

**An analysis of the operational value of the environmental
management systems (ISO14001:2004) implemented at selected
underground platinum mines in South Africa**

Tshegofatso Windy Tyira

**Mini-dissertation submitted in fulfilment of the requirements
for the degree Masters' in Environmental Management at the
Potchefstroom Campus of the North-West University**

Supervisor: Mr.J.A Wessels

November 2012

ABSTRACT

ISO 14001 is the specification and guideline providing the framework for the establishment of the EMS. It was first published in September 1996 and updated in November 2004. It was developed by ISO, a Geneva-based NGO that promotes the development and implementation of international standards (Darnall, 2001:2). EMS is part of the organisation's management system used to develop and implement its environmental policy and manage its environmental impacts (ISO 14001, 2004:2).

In South Africa there is no legal requirement for EMSs to be put into place, other than where it may have been made a condition of a permit or licence application. All Underground Platinum Mines are required to develop, document, implement, maintain and review their EMS, which should be certified to ISO 14001:2004 (AEW, 2009:13).

The problem is that the implementation of an EMS is associated with a number of shortcomings and may be seen as a paper exercise to satisfy the needs of external auditors during audits with no particular value accruing to the organisation.

The aim of the research was to determine the operational value of the ISO 14001 EMS at selected Underground Platinum Mines. A structured survey-based research study was conducted among employees in three different operations within Underground Platinum Mine. This included literature and case studies review, interviews with key EMS implementers and distribution of questionnaires to those employees involved with the EMS implementation.

The main aim of the research has been achieved and all the research sub-questions were answered. The study concludes that the ISO 14001 EMS as implemented at Underground Platinum Mine is not merely a paper exercise but has an operational value.

Keywords: ISO 14001, Environmental Management System, Underground Platinum Mine, value, operations

OPSOMMING

ISO 14001 is die spesifikasie en die riglyn wat die raamwerk verskaf vir die daarstelling van omgewingsbestuurstelsels (OBS). Dit is vir die eerste keer in September 1996 gepubliseer en in November 2004 opgedateer. Dit is ontwikkel deur ISO, 'n Genève-gebaseerde NPO wat die ontwikkeling en implementering van internasionale standaarde promoveer (Darnall, 2001:2). OBS is deel van die organisasie se bestuurstelsel wat gebruik word om die omgewingsbeleid te ontwikkel en te implementeer, en sy omgewingsimpakte te bestuur (ISO 14001, 2004:2).

In Suid-Afrika is daar geen wetlike verpligting vir 'n OBS om gevestig te word nie, behalwe in gevalle waar dit dalk 'n voorwaarde mag wees vir die uitreiking van 'n permit of lisensie-uitreiking. Dit word van alle ondergrondse platinum-myne vereis om hulle OBS te ontwikkel, dokumenteer, implementeer, onderhou en hersien, en die OBS moet ook gesertifiseer word tot ISO14001:2004 (AEW, 2009:13).

Die probleem is dat die implementering van 'n OBS geassosieer is met 'n aantal tekortkominge en dit mag gesien word as 'n blote papier-oefening om die behoeftes van eksterne ouditeure te bevredig tydens oudits sonder dat dit enige werklike waarde vir die organisasie inhou. Die doel van die navorsing was om die operasionele waarde te bepaal van die ISO 14001 OBS by geselekteerde Ondergrondse Platinum-myne. 'n Gestruktureerde opname-gebaseerde navorsingstudie is onderneem onder werknemers in drie verskillende operasionele omgewings binne Ondergrondse Platinum-myne. Dit het 'n literatuuoroorsig en gevalle studie-oorsigte ingesluit, sowel as onderhoude met sleutelwerknemers wat betrokke is by die implementering van die OBS. Die hoofdoelwit van die navorsing is bereik en al die navorsingsvrae is beantwoord. Die studie het tot die gevolgtrekking gekom dat die ISO 14001EMS soos geïmplementeer by die Ondergrondse Platinum-myn nie bloot 'n papieroefening is nie, maar dat dit operasionele waarde het.

Sleutelwoorde: ISO 14001, Omgewingsbestuurstelsel, Ondergrondse Platinum-myn, waarde, operasies

Table of Contents

ABSTRACT.....	2
OPSOMMING	3
List of Figures.....	6
List of Tables.....	6
List of Graphs.....	7
ABBREVIATIONS	8
CHAPTER 1: INTRODUCTION.....	9
1.1 PROBLEM STATEMENT.....	9
1.2 BACKGROUND OF THE STUDY	9
1.3 RESEARCH AIMS AND OBJECTIVES.....	11
1.4 HYPOTHESIS/THEORETICAL STATEMENT.....	12
1.5 STRUCTURE OF THE RESEARCH REPORT	12
1.6 DELIMITATION OF THE STUDY.....	13
1.7 IMPORTANCE OF THE STUDY.....	13
CHAPTER 2: LITERATURE REVIEW.....	14
2.1 ISO 14001 EMS SERIES.....	14
2.2 BENEFITS OF THE ISO 14001 EMS IMPLEMENTATION	15
2.3 PITFALLS OF THE ISO 14001 EMS IMPLEMENTATION	18
2.4 DIFFERENT INTERNATIONAL CASE EXAMPLES DISPLAYING THE VALUE OF THE EMS IMPLEMENTATION.....	20
2.4.1 Case Study 1: Alumax aluminium ingot production facility ISO 14001 EMS ...	20
2.4.2 Case Study 2: Energy and gas companies in Germany ISO 14001 EMS	22
2.4.3 Case Study 3: ISO 14001 EMS in Polish Companies.....	24
2.5 UNDERGROUND PLATINUM MINE.....	25
2.5.1 Underground Platinum Mines ISO 14001 drivers	26
2.5.2 Underground Platinum Mines environmental value	27
2.5.3 Main operational activities at Underground Platinum Mines	27
CHAPTER 3: RESEARCH METHODOLOGY	29
3.1 SCOPE OF THE RESEARCH	29
3.2 SAMPLE DESIGN.....	29
3.2.1 Sampling frame.....	29
3.2.2 Sampling Size.....	29
3.3 RESEARCH DESIGN	30
3.3.1 Literature review	30
3.3.2 Questionnaires.....	31

3.3.3	Interviews	32
3.4	CONSTRAINTS AND LIMITATIONS.....	32
CHAPTER 4: RESEARCH RESULTS.....		34
4.1	Introduction.....	34
4.2	Interview results.....	35
4.3	Method of analysing the survey data.....	36
4.4	Survey results.....	37
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS.....		48
5.1	INTRODUCTION	48
5.2	SUMMARY OF RESULTS	48
5.3	CONCLUSION.....	53
5.4	RECOMMENDATIONS.....	54
REFERENCES		56
APPENDIX A: SENIOR MANAGEMENT QUESTIONNAIRE		60
APPENDIX B: GENERAL EMPLOYEES QUESTIONNAIRE.....		61
APPENDIX C: ENVIRONMENTAL COORDINATOR INTERVIEW QUESTIONS.....		62

List of Figures

Figure 1:	Underground Platinum Mine Schematic diagram	28
Figure 2:	Mine 2 Objectives and Targets	50

List of Tables

Table 1:	Senior Management -EMS Ensure Environmental Protection (Question1)	39
Table 2:	Senior Management- EMS identifies and minimizes the environmental impacts arising from the operation (Question 4)	40
Table 3:	General Employees- Has the EMS reduced the environmental impacts in your area of responsibility? (Question 2)	41
Table 4:	Senior Management -EMS increases workforce awareness of environmental issues (Question 7)	42
Table 5:	General Employees Has the EMS increased employee awareness of environmental issues? (Question 5)	43
Table 6:	Senior Management - EMS contributes towards continual environmental performance (Question 2)	44
Table 7:	General Employees - Has the EMS improved the environmental performance of your operation and your area of responsibility? (Question 4)	45
Table 8:	Senior Management EMS is a paper exercise (Question 15)	46

List of Graphs

Graph 1:	Description of respondents' distribution per years of EMS involvement	38
Graph 2:	Description of total percentage of respondents per duration of EMS involvement	38
Graph 3:	EMS ensures environmental protection- Senior Management responses per duration of EMS involvement	39
Graph 4:	EMS identifies and minimises impacts- Senior Management responses per duration of EMS involvement	40
Graph 5:	EMS reduces environmental impacts- General Employee's responses per duration of EMS experience	41
Graph 6:	Senior Management - EMS increases workforce awareness- responses per duration of EMS involvement	42
Graph 7:	Has the EMS increased employee awareness of environmental issues- General employees' responses per duration of EMS involvement	43
Graph 8:	EMS contributes towards environmental performance – Senior Management responses per years of EMS involvement	44
Graph 9:	EMS improved the environmental performance of operation and area of responsibility- General employees' response by duration of EMS involvement	45
Graph 10:	EMS is a paper exercise- Senior Management response per duration of EMS involvement	46

ABBREVIATIONS

AEW:	Anglo Environmental Way
CEC:	Commission for Environmental Cooperation
DEAT:	Department of Environmental Affairs and Tourism
EC:	Environmental Coordinator
EHS:	Environmental, Health, and Safety
EMAS:	Eco-Management and Audit Scheme
EMS:	Environmental Management System
EPA:	Environmental Protection Agency
ISO:	International Organization for Standardization
MEAG:	Middle Germany Energy Provider
NGO:	Non-governmental organisation
PLC:	Platinum Limited Company
SA:	South Africa
SME:	Small and Medium Enterprise
SPSS:	Statistical Product and Service Solutions
TDF:	Tailings Disposal Facility
US:	United States
VNG:	VerbundnetzGaz
Q:	Question

CHAPTER 1: INTRODUCTION

This chapter introduces the research by presenting the problem statement, main aim and research questions. It concludes by describing the outline and structure of the mini-dissertation.

1.1 PROBLEM STATEMENT

The problem is that the implementation of an EMS is perceptually associated with a number of shortcomings and may be seen as a paper exercise to satisfy the needs of external auditors during audits with no value achieved by accruing to the organisation.

1.2 BACKGROUND OF THE STUDY

Environmental issues are a major social concern on an international, national and regional scale. Companies in polluting industries subsequently face tight governmental regulations, increased media attention, and strong environmental activism from the general public.

Companies are furthermore under pressure to uphold the highest environmental standards due to reputational risk that can threaten a company's existence, and there is a growing understanding in business that social and environmental issues have financial consequences. Although a company is an economic institution, it remains a corporate citizen and therefore has to balance economic, social and environmental value (King III, 2009:52).

Firms respond to these external pressures by implementing environmental instruments and strategies such as an EMS that may help promote good environmental performance and reduce negative environmental impact. According to Berrone and Gomez-Mejia (2009:103), the resulting environmental legitimacy lowers liability exposures, enhances corporate reputation, improves access to resources and strengthens stakeholder relations. As a result environmental credibility plays a critical role in both national and international competitiveness. It makes sense, therefore, that companies should invest in a reputable and acceptable system that would aid in gaining environmental legitimacy, lower legal liability and enhance corporate reputation. By looking beyond immediate financial gain, the company ensures that its reputation, its most significant asset, is protected (King III, 2009:52).

Environmental pressure from mining activities such as those from the platinum sector still occurs through the fine-grounded slurry from the processing plants, with its associated extracting chemicals that reach the TDF. It is important that the effects of these activities on the environment should be analysed. It is self-evident that the mining industry globally is

facing a unique number of environmental challenges. These challenges include but are not limited to poor waste management, inadequate clean and dirty water infrastructures, poor water quality and air quality deterioration.

In 1996, the ISO published Standard 14001 Environmental Management Systems – Requirements with Guidance for Use. ISO mainly promotes "the development and implementation of voluntary international standards" for both particular products and environmental management issues (US EPA, 2006:1). EMS is part of the organisation's management system used to develop and implement its environmental policy and manage its environmental impacts (ISO 14001, 2004:2). It is a system put in place by organisations in line with the requirements of ISO 14001 to address the medium and long-term impacts of the organisation that arise from its activities, products and services.

According to WSP Walmsley (2004:20) there are a number of benefits that are associated with the development and implementation of the EMS and these include:

- Compliance with legislation. Since environmental legislation is continuously changing, the EMS allows the organisation to identify and have access to legal and other requirements to which they subscribe to. This enables the organisation to make an informed judgement on where it stands with regard to legal requirements;
- Enhancement of corporate image. The ability to demonstrate a responsible environmental attitude can dramatically improve the image of the organisation fostering better relations with the organisation's stakeholders and the public at large;
- Increased international competitiveness. International trade barriers may be based on different standards for environmental performance. An organisation implementing an effective EMS, more particularly an international recognised one, such as ISO 14001, will be in a good position against the competitors;
- Satisfaction of customer requirements. The range and diversity of customer needs and expectations are growing constantly with many customers preferring the use of suppliers and sub-contractors who can demonstrate good environmental management practices; and
- Increased financial insurance. Insurance companies are fully aware of the risk associated with poor environmental performance. Organisations with a sound effective EMS are able to demonstrate that they pose less risk to the insurance company and thus may enjoy preferential rates.

As a result of the above-mentioned, the Underground Platinum Mines have implemented EMSs in their operations. The decision to develop and implement an EMS at all their operations came from Senior Management at Head Office level with the aim to support the environmental vision of minimising harm to the environment by designing, operating and closing all the operations in an environmentally responsible manner (AEW, 2009:3). All these EMSs are ISO 14001 certified by third-party accredited bodies. Third-party certification audits provide an independent appraisal of the EMS. The assessment is designed to determine whether or not an organisation satisfies the requirements of the relevant clauses of the ISO 14001 Standard.

The problem statement, as indicated in 1.1, is supported by Bowman (2001:67), who states that most companies do not find it difficult to develop environmental policies and management systems but that the challenge lies in the effective implementation of these initiatives and continued dedication to the commitments embodied in environmental policies and management systems. Therefore, this research will focus on the value added by implemented EMSs at selected Underground Platinum Mines.

1.3 RESEARCH AIMS AND OBJECTIVES

The aim of the study in the light of the aforementioned problem statement is:

To determine the operational value that implemented environmental management systems have in the selected Underground Platinum Mines in South Africa.

In order to address the research aim the following sub-questions need to be answered:

What does Underground Platinum Mine value in their operations?

To what extent does the implementation of an EMS at an operational level contribute to the values defined by Underground Platinum Mine?

To what extent does the implementation of an EMS reduce operational risks associated with the significant environmental aspects identified?

To what extent does the implementation of an EMS improve general environmental awareness within the different levels and functions of the organization?

To what extent does the implementation of an EMS illustrate continual improvement of the environmental performance of the organisation?

1.4 HYPOTHESIS/THEORETICAL STATEMENT

The basic hypothesis of this research is that the EMS, developed in line with the requirements of the ISO 14001, is highly regarded as a management instrument that enhances environmental performance and is associated with a number of benefits to the organisation. Furthermore, the study may inform the improvement of Underground Platinum Mines from a best-practice perspective and the EMS may be aligned with environmental performance and sustainable development on ground and at management level.

1.5 STRUCTURE OF THE RESEARCH REPORT

This dissertation is structured as follows:

Chapter 1: Introduction and problem statement

This chapter serves as the introductory chapter and includes the purpose of the study together with the problem statement and research question. It also includes definitions, delimitations and the importance of the study as well as the outline of the research report.

Chapter 2: Literature review

Chapter 2 provides a review of literature dealing with the research problem.

Chapter 3: Research methodology

This chapter provides the outline of the research design and sampling design with the methodology of execution. It contains the measurement instruments as well as the limitations of the study.

Chapter 4: Research results

In this chapter the results of the study are tabled and displayed.

Chapter 5: Discussion, conclusion and recommendations

In this chapter the outcome of the study results is discussed, conclusions formulated and recommendations made to stakeholders.

References

1.6 DELIMITATION OF THE STUDY

The scope of the research will be limited to three of the Underground Platinum Mines. For the purpose of this research these mines will be called Operation 1, Operation 2, and Operation 3. The real names of the operations are withheld following the request from the Underground Platinum Mines Senior Management.

1.7 IMPORTANCE OF THE STUDY

This study aims to determine and to assist Underground Platinum Mines to understand the actual value that their implemented EMS have on their operations.

CHAPTER 2: LITERATURE REVIEW

This chapter provides an introduction to ISO 14001 EMS, followed by the benefits and pitfalls of the EMS, thereafter followed by the review of different international case studies to determine the operational value of the EMS. The chapter aims to answer sub-question 1: What do Underground Platinum Mines value in their operations.

This chapter also describes the findings from the literature reviewed in respect of the problem statement: “the implementation of an EMS is associated with a number of shortcomings and may be seen as a paper exercise to satisfy the needs of external auditors during audits”.

2.1 ISO 14001 EMS SERIES

ISO is a worldwide federation of international standards (ISO 14001, 2004: IV). ISO 14000 series including 20 separate standards ranging from environmental labelling to assessing the life-cycle of products. ISO 14000 standards are designed to help organizations establish management processes for controlling and improving their environmental performance and reducing operations’ impacts on the environment. A set of international standards brings a world-wide focus to the environment, encouraging a cleaner, safer, healthier world for us all. The existence of the standards allows organizations to focus environmental efforts against internationally accepted criteria (International Standard, undated).

ISO 14001 is the specification and guideline providing the framework for the establishment of the EMS. It was first published in September 1996 and was updated in November 2004. It has been developed by ISO, a Geneva-based NGO that promotes the development and implementation of international standards (Darnall, 2001:2).

EMS is part of the organisation’s management system used to develop and implement its environmental policy and manage its environmental impacts (ISO 14001, 2004:2). It is a system put in place by organisations in line with the requirements of ISO 14001 to address the organisation’s medium and long term impacts arising from its activities, products and services. An EMS consists of internal policies, assessments, and implementation actions that affect the entire enterprise and its relationship with the natural environment (Darnall et al., 2005:364). ISO 14001 is based on “Plan, Do, Check, Act” model aimed at achieving continuous improvement. By using this framework, organizations systematically consider their environmental aspects and impacts by taking into account five broad factors: an

environmental policy, evaluation and goal setting, implementation, monitoring and corrective action procedures, and management review (Darnall, 2001:2).

Although the use of ISO 14001 EMS is voluntary, it is increasingly being recognized as a comprehensive mechanism for improving environmental and business performance. By early 1997, American industries were beginning to back ISO 14001 because they realized that the standard could improve environmental world trade; in early 1998 only 60 US firms had obtained registration compared to 1600 firms worldwide; and by 2001, at least 36,765 ISO 14000 environmental management certificates had been awarded in 112 countries (Hankerson, 2006:23).

The use of an EMS is also increasing in South Africa. Currently there is no legal requirement for EMSs to be put into place, other than where it may have been made a condition of a permit or licence application and those cases are still rare. However, the natural progression of environmental management enforcement and compliance suggests that future legal controls on commerce and industry may include the requirement for EMSs to be part of a mechanism to monitor and measure legal compliance (DEAT, 2004:5).

Overall environmental management is better under ISO14001 than under an informal system; which in turn is better than under no system at all (REMAS, 2006). Organizations that implement EMSs identify how their activities interact with the environment, the types of environmental impacts that emanate from different operations, and alternative means of preventing environmental pollution and natural resource degradation (Darnall et al., 2005:365).

2.2 BENEFITS OF THE ISO 14001 EMS IMPLEMENTATION

Companies are discovering that the development of a system for the measurement, monitoring, and reporting of environmental impacts can yield substantial benefits to both the environment and long-term profitability, and help companies satisfy the expectations of a broad range of stakeholders such as investors, environmental groups, and regulators (Roy & Vezina, 2001:344).

According to Bansal et al., (2002:271), a good EMS will do two things: firstly, it will allow the firm to uncover ways in which the firm can reduce its environmental impacts while simultaneously reducing costs or increasing productivity, and secondly, it will coordinate the environmental activities of the firm in order to achieve greater organizational efficiency and effectiveness.

Apart from the above-mentioned, there are several drivers and benefits associated with the implementation of the ISO 14001 EMS, including but not limited to (WSP Walmsley, 2004:20):

- Compliance with legislation: Since environmental legislation is continuously changing, the EMS allows the organisation to identify and have access to legal and other requirements to which they subscribe to. This enables the organisation to make an informed judgement on where it stands with regard to legal requirements;
- Enhancement of corporate image: The ability to demonstrate a responsible environmental attitude can dramatically improve the image of the organisation, fostering better relations with the organisation's stakeholders and public at large;
- Increased international competitiveness: International trade barriers may be based on different standards for environmental performance. An organisation implementing an effective EMS particularly, an internationally recognised one such as ISO 14001 will be in a good position against the competitors;
- Satisfaction of customer requirements: The range and diversity of customer needs and expectations are growing constantly with many customers preferring the use of suppliers and sub-contractors who can demonstrate good environmental management practices; and
- Increased financial insurance: Insurance companies are fully aware of the risk associated with poor environmental performance. Organisations with a sound effective EMS are able to demonstrate that they pose less of a risk to the insurance company and thus may enjoy preferential rates.

Implementing an EMS is also associated with cost savings. A properly designed EMS promotes efficient identification of opportunities for cost savings by triggering procedural or technological changes that ultimately reduce the cost or improve the value of a product.

According to Matuszak-Flejszman (2009:412) an EMS may achieve cost reduction as a result of:

- streamlining the efficiency of running processes (decreasing resource and energy consumption and the volume of waste, as well as proper maintenance of machine and devices) and implementing new, more effective processes,
- designing products and services so as to limit natural resource consumption and at the same time maintain quality,

- providing proper waste management (recycling and other forms of economic waste utilization),
- optimizing selection of resources, materials and products.

In 1996 Ford became the first automobile company to certify all of their facilities worldwide (Fielding, 2001:140). Certification of Ford's 140 facilities was complete by 1999 after which Ford announced in the fall of that year they would begin requiring their automobile parts suppliers to implement ISO 14001 (Schaarsmith, 2001:32).

Ford Motor Company claims to have saved millions of dollars and reduced substantially its environmental impact as the result of having adopted ISO 14001-certified EMS for its plants worldwide (Wilson, 2001:32). In its 40-year-old, 2.4 million square foot engine plant in Lima, Ohio, for example, Ford claims to have involved all its employees in the implementation of the EMS that reduced water consumption by nearly 757,000 litres a day, eliminated its production of boiler ash, and increased the use of returnable packaging from 60% to 99% (Morrow and Rondinelli, 2002:164).

Hillary, in her journal, indicates that numerous internal and external benefits are expected from the implementation of formal EMSs such as ISO 14001. She defines internal benefits as positive outcomes from the implementation of an EMS which relate to the internal operation of an organisation whereas the external benefits are positive outcomes from the implementation of an EMS that relate to the external interactions of an organisation (Hillary, 2004:563). In her review of a study that evaluated 33 different studies that investigated the practical implementation experience of SMEs with EMSs and the attitudes of smaller firms to the environment study, 22 studies identified benefits from EMS implementation experiences of SMEs. The benefits included the following:

- Organisational benefits, viz. provision of a strategic overview of environmental performance, improved quality of training, improved working conditions, improved quality of environmental information.
- Financial benefits, viz. cost savings from material, energy and waste reductions and efficiencies as well as improved economic conditions of SMEs.
- People benefits, viz. increased employee motivation, awareness and qualifications; improved employee morale; enhanced skills and improved knowledge in SMEs.
- Commercial benefits, viz. gaining new customers/business and satisfying existing customers, gaining a competitive/marketing advantage and receiving a discount on annual insurance.

- Environmental benefits, viz. improved environmental performance, assured legal compliance, increased energy and material efficiencies and increased recycling.
- Communication benefits, viz. creating a positive public image, developing better customer relationships, developing better co-operation and relationships with regulators and administrative bodies and improving communication with stakeholders (Hillary, 2004:564).

2.3 PITFALLS OF THE ISO 14001 EMS IMPLEMENTATION

Although the implementation of ISO 14001 has benefits for organisations, there are also pitfalls associated with the implementation thereof. Critics contend that ISO 14001 does not ensure either legal compliance or continued performance improvements. They claim that at plants or facilities already complying with environmental regulations, ISO14001 certification may merely be an image-building or public relations effort (Rondinelli & Vastag, 2000:499).

An ISO 14001 certificate does not guarantee good environmental performance; however, it does provide guidelines for companies seeking to reduce their impact on the environment. ISO 14001 does not impose specific performance targets or emission levels, but is designed to foster continual environmental improvement (Edwards et al., 1999:1). It does not measure the actual environmental performance of the organisation and it has no requirement to assess whether the organization's environmental performance achieves continuous improvement. (Edwards et al., 1999:V). Even when the particular company shows improved performance after putting an EMS in place, this does not confirm that the improvement was caused entirely by the EMS. It is quite plausible that the improvement might have been achieved with the co-existence of other supporting factors (Nawrocka & Parker, 2009:602).

Accreditation processes require an EMS to be independently assessed and audited by certified auditors who checks compliance against clauses or elements of the system and whether the system illustrates continual improvements. However, an EMS still does not guarantee continual improvement. According to the CEC EMS guideline document (2000:8) in June 1998, the Enforcement Working Group delivered an initial report to Council on Environmental Management Systems and Compliance. In its preliminary findings, the report noted that while EMSs are a useful tool to assist an organization in achieving improved compliance and overall performance, they do not *per se* guarantee compliance or improved environmental performance.

The ISO 14001 standard does not prescribe a minimum environmental performance level that companies must achieve (Roy & Vezina, 2001:345). There is no requirement on the standard detailing how to improve the organisation's environmental performance. Instead the standard requires commitment to continual improvement of environmental performance.

The presence of an EMS allows a firm to evaluate environmental performance against policy, objectives and performance targets while seeking performance improvements. Although it can improve the environmental performance of a company, it is by no means a guarantee.

Although the EMS requires the organisation to identify and have access to legal and other requirements to which it subscribes, it does not guarantee full legal compliance. Furthermore the accreditation auditing process does not focus on legal compliance but rather on ISO 14001 compliance.

In a review study that evaluated 33 different studies in Europe that investigated the practical implementation experience of SMEs with EMSs and the attitudes of smaller firms to the environment, a few studies (7) in the review study identified disbenefits of the EMS. Disbenefits are negative outcomes or non-materialisation of benefits from the adoption of EMSs (Hillary, 2004:564). These are summarised as follows:

- SMEs found that more resources than expected, in terms of cost, time and/or skills were required for EMS implementation;
- Certification fees were higher than expected
- Consultants over-emphasised documentation and over-complicated the system
- Paper work was emphasised instead of environmental performance (Hillary, 2004:564).

While ISO 14001 is intended to deflect scrutiny from outsiders, it may actually result in the opposite. Firms that are certified may actually attract greater scrutiny because they are expected to have a more complete paper trail of their environmental impacts and because they could be perceived as touting their superior environmental performance (Bansal et al., 2002:282). Thus these firms that are ISO 14001 certified could attract more visits from the legal authorities as they might expect high levels of compliance within the organisation.

There are a number of benefits as well as pitfalls relating to the implementation of the ISO 14001 standard as indicated in the section above. Thus the aim of the study is to determine

the operational value of the ISO 14001 EMS implemented in the Underground Platinum Mines.

2.4 DIFFERENT INTERNATIONAL CASE EXAMPLES DISPLAYING THE VALUE OF THE EMS IMPLEMENTATION

2.4.1 Case Study 1: Alumax aluminium ingot production facility ISO 14001 EMS

Rondinelli and Vastag assessed the impacts of ISO 14000 certification through an in-depth case study of a plant that began preparing in 1995, more than a year before the ISO 14000 standards were officially approved. The analysis focused on the Alumax aluminium ingot production facility, called Mt Holly, in South Carolina. The study traced the history of the ISO14001 certification process at Alumax Data and was derived from archival sources, from plant site visits, from interviews with key personnel involved in the development of Mt Holly's EMS, and from a concept-mapping exercise involving 15 of the plant's managers and pollution prevention team members (Rondinelli & Vastag, 2000:500).

Mt Holly uses about 400,000 tons of alumina annually to produce T-shaped, rolling, extrusion, and 30-pound foundry ingots. Most of the metal is alloyed to meet customer specifications and then shipped to fabrication plants throughout the United States.

The ingot plant is located on 6000 acres of land (the former Mt Holly Plantation). Its large site gives it an advantage because environmental pollution (especially air pollution, which is the most significant type at aluminium smelters) is measured at the fence line.

When the plant was constructed Alumax invested more than \$40 million in the environmental control systems to make the \$340 million facility one of the cleanest plants in the world.

The plant's managers saw certification under ISO 14001 as an extension of its ISO 9002 (quality management system) registration to improve the plant's overall operations. In addition, the plant's managers considered certification under ISO 14001 a good way to demonstrate publicly its commitment to protecting the environment. As a plant that supplied products to both domestic and international customers, managers saw possibilities of obtaining competitive advantages as well as environmental benefits from pursuing ISO14001 certification.

Managers expected the EMS to help reduce costs, eliminate incidents that resulted in liabilities and contribute to developing and sharing new environmental solutions, thus improving maintenance, ensuring conformance to policy, and better meeting vendor requirements.

Six major sets of environmental aspects were identified that the EMS had to address: energy losses, air impacts, solid waste impacts, water impacts, recyclables, and raw material and labour inputs.

In the research on the impacts of ISO 14001 certification at Mt Holly, Rondinelli and Vastag (2000:503) used a 'structured conceptualization' methodology. The process is a sequence of concrete operationally-defined steps that yield a conceptual representation of an evaluation result or idea domain — in this case the impacts of ISO 14001 certification of the EMS on the Mt Holly plant -through 'concept mapping'.

The concept mapping exercise was carried out by electronic mail over three months at the end of 1999 after personal interviews and a plant site visit by the researchers. Fifteen Alcoa Mt Holly employees participated in the concept mapping process.

Value of the ISO 14001 EMS at Alumax

One of the strongest impacts of ISO 14001 certification and the adoption of a strengthened EMS was behavioural. Managers at the plant noted that the ISO 14001 certification made everyone more aware of environmental aspects, regulations, and impacts, not only at work, but at home and in the community (Rondinelli & Vastag, 2000:504).

Managers noted that ISO 14001 certification made them aware that environmental improvement was a never-ending process. To maintain their EMS they would have to be continuously alert to new ways of improving environmental performance (Rondinelli & Vastag, 2000:507). The system contributed towards an increase in environmental awareness.

The ISO 14001 certification process not only made employees more sensitive to opportunities for recycling but also led to waste reduction in the plant. The plant's annual trash generation fell from more than 3500 tons in 1989 to about 1500 tons in 1995, and during the period following adoption of the ISO 14001-certified EMS by almost half of the 1995 output by 1998. The amount of waste that had to be sent to landfills was reduced from

7608 tons in 1995 to 4960 tons in 1998. The waste cost of production per ton of aluminium dropped from \$8.33 in 1995 to \$6.50 in 1998 (Rondinelli & Vastag, 2000:505).

The strongest impacts of ISO 14001 certification identified by participants in the concept mapping exercises were that it helped them to achieve the plant's environmental goals. The ISO 14001 certification process required managers to set specific and measurable environmental goals and implement appropriate practices to attain them. Therefore the system increased both operational efficiency and effectiveness.

Case Study Key Learnings

- Support and commitment of senior management in the ISO 14001 implementation within an organisation enables the management to be able to strive towards continual improvement and to increase environmental awareness.
- Exposure of employees to the process of implementing the ISO 14001 EMS contributes to an increase in environmental awareness.
- Setting clear and specific goals/ objectives and targets to address significant environmental impacts can increase operational efficiency and effectiveness.

2.4.2 Case Study 2: Energy and gas companies in Germany ISO 14001 EMS

To determine the benefits of the EMS, in 2002 Morrow carried out in-depth case studies of five energy and gas companies in Germany that had registered their EMS under EMAS or ISO 14001 (Morrow & Rondinelli, 2002:165). The companies that were studied, included the Municipal Utility of Leipzig which had one EMAS-certified facility; the Energy Provider of Halle which certified all of its facilities through EMAS and had a company-wide certification through ISO14001; two firms, VerbundnetzGaz (VNG) and the Municipal Utility of Düsseldorf (StatwerkeDüsseldorf for SWD), which were ISO 14001-certified as well as the Middle Germany Energy Provider (MEAG) had a non-certified EMS.

Reasons why German companies registered their EMS were to achieve continuous improvements in environmental performance, identify weaknesses and potential uses of energy sources, motivate employees, improve their image, and increase legal certainty. Companies were also motivated to improve their internal organization and documentation, detect and minimize environmental and liability risks, and reduce specific environmental impacts.

Value of the ISO 14001 Energy and gas companies in Germany

The employees interviewed in all five German energy and gas companies reported that improved documentation and increased efficiency were primary motives for developing and registering their EMS (Morrow & Rondinelli, 2002:165).

All five the energy and gas case companies reported improvements in regulatory compliance and legal certainty, as the result of developing and registering their EMS. EMS implementation served two main functions for these companies. First, it gave companies a reason to take the time to comb through Germany's complex and extensive environmental laws and regulations in order to determine their stance on compliance. Second, the knowledge gained by going through the process of coming to terms with applicable laws and regulations enabled environmental managers to more easily adapt to the relatively frequent changes that occur in German environmental regulations (Morrow & Rondinelli, 2002:168).

Four companies saw significant improvements in their environmental documentation and a fifth company saw minor improvements. All of the companies had inadequate environmental documentation prior to EMS implementation (Morrow & Rondinelli, 2002:168).

The same companies reported improvements in employee awareness. Each certified company did indeed report substantial improvement in employee awareness, and attributed such improvement to EMS implementation and certification (Morrow & Rondinelli, 2002:168).

The energy and gas firms saw relatively weak impacts in terms of competitive advantage, although most had hoped for such an advantage prior to EMS certification. Only one company in this study, SWD, reported that ISO 14001 certification had resulted in an advantage in winning contracts (Morrow & Rondinelli, 2002:169).

Case Study Key Learnings

- Implementing ISO 14001 EMS is a systematic process requiring a number of documentation exercises, including procedures and records. When the documentation is developed correctly and in line with the requirements of the ISO 14001 guideline it can assist in formalising the overall environmental management of the organisation. Documentation also ensures an effective audit trail as they act as evidence of how the overall EMS of the organisation is implemented.
- Exposure of employees in the process of implementing the ISO 14001 EMS contributes to an increase in environmental awareness.

- According to Section 4.3.2 of the ISO 14001 (2004:5) the organisation shall identify and have access to applicable legal and other requirements to which it subscribes and which are related to its environmental aspects. Understanding and being able to identify all the significant environmental aspects in line with the operation's activities, products and services leads to the organisation and management being able to understand their stance in terms of legal compliance. This knowledge also contributes towards increase in environmental awareness.

2.4.3 Case Study 3: ISO 14001 EMS in Polish Companies

The empirical research was carried out by Matuszak-Flejszman at the Department of Standardized Management Systems of Poznań University of Economics between 2005 and 2007 (Matuszak-Flejszman, 2009:415). One of the main questions the author focused on in his research was: "What benefits have the organizations gained as a result of implementing environmental management systems and certifying them against ISO 14001?".

The main goal of her survey was to identify and assess all the factors influencing the development of environmental management systems, as well as to identify all the benefits of an environmental management system operating in Polish companies which had certified their environmental management system against ISO14001.

The questionnaire was compiled and sent at random to 700 out of 1,500 companies which as of June 2007 were certified against ISO 14001. Based on 202 correctly filled-in questionnaires which were sent back, survey results were drawn up (Matuszak-Flejszman, 2009:415).

Value of the ISO 14001 EMS in Polish companies

According to surveyed companies, 97% indicated that the most important positive impacts from implementing and maintaining the EMS were enhancing management in the field of environmental protection and raising the employees awareness on environmental requirements (95%) (Matuszak-Flejszman, 2009:416).

Another group of benefits was that the ISO 14001 EMS enabled them to identify and address significant operational environmental impacts. These impacts included reducing the volume of produced waste (79%), reducing or eliminating air pollution (69%) and reducing resource consumption(66%) (Matuszak-Flejszman, 2009:416).

Another group of benefits arising from having a certified EMS conforming to ISO14001 were benefits that affect the financial situation of the organization, i.e. economic impacts. In this field the surveyed organizations achieved benefits connected with enhanced market position (67%), a rise in competitiveness(63%), and cost reduction due to smaller resource consumption(62%)(Matuszak-Flejszman, 2009:417).

The last, fourth group of benefits included the external benefits. In this case, 84% of the surveyed organizations recognized that their image in the eyes of local authorities was enhanced. Slightly fewer, i.e. 63% of the respondents, noted that they instilled the idea of environmental protection in their subcontractors and suppliers (Matuszak-Flejszman, 2009:418).

Nevertheless, the results of the survey indicate that the organizations achieved benefits in all areas. The surveyed companies were also asked about the effectiveness and efficiency of environmental management systems. 85% of respondents considered environmental management systems to be effective and 76% considered it to be efficient (Matuszak-Flejszman, 2009:418).

Case Study Key Learnings

- Exposure of employees in the process of implementing the ISO 14001 EMS contributes to an increase in environmental awareness.
- The ISO 14001 system can increase operational efficiency and effectiveness when clear operational specific goals are set to address significant environmental impacts.
- ISO 14001 EMS enables organisations to identify environmental aspects and impacts associated with their activities, products and services and to develop control measures to mitigate those impacts, thus striving towards protection of the environment. This in turn strengthens the company image from the authorities and suppliers point of view.

2.5 UNDERGROUND PLATINUM MINE

Three mines of Underground Platinum Mine were reviewed in this research, Operation1, Operation 2 and Operation 3.

Underground Platinum Mine is a division of a large Platinum limited company that is part of the world's leading primary producer of platinum group metals (PGMs) and accounts for about 40% of the world's newly-mined platinum. The Company is listed on the JSE and has

its headquarters in Johannesburg, South Africa (Underground Platinum Mine website address not referenced due to confidentiality reasons).

2.5.1 Underground Platinum Mines ISO 14001 drivers

The Underground Platinum Mines Environmental Vision is to minimise harm to the environment by designing, operating and closing all their operations in an environmentally responsible manner (AEW, 2009:3).

One of the standards developed by Underground Platinum Mines to support this vision is an Environmental Management System Standard. This standard is mandatory at Underground Platinum Mines and the requirements thereof are set at corporate level. Furthermore the standards, including the EMS standard, are supported by detailed procedures and guidelines.

The objectives of the Standards are to:

- Support the realisation of the “Good Citizenship: Our Business Principles” and our Environmental Vision, Principles and Policy;
- Provide a risk/opportunity-based management strategy that is consistent with ISO 14001;
- Provide clear environmental performance criteria against which environmental management across the Group can be measured and audited; and
- Provide a uniform basis for the provision of assurance and from which to drive continual improvement across the Group. (AEW, 2009:7).

All Underground Platinum Mines are required to develop, document, implement, maintain and review their EMS, which should be certified to ISO14001:2004 (AEW, 2009:13).

The purpose of their EMS standard is to ensure that all Underground Platinum Mines implement a formal certified Environmental Management System (EMS) to avoid or mitigate potential adverse impacts on the environment (AEW, 2009:9).

The presence of a formal and certified EMS should establish a system of operation, control and maintenance of the environmental program to ensure continuing high levels of overall system performance (Melnyk et al., 2003:333).

Even though domestic standards and customers may not be making demands, firms may discover that their international customers require ISO 14001 certification to ensure that their

environmental risks are minimal. For example, Bahia Sul Cellulose was the first firm to be ISO 14001 certified in Brazil and it did so in anticipation of ISO 14001 certification being required by its European customers (Bansal & Bogner, 2002:279).

2.5.2 Underground Platinum Mines environmental value

When it comes to the environment, Underground Platinum Mines is committed to this value:

We value and care about each other. Our care reaches out to include our communities and the environment (Underground Platinum Mine Strategy website – address omitted for confidentiality purposes).

2.5.3 Main operational activities at Underground Platinum Mines

a) Operation 1 - Mine

In operation 1, ore is extracted from underground through a labour-intensive process. Miners bore holes with hand-held pneumatic devices and then blast them with explosives to obtain the ore. Then the ore is transported to the surface for processing.

b) Operation 2 - Concentrator

Operation 2 separates platinum group metals and associated base metal sulphides from the mined reef from underground. The ore is crushed and milled to obtain smaller rock particles, thus exposing the PGM minerals.

c) Operation 3 -Smelter operation

Operation 3 processes concentrate from the concentrators operated by the Company, joint-venture partners and third parties. Once Concentrate is smelted, it results in the production of furnace matte. The matte is then treated using the Underground Platinum mines converting process. The converter matte tapped from the converter is then slow-cooled, crushed and dispatched to the refineries for further processing.

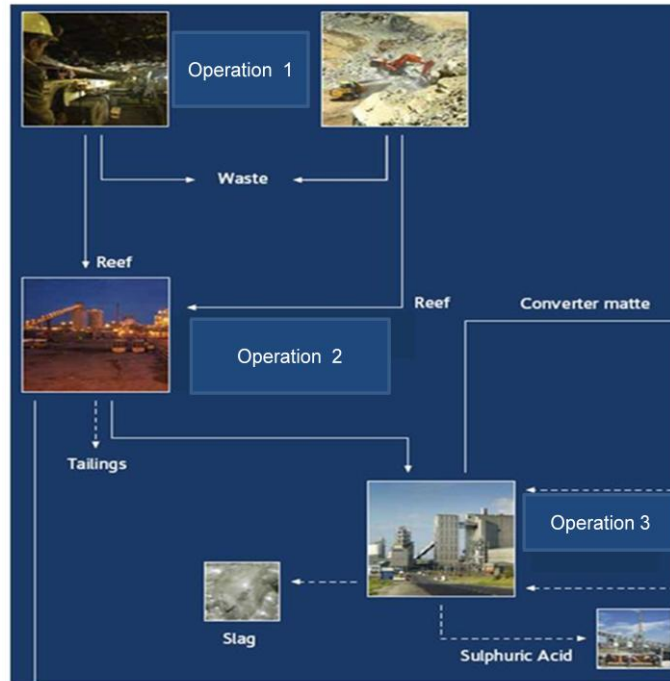


Figure 1 Underground Platinum Mine schematic diagram

The literature reviewed has illustrated a number of internal and external benefits as well as shortcomings associated with the implementation of the ISO 14001. Different case studies reviewed showed the effectiveness of the ISO 14001 resulting in a number of operational values experienced by different organizations.

Underground Platinum Mines have implemented ISO 14001 EMS with the aim of meeting their vision of minimizing harm to the environment as well as addressing their value of caring of the environment. According to Prinsloo and Van Der Walt (1999:12) the EMS provides a tool whereby organizations can prove their responsible management of environmental issues. If successfully implemented the EMS also provides internal and external parties with confidence to ensure that all environmental issues associated with activities, products and services of the organization are responsibly managed (Raubenheimer & Logie, 1997:1). The extent to which the implementation of an EMS at operational level contributes to the value defined by Underground Platinum Mine is described in Chapter 4.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes the research methodology applied to address the main research aim/problem statement.

The chapter provides the outline of the research design, sampling techniques, data collection, data analysis and the methodology of execution. The approach to the literature review, questionnaires and interviews is clearly explained and measurement instruments as well as the limitations of studies are outlined.

The researcher proposed to conduct a structured survey-based research study among employees in three different operations within Underground Platinum Mines.

3.1 SCOPE OF THE RESEARCH

The scope of the research is limited to three of the Underground Platinum Mines: Operation 1, Operation 2 and Operation 3. Each operation has its own EMS. The three EMSs are used as three different case studies and are reviewed and analysed to determine the value the systems added to the operations selected as well as in the overall Underground Platinum mines.

3.2 SAMPLE DESIGN

3.2.1 Sampling frame

The research target particularly senior managers as they are main decision-makers within the operations as well as the environmental practitioners who at Underground Platinum mines are referred to as Environmental Coordinators (EC). EC are targeted because they are responsible for the development, implementation and maintenance of the EMS.

Low and middle level employees who are responsible for the implementation of the EMS in various sections of the operation such as workshops, underground operations, sewage plant and waste disposal areas were randomly chosen or selected to participate in the survey.

3.2.2 Sampling Size

The basic rule is the larger the sample the better (Leedy & Omrod, 2005:207). The researcher targeted atleast 40 employees however only 29 employees responded. The

sample allowed the researcher to obtain information related to the research and make conclusions as indicated in chapter 5.

3.3 RESEARCH DESIGN

The research was qualitative assessment and a basic analysis was performed “Collecting credible data is a tough task and it is worth remembering that one method of data collection is not inherently better than another”. Data collection can be derived from a number of methods, which include interviews, focus groups, surveys, telephone interviews, field-notes, taped social interaction or questionnaires (Heaton, 2004:37).

Data was collected using a structured survey method. The main research methods that were applied included literature review, questionnaires and interviews. These are described below:

3.3.1 Literature review

Both a local and an international literature review were conducted to obtain an overview of the EMS developed in line with the requirements of ISO 14001; its concepts and associated benefits and values. Literature was collected and reviewed to gain access and an understanding of the current knowledge including findings as well as theoretical and methodological contributions already made in terms of the value of the EMS to operations at large, see chapter 2.

Particular attention was given to different case studies illustrating the operational value of the EMS. Three to four operational values were selected and used to determine the actual operational value of the Underground Platinum Mine. Various journals, books and publications relating to the operational value and effectiveness of the ISO 14001 EMS were also reviewed.

The EMS documentation of each selected Underground Platinum Mine operation was also reviewed to gain information about each operation’s significant impacts and to be able to determine the operational value of the EMS.

The Internet proved a valuable source as well for up-to-date information such as research articles and case studies conducted by environmental professionals.

3.3.2 Questionnaires

Two types of questionnaires were developed, one for senior management whom the EMS implementers report to in order to determine their view with regard to the EMS and another questionnaire was developed for general employees at the low and middle levels responsible for the implementation of the EMS in various sections of the operations. Individuals were randomly chosen or selected to participate in the survey (Appendices A and B). The questionnaires were emailed to the ECs to further email to both the senior managers and employees on their operations. Emails were chosen as a viable method as they have the ability to obtain views of key stakeholders quickly and at low cost (Madge, 2006:2). Individuals who were interested in participating were given options to either receive the questionnaire via email or a printed copy whichever was convenient and practical. Follow-up calls were made to the EC to remind them about the questionnaire submission date.

Each questionnaire contained an introductory section related to the personal details of participants, including details of full name, area of responsibility, designation and duration of EMS involvement. Contact details of the researcher were also provided on both questionnaires to ensure sufficient communication. Questions 1 to 4 of the General employees questionnaire and questions 2,4, 5 and 7 of the Senior managers questionnaire were developed to obtain information in relation to the research sub questions described in chapter 1.

Question 1 in the Senior Manager's questionnaire was asked to determine the extent which the implementation of an EMS at an operational level contributed to the values defined by Underground Platinum Mine. Question 15 focuses on the problem statement defined in chapter 1. The rest of the questions were used to obtain detail information relating to Underground Platinum Mine EMSs to further understand the EMSs operational value.

The questionnaires had a combination of a checklist and likert scale to facilitate both the evaluation and the quantification of responses from participants. The questions' responses were grouped under *strongly agree*, *agree*, *neutral*, *disagree* and *strongly disagree* to make it easy for interpretation. Close-ended questions were used. Respondents may find it easier to answer the question when response alternatives are provided, and it is easier and less time-consuming to interpret and analyse the responses to closed questions (Thayer Hart, 2010:9).

All questions were related to the overall effectiveness and value added by the EMS implemented in the Underground Platinum Mines. In order to increase the response rate, participants were given an option to either provide their names or not. According to the Birmingham City University's study guide for writing questionnaires (Undated), if your questionnaire contains sensitive or personal questions, you need to convince potential respondents that their answers will be confidential. If not, they will not respond.

3.3.3 Interviews

Personal Interviews were held with the ECs as they are responsible for the development, implementation and maintenance of the EMSs. The data was collected using structured interviews (Appendix C). Corbetta (2003:269) states that structured interviews are "...interviews in which all respondents are asked the same questions with the same wording and in the same sequence". In a structured interview the researcher only asks a standard set of questions and nothing more (Leedy & Ormrod, 2005:184).

The interviews were done through identification of critical questions in advance. All questions were related to the overall effectiveness and value added by the EMS implemented in the Underground Platinum Mines, individuals' views, experience, general remarks and comments related to the topic.

Interviews were conducted to supplement the questionnaires described in the section above in order to obtain further information when needed.

Only individual interviews were done, not in a group context. According to Leedy and Ormrod (2005:149) whenever you gather two or more individuals into a single interview, these individuals will rarely act as true equals. Some participants are likely to dominate the conversation whilst others may be reluctant to express their views.

3.4 CONSTRAINTS AND LIMITATIONS

There were a number of limitations that were experienced with the study. The questionnaires and interviews that were used for data collection had the following limitations:

Lack of interest – most of the participants had to be reminded several times by the EC to complete the questionnaires. The survey was at times viewed as a nuisance and/or an inconvenience.

Participants were reluctant to answer questions asked by unknown personnel. The Senior Environmental Manager had to send an email to request participants to assist with the survey. Not all personnel who received the questionnaires responded.

There was limited time to perform all necessary on-site interviews due to unavailability of key personnel to be interviewed. ECs were busy with site audits and had limited time to answer interview questions.

With all the above listed constraints and limitations of the research study, it should be noted that only a limited amount of data could be collected and thus the findings are only the interpretation of the researcher.

CHAPTER 4: RESEARCH RESULTS

This chapter aims to describe the extent to which Underground Platinum Mine agrees or disagrees with the problem statement as outlined in chapter 1: as well as to answer the following sub-questions (refer to section 1.3):

- To what extent does the implementation of an EMS at operational level contribute to the values defined by Underground Platinum Mines?
- To what extent does the implementation of an EMS reduce operational risks associated with the significant environmental aspects identified?
- To what extent does the implementation of an EMS improve general environmental awareness within the different levels and functions of the organization?
- To what extent does the implementation of an EMS illustrate continual improvement of the environmental performance of the organisation?

4.1 Introduction

Chapter 2 introduced the research methodology for gathering and analysing the data. In this chapter, the results obtained by applying the research methodology are presented, described and interpreted. The chapter begins with the results from the interview sessions held with the ECs, followed by a demographic profile of respondents who were surveyed and then by the various sections of the research instrument used by the researcher to answer the above-mentioned sub-questions.

The researcher distributed questionnaires via email to the ECs of selected Underground Platinum Mines and requested them to forward them to employees in their responsible selected operations. Twenty-nine (29) questionnaires were returned completed properly and in full.

Two types of questionnaires were developed, viz. one for senior management whom the EMS implementers report to, and another questionnaire for general employees which included low and middle level employees responsible for the implementation of the EMS in various sections of the selected operations. In total there were 29 respondents overall surveyed in the distribution, 12 EMS senior management members and 17 general employees. Graph 1 describes the distribution of all respondents by the number of years they were involved in EMS.

Structured Interviews (Appendix C) were also held with the ECs as they are responsible for the development, implementation and maintenance of the EMSs.

4.2 Interview results

A structured interview questionnaire consisting of fifteen (15) open-ended questions was developed and used to obtain EMS-related information from the three ECs responsible for implementing the EMS in Mines 1, 2 and 3 of the Underground Platinum Mine.

The following are the qualitative interview results grouped according to similar related EMS questions. The results provide an overview of the current status of the EMSs and describe the extent to which the implementation of an EMS at operational level contributes to the Underground Platinum Mines value of caring of the environment.

4.2.1 EMS Development and Implementation Background (Q1 to Q5 and Q7)

All three EMSs were developed between 1996 and 2003. The systems were developed following the decision made from the Underground Platinum Mine Corporate Environmental Department that all operations were to implement and have a certified ISO 14001 EMS. Some of the reasons for implementing the EMSs were aimed at assisting the Underground Platinum Mines with international recognition, ensuring legal compliance and conserving the environment.

The three ECs indicated that they were all new to the operations and all found the EMSs already certified by external third party auditors.

4.2.2 Significant environmental aspects, operational efficiency and EMS contributing towards continual improvement of environmental performance (Q6 and Q10 to Q12)

The EMSs enabled the mines to identify the environmental significant environmental aspects and impacts arising from its operations, activities and processes. These included compliance with issued environmental licences, incorrect storage of hydrocarbons, wastage of natural resources (water and electricity), hydrocarbon spillages, under groundwater pollution and return water dam pollution.

The ECs believe the systems have increased operational efficiency because more focus has been put on saving natural resources, particularly water and electricity. One EC was quoted saying: "The EMS increases operational efficiency because we look at issues such as

energy and water use efficiencies to try and save both water and energy and prevent wastage”. Production equipment is maintained more effectively and the EMS allows deficiencies to be proactively identified during the inspections and audits without delaying any production processes.

Two out of the three ECs believe the EMS has enabled their operations to prevent or minimize significant impacts on the environment. However, one EC believes otherwise and indicated that instead of preventing or minimizing the impacts, the EMS is rather causing an increase in financial implications to the firm.

The management review conducted as per the ISO 14001 requirements allows the operations to assess the effectiveness of the EMS and to put actions in place to improve the environmental performance. As a result, all the ECs agreed that the EMS is contributing towards continual improvement of the operations environmental performance.

4.2.3 EMS and legal compliance (Q8 and Q9)

None of the ECs agree that the EMS guarantees full environmental legal compliance, but they agree that it enables the operations to work towards complying with environmental legislation. They believe the ISO 14001 EMS requirement to conduct the legal compliance evaluations/audits and to have access to the legislation applying to its aspects enables them to know what environmental legislation they comply with, what the gaps are and enables them to develop actions plans towards complying to the relevant legislation.

4.2.4 Employees and the EMS (Q13 to Q15)

All ECs agree that employees are involved in the daily implementation of the EMS and the systems have contributed to the awareness of the employees in terms of the environmental issues. Therefore, it may be concluded that the EMSs are operational on a daily basis.

4.3 Method of analysing the survey data

Analysis for descriptive data was performed using the Statistical Package for Social Sciences (SPSS version 20), SPSS Statistics. SPSS is advanced analytical software specialising in analysing social data and consists of many statistical methods that can interpret and calculate data in the form of organised datasets. SPSS consists of an integrated series of computer programs which enable the user to read data from questionnaire surveys and other sources (e.g. medical and administrative records),to

manipulate them in various ways and to produce a wide range of statistical analyses and reports, together with documentation(Journey in Survey Research, 2012).

SPSS Statistics supports the entire analytical process. It helps people validate assumptions faster, guiding them in using the right statistical capability at the right time. It also gives analysts flexible access to powerful analytical techniques, whatever their level of expertise. Finally, it helps organizations to make the most of their analytical resources by scaling from the simplest to the most wide spread initiative.

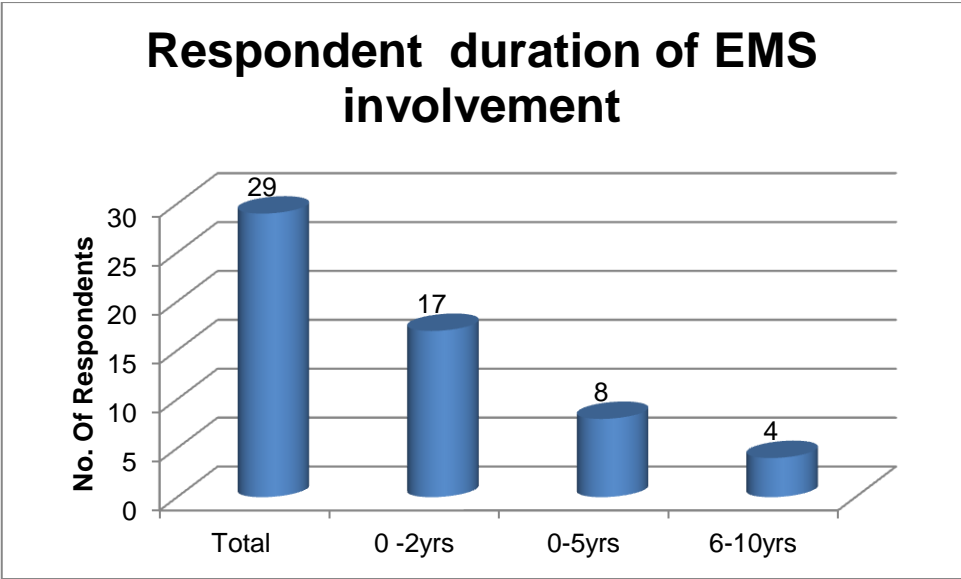
With SPSS Statistics, organizations can streamline their data analysis and reporting processes (IBM, 2012:3).

Tables and graphs are used to summarise the data analysed. System missing values in the data analysed in the tables occur when no value can be obtained for a variable during data transformations. Thus it refers to either the number of general employees or senior managers depending who the questions did not refer to.

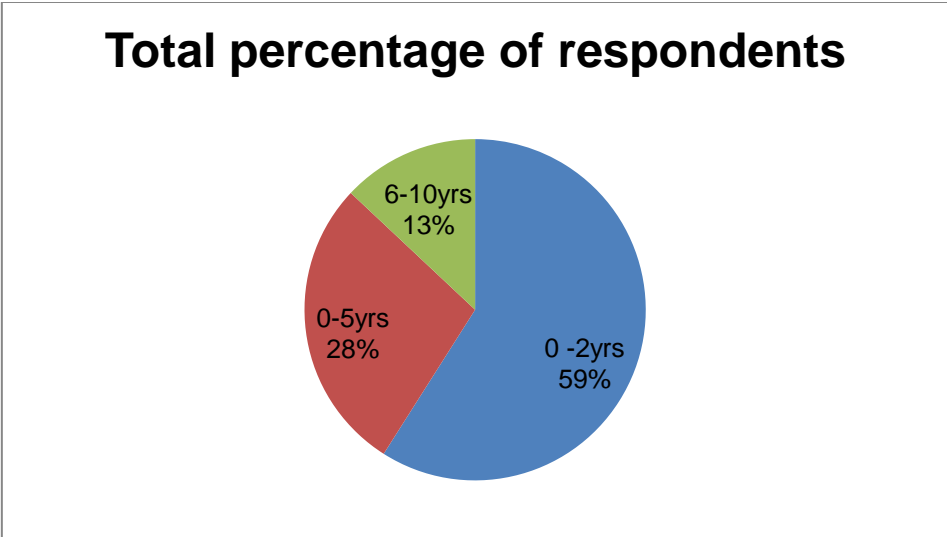
4.4 Survey results

In total there were 29 respondents overall surveyed in the distribution. Graph 1 below describes the distribution of all respondents by the number of years they were involved in EMS.

17 of the EMS respondents who have been involved in EMS for up to 2 years (0-2 years) formed the largest group in the distribution with over half (59%),and these were followed by those respondents who identified themselves as having been involved with EMS for the duration between 3-5 years (28%). EMS respondents who had up to 10 years of EMS involvement (6-10 years) formed the smallest sample in the distribution (with only less than a fifth) (13%) represented. The percentage of respondents is illustrated in Graph 2.



Graph 1. Description of respondents' distribution per years of EMS involvement



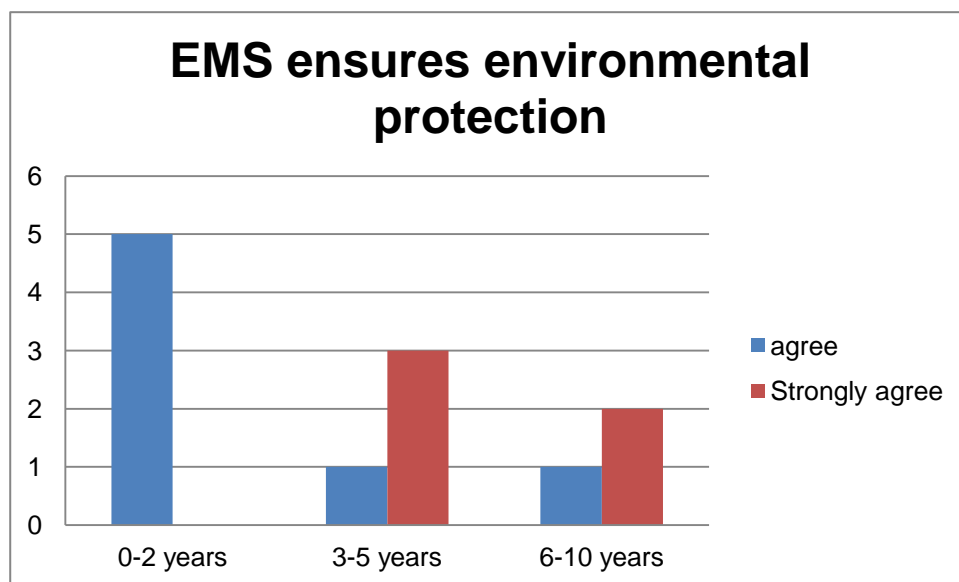
Graph 2: Description of total percentage of respondents per duration of EMS involvement

4.4.1 To what extent does the implementation of an EMS at operational level contribute to the values defined by Underground Platinum Mines?

TABLE 1.Senior Management -EMS Ensures Environmental Protection (Q1)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Agree	7	24.1	58.3	58.3
Valid Strongly Agree	5	17.2	41.7	100.0
Valid Total	12	41.4	100.0	
Missing System	17	58.6		
Total	29	100.0		

All senior managers, when asked if the ISO 14001 EMS ensures environmental protection, agreed, with 58% just agreeing to the statement and 42% strongly agreeing.



Graph 3: EMS ensures environmental protection- Senior Management responses per duration of EMS involvement

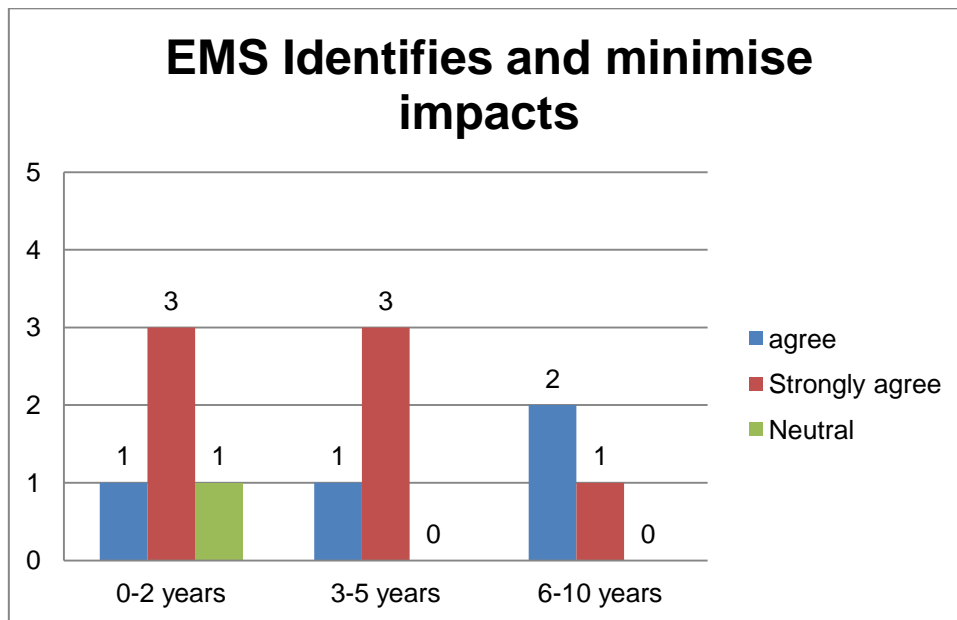
42% of those who strongly agreed were those managers with EMS involvement between 3 to 5 years (3 out of 12) and 6 to 10 years (2 out of 12). The majority of the managers who just agreed to the statement were of EMS involvement between 0 to 2 years (5 out of 12).

4.4.2 To what extent does the implementation of the EMS reduce operational risks associated with the significant aspects identified?

TABLE 2: Senior Management- EMS identifies and minimises the environmental impacts arising from the operation (Q4)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	1	3.4	8.3	8.3
	Agree	4	13.8	33.3	41.7
	Strongly Agree	7	24.1	58.3	100.0
	Total	12	41.4	100.0	
Missing	System	17	58.6		
Total		29	100.0		

58% of Senior Managers strongly agreed with the statement that the EMS identifies and minimises impacts arising from the operation whereas 33% just agreed. None of the managers disagreed with the statement.



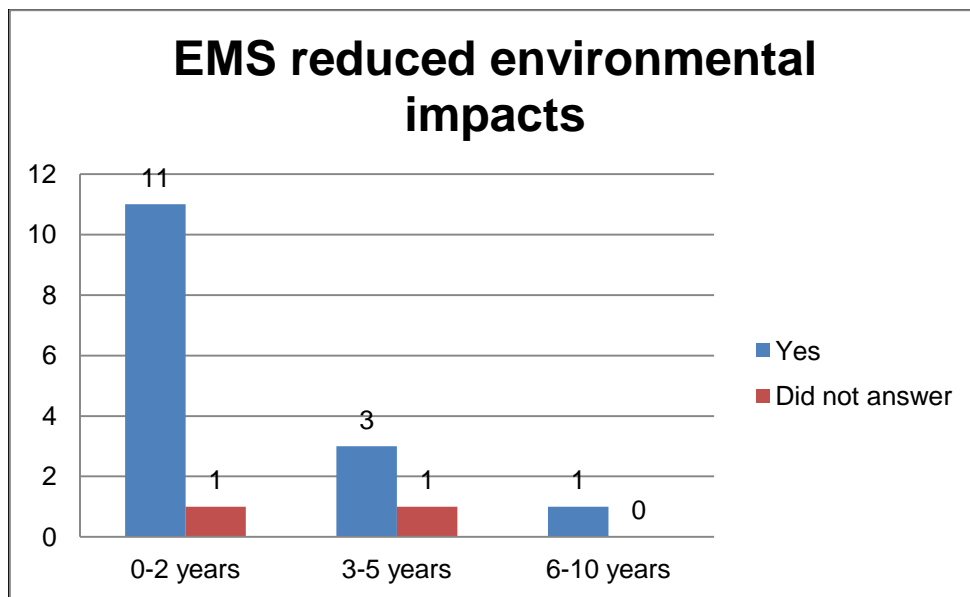
Graph 4: EMS identifies and minimise impacts- Senior Management responses per duration of EMS involvement

The majority of the 58% of senior managers who strongly agreed with the statement that the EMS identifies and minimises impacts from the operation are managers with 0-2 years EMS involvement (3 out of 12) and 3-5 years of EMS involvement (3 out of 12). Only one manager with the EMS experience of 6-10 years strongly agreed. Those who agreed were evenly representing different years of EMS involvement.

TABLE 3. General employees- Has the EMS reduced the environmental impacts in your area of responsibility? (Q3)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	51.7	88.2
	Did not Answer	2	6.9	100.0
	Total	17	58.6	100.0
Missing	System	12	41.4	
Total	29	100.0		

Table 3 above shows results of EMS general employees who responded to the question on whether EMS reduced the environmental impacts in the area of their responsibility. Fifteen out of 17 (88%) of these employees agreed that EMS reduces environmental impacts in the area of their responsibility. Slightly more than a tenth (12%) of them did not answer the question.



Graph 5: EMS reduced environmental impacts- General Employee’s responses per duration of EMS experience

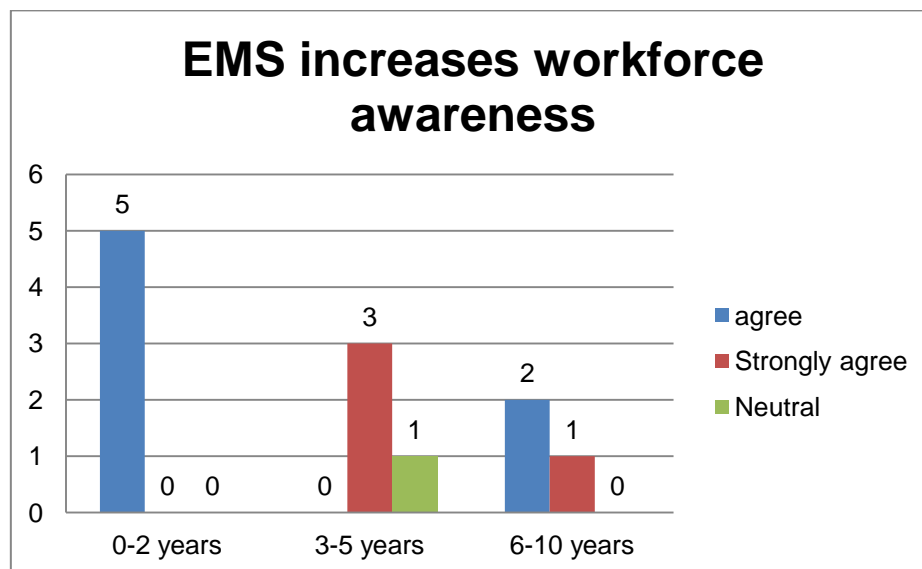
The majority of the 88% of general employees, who agreed with the statement that EMS reduced the environmental impacts, are those with 0-2 years of EMS involvement (11 out of 17) and (3 out of 17) are between 3-5 years of EMS experience. 12% of the general employees did not answer the question.

4.4.3 To what extent does the implementation of an EMS improve general environmental awareness within the different levels and functions of the organization?

TABLE 4. Senior Management -EMS increases workforce awareness of environmental issues (Q7)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	1	3.4	8.3	8.3
	Agree	7	24.1	58.3	66.7
	Strongly Agree	4	13.8	33.3	100.0
	Total	12	41.4	100.0	
Missing	System	17	58.6		
Total		29	100.0		

When EMS senior managers were asked whether they agreed or did not agree that EMS increased workforce awareness of environmental issues, none of them either disagreed or strongly disagreed. Nearly three-fifths (58%) of them indicated that they agreed, with slightly more than three-tenths (33%) showing the strength of their agreement (strongly agreed). Less than a tenth (8%) neither agreed nor disagreed with the statement, choosing to remain neutral instead.



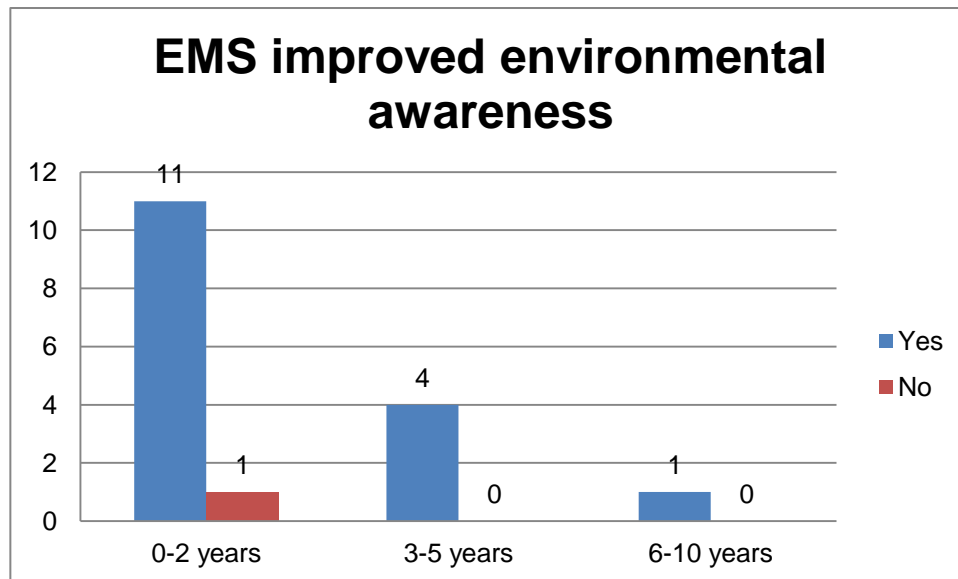
Graph 6: Senior Management - EMS increases workforce awareness- responses per duration of EMS involvement

58% of senior managers who agreed that the EMS increases workforce awareness are mainly those with 0-2 years of EMS involvement (5 out of 12). Only two senior managers with 6-10 years EMS involvement agreed with the statement.

Table 5. General employees- Has the EMS increased employee awareness of environmental issues? (Q5)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	16	55.2	94.1	94.1
Valid No	1	3.4	5.9	100.0
Total	17	58.6	100.0	
Missing System	12	41.4		
Total	29	100.0		

When EMS general employees were asked whether an EMS increased employee awareness of environmental issues, sixteen (94%) out of seventeen of them agreed, while only one (6%) of them disagreed.



Graph 7: Has the EMS increased employee awareness of environmental issues- General employees responses per duration of EMS involvement

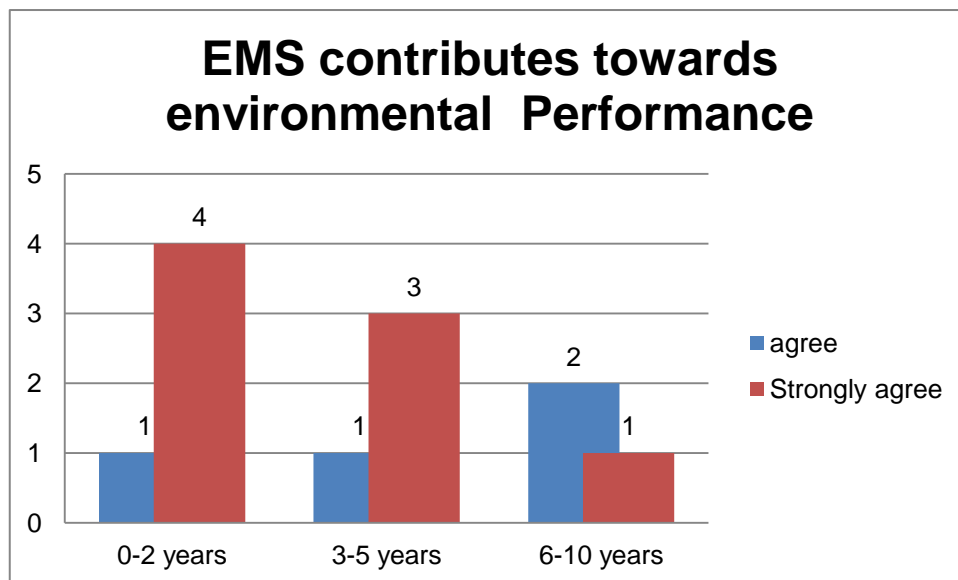
94% of all the employees who agreed with the statement that the EMS improved environmental awareness are mainly from 0-2 years EMS experience and 3-5 years EMS experience with (11 out of 17) and (4 out of 17) respectively.

4.4.4 To what extent does the implementation of an EMS illustrate continual improvement of the environmental performance of the organisation?

TABLE 6. Senior Management - EMS contributes towards continual environmental performance (Q2)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Agree	8	27.6	66.7	66.7
Valid Strongly Agree	4	13.8	33.3	100.0
Total	12	41.4	100.0	
Missing System	17	58.6		
Total	29	100.0		

Table 6 above shows results in the distribution of EMS senior managers who were asked to rate the level of their agreement or disagreement on whether EMS contributed towards a continual environmental performance. Although all EMS senior managers surveyed agreed that EMS did contribute to continual environmental performance, only above three-tenths (33%) of EMS senior managers strongly agreed with the statement, while more than three-fifths (67%) simply agreed.



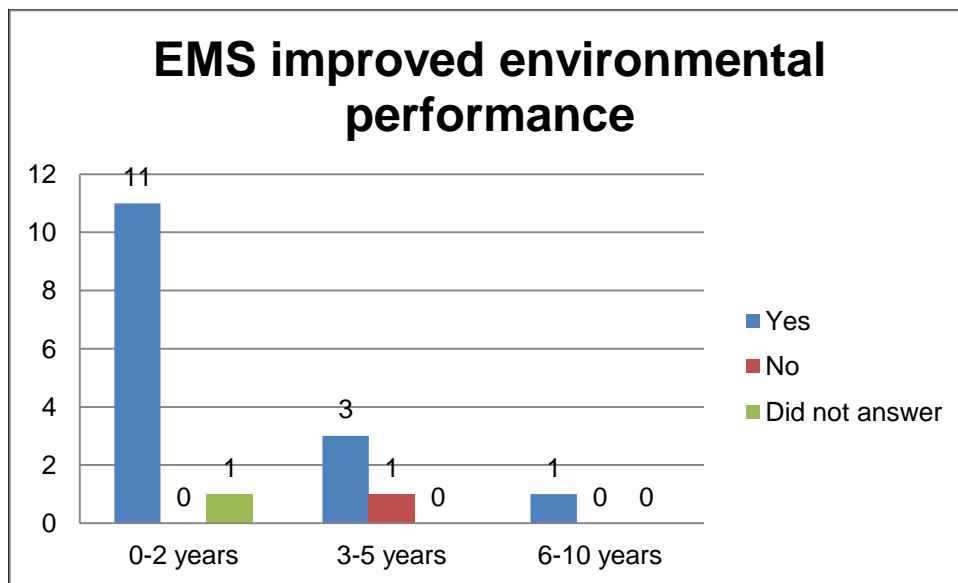
Graph 8: EMS contributes towards environmental performance – Senior Management responses per years of EMS involvement

Out of the of the 67% of EMS senior managers who strongly agreed with the statement of continual improvement, majority of those (4 out of 12) had 0-2 years and 3 out of 12 had 3-5 years of EMS involvement. Those who simply agreed were dispersed in different years of involvement.

TABLE 7. General employees - Has the EMS improved the environmental performance of your operation and your area of responsibility?(Q4)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	15	51.7	88.2	88.2
Valid No	1	3.4	5.9	94.1
Valid Did not Answer	1	3.4	5.9	100.0
Total	17	58.6	100.0	
Missing System	12	41.4		
Total	29	100.0		

The table above shows that fifteen (88%) out of seventeen EMS general employees surveyed agreed that EMS improved the environmental performance of their operation and the area of their responsibility. Only one (6%) of EMS general employees disagreed, while the same number (6%) did not answer the question.



Graph 9: EMS improved the environmental performance of operation and area of responsibility- General employees' response by duration of EMS involvement

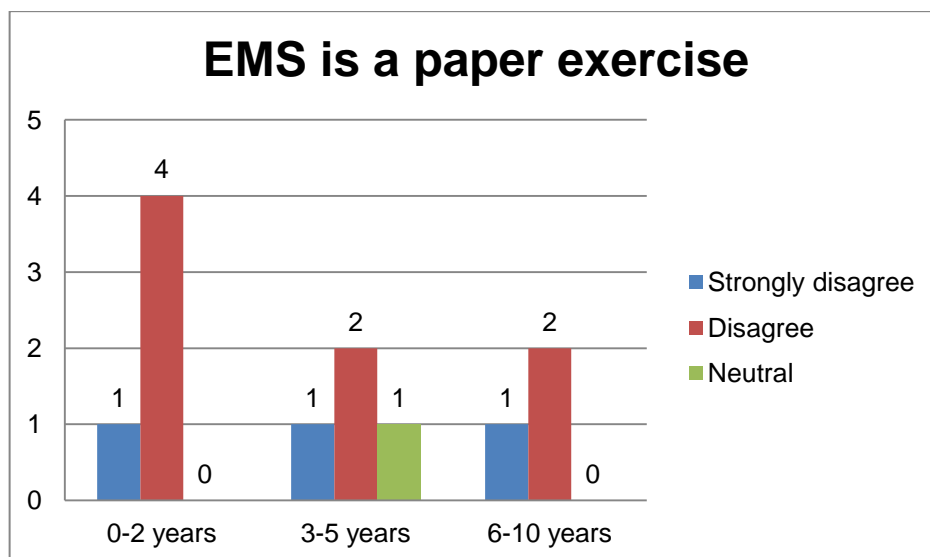
11 out of 17 of the general employees with 0-2 years of EMS experience formed a majority part of the 88% of the employees who agreed with the statement that the EMS improved environmental performance. About 3 of the 17 employees with 3-5 years experience also agreed. Only one employee with 3-5 years experience did not answer.

4.4.4 To what extent do Senior Managers agree or disagree with the problem statement?: The problem is that the implementation of an EMS is associated with a number of shortcomings and may be seen as a paper exercise to satisfy the needs of external auditors during audits with no value achieved by the organization

Table 8. Senior Management - EMS is a paper exercise (Q15)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	10.3	25.0	25.0
	Disagree	8	27.6	66.7	91.7
	Neutral	1	3.4	8.3	100.0
	Total	12	41.4	100.0	
Missing	System	17	58.6		
Total		29	100.0		

When senior managers were asked whether they thought EMS was a paper exercise, 8 out of 12 (67%) of them disagreed, while only a quarter (25%) of them strongly disagreed. Surprisingly, none of them agreed that EMS was a paper exercise, with only 1 (8%) among them choosing to neither agree nor disagree.



Graph 10: EMS is a paper exercise- Senior Management response per duration of EMS involvement

67% of those senior managers who disagreed that the EMS is a paper exercise were mainly from those managers with duration of 0-2 years EMS involvement (4 out of 12). The other (4 out of 12) that disagreed were from both the different years with (2 out of 12) from the 3-5 years of EMS involvement and another (2 out of 12) from the 6-10 years group.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter provides final conclusions drawn and recommendations made in respect of the main aim of the research introduced in Chapter 1, namely:

To determine the operational value that implemented environmental management systems have in the selected Underground Platinum Mines in South Africa.

The chapter illustrates that the main aim of the research has been achieved and research sub-questions have been answered. The chapter therefore provides a summary of the results in relation to each research sub-question and present the overall conclusions and recommendations.

5.2 SUMMARY OF RESULTS

The following is the summary of the results with regard to the research sub-questions.

1. What does the Underground Platinum Mine value in their operations

“We value and care about each other: Our care reaches out to include our communities and the environment”. This is the value that Underground Platinum Mine has committed to in its strategy (Underground Platinum Mine Website). The Underground Platinum Mine management believes that robust management of environmental issues is a fundamental element of good overall operational management, and a source of competitive advantage. Poor management of environmental issues is inconsistent with the mine’s values and long-term business interests (AEW, 2009:3).

The Constitution (South Africa, 1996) provides that “everyone has the right to a safe and healthy environment”. It places the responsibility on the state and the mining industry (including Underground Platinum Mine) and all South Africans to prevent pollution and other damage to the environment and to promote conservation and sustainable development. The Constitution clearly states that this must be done, amongst others, through reasonable legislative measures.

Mining itself is a destructive development activity whereby the ecology suffers. The environmental impacts associated with mining occur through a variety of mining activities such as ore processing, refining and operating tailings disposal facilities. In South Africa

mining activities are responsible for severe environmental impacts (Prinsloo & van der Walt, 1999:12). Mining bodies, including Underground Platinum Mine, are under pressure to uphold the highest environmental standards and to endorse a good public image due to the reputational risk that can threaten their daily operations.

According to AEW (2009: 3), the Underground Platinum Environmental Vision is to minimise harm to the environment by designing, operating and closing all of our operations in an environmentally responsible manner. The vision supports the value of caring for the environment particularly in all the mining processes, from the design until the closure phase.

2. To what extent does the implementation of an EMS at an operational level contribute to the values defined by Underground Platinum Mine?

Evidence shows that environmental proactivity can provide advantages in many areas that concern business organizations. Implementation of an EMS provides a practical and effective framework within which corporate management can address potential environmental liabilities (Cora, 2007:66).

An EMS standard was developed for Underground Platinum Mine with the aim to ensure that the operations implemented a formal EMS in line with the requirements of ISO 14001 to avoid or mitigate potential adverse impacts on the environment (AEW, 2009:9).

During the interviews with the Environmental Coordinators driving the implementation of the EMS, they indicated, among other reasons that the ISO 14001 EMS was developed to ensure environmental protection and has contributed towards continual environmental performance.

All senior management agreed that the ISO 14001 EMS ensured environmental protection. 58% of the managers agreed whilst 42% strongly agreed.

ISO 14001 EMS has a holistic approach towards environmental protection and has enabled the Underground Platinum Mine to meet their set value of caring for the environment. Through the ISO 14001 guideline requirements Underground Platinum Mine has developed environmental policies for each operation and has committed themselves to ensuring compliance with environmental legislation, continually improving on their environmental performance and being committed to prevent environmental pollution (ISO 14001, 2004:4). Management has committed themselves to the Underground Platinum Mine policy to

conserve and protect environmental resources through, amongst others, the efficient use of energy and water, minimising waste and reducing pollution (AEW, 2009:3).

Through the development of an environmental policy, the organization will be able to establish its vision, beliefs, and values (Cora, 2007:66).

The protection of the environment at Underground Platinum mine could be monitored through the implementation of the set objectives and targets as per the requirements of the ISO 14001 section 4.3.3 Objectives, targets and programmes. The operational objectives and targets are consistent with the commitment made in the Environmental Policy to prevent environmental pollution. The following are examples of the objectives and targets that have been set with aim of prevention of environmental pollution:

UNDERGROUND PLATINUM MINE - MINE 2 OBJECTIVES AND TARGETS 2012							
Legend							
	0 to 50%						
	51 to 90%						
	91 to 100%						
Issues	Targets and Objectives	Management Plan	Ref No.	Status	Responsible Person	Target Date	Completion Date
Environmental	Ensure appropriate waste management in line with Waste act and that all waste removed soon as bins are full.	Ensure appropriate water management in line with Waste act and that all waste removed soon as bins are full. Ensure effective inspections and communication with waste sorters, removers and safety officers/engineering employees to ensure no overflowing waste bin.	499781	80%	David Hadzhi	31 December 2012	
Environmental	Ensure ground water management as seepage from tailings dams can result in ground and surface water pollution	Ensure modeling of the seepage contaminant plume currently underway addresses all issues and mitigation measures and that rehabilitation strategies follows from the groundwater model for Paardekraal complex.	499703	60%	Piet Botha	31 December 2012	
Environmental	Prevent overflow of the tailings retention water dams	Regular inspections of dam levels and pumps must be conducted. Ensure the re-use of return water to prevent overflow.	499766	80%	Laurance Ramogale	31 December 2012	

Figure 2: Operation 2 Objectives and targets

3. To what extent does the implementation of an EMS reduce operational risks associated with the significant environmental aspects identified?

Underground Platinum Mine is committed to managing its environmental aspects, impacts and risks through adherence to the internationally recognised ISO 14001:2004 EMS standard. (AEW, 2009:7). All the operations have Environmental Aspects registers dated 2012 and all kept in the Isometrix electronic database. The common significant environmental aspects identified in the three operations reviewed included incorrect storage of hydrocarbons, change in land capability in the form of tailings disposal dams, wastage of natural resources (water and electricity), hydrocarbon and chemical spillages, as well as releases to land in relation to waste generation and disposal (Isometrix electronic database).

The Environmental Coordinators during the interviews all agreed that the EMS has enabled their operations to identify and have a clearer understanding and knowledge of what their operations' key significant environmental aspects are. The ISO 14001 systems have further enabled the operations to put in place control measures in the form of environmental objectives and targets to address and reduce the operational risks and increased operational efficiency

Senior managers (58%) agreed with the statement that the EMS identifies and minimises impacts from the operation. These managers ranged between 1-2 and 3-5 of age in terms of EMS involvement experience. 33% of the senior managers strongly agreed whilst the remaining 9% decided to be neutral. 88% of the general employees agreed that EMS reduces environmental impacts in the area of their responsibility. The majority of those employees have 0-2 years of EMS involvement. Slightly more than a tenth (12%) of them did not answer the question.

The 58% of the senior managers agreeing on both the statements about EMS identifying and minimising the impacts from operation as well as increasing operational efficiency clearly illustrate the relation between the two. This means that identifying and mining the impacts associated with the organisations can increase the operational efficiency thereof.

4. To what extent does the implementation of an EMS improve general environmental awareness within the different levels and functions of the organization?
--

According to clause 4.4.2 of ISO 14001 the organisation shall ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organization is (are) competent on the basis of appropriate education, training or experience, and shall retain associated records. It shall provide training or take other action to meet these needs, and shall retain associated records (ISO 14001, 2004:5).

Based on the aspects and impacts developed for Underground Platinum Mine, a training and development needs matrix is compiled displaying the EMS responsibility, required knowledge and outputs, intervention/environmental training required and the interval of intervention. Environmental training conducted includes job-specific training which addresses, among other topics, waste prevention and control, spillage and handling of chemicals as well as environmental incident reporting (EMS Manual, 2008:25).

All employees (including contractor employees) undergo Underground Platinum Mines general induction which includes an environmental general awareness section. This training takes place continuously and all new employees and employees returning from leave attend induction (EMS Manual, 2008:25).

When EMS senior managers were asked whether they agreed or did not agree that EMS increased workforce awareness of environmental issues, 58% of them indicated that they agreed, with 33% strongly agreeing and 8% choosing to remain neutral.

When EMS general employees were asked whether EMS increased employee awareness of environmental issues, 94% of them agreed, while 6% of them disagreed. All those who agreed have 0--5 years of EMS involvement.

The ECs all agreed that the implementation of ISO 14001 EMS had contributed significantly towards the employees' environmental awareness.

5. To what extent does the implementation of an EMS illustrate continual improvement of the environmental performance of the organisation?

According to Briggs (2006:78) there are differing opinions on what constitutes "improved performance". A parochial view is focused on quantitative reductions in pollutant emissions and discharges, waste generation, natural resource use or other negative environmental impacts. Improvements, however, it can also be measured in terms of:

- Management system improvement -qualitative and quantitative improvements to management support processes such as employee training and awareness, compliance assurance processes or corrective/preventive action programmes.
- Organization reputation -unquantifiable improvements in an organization's reputation or improved relations with regulatory bodies, community organizations or other interested parties.

In the case of Underground Platinum Mine there have been management system improvements; these include an increase in environmental awareness and the extent to which the objectives and targets have been met in order to address the operational risks.

The ECs indicated during the interviews that the ISO 14001 EMS has increased operational efficiency because more focus has been put on saving natural resources particularly water and electricity. It is of their opinion that production equipment is maintained effectively and

the EMS allows deficiencies to be proactively identified during the inspections and audits without delaying any production processes.

In order to monitor the overall EMS performance, the operations personnel hold an annual basis management review meeting to determine whether the system is adequate, suitable and effective (EMS Manual, 2008:67). The minutes of the meetings are kept by the ECs and actions are developed to address key issues of concern that arise from these meetings.

All senior managers agreed with the statement that ISO 14001 EMS contributes to continual environmental awareness with 33% strongly agreeing and 67% simply agreeing. The majority of the employees who strongly agreed are those with 0-2 years of EMS involvement.

88% of EMS general employees surveyed agreed that EMS improved the environmental performance of their operation and the area of their responsibility. Only 6% of EMS general employees disagreed, while the same number (6%) did not answer the question.

5.3 CONCLUSION

There is an ongoing debate about the value that environmental management systems (EMSs) provide to organizations. The debate arises from a lack of comparable, quantifiable data demonstrating that companies with a formal EMS produce fewer environmental emissions, discharges and waste than companies without one (Briggs, 2006:78).

The research covered a number of literature sources relating to the benefits and pitfalls of ISO 14001 EMS. The research was based on the hypothesis that the EMS developed in line with the requirements of the ISO 14001 is highly regarded as a management instrument that enhances environmental performance and is associated with a number of benefits to the organisation. The hypothesis was validated through the responses received from employees during the survey, and the results of the hypothesis also answered the research main aim.

The study concludes that the ISO 14001 EMS as implemented at Underground Platinum Mine is not merely a paper exercise but has an operational value.

- The ISO 14001 EMS has contributed to an increase in environmental awareness at all levels of the operations;
- The ISO 14001 EMS continues to address the significant environmental aspects identified within the operations;

- The ISO 14001 contributes towards continual improvement of environmental performance; and
- The ISO 14001 EMS has enabled Underground Platinum Mine to continue to meet its operational value of caring for the environment.

As a result it is of my opinion that Underground Platinum Mine should continue to use the ISO 14001 as a management tool to protect the environment, prevent environmental pollution and improve their environmental performance.

5.4 RECOMMENDATIONS

During the research there were a number of gaps identified during the survey responses as well as through the literature review that Underground Platinum Mine could implement to improve on their ISO 14001 EMS. There were also three case studies reviewed in Chapter 2 and the key learnings derived there from can be implemented by Underground Platinum Mine to improve on their ISO 1400 EMS. The following is a summary of the recommendations:

- During the interviews with the ECs, not all of them could provide background of their operation's ISO 14001 EMS and its date of certification because they had been recently appointed in their EC position. It is recommended that proper handover processes be developed and ISO 14001 EMS documents be kept in a centralised place to ensure that no data is lost between the resignation and appointment of the EC.
- In the survey the majority of the personnel who supported the ISO 14001 EMS are employees with 0-2 years of EMS involvement. It is recommended that on-going ISO 14001 awareness training be done for employees who have been in the operations for longer periods.
- Besides the formal training, exposure of employees to the process of implementing the ISO 14001 EMS can contribute to an increase in environmental awareness. Employees should be involved as early as possible during the EMS process to assist in reducing their resistance towards the EMS implementation (Zutshi & Sohal, 2002b:14).
- Support and commitment of senior management in the ISO 14001 implementation within an organisation enable the management to strive towards continual improvement and increase environmental awareness. Clause 4.4.1 of the ISO 14001 standard also specifies that "Management shall ensure the availability of resources

essential to establish, implement, maintain and improve the environmental management system" (ISO, 2004:5). The mine should focus on ensuring commitment to the ISO 14001 EMS is obtained from senior management

- Implementing ISO 14001 EMS is a systematic process requiring an amount of documentation, including procedures and records. When the documentation is developed correctly and in line with the requirements of the ISO 14001 guideline, it can assist in formalising the overall environmental management of the organisation. Documentation also ensures effective audit trail as they act as evidence of how the overall EMS of the organisation is implemented.
- According to Section 4.3.2 of the ISO 14001 (2004:5) the organisation shall identify and have access to applicable legal and other requirements to which it subscribes as related to its environmental aspects. Understanding and being able to identify all the significant environmental aspects in line with the operation's activities, products and services leads to the organisation and management being able to understand their stance in terms of legal compliance. This knowledge also contributes towards an increase in environmental awareness.
- Setting clear and specific goals/objectives and targets to address significant environmental impacts, the ISO 14001 system can increase operational efficiency and effectiveness.

REFERENCES

- BANSAL, P., WILLIAM C., & BOGNER. 2002. Deciding on ISO 14001: Economics, Institutions, and Context. *Long Range Planning*, 35:269-290.
- BERRONE, P.& GOMEZ-MEJIA, L.R. 2009. Environmental Performance and executive Compensation: An integrated agency-institutional perspective. *Academy of Management Journal*, 52(1):103-126.
- BOWMAN, V. 2001. Implementing an EMS: Environmental management systems provide a structure for conformance and compliance. *Environmental Protection*, 12(2):36.
- BRIGGS, S.L.K. 2006. Does Environmental Management System improve environmental performance? Standards Outlook.
- CORA, M.G. 2007. Environmental Management as a Tool for Value Creation. *Environmental Quality Management*, doi10.1002/tqem.
- CORBETTA, P. (2003). *Social Research Theory, Methods and Techniques*. London: SAGE Publications.
- DARNALL, N. 2001. Adopting ISO 14001: Why Firms mandate certification while others encourage it. North Carolina State University, Raleigh, NC.
- DARNALL, N., HENRIQUES, I., & SADORSKY, P. 2005. An International comparison of the factors affecting environmental strategy and performance. North Carolina State University and York University.
- DEAT. 2004. Linking EIAs and Environmental Management Systems, Integrated Environmental Management Information Series 20, Department of Environmental Affairs and Tourism (DEAT), Pretoria.
- EDWARDS, B., GRAVENDER, J., KILLMER, A., SCHENKE, G., & WILLIS, M. 1999. The Effectiveness of ISO 14001 in the United States. (Web:) http://www.bren.ucsb.edu/research/1999Group_Projects/iso14k/iso14k_final.pdf [Date of Access: 23 October 2012]
- ENVIRONMENTAL MANAGEMENT SYSTEM MANUAL. 2008. Reference Number: RPMRS-SSD-ENV-PRO-001. Version 4. Underground Platinum Mine 1.
- FIELDING, S. 2001. ISO Delivers Profits. *Automotive Engineering International*, 108:140-4.
- GUIDANCE DOCUMENT. 2000. Improving Environmental Performance and Compliance: 10 Elements of Effective Environmental Management Systems. Commission for Environmental Cooperation. (Web:) <http://www.epa.gov/compliance/resources/policies/incentives/ems/cecguidedoc.pdf> [Date of Access: 23 October 2012].

- HANKERSON, J. 2006. Environmental Management Systems, ISO 14001.CMGT 564.
- HEATON, J. 2004. Reworking Qualitative Data. London: SAGE Publications.
- HILLARY, R. 2004.Environmental management systems and the smaller enterprise.*Journal of Cleaner Production*, 12:561–569.
- IBM SPSS STATISTICS.2012.Solve research problems easily and efficiently. IBM Software. Business Analysts.
- IBM SPSS Statistics Version 20. Software Group.
- INTERNATIONAL STANDARDS ORGANIZATION (ISO). 2004. Environmental Management Systems - Requirements with Guidance for Use. Pretoria.
- INTERNATIONAL STANDARD ISO 14000 from the quality network. (Web:) <http://www.quality.co.uk/iso14000.htm#history> [Date of Access: 23 October 2012].
- ISOMETRIX. Version 3.03.Copyright © 2003.Metrix Software solutions.
- JOURNEY IN SURVEY RESEARCH.2012.What is SPSS? (Web:) <http://surveyresearch.weebly.com/what-is-spss.html> [Date of access: 25 October 2012].
- LEEDY, P.D., & OMROD J.E. 2005. Practical Research: Planning and Design 8th edition. USA: Pearson Merrill Prentice Hall.
- KING III. 2009. King Report on Governance for South Africa, The Institute of Directors in South Africa.
- MADGE, C. 2006. Advantages and Disadvantages of Online Questionnaires. (Web :) <http://www.restore.ac.uk/orm/questionnaires/quesads.htm> [Date of access: 21 October 2012].
- MATUSZAK-FLEJSZMAN,A. 2009.Benefits of Environmental Management System in Polish Companies Compliant with ISO 14001.*Polish J. of Environ. Stud.*, 18(3):,411-419.
- MELNYK, S.A., SROUFE, R.&CALANTONE R. 2003. Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management*, 21:329–351.
- MORROW, D.,& RONDINELLI, D. 2002.Adopting corporate Environmental Management Systems: Motivations and results of ISO 14001 and EMAS Certification. *European Management Journal* (.2):159 -172.
- NAWROCKA, D.,& PARKER,T. 2009. Finding the connection: environmental management systems and environmental performance .*Journal of Cleaner Production*, 17:601–607.
- NORTH-WEST UNIVERSITY. 2010. Manual for Postgraduate Studies. January.

PRINSLOO, H.B. and VAN DER WALT I.J. 1999.The implications of ISO 14001 for the South African Mining Sector. *Quarry SA. Surface mining in Southern Africa*, Second Quarter 1999:12-13.

RAUBENHEIMER, B.,& LOGIE M. 1997.Assessment and development of an Environmental Management System using ISO 14001.(Workshop presented on 16 April 1997 as part of a course in Environmental Management System.) Midrand. p14. (Unpublished)

REMAS.2006.Linking Environmental Management and Performance. The REMAS findings. Available from http://www.remas.info/pdf/reports/remas_finalfact.pdf

RESEARCH METHODOLOGY.(Web:)

http://www.ihmctan.edu/PDF/notes/Research_Methodology.pdf.html [Date of Access: 5 August 2011].

RONDINELLI, D., & VASTAG, G. 2000.Panacea, Common Sense, or Just a Label? The Value of ISO 14001 Environmental Management Systems. *European Management Journal*,18(.5); 499 -510.

ROY, M. & VE'ZINA R. 2001. Environmental Performance as a Basis for Competitive Strategy: Opportunities and Threats. *Corporate Environmental Strategy*, 8(4).

SCHAARSMITH S. 2001. ISO lowers environmental risk. *Business Insurance*, 34: 12.

STUDY GUIDE FOR WRITING QUESTIONNAIRES. Birmingham City University. (Web:) <http://library.bcu.ac.uk/learner/writingguides/1.05.htm> [Date of Access: 23 October 2012]

SOUTH AFRICA. 1996. Constitution of the Republic of South Africa as adopted by the Constitutional Assembly on 8 May 1996 and as amended on 11 October 1996. (B34B-96.) (ISBN: 0-260-20716-7.)

THAYER-HART, N. 2010.Survey Fundamentals. A guide to designing and implementing surveys. Version 2.University of Wisconsin Survey Center.

THE ANGLO ENVIRONMENTAL WAY, 2009.Volume 1, Management System Standards. Anglo American Plc.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (US EPA). 2006. Environmental Management Systems/ISO 14001 - Frequently Asked Questions. (Web:) <http://www.epa.gov/OW-OWM.html/iso14001/isofaq.htm> [Date of access: 09 April 2011].

UNDERGROUND PLATINUM MINE. 2012. Mine 2 Environmental Objectives and Targets

WILSON, R.C. 2001. Ford spreads the word about its EMS success. *Pollution Engineering*, 33(6):32–33.

WSP WALMSLEY ENVIRONMENTAL CONSULTANTS, 2004.5 day Institute of Environmental Management Assessments (IEMA) Approved Environmental Management

System (EMS) implementation and Internal Auditor Course Manual, Johannesburg. www.ihmctan.edu/PDF/notes/Research_Methodology.pdf. Date of Access: 5 August 2011

ZUTSHI, A. SOHAL, A. 2002b. A Study of the Environmental Management System Adoption Process within Australasian Organizations - 2.Role of Stakeholders. Techno vision.

APPENDIX A: SENIOR MANAGEMENT QUESTIONNAIRE

MANAGEMENT EMS RESEARCH QUESTIONNAIRE						
INTRODUCTION						
My Name is Tshego Tyira, I am a third year Masters Student in Environmental Management at University of Potchefstroom.						
PURPOSE OF THE STUDY						
The purpose of this study research is to determine and analyse the operational value added by your ISO 14001 EMS. Your contribution will be highly appreciated and it will assist in understanding the effectiveness of your ISO 14001 EMS and in improving your system.						
1.PERSONAL DETAILS						
1.1 Full Name (Optional)						
1.2 Area of Responsibility						
1.3 Designation						
1.4 Duration of EMS Involvement						
2. ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM						
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unable to judge
	5	4	3	2	1	0
1. EMS enables us to ensure environmental protection.						
2. EMS contributes towards a continual environmental performance.						
3. EMS facilitates environmental best practices.						
4. EMS identifies and minimise the Environmental impacts arising from the operation.						
5. EMS has increased operational efficiency.						
6. Implementation of the EMS in my operation translate into business value.						
7. EMS increases workforce awareness of environmental issues.						
8. EMS contributes towards a competitive advantage in a market place.						
9. EMS enables us to comply with environmental legislation.						
10. It is expensive to implement an EMS.						
11. Implementing an EMS is time consuming.						
12. EMS enable the operation to comply to legal and other requirements.						
13. EMS enhances financial effectiveness due to increased environmental efficiency and resource savings.						
14. External EMS auditing adds value to an operation's EMS.						
15. EMS is a paper exercise.						
16. EMS in our operation offer a system of self check and a state of beyond compliance.						
For any enquiries please do not hesitate to contact: Tshego Tyira						
Email address: tyira@gmail.com						
Please send the complete questionnaire via email to tyira@gmail.com or hand in the hard copy to your Environmental Coordinator on or before 06 July 2012						

APPENDIX B: GENERAL EMPLOYEES QUESTIONNAIRE

EMPLOYEE EMS RESEARCH QUESTIONNAIRE		
INTRODUCTION		
My Name is Tshego Tyira, I am a third year Masters Student in Environmental Management at University of Potchefstroom.		
PURPOSE OF THE STUDY		
The purpose of this study research is to determine and analyse the operational value added by your ISO 14001 EMS. Your contribution will be highly appreciated and it will assist in understanding the effectiveness of your ISO 14001 EMS and in improving your system.		
1.PERSONAL DETAILS:		
Full Name (Optional):		
Area of Responsibility:		
Designation:		
Duration of EMS Involvement		
2. ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM		
	Yes	No
1.Does the EMS add positive value to your operation and your area of responsibility?		
2.Are you aware of the environmental impacts of your daily activities?		
3.Has the EMS reduced the environmental impacts in your area of responsibility?		
4.Has the EMS improved the environmental performance of your operation and your area of responsibility?		
5.Has the EMS increased the employee awareness of environmental issues?		
6.Has EMS reduced or saved costs in your department?		
7.Is the EMS operational on daily basis?		
8.Is the EMS only operational before the EMS audits?		
9.Does the EMS audits add value to your area of responsibility and your operation?		
10. Can your department and operation operate without the EMS?		
For any enquiries please do not hesitate to contact: Tshego Tyira		
Email adress: ttyira@gmail.com		
Please send the complete questionnaire via email to ttyira@gmail.com or hand in the hard copy to your Environmental Coordinator on or before 06 July 2012		

APPENDIX C: ENVIRONMENTAL COORDINATOR INTERVIEW QUESTIONS

ENVIRONMENTAL COORDINATOR EMS INTERVIEW QUESTIONS
INTRODUCTION
My Name is Tshego Tyira, I am a third year Masters Student in Environmental Management at University of Potchefstroom.
PURPOSE OF THE STUDY
The purpose of this study research is to determine and analyse the operational value added by your ISO 14001 EMS. Your contribution will be highly appreciated and it will assist in understanding the effectiveness of your ISO 14001 EMS and in improving your system.
1.PERSONAL DETAILS
Full Name (optional):
Area of Responsibility:
Designation:
Duration of EMS Involvement:
2. ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM
1.When was your EMS developed and implemented?
2.Was the EMS implemented internally or by an independent consultant?
3.Which year was the EMS certified?
4.Who certified your EMS?
5.What was the driving force behind implementing your EMS?
6.Has the EMS improved the efficiency of the business? For example, the operational efficiency. If yes please elaborate
7.Has the EMS helped to enhance reputation of your operation? If yes, Please elaborate
8.Does the EMS enable you to comply to legislation? If yes Please elaborate
9.Does the EMS guarantee full legal compliance? Please elaborate
10.Does the EMS contributes towards the continual improvement of the environmental performance of the operation? If yes Please elaborate
11.What significant aspects has your EMS identified?
12.Did your EMS enable you to prevent or minimise these significant aspects?
13.What benefits has your EMS added to your employees?
14.Are the employees involved in the implementation of the EMS? How?
15.Is the EMS operational on daily basis? If yes Please elaborate
For any enquiries please do not hesitate to contact:
Tshego Tyira
email adress: ttyira@gmail.com