The improvement of Environmental Impact Assessment Report quality for Solar Photovoltaic projects in South Africa

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List of Acronyms

DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DoE	Department of Energy
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	European Commission
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EMPr	Environmental Management Programme
ESRP	Environmental Statement Review Package
GHG	Greenhouse Gas
I&AP	Interested and Affected Parties
MWp	Mega Watt peak
NEMA	National Environmental Management Act
NWU	North West University
PV	Photovoltaic
RA	Review Area
RC	Review Categories
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RSC	Review Sub-Categories

Definitions

Environmental Impact Assessment	*"is a process for assessing the environmental impacts of development actions in advance."* Glasson & Therivel, 1997
Environmental Impact Assessment Report (EIAR)	*"presents the information collected during the assessment process and the subsequent analysis and interpretation of that data. Its aim is to aid the decision about the project's implementation. The ES should also identify any assumptions, premises and techniques used in the analysis."* Gray & Edward-Jones, 1999
Independent Power Producers	*"producers of power (electricity), who sell their power to electricity distributors for supplying to the national electricity grid."* Department of Minerals and Energy (DME), 2004
Photovoltaic (PV)	*"relates to cells made from semi-conductor materials that are able to release electrons when exposed to solar radiation (sunlight) by using the photo-electric effect."* Department of Environmental Affairs (DEA), 2015
Renewable Energy (RE)	*"energy that comes from sources that are continually replenished, such as sunlight, wind, rain, tides, waves and geo-thermal heat"* Department of Environmental Affairs (DEA), 2015

Key Words

Quality
Improvement
Environmental Impact Assessment Report
Photovoltaic Solar projects
South Africa
Lee & Colley review package

Abstract

The quality of Environmental Impact Assessment Reports (EIARs) plays a critical role in a well-functioning Environmental Impact Assessment (EIA) system as EIARs are the key tool used by decision makers. Several studies have been conducted locally and abroad regarding the quality of EIARs across various sectors. This research presents the results of a comparative analysis of the report quality of EIARs between 2011 and 2017, compiled for Solar PV projects in South Africa. The aim of the study was to determine whether report quality for such projects improved over the stipulated timeframe.

In order to do so, the Lee & Colley review package was adapted to the South African context and used to evaluate seven EIARs. The outcome of the study suggests minor improvements in EIAR quality for Solar PV projects over time. In particular, it was found that the methodology used and quantification of information (magnitude/significance) improved over the years. The two main contributing factors identified were the experience of environmental assessment practitioners (EAPs) that conducted the studies, and the introduction of environmental legislation, such as Environmental Impact Assessment (EIA) regulations and/or sectoral guidelines.

Vir Bennie, CG en Gideon

1. Introduction

1.1 Problem statement

The concept of quality environmental impact assessment reports has become increasingly important in an effort to contribute to sustainable, responsible decision making regarding development. Morgan (2012:11) found that there is a "significant gap" between theoretical best practice and actual Environmental Impact Assessment Reports (EIARs) produced. The importance of EIAR quality links back to the core function of Environmental Impact Assessment (EIA): to achieve sustainable development (Samarakoon & Rowan 2008:441 & Barker & Wood, 1999:387).

The intention to achieve sustainable development lies at the heart of environmental authorisation. EIARs are often the only tool decision-makers use when considering an application. Good quality EIARs lend themselves to good decision making and greatly improves the effectiveness of the EIA process (Pölönen, 2006 and Sandham & Pretorius, 2008:229). It is therefore important that the report is comprehensive, objective and truthful (Gray & Edward-Jones, 1999:2), providing all the relevant information with regards to the project. The measurement of quality is essential to ensure a well-functioning EIA system.

Barker and Wood (1999:395-396) identified several factors that influence EIA report quality. These included the date of an EIA, experience of various role-players and EIA legislation. Studying EIAs in eight European Union countries they found report quality increased from 50% to 71% between 1190 – 1991 and 1994 - 1996.
Several articles and dissertations have studied the quality of EIA reports in South Africa (Boshoff, 2013; Sandham et al., 2010; Sandham et al., 2008a; Kruger, 2012; Laven, 2017; Mbhele, 2009; Sandham et al., 2008b; Sandham & Pretorius, 2008 and Sandham et al., 2013a). However, there exists a definite gap in the local literature regarding the quality of EIA reports for PV power projects in South Africa (SA). Kadir and Momtaz (2014:1596) argue that it is imperative to determine the quality of EIAR in a specific sector in order to determine sectors where more intervention is required in order to improve EIA performance.

In addition, limited research (with the exemption of Sandham et al., 2013b) exists that measures the improvement of South African report quality over a certain time. This study will address these shortcomings in the existing literature through a critical evaluation of report

quality for Solar PV projects between 2011 and 2017, measuring specifically whether report quality improved over time.

South Africa is traditionally dependent on coal fuelled power generation, despite experiencing some of the highest levels of solar radiation internationally (South Africa, 2015:15). However, following the international trend of incorporating more sustainable, renewable energy sources in the national grid, SA launched the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in 2011. The aim of the programme is to increase renewable energy production in the country through various technologies.

As part of this Programme, approximately 1129 EIARs for renewable energy projects were submitted to the Department of Environmental Affairs by April 2017 (South Africa, 2016). Since renewable energy projects are a fairly new development in South Africa, it stands to reason that many of these EIARs were pioneer work within the South African context. Although renewable energy projects tend to have a smaller environmental impact than fossil fuel power generation, there are still adverse impacts related to these projects that need to be considered and addressed (Sokka et al., 2016:1600-1605). It is assumed that relevant role-players (EAPs and decision makers) would be more familiar with these impacts as the number of projects increased over time and new information regarding Solar PV plants were made available (for example the EIA Guidelines for Renewable Energy Projects, published by the Department of Environmental Affairs [DEA] in 2015).

In addition, since the initiation of the REIPPP Programme, new EIA Regulations and listing notices were promulgated in 2014 (South Africa, 2014) with the aim to improve EIA efficiency in general in South Africa. Given the departmental regulations and policies listed above, and the general learning curve over seven years, the question can be posed whether report quality for PV projects improved since the inception of the REIPPPP.

Based on the observations by Barker and Wood (1999), it is assumed that the report quality of EIARs to be scrutinised as part of the case studies, should improve over time. It is assumed that relevant role-players (Environmental Assessment Practitioners who compile reports and officials who review them and provide feedback) would be more experienced in 2017 than 2011.

1.2 Research aim and objectives

Based on the problem statement above the following statement serves as the research aim of this study:

Using an adapted Lee and Colley review package, investigate whether EIA report quality for Solar PV projects in South Africa improved between 2011 and 2017.

In order to achieve the aim of the research the following objectives need to be met through the study:

1. To adapt the Lee and Colley review package to the South African context.
2. To review selected Solar PV EIA reports from 2011 - 2017 using the adapted Lee and Colley review package.
3. To identify strengths and weaknesses in Solar PV EIARs.
4. To analyse and compare the improvement of report quality between 2011 and 2017.

1.3 Basic hypothesis

The main hypothesis is that the quality of reports should improve over the seven year timeframe, as consulting companies/Environmental Assessment Practitioners (EAPs) gain experience in the field of Solar PV projects and new legislation/guidelines are introduced regarding environmental assessments (Landim & Sánchez, 2012:225).and Barker & Wood, 1999:395-396).

1.4 Structure of the mini-dissertation

The study comprised of the following chapters and phases:

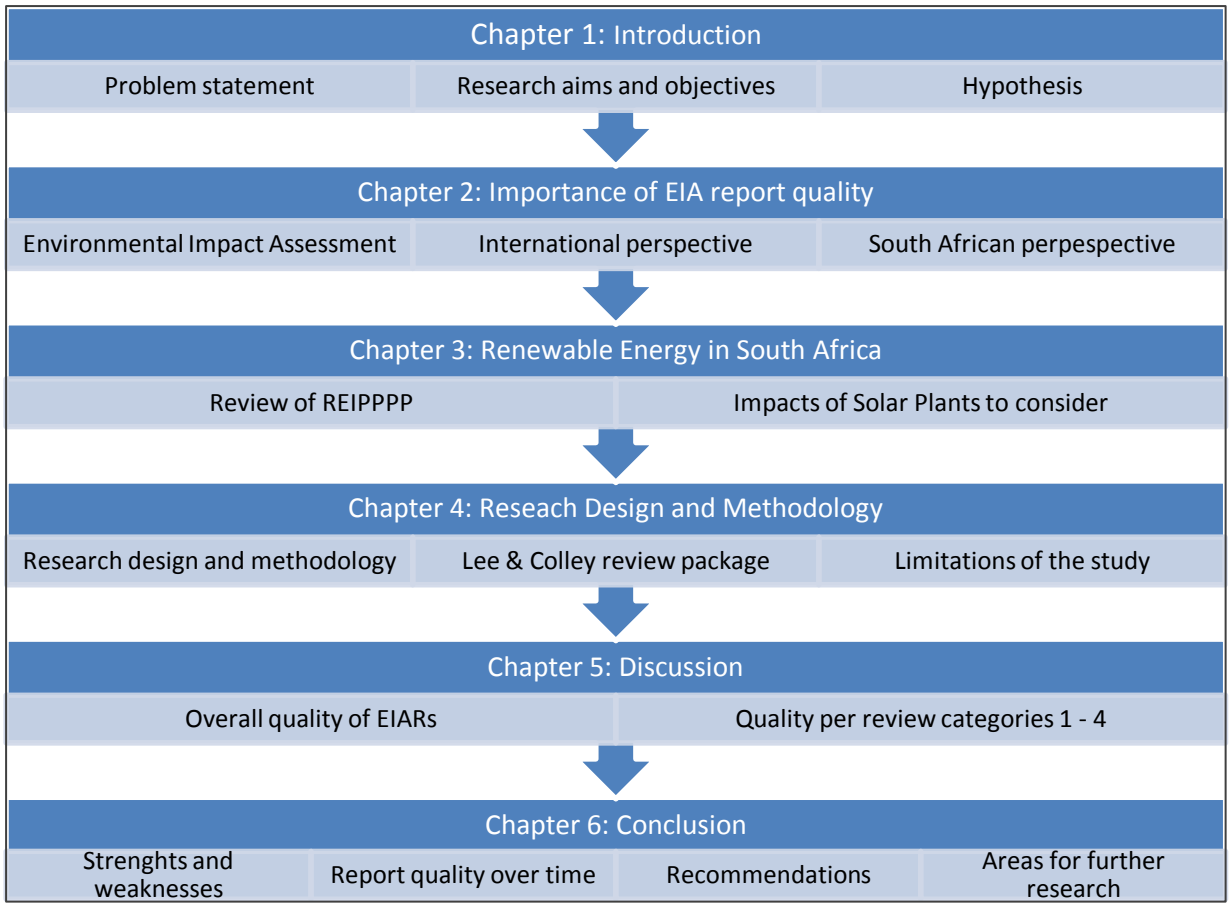

Figure 1: Structure of mini dissertation

Source: Own creation, 2018.

2. Importance of EIA report quality

1.1 Introduction

"It is routine and wholly correct to say that one should incorporate into any research project a systematic review of previous research on the subject" (Vogt et al., 2012:89)

The aim of this chapter is to provide a brief overview of literature regarding the quality of EIARs and the improvement of these reports over the years, both internationally and nationally. In order to do so, the nature of EIA will be discussed, along with a summary of previous studies regarding the quality of EIARs.

2.2 Environmental Impact Assessment

> *"Environmental impact assessment is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from a major activity (policy, plan, program, or project) that are likely to have significant environmental effects. It is anticipatory, participatory, and systematic in nature and relies on multidisciplinary input" (Barker & Wood, 1999:387)*

In order to fully comprehend the importance of report quality, the goal of an Environmental Impact Assessment must first be understood. At its core, EIA is a tool that aims to achieve sustainable development (Samarakoon & Rowan, 2008:441 and Barker & Wood, 1999:387) by informing decision making before project implementation (Gray & Edward-Jones, 1999:2, Jay et al., 2007:288 and Peterson 2010:169). According to Morrison-Saunders and Retief (2012:34), "*EIA is employed in nearly all countries of the world*". Fonseca et al. (2016:90) agree that EIA is the most widespread environmental tool which plays a vital role in environmental assessment, the world over.

According to UNEP (2002:103) the purpose of an EIA report is threefold. Firstly, reports aid decision making by the relevant authority. Secondly, reports provide the public with information regarding the likely impacts of the proposed development, and thirdly, reports help the proponent to mitigate/manage likely impacts.

Therefore, it is important for the conclusions of an EIA to be unbiased and rigorous (Bojo´rquez-Tapia & Garcia, 1998:218). A thorough EIA report includes (Bojo´rquez-Tapia & Garcia, 1998:233)

- all relevant information regarding a development
- both positive and negative expected impacts
- mitigation measures to minimize above mentioned impacts

Badr et al. (2011) and Kabir and Momtaz (2014:1595) argue that EIAR quality is an indication of the effectiveness of the EIA system. As such, it is important to review EIARs in order to identify strengths and weaknesses. A popular method to determine the quality of EIARs is through the use of a review package such as the Lee and Colley package. The package has been successfully applied to several international and local studies (as discussed in the following sections) and forms the basis of this study. The Lee and Colley package is discussed in more detail in Chapter 4. The following section highlights the importance of EIAR quality, as seen in international and local literature.

2.1.2 Quality of Environmental Impact Assessment Reports

"Quality EIS is the kind that gives, primarily to the decision maker but also to other interested parties, all information about EIA that (supposedly) is important for decision-making"

Põder and Lukki (2011:29)

In order to establish quality, it is important to know what constitutes a complete and meaningful EIA report. The following aspects are agreed upon throughout the literature as characteristics of a good EIAR:

- *A clear structure including baseline conditions, predicted impacts and proposed mitigation*
- *Description of relevant EIA procedures*
- *Reads as a single document*
- *Succinct, comprehensive*
- *Objective, without bias*
- *Complete overview of development proposals*
- *Uses graphic information to support text*
- *Contains a glossary*
- *Contains complete reference list*
- *Explains complex issues*
- *Clearly describes methodology used*
- *Provides evidence of public participation Indicates and discusses alternatives*
- *Includes mitigation and monitoring methods*
- *Includes a non-technical executive summary*

Figure 2: Characteristics of a good EIA report

Source: Own Creation, 2016, based on Bonde and Cherp, 2000:101; EC, 2001:13; DEAT, 2004:12 & Lee et al., 1999:19.

Gray and Edward-Jones (1999:2) argue that EIAs are of little value if the validity and impartiality of the data provided in the report are not verified. Therefore, there exists a need to measure the quality of reports submitted in order to establish whether they are credible. Gray and Edward-Jones (1999:2-3) argue that reviewing EIARs in turn:

- ascertain the completeness of the environmental assessment
- assess the accuracy and validity of information presented
- familiarize reviewers with the project and location
- determines whether further assessment is required
- assesses the significance of the effects of the proposal.

2.3 International perspective on EIA report quality

"Quality control of the EIA process therefore became something of a preoccupation of EIA professionals." Cashmore et al. (2002:372)

The quality of EIA reports has become a popular discussion in the field of environmental management in recent years (Kagstrom, 2016:169). Due to the importance of the EIAR in the EA process various studies have been conducted internationally regarding the quality of EIARs across various sectors. As previously discussed, international studies (Bojo´rquez-Tapia & Garcı´a, 1998:236 and Barker & Wood, 1999:395-396) found that EIAR quality tended to improve over time. The findings of several other studies are briefly discussed below:

South America

EIA in Brazil started in 1970 due to pressure from the World Bank and became a mandatory requirement for environmental licensing in 1983 (Fonseca et al., 2016:91). Landim and Sánchez (2012) analysed the contents of 9 EIARs produced by the same consulting firm in Brazil for mining and quarrying projects between 1987 and 2010. The study (2012:224) found an improvement in the quality of reporting over time, specifically in the following fields:

1. graphical presentation
2. project description
3. baseline studies
4. impact identification
5. mitigation and environmental management plans

It was found that the discussion of alternatives did not significantly improve over time, however, and that preference was given to the justification of the proponent's preferred alternatives.

Following interviews with regulators and consultants the study also provided possible driving factors behind the improved quality as follows:

1. increased capacity at consulting firms
2. *the adoption and implementation of policies or standards by project proponents*
3. *improvements in relevant legislation*
4. *more specific terms of reference provided for EIARs and*

5. *the mandatory provision of supplementary information* Landim and Sánchez (2012:225).

Europe

Jalava et al., (2010:25) examined the quality of 15 EISs in Finland using the input of competent authorities and environmental consultants and the EC Guidance on EIS Review package. Not surprisingly, the study found that consultants regarded the EISs of a higher quality than the regulating authority. This study reinforces the subjective nature of quality review.

Of the 15 reports scrutinised one was deemed good (B), 11 satisfactory (8 B- and 3 C+) and 3 unsatisfactory (2 C- and 1D+). The improvement of quality over time was not measured in this study, but Pölönen et al., (2011:123) indicate that report quality in Finland had improved over recent years. They credit the Finnish liaison authority (a designated EIA authority which coordinates the EIA process and assesses the quality of reports, but does not issue permit decisions) and their emphasis on educating EIA practitioners.

Africa

45 EISs compiled in Egypt between 2000 and 2007 were scrutinised by Badr et al., (2011) using an adapted Lee and Colley Review Package. The reviewers found that 69% (31 reports) of the reports were satisfactory, 35.5% (16 reports) were good and 4.5% (2 reports) were deemed poor (Badr et al., 2011:281). The study also investigated the improvement of report quality over time, but only found a marginal correlation. It is argued that consultants were already well versed with the EIA process at the time of the study and that no external stimuli (e.g. changes to the legislation) were introduced during the timeframe (Badr et al., 2011:283).

Anifowose et al., (2016) in turn evaluated 19 EISs for oil and gas projects in Nigeria between 1998 and 2008 using an adapted Lee and Colley Review Package. They found (2016:578) almost half of the EISs to be unsatisfactory (37% - D and 11 % - E). Ten reports were rated satisfactory (26% - B and 26% - C). The study further investigated the correlation between time and the quality of report quality but could not establish a statistically significant correlation (2016:581).

Asia

40 EIARs across four sectors (infrastructure, industrial, energy and water) in Bangladesh were reviewed by Kabir and Momtez (2014). The study found 10% of reports were Excellent (A), 20% good (B), 35% just satisfactory (C), 25% poor (D) and 10% very poor with no reports having failed (F) (Kabir & Momtez, 2014:1601). The quality of EIARs in the energy sector were found to be inferior to the water and infrastructure sectors. Kabir and Momtez (2014:1604) argue that this is because

- the industry is relatively new in Bangladesh
- projects funded by public agencies do not have sufficient funds to produce high quality studies
- there are no EIA guidelines for the sector

In addition, the authors considered the quality of EIARs over time (1995 – 2015) as seen in Figure 3 below but found no apparent relationship between the quality of reports and the year of publication.

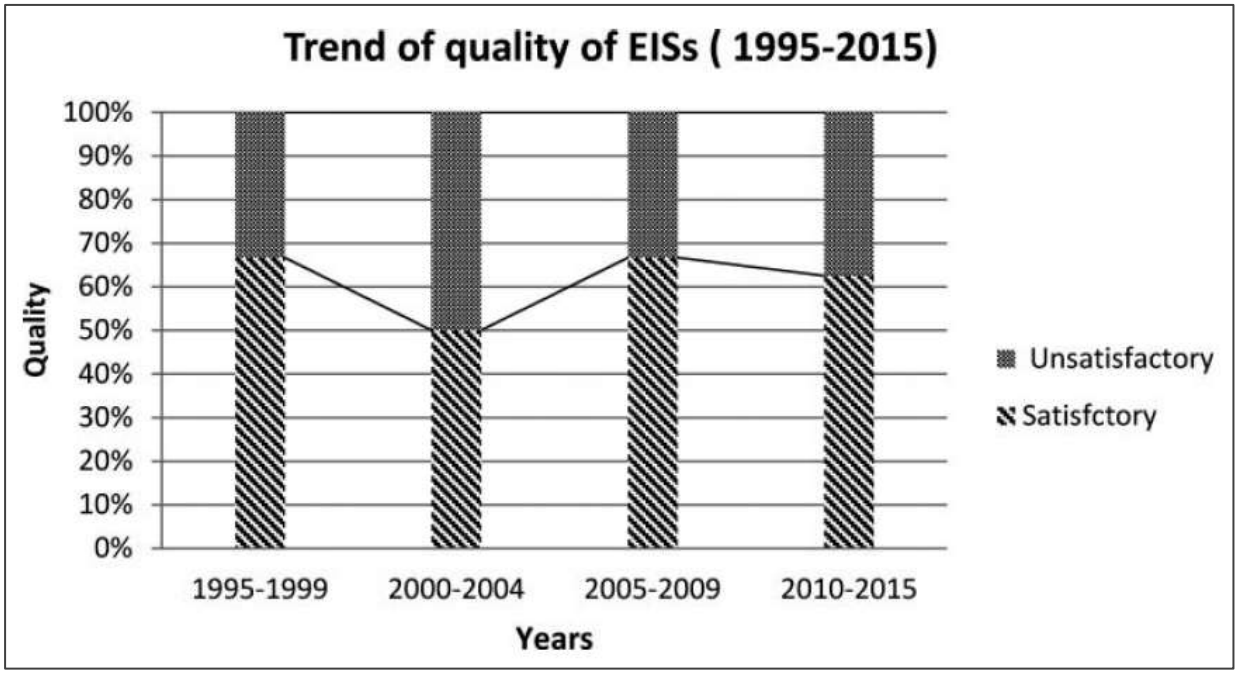

Figure 3: Quality of EIARs in Bangladesh over time

Source: Kabir and Momtez (2014:1605)

Kamijo and Huang (2016:143) in turn evaluated 120 EIARs submitted in Japan between 2001 and 2012, using an adapted Lee and Colley review package. The study (2016:146) found only 35% of reports to be satisfactory (17 – B and 25 – C) and 65% unsatisfactory (63

– D and 15 – E). Results were also analysed in 4 year intervals to determine the effect of guidelines introduced in 2004. It was determined that reports performed better following the introduction of the guidelines with a steady increase in reports scoring B and a steady decrease in reports scoring a D.

It is clear from the above that the quality of EIARs are deemed important internationally and have been studied extensively across the globe. The studies returned mixed results regarding the improvement of quality over time for reports, as seen in Table 1 below, specifically in African countries.

Table 1: International quality of EIARs over time

Study	Landim and Sánchez (2012) Brazil	Jalava et al., (2010) Finland	Badr et al., (2011) Egypt	Anifowose et al., (2016) Nigeria	Kabir and Momtez (2014) Bangladesh	Kamijo and Huang (2016) Japan
Improve-ment over time	YES	NOT CON-SIDERED	NO	NO	NO	YES

Source: Own creation (2018) based on Anifowose et al., (2016), Badr et al., (2011), Jalava et al., (2012), Kabir and Momtez (2014), Kamijo and Huang (2016) and Landim and Sánchez (2012).

The following section scrutinises similar studies conducted in South Africa.

2.4 South African perspective on EIA report quality

South Africa has also produced a wealth of studies regarding the quality of EIARs. From the local literature it is clear that there exists a need to investigate the quality of reports within given sectors. Table 2 below summarises the results of studies conducted over various sectors including (but not limited to) housing projects, waste management and even

renewable energy. A key element lacking in the research below is an indication of the improvement of quality of reports over time.

Table 2: Summary of South African studies regarding EIAR quality

Year	Authors	Sector	Method	Reports evaluated	Results*
2008	Sandham et al.,	Wetlands	Adapted Lee and Colley review package	4	3 – B (75%) 1 – C (25%)
2008	Sandham and Pretorius	North West		32	8 – B (25%) 18 – C (56%) 5 – D (16%) 1 – E (3%)
2008	Sandham et al.,	Mining industry		20	8 – B (40%) 9 – C (45%) 2 – D (10%) 1 – E (5%)
2009	Mbhele	Housing developments in Mpumalanga		15	1 – A (6%) 4 – B (27%) 6 – C (40%) 4 – D (27%)
2010	Sandham et al.,	Biological pest control		6	4 – D (66%) 1 – E (17%) 1 – F (17%)
2012	Kruger	Filling Stations		20	2 – B (10%) 11 – C (55%) 7 – D (35%)
2013	Boshoff	Renewable energy projects		30	5 – B (17%) 16 – C (53%) 8 – D (27%) 1 – E (3%)
2013	Sandham et al.,	Explosive Industry		4	3 – B (75%) 1 – C (25%)
2017	Laven	Waste management projects		10	4 – B (40%) 6 – C (60%)

* Results	
A	**Generally well performed, no important tasks left incomplete**
B	**Generally satisfactory and complete, only minor omissions and inadequacies**
C	**Can be considered satisfactory despite omissions and/or inadequacies**
D	**Parts are well attempted but must, as a whole, be considered unsatisfactory because of omissions or inadequacies**
E	**Not satisfactory, significant omissions or inadequacies**
F	**Very unsatisfactory, important task(s) poorly done or not attempted**

Source: Own creation (2018) based on Boshoff (2013), Kruger (2012), Laven (2017), Mbhele (2009), Sandham et al., (2008a), Sandham et al., (2008b), Sandham et al., (2010), Sandham et al., (2013a) and Sandham and Pretorius (2008).

The majority of the studies identified Review Area 1 and 4 (Description of the development, the local environment and the baseline conditions and Communication of results, respectively) as strengths and Review Area 2 and 3 (Identification and evaluation of key impacts and Alternatives and mitigation, respectively), as weaknesses (Boshoff, 2013; Kruger, 2012; Laven, 2017; Mbhele, 2009; Sandham et al., 2008a; Sandham et al., 2008b; Sandham et al., 2010; Sandham et al., 2013a and Sandham and Pretorius, 2008). However, the study pertaining to renewable energy projects in South Africa by Boshoff (2013) found Review Area 1 and 2 to be the best addressed and Review Area 3 and 4 lacking. The study identified the following strengths and weaknesses across renewable energy EIARs:

Table 3: Strengths and weaknesses of Renewable Energy EIARs

Strengths		**Weaknesses**	
RC 1.1	**Description of the development** ○ Purpose and objectives of the development ○ Nature of the development	**RC 4.4**	**Non-technical summary** ○ Lack of non-technical summaries ○ Summary of main issues
RC 1.2	**Site description** ○ Expected number of visitors	**RC 3.2**	**Mitigation**
RC 3.1	**Alternatives** ○ Description and analysis of alternatives	**RC 4.3**	**Emphasis**

Source: Own creation, 2018 based on Boshoff (2013:76).

Since none of the studies listed above considered the improvement of report quality over time a comparison of the results over time is provided in Figure 4 below:

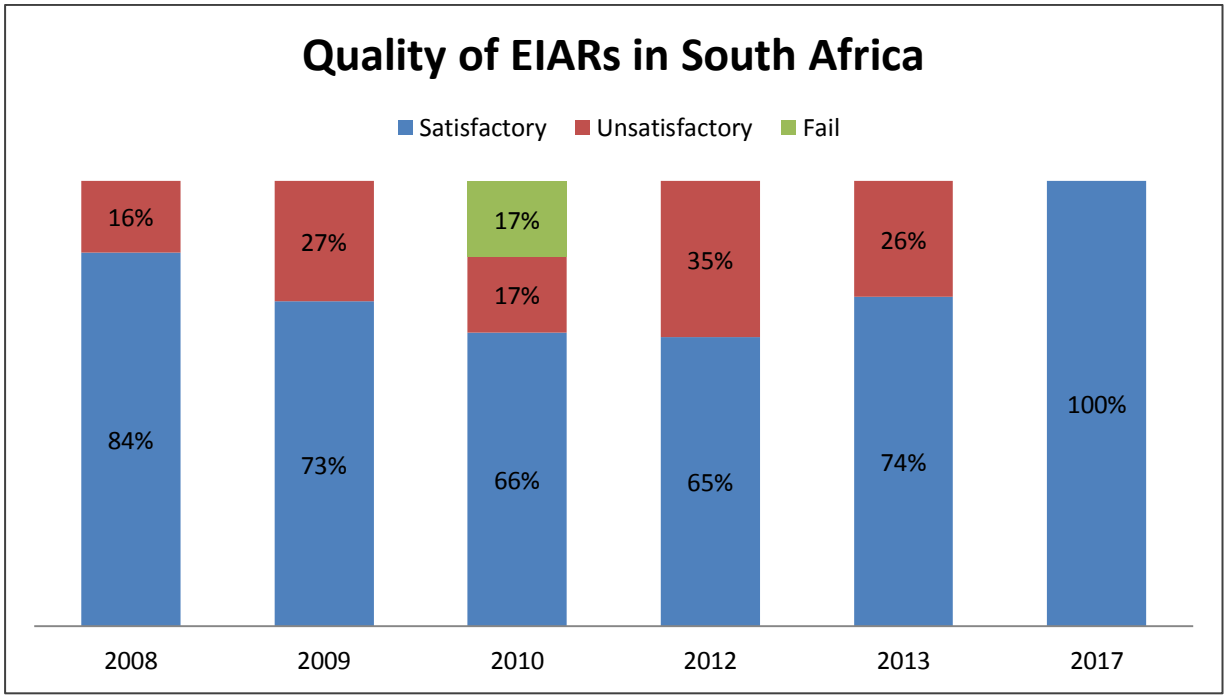

Figure 4: Quality of EIARs in South Africa (2005 - 2017)

Own creation (2018) based on Boshoff (2013), Kruger (2012), Laven (2017), Mbhele (2009), Sandham et al., (2008a), Sandham et al., (2008b), Sandham et al., (2010), Sandham et al., (2013a) and Sandham and Pretorius (2008).

The graph above does not indicate a clear improvement in EIAR quality in South Africa over time, as quality decreased between 2008 and 2012, before increasing again between 2012 and 2017. It should be noted, however, that the purpose of these studies was not to determine whether quality improved, and the studies were conducted independently of one another. As indicated in Table 2 above, all the studies are focused on separate sectors, which may skew the results. It is impossible to take into account the influence of factors influencing EIAR quality, such as the introduction of sector specific guidelines or the experience gained by consultants. However, it can be noted that quality seemed to improve following the introduction of the 2010, 2014 and 2017 EIA Regulations published by DEA (2010, 2014 & 2017).

A study conducted by Sandham et al., (2013b), regarding the report quality in South Africa before and after 2006, found that reports compiled under the 1997 EIA system actually

performed better than reports compiled under the 2006 system. 91% of reports were found to be satisfactory under the 1997 regulations, compared to only 80% under the 2006 regulations.

These results correlate with the findings of similar studies in Africa (Badr et al., 2011 and Anifowose et al., 2016). As previously mentioned, limited studies exist in the South African context regarding

1. The quality of EIARs for Solar Photovoltaic projects and
2. The improvement of quality of EIARs over a period of time.

This study aims to add to the knowledge base regarding EIAR quality over time in South Africa, by focusing on a single sector (Solar Photovoltaic projects) in order to compare results with ease.

2.5 Conclusion

From the information above, it is clear that the quality of EIARs has received a lot of attention in academic circles over the past few decades (Cashmore et al., 2002:372). Studies have been conducted both locally and abroad in order to determine the quality of EIARs in various sectors. With regards to the quality of reports over time, findings seem to vary. While studies in Europe, Asia and South America showed improvement of quality over time, studies in Africa did not.

The studies that did note an improvement in quality over time, listed improvements in legislation/guidelines as contributing factors (Kamijo & Huang, 2016 and Landin & Sánchez, 2012). Kabir and Momtez (2014) note that a lack of guidelines for specific sectors could be the reason EIAR quality did not improve over time. Given that EIA regulations were updated twice during the timeframe of this study, and guidelines for Renewable Energy Projects were introduced by DEA (2015), it might reasonable be expected that EIAR quality for Solar PV projects in South Africa should improve over the given timeframe.

3. Renewable Energy in South Africa

"15 years ago no one could imagine that environmentally friendly growth could be economically affordable and that green technologies make sense even for the poorest of economies" M Kituyi (cited by Kabukuru, 2015:24).

Economic growth of a country is inextricably connected to stable energy provision (Nhamo & Mukonza, 2016:69, Maludzi & Bull, 2016 and Boshoff, 2013:6). South Africa traditionally relies heavily on fossil fuel power production with approximately 90% of national energy production being coal powered (Nakumuryango & Inglesi-Lotz, 2015:999). However, over the past few decades it has come to light that fossil fuel dependency in power generation is a large contributor of global climate change due to greenhouse gas (GHG) emissions (IEA, 2011). As a developing country, with extreme poverty in certain areas, South Africa is particularly susceptible to the effects of climate change (Nakumuryango & Inglesi-Lotz, 2015:999-1000 and Aliyu et al., 2018:2503).

In addition, the country has experienced a shortage of electricity by the national utility Eskom in recent years due to outdated structures and demands that exceeded production capacity (Giglmayr et al., 2015:779)causing a demand for energy production in the country. There has been a worldwide movement towards sustainable energy production and specifically renewable energy (RE) sources that reduce the use of finite fossil fuels (Giebler et al., 2012:71). South Africa too realized the need for varied energy sources, including renewable energy sources.

Similarly to the presence of fossil fuel reserves, South Africa has immense natural resources for the generation of renewable energy. It is estimated that South Africa has the potential to generate 10 000GW of energy through RE (Kabukuru, 2015:25) and that 94% of the national energy demand can be met through RE by 2050 (van Wyk, 2014:23). In particular, South Africa has immense solar potential due to extremely high levels of solar radiation (South Africa, 2015:15 and Visser et al., 2018:2). It is estimated that South Africa receives more than double the solar irradiation of Germany (South Africa, 2012:28). In addition, the price of solar panels has decreased significantly in recent years (Sokka et al., 2016:1602 and Nhamo & Mukonza, 2016:70), making the technology more accessible. The use of natural resources to generate electricity positively contributes to the energy security in the country (South Africa, 2015:27).

In order to optimally utilise the renewable energy potential in the country, the Department of Energy (DoE) introduced the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in 2011 (Nhamo & Mukonza, 2016:78 and Davies et al., 2018:61). The Programme encourages private investors to develop renewable energy plants throughout the country. The programme has connected 2902MW of renewable energy to the current electricity grid through 56 projects (Visser et al., 2018:64). To date, solar PV plants dominate the REIPPPP, contributing approximately 52% of energy generated (Nhamo & Mukonza, 2016:80). The map below shows the location of PV projects that have been approved to date as part of the REIPPPP.

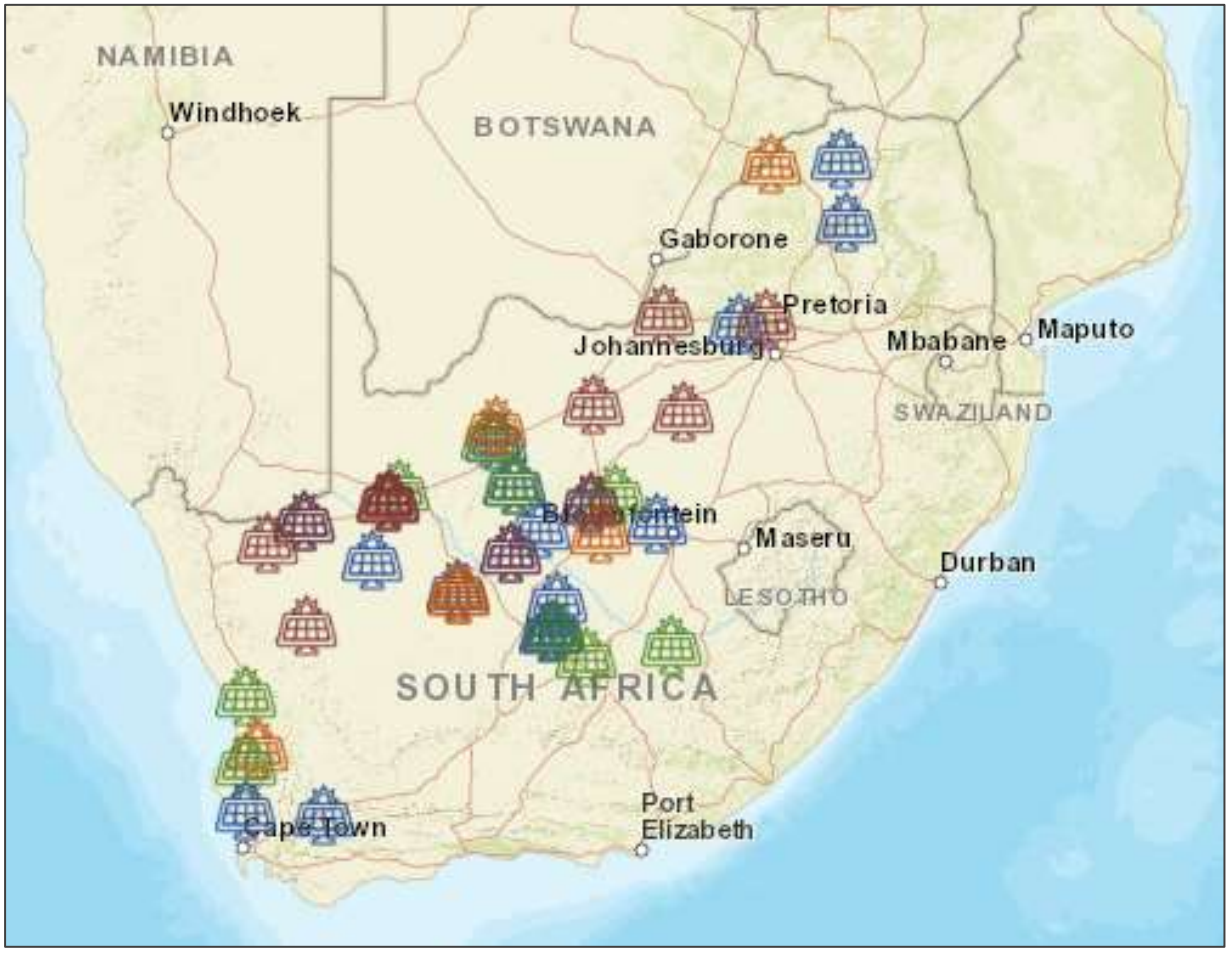

Figure 5: Map of approved PV projects in South Africa

Source: DOE, 2018[1].

[1] It should be noted that the map provided only indicates approved projects and is not an indication of EIARs submitted to the Department.

3.1 Impacts to consider for PV projects

Renewable energy sources are considered clean energy sources due to the limited greenhouse gas emissions associated with the technology. However, other environmental impacts remain that should not be overshadowed by the shortage of greenhouse gas emissions, especially as the role of renewable energy increases internationally (Sokka et al., 2016:1600-1605).

For the purpose of this study, environmental impacts are limited to the construction and operational phases of solar plants. Impacts associated with the manufacturing of the panels or decommissioning phase were not considered.

3.1.1 Water use

Traditional coal driven power plants use exorbitant amounts of water, second only to agricultural requirements. In comparison, solar PV plants use virtually no water (McCombie & Jefferson, 2016:760), since no water is used to generate electricity (South Africa, 2015:17). However, water is used throughout the year for maintenance purposes as panels have to be washed in order to function optimally. Turney and Fthenakis (2011:3263) estimate that 1892 – 3785 litres of water are used per Mega Watt peak (MWp) to wash the solar panels each year. Water may also be used for dust suppression in certain instances (Hernandez et al., 2014:770).

PV projects often take place on agricultural land (discussed in more detail below) without access to municipal water. Water provision should therefore be considered in EIARs for these projects in order to promote sustainable use of local water sources.

Based on the information above, it is critical that the water demand for Solar PV projects be addressed in EIARs, along with the proposed source of the water. Water provision is addressed under Review Sub Category 1.1.8 in the proposed review package

2

[2] For more information regarding the structure of the Lee and Colley review package and Review Sub Categories please refer to Chapter 4.

3.1.2 Land use

Since utility scale PV projects are land intensive, requiring between 2 and 5 ha per megawatt (Visser et al., 2018:1), concerns have been raised regarding the loss of land use (particularly agriculture) and habitat (South Africa, 2015:17 and Sacchelli et al., 2016:91). Abassi and Abassi (2000:130) state that utility scale PV plants require large tracts of land, ideally:

- in areas receiving high solar radiation
- with low agricultural value
- in close proximity to population centres/supporting infrastructure.

Hernandez et al., (2014:773), however, argues that PV plants are the most efficient power producers in terms of land use, generating the most energy per area of all renewable energy sources. And it needs to be taken into account that approximately 90% of PV projects in South Africa are located in the Northern Cape Province (Boshoff, 2013:15), where commercial farming requires large areas of land due to the climate.

The issue of land use is addressed in review subcategory 1.5.3 of the proposed review package, which requires the investigation of local land use plans to ensure the proposed development is aligned with the guiding principles of the area.
It is also recommended that an Agricultural Potential Study form part of all Solar PV EIARs in order to limit the degradation of valuable farmland.

3.1.3 Loss of Biodiversity

Linked to land use is a possible loss of habitat for fauna and flora. Natural vegetation is usually cleared before installation and kept in check during operation to limit interference with solar panels by mowing or herbicides (Hernandez et al., 2014:769 and Turney & Fthenakis, 2011:326). In addition, the erection of fences often limits movement by animals in the area (Turney & Fthenakis, 2011:3265).

A study conducted by Visser et al (2018) found that the bird species richness and density within a PV facility in the Northern Cape was less than the boundary zone (38 species vs. 50 species, respectively). The study does note, however, that the global costs to bird populations are higher for fossil fuel consumption than solar energy and encourage the efforts at increasing renewable energy generation (2018:8).

In order to limit the potential loss of biodiversity, the EIAR needs to sufficiently address the existing biological aspects of the environment (review sub category 1.4.4 of the proposed review package), and the expected impacts (review categories 2.2 – 2.5 of the proposed review package). It is also recommended that a Biodiversity study be conducted as part of the EIA.

3.1.4 Waste generation

Solar panels may contain dangerous material (such as cadmium which is used in thin film solar panels and considered a carcinogenic) that may not decay over time (McCombie & Jefferson, 2016:764). Attention should therefore be paid in the EIAR to the proposed decommissioning of a PV plant.

The proposed review package addresses the issue of waste under review category 1.3. In accordance with the Department of Environmental Affairs' EIA Guideline for Renewable Energy Projects (South Africa, 2015:18-19) it is also suggested that a Waste Management Plan be submitted as part of the EIA for Solar PV projects.

3.1.5 Visual Impact

Although more subjective and difficult to measure, the aesthetic impact of PV plants need to be considered in EIARs. The state of California in the United States of America (USA) has gone as far as to mark certain areas off limits for solar development, due to the visual impact on the surrounding area (Turney & Fthenakis, 2011: 3265). It can, however, be argued that the impact of solar parks are significantly less than those of coal operated power plants and their supporting coal mines.

The visual appearance of the proposed development should therefore be taken into consideration when determining the impacts of the proposed development (review categories 2.2 – 2.5 of the proposed review package). In order to accurately determine the visual impact, a Visual Impact Assessment is recommended as part of the specialist studies to be conducted.

Despite the factors listed above, solar power has a considerably smaller environmental impact than traditional fossil fuel power generation (Turney & Fthenakis, 2011:3268 and Sokka et al., 2016:1605). But these factors remain important to remember when considering the environmental impact of proposed PV plants. The following mitigation measures for solar plants were therefore proposed in the Department of Environmental Affairs' EIA Guideline for Renewable Energy Projects (South Africa, 2015:18-19):

- Identify sensitive areas/habitats by conducting pre-disturbance surveys.
- Reduce visual impacts through engineered (fences/berms/shades) or natural (vegetation/topography) measures.
- Limit project footprint by using existing infrastructure (roads/servitudes) where possible.
- Carefully consider project location away from pristine natural areas and communities.
- Locate projects away from important faunal habitats (especially threatened/collision prone- and vulnerable species).
- Propose and implement a storm water management plan.
- Propose and implement a waste management plan.
- Prevent dust and erosion by introducing appropriate indigenous species.

It is important that these factors are adequately addressed in the proposed mitigation measures of EIARs for Solar PV projects.

4. Research Design and Methodology

4.1 Introduction

"EIA undertaking is supposed to ensure compliance with the requirements both to the letter and the spirit of the legislation." Mhango, 2005:383.

A common method of measuring the quality of EIARs is through a review process, where reports are scrutinized in accordance with accepted standards. A variety of review packages have been developed, as listed in Table 4 below:

Table 4: EIAR review packages

Review Package	Developed by
Environmental Statement Review Package	Lee and Colley of the University of Manchester
European Commission's (EC) Guidance on EIS Review	European Commission
EIS Review Package	Impact Assessment Unit of Oxford Brookes University
Guidelines for Ecological Impact Assessment	Chartered Institute of Ecology and Environmental Management
North West University (NWU) review package (adapted Lee and Colley package)	Sandham and Pretorius

Source: Own creation based on Loomis and Dziedzic (2018:31) and Sandham and Pretorius (2008).

The Lee and Colley package has been used internationally for the review of several EIARs (Anifowose et al., 2016, Badr et al., 2011, Kamijo & Huang, 2016 and Mounir, 2015). The familiarity of the package in EA fields and the ease of use (Simpson, 2001:86) makes it a natural choice for the study. The package has also been successfully applied to numerous studies in South Africa, as indicated in Table 2 in Chapter 2. According to Lee (2000:138), the legislative and procedural context of an EIA system needs to be taken into account when assessing the quality of an EIAR. This is especially true when considering developing countries (Zeremariam & Quinn, 2007:56)

The following timeline, indicating some of the changes in EIA legislation over the past twenty years, is important for this study:

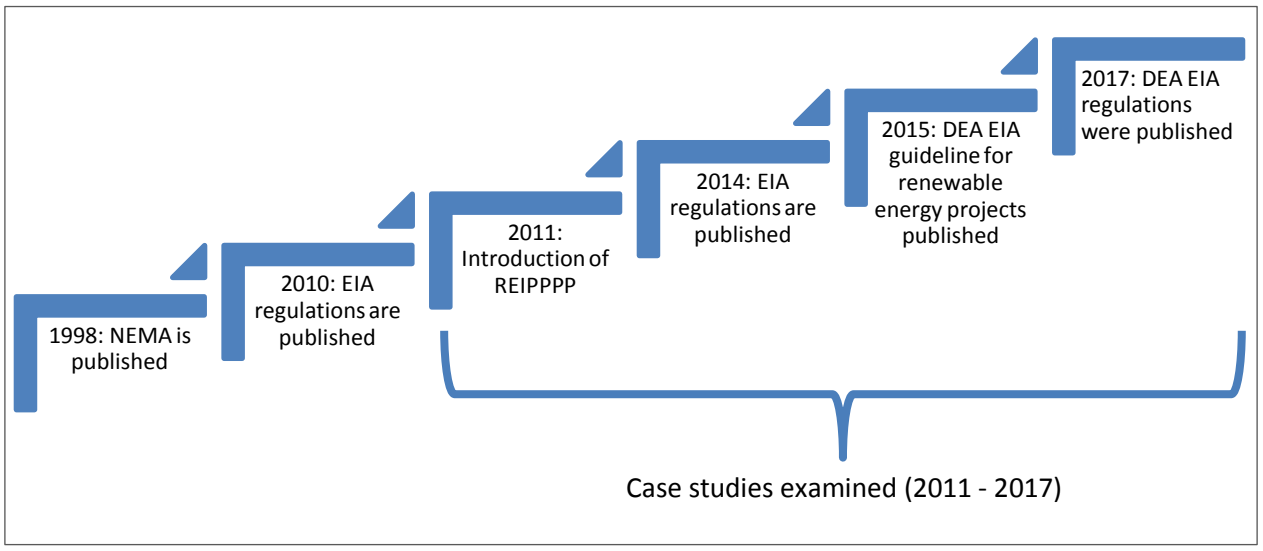

Figure 6: Timeline of policies and legislation applicable to study

Source: Own creation, 2018 based on South Africa (2018), DEA (2010), South Africa (2018), DEA (2014), DEA (2015) and DEA (2017).

4.2 Research design and methodology

"While there is no ideal number of cases, a number between 4 and 10 cases usually works well. With fewer than 4 cases, it is often difficult to generate theory with much complexity, and its empirical grounding is likely to be unconvincing… With more than 10 cases, it quickly becomes difficult to cope with the complexity and volume of data" Eisenhardt (2002:27)

Taking into account the objectives of the research, a qualitative approach was adopted for this study (Creswell, 2009, Edmonds & Kennedy, 2013 and Leedy & Ormrod, 2014). In order to gauge which aspects need to be included in the review criteria an in depth literature review was conducted. From the literature study, the Lee and Colley review package was adapted to a South African context, ensuring that all legal requirements were contained in the review package.

This adapted review package was then applied to seven EIARs for PV projects that have been submitted for approval to the Department. An evaluation approach was followed in order to determine whether the various EA reports are of a high quality and have produced

the desired results (Rossi et al., 2004:2). Reports from various consulting companies were included, ranging from 2011 to 2017 (one from each year). Results were compared with one another (Hammond & Wellington, 2013:27) to determine whether report quality had improved over the provided timeframe.

As with previous studies (Cashmore et al., 2002:380 and Sandham et al., 2013b:157) a pilot study was undertaken using the double-reviewer method recommended for the Lee and Colley method. The remainder of the reports were however reviewed by a single reviewer due to the constraints of the study. A comparative analysis was performed to determine whether or not report quality had improved over the past seven years and to identify the various strengths and weaknesses of the reports.

4.2.1 Case Study Selection

It is generally accepted that a larger sampling size will lead to more robust research findings (Vogt et al., 2012:91). However, given the limitations of a mini-dissertation, the study relied on 'replication logic' i.e. the assumption that results will be comparable for similar studies in South Africa (Yin, 2003). Caddick (2015:23) found that most published peer reviewed research on EIAR quality evaluated between 10 and 25 reports. As stated above, Eisenhardt (2002:27) believed that studying more than 10 case studies may become overwhelming. Therefore, seven reports were deemed sufficient for the purpose of this study.

The Department of Environmental Affairs was contacted for a list of EIA applications submitted to their offices for renewable energy projects between 2011 and 2017. From there results were narrowed using the following criteria:

Consulting Firms

EIARs for the study were sourced from five consulting firms. Three of the EIARs (2013, 2014 and 2016) were from the same consulting firm, allowing the reviewer to investigate the improvement of quality over time in a consulting firm.

Timeframe

Since the REIPPPP was launched in 2011, it was considered sensible that the timeframe for the research stretch from 2011 onwards. The case studies evaluated include an EIAR from each year within the provided timeframe.

Several developments during this timeframe could have an influence on the quality of EIARs. As seen in Figure 6 three sets of EIA regulations were introduced during this timeframe (2010, 2014 and 2017 regulations). In addition, guidelines were published in 2015, specifically for renewable energy projects in South Africa.

Based on the international case studies (Kamijo & Huang, 2016:143 and Landim & Sánchez, 2012) and the observations made by Barker and Wood (1999:395-396) it is assumed that report quality should improve following the introduction of these regulations and guidelines.

Complexity

For ease of comparison, it was considered ideal to select cases of the same level of complexity. Since the amount of power generated (MW) has an impact on the scale and size of the project, it would be unfair for example to compare a 10MW plant with a 75MW plant. Similar project sizes (in terms of MW) were therefore considered. On average, the projects selected for this study produce approximately 80MW.

Technology

In order to ensure consistency throughout the research, it was decided to limit the focus to one technology. Boshoff (2013:39) found that the majority of EIARs submitted to DEA were for solar PV projects. Therefore, for the purpose of this study, only EIARs for photovoltaic projects were considered.

EIARs that complied with the above mentioned criteria were sourced directly from consulting firms, either via email or company websites. Table 5 below provides a summary of the EIARs selected for this research. The consulting firms who participated in the research prefer to remain anonymous and as such no details of the consulting firm are provided. Projects are identified through their description and location, as can be seen below:

Table 5: Case studies

Year	Description	Municipality	Province	MW
2011	Touwsrivier Solar Power facility	Breedevalley Local Municipality	Western Cape	50
2012	The Farm Hoekspruit	Siyathemba Local Municipality	Northern Cape	100
2013*	Carocraft Solar Park	Naledi Local Municipality	North West	60
2014*	Avondale 1 Solar Park	//Khara Hais Local Municipality	Northern Cape	75
2015	Sand draai Solar facility	//Khara Hais Local Municipality	Northern Cape	125
2016*	Bolebedu Solar Park	Greater Letaba Local Municipality	Limpopo	75
2017	Kloofsig Solar facility	Renosterberg Local Municipality	Northern Cape	75

Source: Own creation, 2018

** reports were compiled by the same consulting firm*

4.3 The Lee-Colley review package

The Lee-Colley review package was developed in the United Kingdom in the 1990's in order to evaluate the quality of Environmental Impact Statements (Lee et al., 1999). In the past 30 years the package has gained popularity and has been adopted and used internationally (Badr et al., 2011, Anifowose et al., 2016 and Mounir, 2015). The package is widely used (Kamijo & Huang, 2016:145), praised for its ease of use (Sandham et al., 2013a) and incorporates elements considered to be global best practice (Barker & Wood, 1999:391).

The Review Package has a four-level hierarchical design. The overall assessment is based on the following four Review Areas (RA) of Environmental Assessment activity (Põder & Lukki, 2011:28):

1. Description of the development, the local environment and the baseline condition.
2. Identification and evaluation of the key impacts.
3. Alternatives and mitigation of impacts.
4. Communication of results.

Below each RA, Review Categories (RC) are listed, and then Review Sub-Categories (RSC), as illustrated in Figure 7 below. The EIAR is scored from the bottom tier up, using a collation sheet. In other words, review sub-categories are scored first (using the grading system in Table 6 below). An overall grade is then determined for the review category (based on the grades allocated to the RSC) and then for the review area until the EIAR is allocated an overall grade.

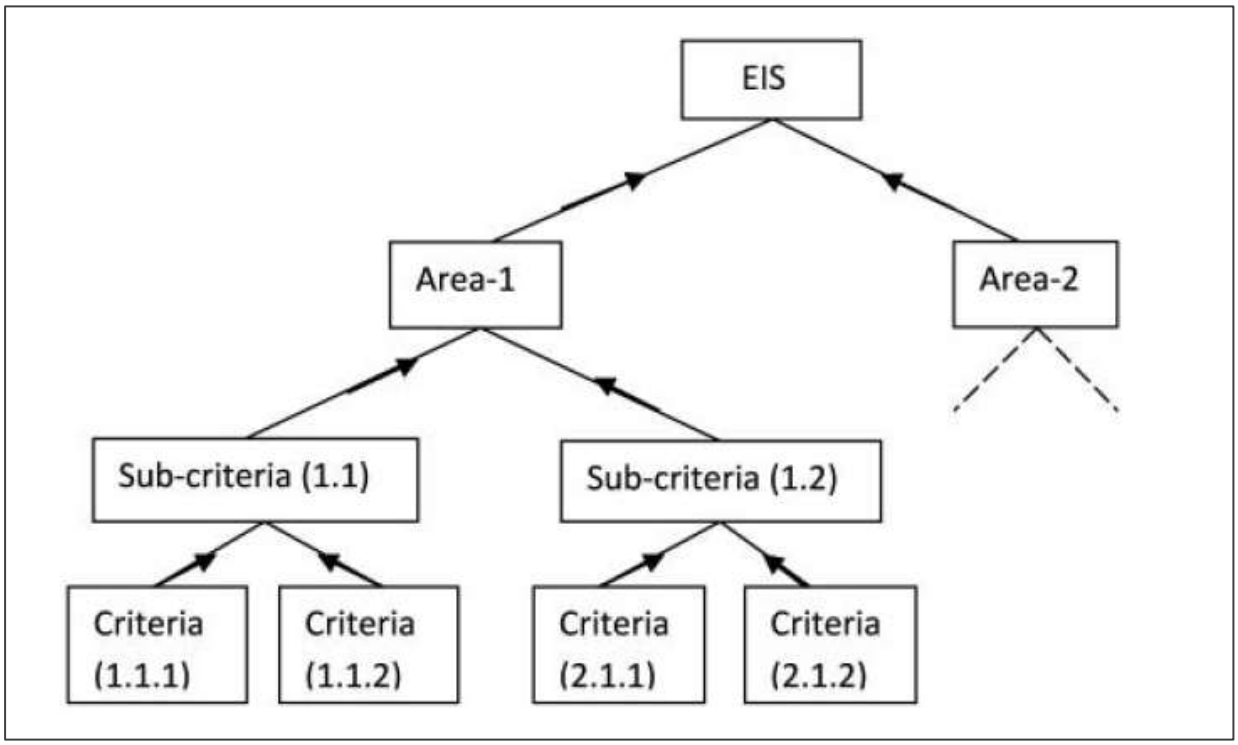

Figure 7: Hierarchical assessment of EIAR

Source: Kabir and Momtaz (2014:1600)

The following grading system is used when scoring the EIAR. As can be seen in Table 6 below, scores from C and above are deemed satisfactorily addressed and scores below a C are deemed as unsatisfactory. Provision is also made for a not applicable (N/A) score for instances where the review topic is not relevant in the context of the EIAR.

Table 6: Grading system of Lee and Colley Review Package

Rating	Symbol[3]	Grade	Explanation
Satisfactory	A	Excellent	Generally well performed, no important tasks left incomplete
	B	Good	Generally satisfactory and complete, only minor omissions and inadequacies
	C	Just satisfactory	Can be considered satisfactory despite omissions and/or inadequacies
Unsatisfactory	D	Poor	Parts are well attempted but must, as a whole, be considered unsatisfactory because of omissions or inadequacies
	E	Very poor	Not satisfactory, significant omissions or inadequacies
	F	Fail	Very unsatisfactory, important task(s) poorly done or not attempted
N/A			Not applicable. The review topic is not applicable or irrelevant in the context of this EA report

Source: Own creation (2018) based on Lee et al., (1999:17) and Kabir and Momtez (2014:1600)

4.4 Adapted Lee-Colley review package

Lee (2000:138) states that the regulatory and procedural context needs to be taken into account when determining the quality of an EIAR. As such, the proposed assessment criteria were aligned with South African regulations. However, van Heerden (2010:47) states that no review topics from the original review package should be removed as the model is based on best practice principles. Therefore, only additions were made as deemed necessary in the South African context. Due to the timeline of this study both the 2010 and 2014 EIA regulations were taken into account. Table 7 below provides a summary of the review areas and categories used for the collation sheet. Additions to the original review package are indicated in blue, with the regulations necessitating the inclusion included at the end in brackets.

[3] The review package utilises symbols instead of numbers. This approach is specifically followed in order to discourage crude aggregations of the lower review categories (through addition/subtraction) in order to determine the overall results (Lee et al., 1999:6)

Table 7: Abbreviated EIAR review criteria

DESCRIPTION OF THE DEVELOPMENT, THE LOCAL ENVIRONMENT AND THE BASELINE CONDITIONS	***1.1***	***DESCRIPTION OF DEVELOPMENT***
	1.1.1	***Identification of the Applicant (NWU)***
	1.1.2	Purpose and objectives of development
	1.1.3	***Description and nature of activity (NWU)***
	1.1.4	Design and size (diagrams and maps)
	1.1.5	Presence and appearance of completed development
	1.1.6	Nature of production processes and expected rate of production
	1.1.7	Nature and quantity of raw materials needed during different phases
	1.1.8	***Source and availability of water and materials (NWU)***
	1.1.9	***Description of need and desirability (2010)***
	1.1.10	***Details of EAP (including any specialists), including expertise (2010)***
	1.2	***SITE DESCRIPTION***
	1.2.1	***Address or coordinates of application site (2014)***
	1.2.2	***21 SG digit code of application site (2014)***
	1.2.3	Area of the development site and proposed activities (locality map)
	1.2.4	Description and demarcation of proposed land use areas
	1.2.5	Estimated duration of phases (construction, operational and decommissioning)
	1.2.6	Expected number of workers/visitors and access to site
	1.2.7	Means of transporting raw materials/products and quantities involved
	1.2.8	***Infrastructure required (NWU)***
	1.3	***WASTES***
	1.3.1	Types and quantities of wastes
	1.3.2	Treatment, disposal and disposal routes
	1.3.3	Methods of obtaining quantity of wastes
	1.4	***ENVIRONMENTAL DESCRIPTION***
	1.4.1	Indication of area likely to be affected by development (map)
	1.4.2	Effects occurring away from immediate affected environment
	1.4.3	***Geographical aspects of environment (NWU & 2010)***
	1.4.4	***Biological aspects of environment (NWU & 2010)***
	1.4.5	***Social/cultural characteristics (NWU & 2010)***
	1.4.6	***Cumulative impacts (NWU & 2010)***
	1.5	***BASELINE CONDITIONS***
	1.5.1	Important components of the affected environment (indicate methods)
	1.5.2	Existing data sources

	1.5.3	Local land use plans, policies consulted and other data collected
	1.5.4	***Summary of specialist reports (2010)***
IDENTIFICATION AND EVALUATION OF KEY IMPACTS	***2.1***	***SCOPING***
	2.1.1	***Example of notice published in media (NWU)***
	2.1.2	***On-site notice (NWU)***
	2.1.3	***Identify affected people (NWU)***
	2.1.4	Contact general public and special interest groups
	2.1.5	Collect opinions and concerns of I&APs ***(record as addendum - NWU)***
	2.1.6	***Notification criteria (NWU)***
	2.1.7	Evidence of public participation
	2.1.8	Key Impacts identified for further investigation
	2.1.9	***List of activities triggered (2014)***
	2.2	***DEFINITION OF IMPACTS***
	2.2.1	Description of effects on environment (direct, indirect, cumulative etc.)
	2.2.2	Description of interaction of effects on the environment
	2.2.3	Impacts from non-standard operating conditions
	2.2.4	Impacts from deviation from baseline conditions
	2.3	***IDENTIFICATION OF IMPACTS***
	2.3.1	***Project divided into distinct phases (NWU)***
	2.3.2	***All possible impacts from each phase identified (NWU)***
	2.4	***PREDICTION OF IMPACT MAGNITUDE***
	2.4.1	Data used for prediction of impact magnitude
	2.4.2	Methodology of impact magnitude (description and appropriateness)
	2.4.3	Quantification of impact magnitude predictions
	2.5	***ASSESSMENT OF IMPACT SIGNIFICANCE***
	2.5.1	Significance to the affected community distinguished
	2.5.2	Significance of impact **(*nature, intensity, duration, probability, extent - NWU*)**
	2.5.3	Method of assessing significance
ALTERNATIVES AND MITIGATION	***3.1***	***ALTERNATIVES***
	3.1.1	***Description of methods used to identify alternatives (NWU)***
	3.1.2	Description of alternative sites (advantages and disadvantages)
	3.1.3	Description of alternative processes, designs and operating conditions
	3.1.4	For severe adverse impacts, rejected alternatives identified
	3.1.5	***Comparative assessment of all alternatives identified and reasons for final choice (NWU &***

		2010)
	3.2	***SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES***
	3.2.1	Consider mitigation of all significant adverse impacts
	3.2.2	Mitigation methods considered (modification, compensation, alternatives and pollution control)
	3.2.3	***Mitigation measures clearly defined (NWU)***
	3.2.4	Extent of effectiveness of mitigation when implemented
	3.3	***COMMITMENT TO MITIGATION***
	3.3.1	Record of commitment from developer to mitigation measures
	3.3.2	Monitoring arrangements
	3.3.3	***Financial provisions for rehabilitation/closure (2014)***
COMMUNICATION OF RESULTS	***4.1***	***LAYOUT OF REPORT***
	4.1.1	Introduction (project description, aims of the EA)
	4.1.2	Information logically arranged
	4.1.3	Chapter summaries for very long chapters
	4.1.4	External sources acknowledged
	4.2	***PRESENTATION***
	4.2.1	Comprehensible presentation of information (non-specialist language)
	4.2.2	Technical terms, acronyms, initials defined
	4.2.3	Report presented as an integrated whole
	4.3	***EMPHASIS***
	4.3.1	Emphasis to potentially severe/favourable impacts
	4.3.2	Statement must be unbiased
	4.3.3	***Opinion as to whether activity should/should not be authorised (2010)***
	4.3.4	***Oath/affirmation by EAP (2014)***
	4.3.5	***Proposed conditions of authorisation (2014)***
	4.4	***NON-TECHNICAL SUMMARY***
	4.4.1	Non-technical summary of main findings and conclusions
	4.4.2	Summary must cover all main issues

1 REVIEW AREA, ***1.1 REVIEW CATEGORY***, 1.1.1 Review sub-category

Source: Own creation, 2018, based on DEA (2010), DEA (2014), Lee et al., (1999:39 - 45), and Sandham and Pretorius (2008:233).

The criteria derived from the 2014 EIA regulations were only applied to the case studies from 2015 as the 2014 EIAR was submitted to the Department prior to the promulgation of the

EIA regulations. For EIARs between 2011 and 2014 they were assessed where included, or marked as not applicable.

4.5 Limitations of the study

The Lee and Colley review method recommends the use of at least two independent reviewers in order to ensure objectivity within the review process (Cashmore *et al*., 2002:380). The preferred process involves the independent review of an EIAR by the reviewers, who compare and collate scores following the review to determine the final score of a review.

However, given the nature of the study, and the overall objective of establishing whether or not report quality had improved over time, it is believed that review by a single reviewer will not create bias in this instance. The double-reviewer approach was therefore only applied to the first review to establish a baseline study. As previously discussed in this Chapter, this approach has been utilised successfully in both international (Cashmore *et al*., 2002:380 and Canelas *et al*., 2005) and local (Sandham et al., 2013b:157) studies of the same nature. It should also be emphasised that the study focuses on the quality of EIARs, but does not take into account the proposed Environmental Management Programme (EMPr) of the project or the implementation thereof.

The methodology described in this chapter was applied to the seven studies selected. The following section discusses the results from the study, starting with the overall quality of the EIARs examined over time. Thereafter, the results for individual review categories are compared and discussed.

5. Presentation and Discussion of results

The following sections will examine the quality of the seven reports that were reviewed, with specific focus on whether or not the quality improved over time. The discussion follows the hierarchical structure of the Lee and Colley review package, by discussing the overall quality of the reports first, followed by a discussion of the review categories and lastly mention of review sub-categories that stood out.

5.1 Pilot study

A double reviewer approach (as suggested by Lee et al., 1999) was employed for the 2011 report, in order to create a baseline for the other studies. Results from both reviewers were compared and discussed in order to calculate the final scores. The scores of both reviewers were found to be similar, and where discrepancies occurred these were discussed and clarified. A copy of the results from both reviewers is attached in Annexure A of this report.

5.2 Overall quality of EIARs

Table 8 and Figure 8 below indicates the overall findings of the reviews conducted:

Table 8: Overall EIAR scores

YEARS	2011	2012	2013*	2014*	2015	2016*	2017
OVERALL SCORE	**C**	**B**	**C**	**C**	**B**	**A**	**B**

Source: Own creation, 2018.

** reports were compiled by the same consulting firm*

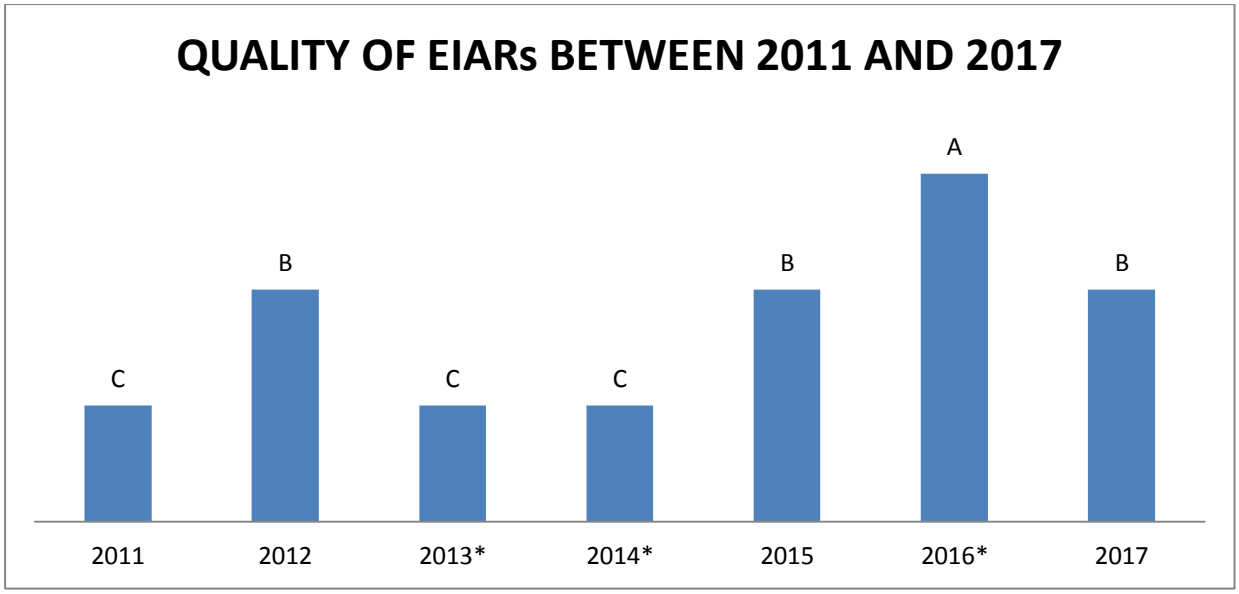

Figure 8: Quality of EIARs between 2011 and 2017

Source: Own creation, 2018.

As can be seen in Table 8 and Figure 8 above, all the reports reviewed were considered to be of an acceptable standard (C grading and above), similar to previous South African studies (Sandham et al., 2008b, Sandham et al., 2013a and Laven, 2017). Of the seven reports reviewed, 3 (43%) were rated C (just satisfactory), 3 (43%) were rated B (satisfactory with minor omissions) and 1 (14%) was rated A (satisfactory). The results per review categories are discussed in the following section.

5.3 Quality of Review Categories

Table 9 below indicates the scores for each EIAR, per Review Area:

Table 9: Score per review area

YEAR → / REVIEW AREA ↓	2011	2012	2013	2014	2015	2016	2017
REVIEW AREA 1	C	B	C	C	B	B	B
REVIEW AREA 2	C	B	C	C	B	A	B
REVIEW AREA 3	A	B	C	C	A	B	A
REVIEW AREA 4	A	A	B	B	B	A	B

Source: Own creation, 2018

Again, the aggregate of the scores achieved were all satisfactory (C and above). From Table 9 above, it is clear that Review Category 4 (Communication of Results) achieved the highest results, with no C ratings awarded. This is a common trend in South African EIARs and was found to be the case in most of the local studies examined in Chapter 3 (Kruger, 2012; Laven, 2017; Mbhele, 2009; Sandham et al., 2008a; Sandham et al., 2008b; Sandham et al., 2010; , Sandham et al., 2013a and Sandham & Pretorius, 2008).

Detailed results for all four review categories (as seen in Table 10 below) will be briefly discussed in the following sections.

Table 10: Results per review category

REVIEW CATEGORY		2011	2012	2013	2014	2015	2016	2017
1,1	DESCRIPTION OF DEVELOPMENT	C	B	B	B	B	B	C
1,2	SITE DESCRIPTION	C	A	A	A	C	B	A
1,3	WASTES	F	F	F	F	C	F	C
1,4	ENVIRONMENTAL DESCRIPTION	B	A	B	B	B	B	A
1,5	BASELINE CONDITIONS	A	A	B	B	A	A	A
2,1	SCOPING	A	A	A	A	A	A	A
2,2	DEFINITION OF IMPACTS	F	B	D	D	B	C	B
2,3	IDENTIFICATION OF IMPACTS	C	A	A	A	A	A	A
2,4	PREDICTION OF IMPACT MAGNITUDE	F	A	C	C	A	A	A
2,5	ASSESSMENT OF IMPACT SIGNIFICANCE	B	B	C	C	B	A	B
3,1	ALTERNATIVES	A	B	C	C	A	C	A
3,2	SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES	B	B	B	B	A	A	A
3,3	COMMITMENT TO MITIGATION	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,1	LAYOUT OF REPORT	B	A	B	B	A	A	A
4,2	PRESENTATION	A	A	A	A	A	A	A
4,3	EMPHASIS	A	A	B	B	A	A	A
4,4	NON-TECHNICAL SUMMARY	A	A	B	B	C	B	C
LEGEND		Satisfactory (A – C)		Unsatisfactory (D – F)		Not Applicable		

Source: Own creation, 2018.

5.4 Review Area 1: Description of the environment and the baseline conditions

From the results in Table 9, it can be seen that Review Area 1 achieved the lowest results of the four categories. The detailed results (attached in Annexure B) indicate that the following sections were particularly poorly addressed across the EIARs:

- **RSC 1.1.6 – nature of production processes and expected rate of production**
  Most reports failed to address/mention this issue, with the exception of the 2013 and 2014 reports (compiled by the same consulting firm), that discussed the generation capacity of the PV panels and plants in scientific detail. During the discussions of the pilot study, both reviewers indicated that EAPs may not deem this RSC applicable as traditional production processes through manufacturing are not taking place on site. This may prove to be true as the same consulting firm did not include the generation capacity information in their 2016 report.

- **RSC 1.1.7 – nature and quantity of raw materials needed during different phases**
  All seven reports failed to address this category.

- **RSC 1.4.2 – effects occurring away from the immediate affected environment**
  Only three EIARs considered effects away from the immediate affected environment. The identified effects were generally socio-economic in nature and related to nearby communities.

In addition, the entire Review Category 1.3 (dealing with wastes) was poorly addressed. Only two of the seven EIARs attempted to the address the issue of waste regarding the proposed development, with five failing to take it into consideration. This is alarming as waste generation, especially during the decommissioning phase, is considered a negative aspect of PV plants (as discussed in Section 3.1.4 of this study).

It should be noted that the Department of Environmental Affairs' EIA Guideline for Renewable Energy Projects, introduced in 2015, requires a waste management plan as part of the mitigation measures for PV projects (South Africa, 2015:18-19). The two reports that

discussed waste generation and management were prepared in 2015 and 2017 respectively. This suggests that the introduction of the guideline has a positive impact on report quality.

5.5 Review Area 2: Identification and evaluation of key impacts

From the results in Table 9, it can be seen that Review Area 2 achieved the second lowest results of the four categories. This finding is similar to that of other studies conducted in South Africa (Sandham et al., 2008a; Sandham et al., 2008b; Sandham et al., 2010; Sandham et al., 2013a and Sandham & Pretorius, 2008) that identified RC 2 as a weakness of EIARs. The detailed results (attached in Annexure B) indicate that the following sections were particularly poorly addressed across the EIARs:

- **RC 2.2: Definitions of impacts**

  The main shortcomings found in this review category were RSC 2.2.3 and RSC 2.2.4 regarding impacts from non-standard operating conditions and impacts from deviation from baseline conditions, respectively, which were not addressed throughout the reports. Some reports also struggled to categorise impacts into direct/indirect/cumulative impacts.

  RSC 2.2.2 (description of the interaction of effects on the environment) was poorly addressed in the first four studies. However, there was a remarkable improvement over time as the three latest studies were all awarded an A for this category.

- **RSC 2.5.1: Significance to the affected community distinguished.**

  Barely any mention was made of how impacts will affect the distinguished community, with the exception of the 2016 report.

It should also be noted that Review Category 2.1 (Scoping) was the best addressed review category in the study, receiving all satisfactory results. The review category deals predominantly with public participation, as mandated by the relevant legislation. The quality of the public participation was not evaluated (e.g. content of site notices/response to comments etc) as it falls outside the scope of this study.

Improvements over time were evident in several areas, particularly Review category 2.4 (magnitude), with marked improvement from 2015 onwards. Similarly, methods of assessing

significance (RSC 2.5.3) improved from 2015 onwards. It seems that methodology and quantification methods used in EIARs received more attention in later years, improving the quality of the reporting.

5.6 Review Area 3: Alternatives and Mitigation

Review Area 3 performed the second best of all three review areas, in contrast to other South African studies conducted where RA 3 was generally found to be a weakness of EIARs (Boshoff, 2013, Sandham et al., 2010, Sandham et al., 2008a, Kruger, 2012, Laven, 2017, Mbhele, 2009, Sandham et al., 2008b, Sandham & Pretorius, 2008 and Sandham et al., 2013a). However, as can be seen in the detailed results in Annexure B, review category 3.3 (commitment to mitigation) was not addressed in the EIAR itself, but rather in the attached EMPrs (presumably). As discussed in Section 4.5 above, EMPrs were not considered/evaluated during this study. This may skew the results as an entire review category could not be evaluated, leaving review area 3 with only 9 review sub-categories. Boshoff (2013) also found mitigation measures to be poorly addressed with regards to EIARs conducted for renewable energy projects in South Africa.

Similarly to Review Area 2, improvements were evident over time, specifically with regards to RSC 3.2 (scope and effectiveness of mitigation measures) and RSC 3.1.1 and 3.1.2 (description of methods used to identify alternatives and description of alternative sites, respectively). Again, a description of the methodology used to obtain results, which was missing in earlier reports, was described from 2015 onwards.

All the EIARs evaluated enlisted several specialist studies. It is believed that this broad knowledge base added significantly to the quality of the reports as specialised mitigation methods could be identified for various impacts

5.7 Review Area 4: Communication of results

As previously discussed, Review Area 4 performed the best across all EIARs. It is generally accepted that Review Category 4 performs well due to the non-technical nature of the criteria (Kruger, 2012; Laven, 2017; Mbhele, 2009; Sandham et al., 2008a; Sandham et al., 2008b; Sandham et al., 2010; , Sandham et al., 2013a and Sandham & Pretorius, 2008).

The reports were all professionally presented and aesthetically pleasing. The following observations were deemed significant to the results:

- **RSC 4.1.1: External sources acknowledged**

  The only F grading in review area 4 was allocated in this RSC to the 2013 and 2014 reports which did not include a reference list. However, it should be noted that the 2016 report (compiled by the same consulting firm), was awarded an A for referencing all external resources. An improvement in quality over time is therefore evident based on the experience of the EAP.

- **RC 4.4: Non-technical summary**

  Interestingly, a decrease in quality over time is evident in review category 4.4. This is consistent with the study by Boshoff (2013) that found non-technical summaries to be lacking for renewable energy EIARs.

The following section provides a brief overview of the results above, and how they relate to the research.

6. Conclusions and Recommendations

The study considered the improvement of quality of EIARs compiled for solar PV projects in South Africa between 2011 and 2017. In order to establish the necessary understanding of EIAR quality, a literature review was conducted, investigating both international and local case studies of a similar nature.

From the studies scrutinised, it was clear that the preferred method for establishing report quality is through a review method. It was decided to adapt the Lee and Colley review package to the South African context and apply it to seven EIARs for solar PV projects submitted from 2011 – 2017. The aim of the research was fourfold:

Table 11: Research aim and objectives of the study

Research Aim	**Using an adapted Lee and Colley review package, investigate whether EIA report quality for Solar PV projects in South Africa improved between 2011 and 2017.**
Research objectives	**Relevant Section in study**
1	To adapt the Lee and Colley review package for South African use	Section 4.4
2	To review selected Solar PV EIARs between 2011 – 2017	Chapter 5, read with Annexures A and B
3	To identify strengths and weaknesses in the EIARs scrutinised	Section 5.4 – 5.7 and 6.1
4	To establish whether report quality improved over the timeframe.	Section 5.2 and 6.2

Source: Own creation, 2018

The hypothesis of the study was that report quality should improve over time due to experience gained by role-players (EAPs and decision makers) and the introduction of legislation/guidelines throughout the timeframe. As can be seen in Table 11 above, the

necessary adjustments were made to the Lee and Colley review package in Section 4.4 to include legal requirements prescribed in terms of South African EIA regulations. In addition, three EIARs from the same consulting firm (reports from 2013, 2014 and 2016) were scrutinised to determine whether the increased experience of EAPs contribute to the improvement of quality of EIARs over time.

6.1 Identified strengths and weaknesses

The study found that Review Area 4 (Communication of results) and Review Area 3 (Alternatives and Mitigation) were the best addressed, whilst Review Area 2 (Identification and evaluation of key impacts) and Review Area 1 (Description of the environment and baseline conditions) achieved the lowest scores. The strengths and weaknesses of the EIARs evaluated can be summarised as follows:

Table 12: Strengths and weaknesses of EIARs for Solar PV projects in South Africa

Strengths	Weaknesses
2.1 - Scoping	1.3 - Wastes
4.2 - Presentation	2.2 – Definition of Impacts
4.3 - Emphasis	
4.1 – Layout of report	

Source: Own creation, 2018

The issue of waste was not adequately addressed in the EIARs. It is assumed that these issued were considered in the EMPrs, which were submitted as annexures to the reports and not scrutinised due to the limitations of the study (discussed in Section 4.5).

Other South African studies (Kruger, 2012; Laven, 2017; Mbhele, 2009; Sandham et al., 2008a; Sandham et al., 2008b; Sandham et al., 2010; , Sandham et al., 2013a and Sandham & Pretorius, 2008) have also found Review Area 4 to perform well under review. It should be noted that, although important, the majority of aspects in Review Area 4 are not mandated but rather reflect the professionalism of the EAP conducting the review. A document which is logically arranged and easy to follow will definitely assist decision makers in identifying key aspects addressed in the EIAR. However, the professional presentation of the document cannot compensate for insufficient information provided.

6.2 Report quality over time

Although small, there seems to be an improvement in quality over the years. It was found that all three C ratings are found in the first four years of the study, with the only A rating found near the end of the study. When viewed in terms of the timeline provided in Figure 9, the following can be seen:

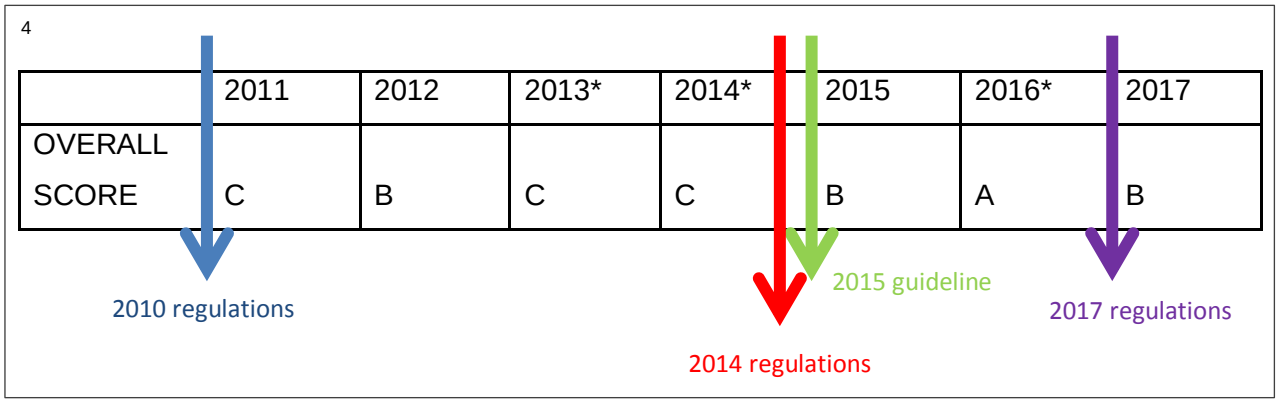

Figure 9: Results of review over time

Source: Own creation, 2018.

** reports were compiled by the same consulting firm*

Figure 9 above indicates that the observed improvement coincides with the implementation of revised regulations and guidelines by the Department of Environmental Affairs in 2014 and 2015. This finding is in accordance with the results of Kamijo and Huang (2016), Anifowose et al., (2016), Landim and Sánchez (2012) and Barker and Wood (1999).

It is also interesting to note that the quality of EIARs produced by the same consulting company improved from 2013 and 2014 to 2016 (C's to A). It was gathered from these reports that the same EAP worked on all three projects. This supports the research of Chanty and Grünbühel (2015:231) who argue that consultants play a vital role in the quality of EIARs and the findings of Barker and Wood (1999) that the experience of EAPs contribute to the quality of EIARs.

[4] The 2014 regulations were published in December, after the Avondale report had been submitted for approval in June. The EIAR was therefore compiled in terms of the 2010 regulations.

As discussed in Chapter 4, the sample size is too small to be considered a statistical representation. Instead, the study relies on 'replication logic'. Additional research may be required to prove the correlations found above.

6.3 Recommendations

The results of the review process discussed above identified several weaknesses in EIAR quality for solar PV projects. These include:

- Nature of production processes and expected rate of production
- Nature and quantity of raw materials needed during different phases
- Waste generation, quantification and disposal
- Effects occurring away from the immediate affected environment
- Impacts from non-standard operating conditions
- Impacts from deviation from baseline conditions
- Significance to the affected community

Since utility scale renewable energy projects are still fairly new to South Africa (in comparison with other developed countries), it could be argued that EAPs are simply less informed about the issues listed above. The research found that the introduction of revised EIA regulations (DEA, 2014) and the Guidelines for Renewable Energy projects in South Africa (DEA, 2015) preceded an improvement in the quality of the EIARs. Therefore, it is recommended that the Guidelines for Renewable Energy projects in South Africa be updated, with specific attention paid to the above mentioned issues. Operational solar PV plants throughout South Africa could be used as case studies in this regard.

6.4 Areas for further research

Based on the results of this study, it is proposed that a South African review package be compiled for Solar PV projects, specifically taking into account the impacts associated with utility scale Solar PV projects. In the opinion of the researcher, such a package would benefit decision making authorities and EAPs alike by providing a clear indication of aspects to be addressed. A similar sector-specific review package was compiled for the filling station industry by Sandham et al., (2008a).

Further research could also be conducted regarding the quality of EMPrs and the proposed mitigation measures for Solar PV projects in South Africa. In addition, the implementation/operation of PV projects in line with EMPrs could also be studied.

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Annexure A – Results –pilot study

		Reviewer 1 (EY Scheepers - researcher)	Reviewer 2 (CS Steenkamp - supervisor)	Final result based on Reviewer 1 & 2
OVERALL SCORE		**C**	**C**	**C**
DESCRIPTION OF THE DEVELOPMENT, THE LOCAL ENVIRONMENT AND THE BASELINE CONDITIONS	**1**	**C**	**C**	**C**
DESCRIPTION OF DEVELOPMENT	**1,1**	**B**	**B**	**C**
Identification of the Applicant (NWU)	1,1,1	A	A	A
Purpose and objectives of development	1,1,2	B	A	A
Description and nature of activity (NWU)	1,1,3	A	A	A
Design and size (diagrams & maps)	1,1,4	D	C	D
Presence and appearance of completed development	1,1,5	C	B	C
Nature of production processes & expected rate of production	1,1,6	F	F	F
Nature and quantity of raw materials needed during different phases	1,1,7	F	F	F
Source and availability of water and materials (NWU)	1,1,8	C	C	C
Description of need and desirability (2010)	1,1,9	A	A	A
Details of EAP (including any specialists), including expertise (2010)	1,1,10	A	A	A
SITE DESCRIPTION	**1,2**	**C**	**C**	**C**
Address or coordinates of application site (2014)	1,2,1	N/A	N/A	N/A
21 SG digit code of application site (2014)	1,2,2	N/A	N/A	N/A

Area of the development site and proposed activities (locality map)	1,2,3	C	B	B
Description and demarcation of proposed land use areas	1,2,4	C	C	C
Estimated duration of phases (construction, operational and decommissioning)	1,2,5	B	B	B
Expected number of workers/visitors and access to site	1,2,6	B	B	B
Means of transporting raw materials/products and quantities involved	1,2,7	A	A	A
Infrastructure required (NWU)	1,2,8	A	A	A
WASTES	**1,3**	**F**	**F**	**F**
Types and quantities of wastes	1,3,1	F	F	F
Treatment, disposal and disposal routes	1,3,2	F	F	F
Methods of obtaining quantity of wastes	1,3,3	F	F	F
ENVIRONMENTAL DESCRIPTION	**1,4**	**C**	**B**	**B**
Indication of area likely to be affected by development (map)	1,4,1	B	A	A
Effects occurring away from immediate affected environment	1,4,2	F	F	F
Geographical aspects of environment (NWU & 2010)	1,4,3	B	A	A
Biological aspects of environment (NWU & 2010)	1,4,4	A	A	A
Social/cultural characteristics (NWU & 2010)	1,4,5	B	A	A
Cumulative impacts (NWU & 2010)	1,4,6	C	B	B
BASELINE CONDITIONS	**1,5**	**A**	**A**	**A**
Important components of the affected environment (indicate methods)	1,5,1	A	A	A
Existing data sources	1,5,2	A	A	A
Local land use plans, policies/*legislation* consulted and other data collected *(2010)*	1,5,3	B	A	A
Summary of specialist reports (2010)	1,5,4	A	A	A
IDENTIFICATION AND EVALUATION OF KEY IMPACTS	**2**	**C**	**C**	**C**
SCOPING	**2,1**	**A**	**B**	**A**
Example of notice published in media (NWU)	2,1,1	A	A	A
On-site notice (NWU)	2,1,2	A	A	A
Identify affected people (NWU)	2,1,3	A	A	A

Contact general public and special interest groups	2,1,4	A	A	A
Collect opinions and concerns of I&APs *(record as addendum - NWU)*	2,1,5	A	A	A
Notification criteria (NWU)	2,1,6	A	B	A
Evidence of public participation	2,1,7	A	A	A
Key Impacts identified for further investigation	2,1,8	A	A	A
List of activities triggered (2014)	2,1,9	A	A	A
DEFINITION OF IMPACTS	**2,2**	**F**	**F**	**F**
Description of effects on environment (direct, indirect, cumulative etc.)	2,2,1	C	C	C
Description of interaction of effects on the environment	2,2,2	F	F	F
Impacts from non-standard operating conditions	2,2,3	E	E	E
Impacts from deviation from baseline conditions	2,2,4	F	F	F
IDENTIFICATION OF IMPACTS	**2,3**	**C**	**C**	**C**
Project divided into distinct phases (NWU)	2,3,1	D	D	D
All possible impacts from each phase identified (NWU	2,3,2	C	B	C
PREDICTION OF IMPACT MAGNITUDE	**2,4**	**F**	**F**	**F**
Data used for prediction of impact magnitude	2,4,1	F	F	F
Methodology of impact magnitude (description and appropriateness)	2,4,2	F	F	F
Quantification of impact magnitude predictions	2,4,3	F	F	F
ASSESSMENT OF IMPACT SIGNIFICANCE	2,5	B	C	B
Significance to the affected community distinguished	2,5,1	E	F	E
Significance of impact (*nature, intensity, duration, probability, extent - NWU*)	2,5,2	A	A	A
Method of assessing significance	2,5,3	B	B	B
ALTERNATIVES AND MITIGATION	**3**	**A**	**A**	**A**
ALTERNATIVES	**3,1**	**B**	**A**	**A**
Description of methods used to identify alternatives (NWU)	3,1,1	A	A	A
Description of alternative sites (advantages and disadvantages)	3,1,2	B	A	B

Description of alternative processes, designs and operating conditions	3,1,3	A	A	A
For severe adverse impacts, rejected alternatives identified	3,1,4	A	A	A
Comparative assessment of all alternatives identified and reasons for final choice (NWU & 2010)	3,1,5	B	A	B
SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES	**3,2**	**B**	**A**	**B**
Consider mitigation of all significant adverse impacts	3,2,1	A	A	A
Mitigation methods considered (modification, compensation, alternatives and pollution control)	3,2,2	A	A	A
Mitigation measures clearly defined (NWU)	3,2,3	C	B	C
Extent of effectiveness of mitigation when implemented	3,2,4	B	A	B
COMMITMENT TO MITIGATION	**3,3**	**N/A**	**N/A**	**N/A**
Record of commitment from developer to mitigation measures	3,3,1	N/A	N/A	N/A
Monitoring arrangements	3,3,2	N/A	N/A	N/A
Financial provisions for rehabilitation/closure (2014)	3,3,3	N/A	N/A	N/A
COMMUNICATION OF RESULTS	**4**	**A**	**A**	**A**
LAYOUT OF REPORT	**4,1**	**B**	**A**	**B**
Introduction (project description, aims of the EA)	4,1,1	A	A	A
Information logically arranged	4,1,2	C	C	C
Chapter summaries for very long chapters	4,1,3	E	D	D
External sources acknowledged	4,1,4	A	A	A
PRESENTATION	**4,2**	**A**	**A**	**A**
Comprehensible presentation of information (non-specialist language)	4,2,1	B	A	B
Technical terms, acronyms, initials defined	4,2,2	A	A	A
Report presented as an integrated whole	4,2,3	A	A	A
EMPHASIS	**4,3**	**A**	**A**	**A**
Emphasis on potentially severe/favourable impacts	4,3,1	A	A	A
Statement must be unbiased	4,3,2	A	A	A
Opinion as to whether activity should/should not be authorised (DEA, 2010)	4,3,3	B	A	B

Oath/affirmation by EAP (2014)	4,3,4	N/A	N/A	N/A
Proposed conditions of authorisation (2014)	4,3,5	N/A	N/A	N/A
NON-TECHNICAL SUMMARY	4,4	A	A	A
Non-technical summary of main findings and conclusions	4,4,1	A	A	A
Summary must cover all main issues	4,4,2	A	A	A

Annexure B – Results – case studies

YEAR		2011	2012	2013	2014	2015	2016	2017
OVERALL SCORE		**C**	**B**	**C**	**C**	**B**	**A**	**B**
DESCRIPTION OF THE DEVELOPMENT, THE LOCAL ENVIRONMENT AND THE BASELINE CONDITIONS	**1**	**C**	**B**	**C**	**C**	**B**	**B**	**B**
DESCRIPTION OF DEVELOPMENT	1,1	C	B	B	B	B	B	C
Identification of the Applicant (NWU)	1,1,1	A	A	A	A	A	A	D
Purpose and objectives of development	1,1,2	A	A	A	A	A	A	A
Description and nature of activity (NWU)	1,1,3	A	A	A	A	A	B	A
Design and size (diagrams & maps)	1,1,4	D	A	A	A	D	A	A
Presence and appearance of completed development	1,1,5	C	A	A	A	B	A	A
Nature of production processes & expected rate of production	1,1,6	F	F	A	A	F	F	F
Nature and quantity of raw materials needed during different phases	1,1,7	F	F	F	F	F	F	F
Source and availability of water and materials (NWU)	1,1,8	C	F	A	A	C	C	B
Description of need and desirability (2010)	1,1,9	A	A	A	A	B	A	A
Details of EAP (including any specialists), including expertise (2010)	1,1,10	A	C	E	E	A	A	A
SITE DESCRIPTION	1,2	C	A	A	A	C	B	A
Address or coordinates of application site (2014)	1,2,1	N/A	A	A	A	C	A	C
21 SG digit code of application site (2014)	1,2,2	N/A	N/A	A	A	A	A	A
Area of the development site and proposed activities (locality map)	1,2,3	B	A	C	C	A	A	A
Description and demarcation of proposed land use areas	1,2,4	C	A	A	A	C	A	A
Estimated duration of phases (construction, operational and decommissioning)	1,2,5	B	A	A	A	A	A	A
Expected number of workers/visitors and access to site	1,2,6	B	A	A	A	B	B	A
Means of transporting raw materials/products and quantities involved	1,2,7	A	A	C	C	F	F	A

YEAR		2011	2012	2013	2014	2015	2016	2017
Infrastructure required (NWU)	1,2,8	A	A	A	A	C	A	A
WASTES	1,3	F	F	F	F	C	F	C
Types and quantities of wastes	1,3,1	F	F	F	F	C	F	C
Treatment, disposal and disposal routes	1,3,2	F	F	F	F	C	F	C
Methods of obtaining quantity of wastes	1,3,3	F	F	F	F	C	F	C
ENVIRONMENTAL DESCRIPTION	1,4	B	A	B	B	B	B	A
Indication of area likely to be affected by development (map)	1,4,1	A	F	A	A	A	A	A
Effects occurring away from immediate affected environment	1,4,2	F	A	F	F	C	F	A
Geographical aspects of environment (NWU & 2010)	1,4,3	A	A	A	A	A	A	A
Biological aspects of environment (NWU & 2010)	1,4,4	A	A	A	A	A	A	A
Social/cultural characteristics (NWU & 2010)	1,4,5	A	A	A	A	A	A	A
Cumulative impacts (NWU & 2010)	1,4,6	B	A	C	C	B	C	A
BASELINE CONDITIONS	1,5	A	A	B	B	A	A	A
Important components of the affected environment (indicate methods)	1,5,1	A	A	A	A	A	A	A
Existing data sources	1,5,2	A	A	B	B	A	A	A
Local land use plans, policies/*legislation* consulted and other data collected *(2010)*	1,5,3	A	A	C	C	A	B	A
Summary of specialist reports (2010)	1,5,4	A	A	A	A	A	A	A
IDENTIFICATION AND EVALUATION OF KEY IMPACTS	**2**	**C**	**B**	**C**	**C**	**B**	**A**	**B**
SCOPING	2,1	A	A	A	A	A	A	A
Example of notice published in media (NWU)	2,1,1	A	A	A	A	A	A	A
On-site notice (NWU)	2,1,2	A	A	A	A	A	A	A
Identify affected people (NWU)	2,1,3	A	A	A	A	A	A	A
Contact general public and special interest groups	2,1,4	A	A	A	A	A	A	A
Collect opinions and concerns of I&APs *(record as addendum - NWU)*	2,1,5	A	A	A	A	A	A	A

YEAR		2011	2012	2013	2014	2015	2016	2017
Notification criteria (NWU)	2,1,6	A	A	A	A	A	A	A
Evidence of public participation	2,1,7	A	A	A	A	A	A	A
Key Impacts identified for further investigation	2,1,8	A	N/A	N/A	N/A	N/A	A	A
List of activities triggered (2014)	2,1,9	A	A	A	A	A	A	A
DEFINITION OF IMPACTS	2,2	F	B	D	D	B	C	B
Description of effects on environment (direct, indirect, cumulative etc.)	2,2,1	C	A	D	D	A	D	A
Description of interaction of effects on the environment	2,2,2	F	B	D	D	A	A	A
Impacts from non-standard operating conditions	2,2,3	E	F	F	F	F	F	F
Impacts from deviation from baseline conditions	2,2,4	F	F	F	F	F	F	F
IDENTIFICATION OF IMPACTS	2,3	C	A	A	A	A	A	A
Project divided into distinct phases (NWU)	2,3,1	D	A	A	A	A	A	A
All possible impacts from each phase identified (NWU	2,3,2	C	A	A	A	A	A	A
PREDICTION OF IMPACT MAGNITUDE	2,4	F	A	C	C	A	A	A
Data used for prediction of impact magnitude	2,4,1	F	A	C	C	A	A	A
Methodology of impact magnitude (description and appropriateness)	2,4,2	F	A	C	C	A	A	A
Quantification of impact magnitude predictions	2,4,3	F	A	F	F	A	A	A
ASSESSMENT OF IMPACT SIGNIFICANCE	2,5	B	B	C	C	B	A	B
Significance to the affected community distinguished	2,5,1	E	F	F	F	F	B	F
Significance of impact (*nature, intensity, duration, probability, extent - NWU*)	2,5,2	A	A	A	A	A	A	A
Method of assessing significance	2,5,3	B	A	B	B	A	A	A
ALTERNATIVES AND MITIGATION	**3**	**A**	**B**	**C**	**C**	**A**	**B**	**A**
ALTERNATIVES	3,1	A	B	C	C	A	C	A
Description of methods used to identify alternatives (NWU)	3,1,1	A	B	C	C	A	A	A
Description of alternative sites (advantages and disadvantages)	3,1,2	B	B	D	D	A	A	A

YEAR		2011	2012	2013	2014	2015	2016	2017
Description of alternative processes, designs and operating conditions	3,1,3	A	B	B	B	A	E	A
For severe adverse impacts, rejected alternatives identified	3,1,4	A	N/A	N/A	N/A	N/A	A	N/A
Comparative assessment of all alternatives identified and reasons for final choice (NWU & 2010)	3,1,5	B	C	C	C	A	B	A
SCOPE AND EFFECTIVENESS OF MITIGATION MEASURES	3,2	B	B	B	B	A	A	A
Consider mitigation of all significant adverse impacts	3,2,1	A	A	A	A	A	A	A
Mitigation methods considered (modification, compensation, alternatives and pollution control)	3,2,2	A	C	C	C	B	A	A
Mitigation measures clearly defined (NWU)	3,2,3	C	C	C	C	B	A	B
Extent of effectiveness of mitigation when implemented	3,2,4	B	A	A	A	A	A	A
COMMITMENT TO MITIGATION	3,3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Record of commitment from developer to mitigation measures	3,3,1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Monitoring arrangements	3,3,2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Financial provisions for rehabilitation/closure (2014)	3,3,3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COMMUNICATION OF RESULTS	**4**	**A**	**A**	**B**	**B**	**B**	**A**	**B**
LAYOUT OF REPORT	4,1	B	A	B	B	A	A	A
Introduction (project description, aims of the EA)	4,1,1	A	A	A	A	A	A	A
Information logically arranged	4,1,2	C	A	A	A	A	A	A
Chapter summaries for very long chapters	4,1,3	D	A	N/A	N/A	N/A	N/A	A
External sources acknowledged	4,1,4	A	A	F	F	A	A	A
PRESENTATION	4,2	A	A	A	A	A	A	A
Comprehensible presentation of information (non-specialist language)	4,2,1	B	A	A	A	A	A	A
Technical terms, acronyms, initials defined	4,2,2	A	A	B	B	A	B	A
Report presented as an integrated whole	4,2,3	A	A	A	A	A	A	A
EMPHASIS	4,3	A	A	B	B	A	A	A
Emphasis on potentially severe/favourable impacts	4,3,1	A	A	A	A	A	A	A

YEAR		2011	2012	2013	2014	2015	2016	2017
Statement must be unbiased	4,3,2	A	A	A	A	A	A	A
Opinion as to whether activity should/should not be authorised (DEA, 2010)	4,3,3	B	A	B	B	A	A	A
Oath/affirmation by EAP (2014)	4,3,4	N/A	N/A	N/A	N/A	A	A	A
Proposed conditions of authorisation (2014)	4,3,5	N/A	A	N/A	B	A	A	A
NON-TECHNICAL SUMMARY	4,4	A	A	B	B	C	B	C
Non-technical summary of main findings and conclusions	4,4,1	A	A	A	A	C	C	C
Summary must cover all main issues	4,4,2	A	A	C	C	C	A	C
LEGEND		**Satisfactory (A – C)**		**Unsatisfactory (D – F)**			**Not Applicable**	

Source: Own Creation, 2018

9. Annexure C – collation sheet

Below please find the adapted collation sheet used for the evaluation of the EIARs

EIAR: _____

Overall Assessment: _____

1.	_____		2.	_____	3.	_____	4.	_____
1.1	_____	1.4 _____	2.1	_____	3.1	_____	4.1	_____
1.1.1	_____	1.4.1 _____	2.1.1	_____	3.1.1	_____	4.1.1	_____
1.1.2	_____	1.4.2 _____	2.1.2	_____	3.1.2	_____	4.1.2	_____
1.1.3	_____	1.4.3 _____	2.1.3	_____	3.1.3	_____	4.1.3	_____
1.1.4	_____	1.4.4 _____	2.1.4	_____	3.1.4	_____	4.1.4	_____
1.1.5	_____	1.4.5 _____	2.1.5	_____	3.1.5	_____		
1.1.6	_____	1.4.6 _____	2.1.6	_____			4.2	_____
1.1.7	_____		2.1.7	_____	3.2	_____	4.2.1	_____
1.1.8	_____	1.5 _____	2.1.8	_____	3.2.1	_____	4.2.2	_____
1.1.9	_____	1.5.1 _____	2.1.9	_____	3.2.2	_____	4.2.3	_____
1.1.10	_____	1.5.2 _____			3.2.3	_____		
		1.5.3 _____	2.2	_____	3.2.4	_____	4.3	_____
1.2	_____	1.5.4 _____	2.2.1	_____			4.3.1	_____
1.2.1	_____		2.2.2	_____	3.3	_____	4.3.2	_____
1.2.2	_____		2.2.3	_____	3.3.1	_____	4.3.3	_____
1.2.3	_____		2.2.4	_____	3.3.2	_____	4.3.4	_____
1.2.4	_____				3.3.3	_____	4.3.5	_____
1.2.5	_____		2.3	_____				
1.2.6	_____		2.3.1	_____			4.4	_____
1.2.7	_____		2.3.2	_____			4.4.1	_____
1.2.8	_____						4.4.2	_____
			2.4	_____				
1.3	_____		2.4.1	_____				
1.3.1	_____		2.4.2	_____				
1.3.2	_____		2.4.3	_____				
1.3.3	_____							
			2.5	_____				
			2.5.1	_____				
			2.5.2	_____				
			2.5.3	_____				