
4.1.2	Information should be logically arranged in sections or chapters and the whereabouts of important data should be signalled in a table of contents or index.	6	9	3	1	1	0	90	80

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
4.1.3	Unless the chapters themselves are very short, there should be chapter summaries outlining the main findings of each phase of the investigation.	6	7	6	1	0	0	95	65
4.1.4	When data, conclusions or quality standards from external sources are introduced, the original source should be acknowledged at that point in the text. A full reference should also be included either with the acknowledgement, at the bottom of the page, or in a list of references.	8	5	6	0	0	1	85	65
4.2	Presentation: Care should be taken in the presentation of information to make sure that it is accessible to the non-specialist.	2	15	3	0	0	0	100	85
4.2.1	Information should be presented so as to be comprehensible to the non-specialist. Tables, graphs and other devices should be used as appropriate. Unnecessarily technical or obscure language should be avoided.	10	6	4	0	0	0	100	80
4.2.2	Technical terms, acronyms and initials should be defined, either when first introduced into the text or in a glossary. Important data should be presented and discussed in the main text.	4	9	7	0	0	0	100	65
4.2.3	The EIR should be presented as an integrated whole. Summaries of data presented in separately bound appendices should be introduced in the main body of the text.	5	10	4	1	0	0	95	70
4.3	Emphasis: Information should be presented without bias and receive the emphasis appropriate to its importance in the context of the EIA.	0	10	9	0	1	0	95	50

Review Area/category/sub-category	Summary of all review categories	A	B	C	D	E	F	% scoring C or better	% scoring B or better
4.3.1	Prominence and emphasis should be given to potentially severe adverse impacts as well as to potentially substantial favourable environmental impacts. The EIR should avoid according space disproportionately to impacts which have been well investigated or are beneficial.	3	6	9	2	0	0	90	45
4.3.2	The EIR should be unbiased; it should not lobby for any particular point of view. Adverse impacts should not be disguised by euphemisms or platitudes.	1	4	14	1	0	0	95	25
4.4	Executive summary: There should be a clearly written executive summary of the main findings of the study and how they were reached.	4	8	6	1	0	1	90	60
4.4.1	There should be an executive summary of the main findings and conclusions of the study. Technical terms, lists of data and detailed explanations of scientific reasoning should be avoided.	5	8	4	2	0	1	90	65
4.4.2	The summary should cover all main issues discussed in the EIR and contain at least a brief description of the project and the environment, an account of the main mitigation measures to be undertaken by the developer, and a description of any significant residual impacts. A brief explanation of the methods by which these data were obtained, and an indication of the confidence which can be placed in them, should also be included.	4	10	3	2	0	1	85	70

Review Area 1

Review Area 1 summarises three review categories. The aim of this Review Area is to describe the site, the environment in which it is situated and the baseline conditions that prevail. In each of the three categories, 85% of the EIRs received a

score of C or higher. In terms of the review categories the difference between the percentage of EIRs scoring C or above and the percentage scoring B or above ranges between 20 and 35%, a relatively small difference. More than half the EIRs evaluated scored B or above, indicating that this Review Area is relatively well conducted. Several of the sub-categories within review categories 1.1 and 1.3, which focuses on site description and baseline conditions contain a relatively even distribution of scores ranging from A to F. This may be an indication that there may be ambiguity regarding the interpretation of the legal requirement represented by said sub-category, or possibly of a particular attitude among applicants regarding the life and operation of the mine as well as the consideration of possible alternative land uses. Specific review categories that show this distribution pattern include the duration of each phase in the life of the mine (review sub-category 1.1.3), the description of the environment (review sub-category 1.3.1), consulting existing data sources (review sub-category 1.3.2) and the "do nothing" scenario (review sub-category 1.3.3). In terms of the "do nothing" scenario, mining is seen as a fully justified impact due to its contribution to the economy, and therefore the attitude exists that mining should continue as a matter of course, and as a result, certain key points of the EIR is neglected. The relatively poor performance of sub-category 1.1.3 (duration of each phase of the mine) could be due to economic uncertainty as to the future economic viability of a mine, due to fluctuations in mineral prices.

Review Area 2

Review Area 2 (Identification and evaluation of key impacts) summarises six review categories:

- 2.1 Identification of impacts
- 2.2 Methods of identifying impact
- 2.3 Scoping
- 2.4 Prediction of impact magnitude

- 2.5 Impact significance
- 2.6 Wastes

The aim of this Review Area is to identify and evaluate impacts in terms of their significance, as well as to determine the level of public participation. Again, the results are not dissimilar from previous studies indicating conformity to international findings (Moloto, 2005; Pretorius, 2006). The overall score for RA2 is lower than that of RA1, which is in line with both local and international findings (Barker & Wood, 1999; Pretorius, 2006). However, the difference between the number of EIRs scoring C or better and those scoring B or better is significantly larger than that encountered in RA1, with particular reference to review category 2.1 (Definition of impacts) of which a scant 25% of EIRs could be considered better than acceptable. Likewise review category 2.4 (Impact magnitude) where only 10% of EIRs performed well. These areas are critical to the correct functioning of EIA as a tool for achieving sustainable development. Review category 2.3, dealing with scoping and public participation, received a significantly higher score in both the percentage scoring C or higher as well as the percentage scoring B or higher, indicating that this area in particular receives special attention. Due to the exclusion of a large part of the population from participating in public matters in the past, public participation is given prominence within the legislation, which is also reflected in the EIRs, and consistently scores higher than any other review criterion. The distribution pattern of EIRs within the review sub-categories also indicate that particular attention is being paid to this single aspect of EIA. This is yet another indication of an apparent adherence to regulations rather than a genuine attempt to fulfil the goal of EIA. RA2 also shows a far wider diversity of scores than the other Review Areas, with virtually all scores represented within most of the review categories. The distribution of scores ranging from D to F vs. the distribution of scores ranging A to C are virtually equal in some review categories and sub-categories, especially in review categories 2.2 (Methods used to obtain the data)

and 2.4 (Prediction of impact magnitude). The prediction of impact magnitude is one of the key components of EIA, and this is precisely the review category in which the distribution pattern of the number of EIRs per score symbol is most evenly distributed. The majority of EIRs are grouped around C and D, where marginal scores begin to play a role. As one of the key components in EIA, prediction of impact magnitude should ideally be well conducted, and yet the results indicate that this is not the case. The legislation does not specify the methods which may be used and therefore the methods used are to be decided on between the applicant and the consultant, highlighting the critical role the independent consultant plays in the EIA process. To date, there is no accreditation of consultants, nor any criteria for qualifying as a consultant, and therefore this may be a critical weakness within the legislation. Although independence of consultants is required by law, the lack of accreditation means that unqualified individuals may conduct EIA.

Review Area 3

Review Area 3 (Alternatives and mitigation) summarises three review categories:

- 3.1 Alternatives
- 3.2 Scope and effectiveness of mitigation
- 3.3 Monitoring

The aim of this Review Area is to assess the consideration of alternatives, mitigation and monitoring. This Review Area received the lowest overall score and is therefore the one that requires most attention on the part of mining applicants and consultants. Only 65% of all EIRs received a score of C or better and 35% a score of B or better. As previously indicated, RA3 seems to be the area where most ambiguity exists. An evaluation of the graphs for this Review Area (see Appendix D) indicates that the scores are evenly distributed between a score of A and F, supporting this supposition, especially with regards to review category 3.1 which is concerned with the consideration of alternatives (see Table

1). The distribution pattern of scores within the sub-categories indicates that most EIRs score a C or a D. As such, the difference between scoring a C or a D are marginal. The percentage of EIRs scoring C or above and the percentage of EIRs scoring B or above are not large. Also, the overall score for RA3 indicates that few EIRs scored C or above than with most other review areas. Alternative sites were evaluated in few cases, as indicated in review sub-category 3.1.1. Again, the scores were evenly distributed. Comparative studies of alternative sites (review sub-category 3.1.3) were lacking, possibly due to the perception of alternative sites as irrelevant to due to the fact that the mine must be located where the resource is. Few considered alternative methods of mineral extraction, focussing instead on justifying the extraction method chosen.

Mitigation measures showed an entirely different distribution pattern, with a larger proportion of EIRs scoring C or better, and few scoring below D. The effectiveness of mitigation measures (review sub-category 3.2.3) show that most of the EIRs scored closer to C, possibly indicating that less attention is paid to mitigation, which in turn indicates a lack of depth to the study.

As with RA 2, the difference between EIRs scoring C and better and scoring B and better are significant, especially in the case of review category 3.2 (scope and effectiveness of mitigation), where the difference is 40%. The margin between just acceptable and just not acceptable is very thin. Such large difference between the number of EIRs that are just acceptable and those that are well conducted indicates a worrisome tendency to do just enough to get the mining operation approved rather than a genuine concern for the environment.

Review Area 4

The final Review Area, RA4, evaluates the communication of results and summarises four review categories. All four categories scored high, although

review category 4.4 (Executive summary) was more poorly performed than the other review categories. However, the difference between the number of EIRs scoring C or better and EIRs scoring B or better are once again very high, especially concerning review category 4.3 and 4.4, where the difference is as high as 40%. Although the regulations do not provide guidelines as to the layout and structure of the EIRs, the structures were found to be consistent with the structure of the regulations.

Conclusion

The results show that for this sample, in terms of the review package, EIR quality in the mining industry is of a generally satisfactory standard. Few EIRs scored significantly below acceptable limits in terms of C or better. The results indicate that several key areas do not receive the attention they should, especially the consideration of alternatives, definition of impacts and prediction of impact magnitude. These areas are of critical importance if EIA is to achieve sustainability, although the sustainability of the mining industry has not yet been established. More alarming still is the indication that a large percentage of EIRs are barely of an acceptable standard. Only 20% of all EIRs reviewed scored B or better. This might be an indication that the mining industry may be very compliance-driven, rather than truly committed to the goals of sustainability. The reintroduction of a guideline document outlining the goals of EIA as well as a generic structure for the EIR could possibly contribute to remedying some of the problems. The weaknesses indicated by the results could also be the result of inexperienced or incompetent consultants and ambiguous legislation, as well as understaffing and lack of motivation within the DME. The distribution of results between scores A to F in some Review Areas and review categories compared to the clumped distribution of scores in other Review Areas and categories serves as another indication of possible inexperience on the part of the consultant or more compliance with regulations.

The fact that the results reflect the results of other studies, both nationally and internationally, indicate that although the specific legislation may vary, there is nevertheless conformity to an overall standard of EIA. The quality of EIRs in the South African mining industry also reflect this, an indication that the EIRs conform to internationally accepted standards and that the EIA system is producing generally similar EIRs to international practice. This does not necessarily mean that EIAs in other countries are well performed.

Personal interviews with various DME environmental officers revealed that they consider themselves to be understaffed. Several admitted that the lure of the private sector was very strong. This could create a problem in the future, especially considering that tourism recently for the first time overtook mining in generating income for South Africa. The DME is currently revising their legislation again to bring it in line with the NEMA regulations, and on the 19th of April 2007 released an amended bill for comment (South Africa, 2007). This could mean one of two things: that the DEAT could take over all matters pertaining to the environment, including the mining sector, thus bringing an end to the current fragmentary and disunified system, or it could simply be another revision of the current MPRDA and the DME would continue to remain responsible for mining EIAs. Should the former take place, the implications are numerous: first and foremost is the question whether the DEAT is equipped to handle the extra workload. Furthermore, considering that the bulk of DEAT EIAs are dealt with at the provincial level, this could potentially weaken EIA practice as many mines operate across provincial borders.

The quality review of EIRs is but one method used to evaluate the effectiveness of EIA systems. The results indicate that overall, much more needs to be done,

both within the mining sector and other areas in order to ensure effective EIA practice is South Africa.

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Chapter 4 Conclusion

This study focussed on the evaluation of the quality of EIR in the mining industry. In order to achieve the main objective, a secondary objective, that of creating a new quality review model specific to the mining industry in South Africa had to be developed. A thorough study of the EIA process, its history and its main objectives was conducted to provide a suitable context for the formulation of the specific criteria that would form the basis for the model. This, together with a careful examination of the relevant legislation, provided the information needed to adapt a pre-existing model (The Lee and Colley review package) for use in the South African mining industry.

The use of this model was instrumental in achieving the main goal: that of assessing the quality of EIR in the South African mining industry. The results indicate that, even though 85% of the sample was of an acceptable standard overall, several key areas were being neglected, especially in such crucial areas as the definition of impacts and prediction of impact magnitude. A large proportion of the EIRs evaluated were of marginal quality, and could indicate that, although the regulations are generally adhered to, just enough is being done to satisfy the regulations. Several key weaknesses within the South African practice of EIA were identified, namely, ambiguous legislation, understaffed and under-motivated environmental officers and the lack of accredited and qualified consultants. The lack of accreditation for consultants is a potentially major fault in the EIA system.

The weaknesses within the practice of EIA in the mining industry are not limited to just the mining industry. Both national and international studies support the results, emphasising the need for proper quality review in EIA in order to

achieve the goal of sustainable development. The current EIA system is not perfect. Much work needs to be done in order for the EIA system to be effective. It might also be beneficial to the consultants if the relevant authority were to introduce a guideline document that outlined a generic structure for the EIR, as well as guidelines as to the purpose of EIR so it does not become a mere repetition of form.

Appendix A: The Potchefstroom review package for the mining industry

1. DESCRIPTION OF THE ENVIRONMENT

1.1 Site description: The on site land requirements of the developments should be described and the duration of each land use indicated.

1.1.1 The land area taken up by the development site should be defined and its location clearly shown on a map.

1.1.2 The uses to which this land will be put should be described and the different land use areas demarcated.

1.1.3 The estimated duration of the construction phase, operational phase and, where appropriate, decommissioning phase should be given.

1.1.4 The means of transporting raw materials to and from the site should be described

1.2 Environmental description: The area and location of the environment likely to be affected by the development proposals should be described.

1.2.1 The environment expected to be affected by the development should be indicated with the aid of a suitable map of the area.

1.2.2 The affected environment should be defined broadly enough to include any potentially significant effects occurring away from the immediate

construction site. These may be caused by, for example, the dispersion of pollutants, infrastructural requirements of the project, traffic, etc.

1.3 Baseline conditions: A description of the affected environment as it is currently, and as it could be expected to develop if the project were not to proceed, should be presented.

1.3.1 The environment should be described in terms of the following: geotechnical aspects, groundwater investigation, land use, topography and surface drainage, infrastructure and man-made features (including sites of potential archaeological value) , climate, fauna and flora, soils, surface water, noise and air quality.

1.3.2 Existing data sources should have been searched and, where relevant utilized. These should include local authority records and studies carried out by, or on behalf of, conservation agencies and/or special interest groups.

1.3.3 All other data should be collected as necessary to assist in the determination of the "baseline" conditions, i.e. the probable future state of the environment, in the absence of the project, taking into account natural fluctuations and human activities (often called the "do-nothing" scenario).

2. IDENTIFICATION AND EVALUATION OF KEY IMPACTS

2.1 Identification of impacts: Potential impacts of the development on the environment should be investigated and described. Impacts should be broadly defined to cover all potential effects on the environment and should be determined as the predicted deviation from the baseline state.

2.1.1 A description should be given of the nature, extent and duration of the identified impacts.

2.1.2 The above types of effects should be investigated and assessed with regards to impacts on the environment, social impacts and cultural impacts, including cumulative impacts.

2.1.3 The probability of any impact occurring should be assessed.

2.1.4 The impacts should be determined as the deviation from baseline conditions, i.e. the difference between the conditions which would prevail if the development were not to proceed and those predicted to prevail as a consequence of it.

2.2 Identification of impacts: Methods should be used which are capable of identifying all significant impacts.

2.2.1 Impacts should be identified by an independent consultant and any lab testing should be carried out by a competent person.

2.2.2 A brief description of the impact identification methods should be given.

2.3. Scoping: Not all impacts should be studied in equal depth. Key impacts should be identified, taking into account the views of interested and affected parties, and the main investigation centred on these.

2.3.1 There should be a genuine attempt to inform interested and affected parties of the proposed development.

2.3.2 Arrangements should be made to both inform the interested and affected parties and to allow them to participate.

2.3.3 Participation should take the form of notification in the relevant provincial gazette and/or a local gazette and/or notice in the local magistrate's court as well as in the local office of the DME.

2.3.4 Public meetings should be held and advertised in the local gazette to allow the public to participate

2.3.5 The public participation campaign should be conducted by an independent consultant.

2.3.6 Key impacts should be identified and selected for more intense investigation. Impact areas not selected for thorough study should nevertheless be identified and the reasons they require less detailed investigation should be given.

2.4 Prediction of impact magnitude: The likely impacts of the development on the environment should be described in exact terms wherever possible.

2.4.1 Any gaps in the required data should be indicated.

2.4.2 The methods used to predict the impact magnitude should be described, and its adequacy reported.

2.4.3 Underlying assumptions and uncertainties encountered in compiling the required information should be noted.

2.5 Assessment of impact significance: The expected significance that the projected impacts will have for society should be estimated. The rationale, assumptions and value judgements used in assessing significance, should be fully described.

2.5.1 The significance to the affected community and to society in general should be described and clearly distinguished from impact magnitude. Where mitigating measures are proposed, the significance of any impact remaining after mitigation, should also be described.

2.5.2 Account should also be taken of the magnitude, location and duration of the impact with the principles of sustainability in mind.

2.6 Wastes: The types and quantities of wastes which might be produced should be estimated, and the proposed disposal routes to the environment described.

[NB: Wastes include all residual process materials, effluents and emissions. Waste energy, waste heat, noise etc. should also be considered.]

2.6.1 A description of impacts relating to the disposal of waste materials, air pollution, noise management, blasting, vibration and shock – control, soil pollution and erosion and management of stockpiles and deposits should be included where appropriate.

3. ALTERNATIVES AND MITIGATION

3.1 Alternatives: Feasible alternatives to the proposed project should have been considered. These should be outlined in the EIR, the environmental implications of each presented, and the reasons for their rejection briefly discussed, particularly where the preferred project is likely to have significant, adverse environmental impacts.

3.1.1 Alternative sites should have been considered where these are practicable and available to the developer. The main environmental advantages and disadvantages of these should be discussed and the reasons for the final choice given.

3.1.2 Where available, alternative land use or development and their impacts should be considered.

3.1.3 Comparative assessments of the identified land use and development alternatives should be conducted.

3.1.4 If unexpectedly severe adverse impacts are identified during the course of the investigation, which are difficult to mitigate, alternatives rejected in the earlier planning phases should be re-appraised.

3.2 Scope and effectiveness of mitigation measures: All significant adverse impacts should be considered for mitigation. Evidence should be presented to show that proposed mitigation measures will be effective when implemented.

3.2.1 The mitigation of all significant adverse impacts should be considered and, where practicable, specific mitigation measures should be put forward. Any residual or unmitigated impacts should be mitigated.

3.2.2 Mitigation methods considered should include modification of the project, compensation and the provision of alternative facilities as well as pollution control.

3.2.3 It should be clear to what extent the mitigation methods will be effective when implemented. Where the effectiveness is uncertain or depends on assumptions about operating procedures, climatic conditions, etc., data should be introduced to justify the acceptance of these assumptions.

3.3 Monitoring: A monitoring program must be in place.

3.3.1 Monitoring arrangements should be proposed to check the environmental impacts resulting from the implementation of the project and their conformity with the predictions within the EIR. Provision should be made to adjust mitigating measures where unexpected adverse impacts occur. The scale of these monitoring arrangements should correspond to the likely scale and significance of deviations from expected impacts.

4. COMMUNICATION OF RESULTS

4.1 Layout: The layout of the EIR should enable the reader to find and assimilate data easily and quickly. External data sources should be acknowledged.

4.1.1 There should be an introduction briefly describing the project, the aims of the environmental assessment and how those aims are to be achieved.

4.1.2 Information should be logically arranged in sections or chapters and the whereabouts of important data should be signalled in a table of contents or index.

4.1.3 Unless the chapters themselves are very short, there should be chapter summaries outlining the main findings of each phase of the investigation.

4.1.4 When data, conclusions or quality standards from external sources are introduced, the original source should be acknowledged at that point in the text. A full reference should also be included either with the acknowledgement, at the bottom of the page, or in a list of references.

4.2 Presentation: Care should be taken in the presentation of information to make sure that it is accessible to the non-specialist.

4.2.1 Information should be presented so as to be comprehensible to the non-specialist. Tables, graphs and other devices should be used as appropriate. Unnecessarily technical or obscure language should be avoided.

4.2.2 Technical terms, acronyms and initials should be defined, either when first introduced into the text or in a glossary. Important data should be presented and discussed in the main text.

4.2.3 The EIR should be presented as an integrated whole. Summaries of data presented in separately bound appendices should be introduced in the main body of the text.

4.3 Emphasis: Information should be presented without bias and receive the emphasis appropriate to its importance in the context of the EIA.

4.3.1 Prominence and emphasis should be given to potentially severe adverse impacts as well as to potentially substantial favourable environmental impacts. The EIR should avoid according space disproportionately to impacts which have been well investigated or are beneficial.

4.3.2 The EIR should be unbiased; it should not lobby for any particular point of view. Adverse impacts should not be disguised by euphemisms or platitudes.

4.4 Executive summary: There should be a clearly written executive summary of the main findings of the study and how they were reached.

4.4.1 There should be an executive summary of the main findings and conclusions of the study. Technical terms, lists of data and detailed explanations of scientific reasoning should be avoided.

4.4.2 The summary should cover all main issues discussed in the EIR and contain at least a brief description of the project and the environment, an account of the main mitigation measures to be undertaken by the developer, and a description of any significant residual impacts. A brief explanation of the methods by which these data were obtained, and an indication of the confidence which can be placed in them, should also be included.

Appendix B:

COLLATION SHEET

1. **ASSESSMENT SYMBOLS:** Use the following symbols when completing the Collation Sheet below.

Symbol Explanation

- A Relevant tasks well performed, no important tasks left incomplete.
- B Generally satisfactory and complete, only minor omissions and inadequacies.
- C Can be considered just satisfactory despite omissions and/or inadequacies.
- D Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies.
- E Not satisfactory, significant omissions or inadequacies.
- F Very unsatisfactory, important task(s) poorly done or not attempted.
- NA Not applicable. The Review Topic is not applicable or it is irrelevant in the context of this Statement.

2. COLLATION SHEET

Overall assessment

1	.....	2	.....	3	.....	4	.....
1.1	.....	2.1	.....	3.1	.....	4.1	.....
1.1.1	.....	2.1.1	.....	3.1.1	.....	4.1.1	.....
1.1.2	.....	2.1.2	.....	3.1.2	.....	4.1.2	.....

1.1.3	.....	2.1.3	.....	3.1.3	.....	4.1.3	.....
1.1.4	.....	2.1.4		3.1.4	.....	4.1.4	.....
1.2	.....	2.2	.....	3.2	.....	4.2	.....
1.2.1	.....	2.2.1	.....	3.2.1	.....	4.2.1	.....
1.2.2	.....	2.2.2	.....	3.2.2	.....	4.2.2.	.....
				3.2.3	.....	4.2.3	.....
1.3	.....	2.3	.....	3.3	.....	4.3	
						
1.3.1	.....	2.3.1	.....	3.3.1	.....	4.3.1	
						
1.3.2	.....	2.3.2	.....			4.3.2	
						
1.3.3	.....	2.3.3	.....			
		2.3.3	.....			
		2.3.4	.....			
		2.3.5	.....			
		2.3.6	.....			
		2.4	.....			4.4	
						
		2.4.1	.....			4.4.1	
						
		2.4.2	.....			4.4.2	
						
		2.4.3	.....			

2.5	.....
2.5.1	.....
2.5.2	.....
2.6	.....
2.6.1	.....

Overall Quality

Assign an assessment symbol (A, B, C, D, E or F) to the environmental impact report as a whole and summarise, in one or two paragraphs, its main strengths and weaknesses indicating any key deficiencies which would need correction to bring it up to a satisfactory ('C' or above) standard.

This Report was reviewed (delete as appropriate):

- as a self-contained document;
- with additional planning material.

What, if any, additional planning material was used in assessing the quality of the Report?

Appendix C:

Intended journal of publication and guidelines for authors

The South African Geographical Journal

Information for contributors

The South African Geographical Journal considers publication of original material on all aspects of geography, physical and human, with particular reference to southern Africa. Material published includes peer-reviewed research papers, review articles on specific topics of geographical interest short research notes and book reviews. The major requirement for publication is the significance of the work for the development of geography and geographers. Authors receive a complimentary copy of the Journal and 25 reprints free of charge; additional reprints may be ordered on request.

The full length should not normally exceed 7500 words in length. Manuscripts should be typed double-spaced with wide margins, and must be submitted in triplicate. The title, the author's name(s) and affiliation(s) should appear on a separate sheet. Original positives of all figures, together with photocopies of figures to accompany the two reviewer copies of the text, must accompany all submissions. All figures should be sized to fit either a double or single column of the journal when reproduced full size, or reduced by a factor of two. Computer-generated graphics are acceptable only if they are of comparable quality to those produced conventionally; linework must be clear and readily reproducible, and computer characters should be of high quality with typeset lettering. Figures will be reviewed by the Cartographic Advisor, and those not meeting the required standards will be returned for revision.

Submissions should be accompanied by an indication of word length and by the statement that the paper has not been submitted elsewhere for publication.

Copyright of papers in the Journal will be vested in the society.

Appendix D

Additional Figures

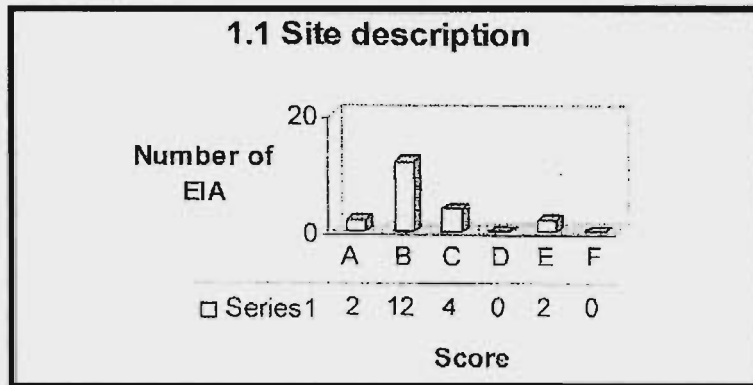


Figure 1: Review category 1.1: Distribution of EIR scores

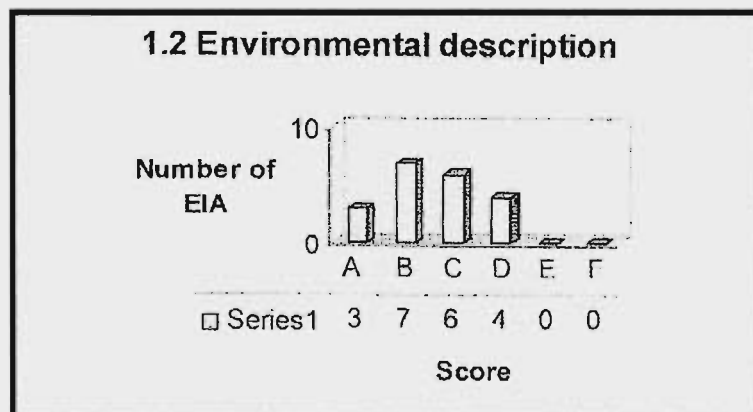


Figure 2: Review category 1.2: Distribution of EIR scores

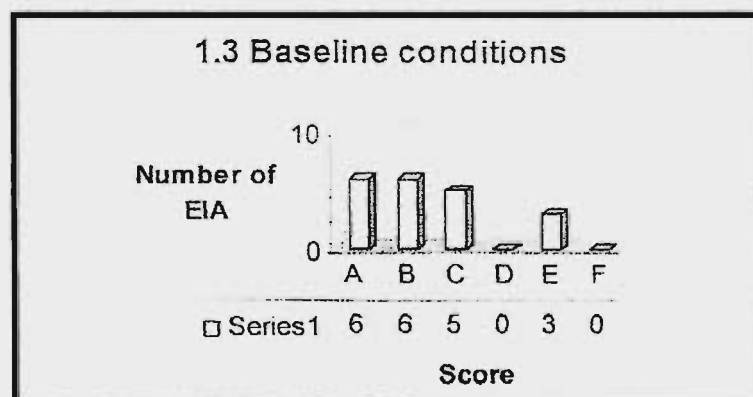


Figure 3: Review category 1.3: Distribution of EIR scores

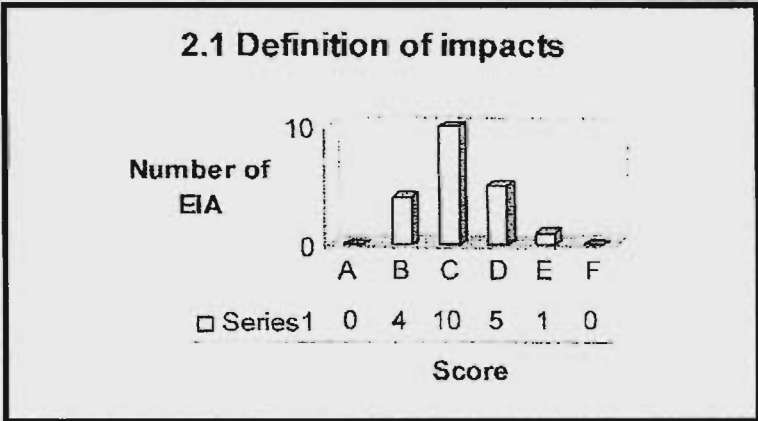


Figure 4: Review category 2.1: Distribution of EIR scores

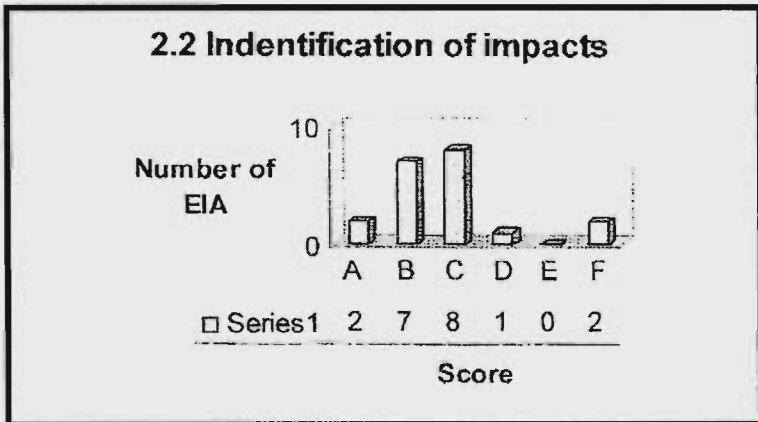


Figure 5: Review category 2.2: Distribution of EIR scores

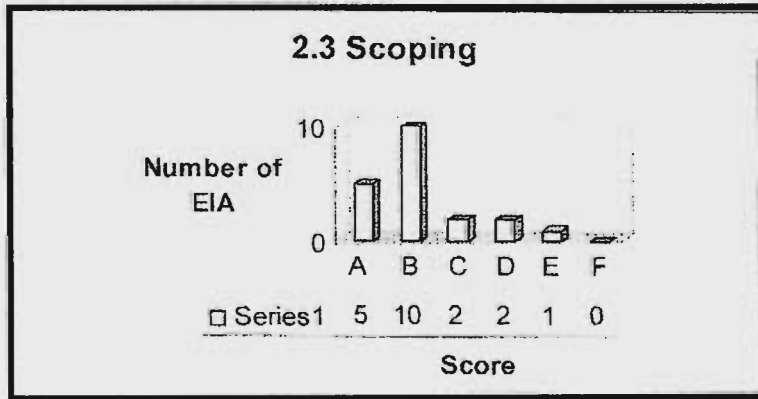


Figure 6: Review category 2.3: Distribution of EIR scores

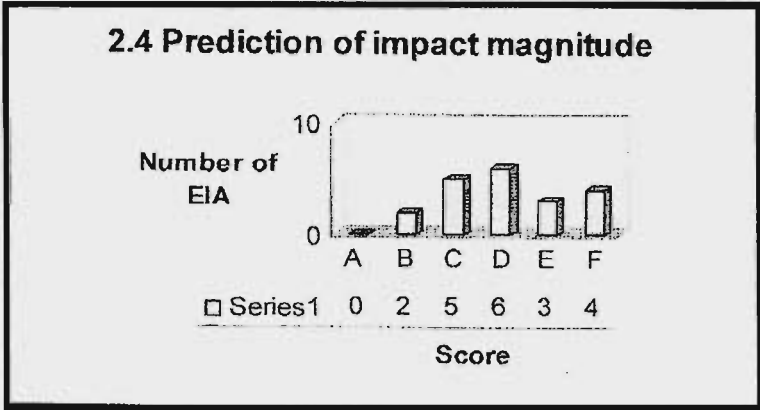


Figure 7: Review category 2.4: Distribution of EIR scores

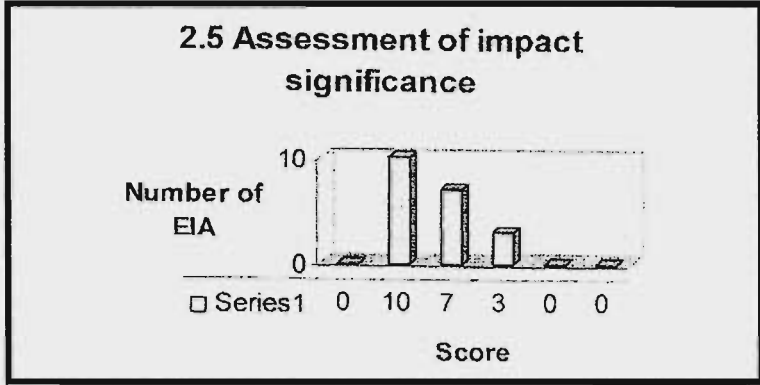


Figure 8: Review category 2.5: Distribution of EIR scores

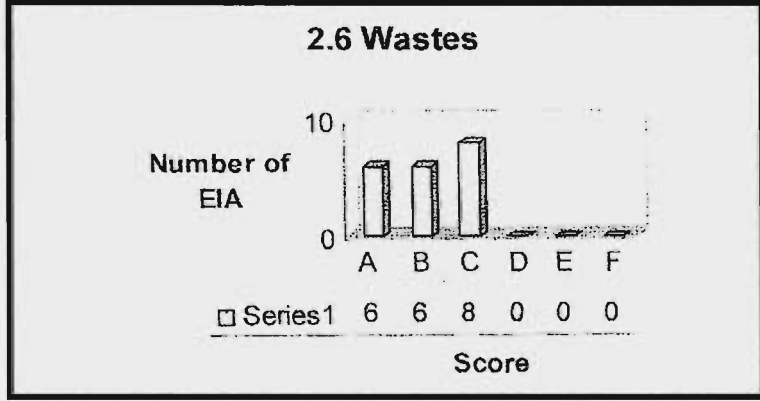


Figure 9: Review category 2.6: Distribution of EIR scores

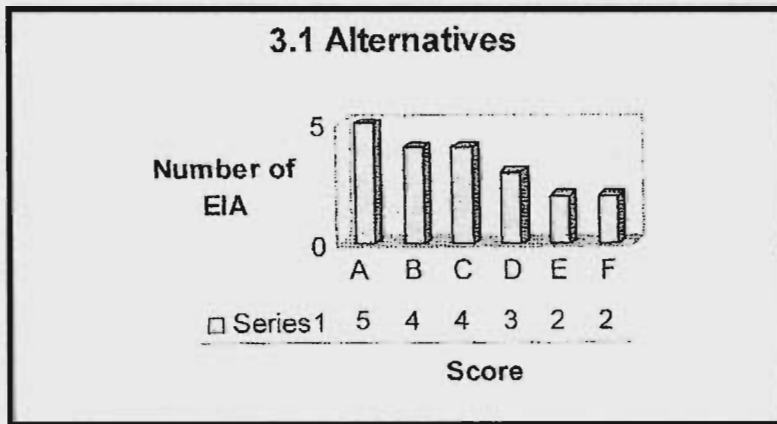


Figure 10: Review category 3.1: Distribution of EIR scores

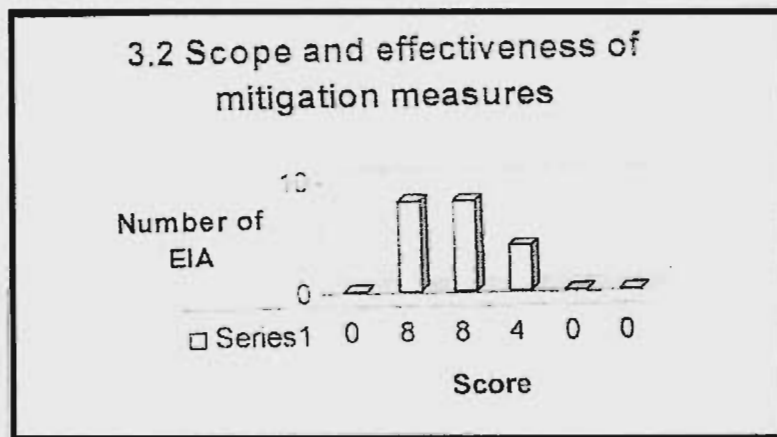


Figure 11: Review category 3.2: Distribution of EIR scores

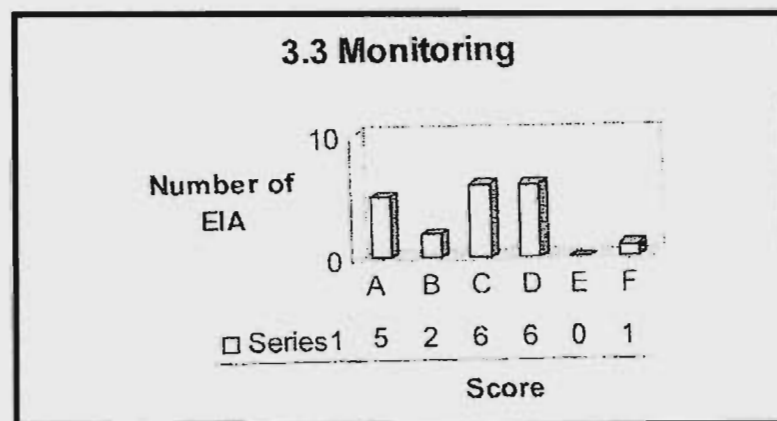


Figure 12: Review category 3.3: Distribution of EIR scores

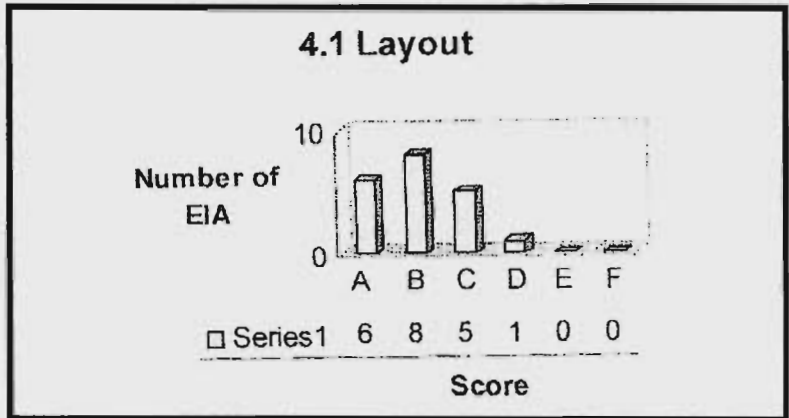


Figure 13: Review category 4.1: Distribution of EIR scores

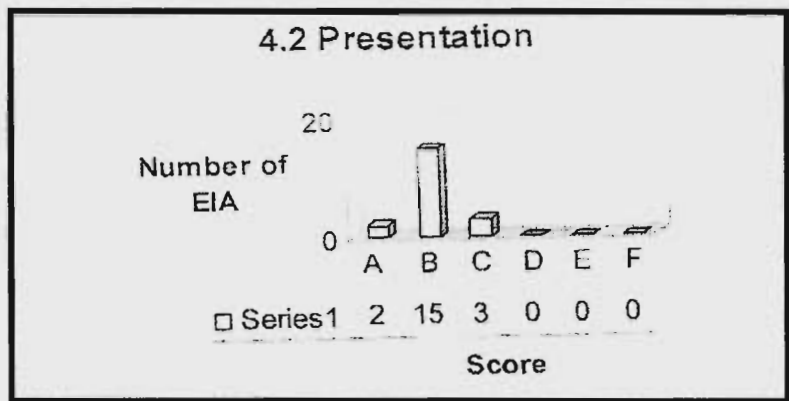


Figure 14: Review category 4.2: Distribution of EIR scores

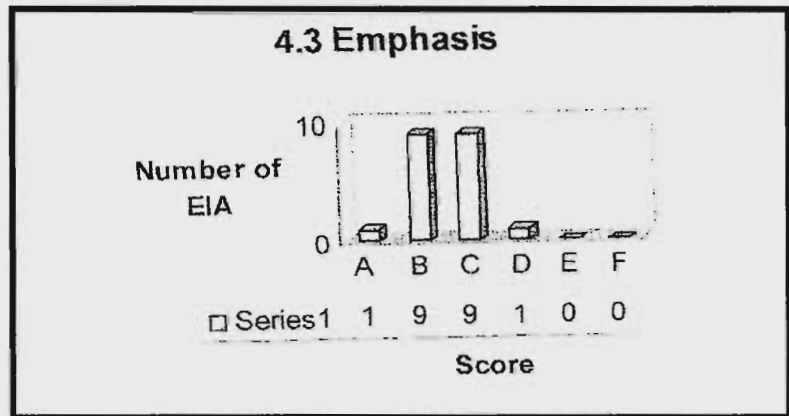


Figure 15: Review category 4.3: Distribution of EIR scores

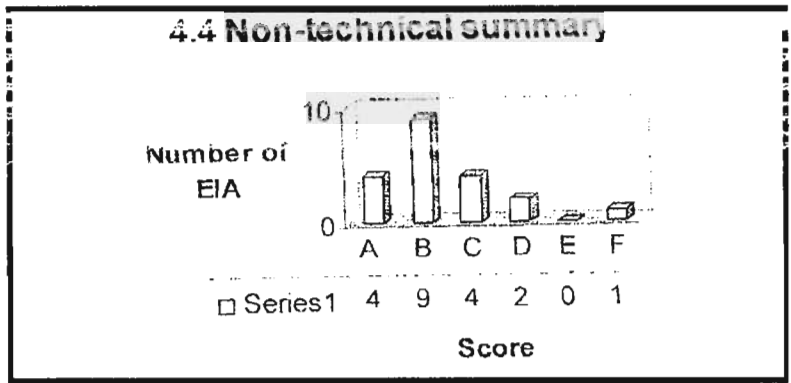


Figure 16: Review category 4.4: Distribution of EIR scores