FACTORS INFLUENCING ADHERENCE AND EMPLOYEE PERCEPTIONS TOWARDS SAFETY CONTROL IN A MINING COMPANY

by

THAMI MALCOLM MODIBA

Student number: 20135556

Dissertation submitted in partial fulfilment of the requirements for the degree

MAGISTER TECHNOLOGIAE

in the discipline of

BUSINESS ADMINISTRATION

in the

FACULTY OF MANAGEMENT SCIENCES

at the

VAAL UNIVERSITY OF TECHNOLOGY

SUPERVISOR: Prof M Dhurup

CO-SUPERVISOR: Dr B.A Mokoena

January 2018

DEDICATION

This dissertation is dedicated to my late mother, Maiyah (Maria). May her soul rest in peace. Mama stood by my side in prayers. She taught me that no matter how big the task it can be accomplished if it is done one step at a time.

To my lovely daughter, Naledi, and the boys, Leano and Letlotlo La-rona, this dissertation is also dedicated to you. Always remember:

"Education is the passport to the future,
for tomorrow belongs to those who prepare for it today."

(Malcolm X).

DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree in any university or other tertiary institution and to the best of my knowledge and belief, contains no material previously published or written by another person. This dissertation is the result of my own independent work/ investigation, except where due reference has been made in the text. A bibliography is affixed.

Signature: _____ **Date:** _____

STATEMENT 1

This dissertation is being submitted in fulfilment of the requirements for the degree Magister Technologiae: Business Administration.

Signature: _____ **Date:** _____

STATEMENT 2

In addition, I certify that no part of this work will be used in a submission in my name for any other degree in any university or other tertiary institution without the prior approval of the Vaal University of Technology.

Signature: _____ **Date:** _____

STATEMENT 3

I hereby give consent to this copy of my dissertation, if acceptable, to be available for interlibrary loan and photocopying. I also give permission for the digital version of my dissertation to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the university to restrict access for a period of time.

Signature: _____ **Date:** _____

CERTIFICATE OF COPY-EDITING

Ms Linda Scott
English language editing
SATI membership number: 1002595
Tel: 083 654 4156
E-mail: lindascott1984@gmail.com

18 September 2018

To whom it may concern

This is to confirm that I, the undersigned, have language edited the **dissertation** of

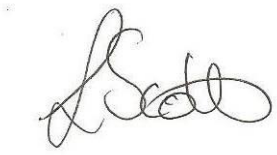
Thami Malcolm Modiba

Magister Technologiae in Business Administration
entitled:

Factors influencing adherence and employee perceptions towards safety controls in a mining company

The responsibility of implementing the recommended language changes rests with the author of the dissertation.

Yours truly,



Linda Scott

ACKNOWLEDGEMENTS

My gratitude goes to my academic supervisor, Professor Roy M Dhurup, for his mentorship and devotion. His academic expertise, knowledge and guidance, endurance, progress tracking and typed feedback and comments played a key role for me to discover my potential in the world of academic research. I have a lot to offer the world and to the discovery of the origin of our existence in this universe. It has been a privilege indeed to have Professor Dhurup as my supervisor and mentor. His shoulders are broad enough to carry upcoming young researchers. May the Almighty God keep him healthy and strong for more years to come.

I also salute and honour my co-supervisor, Dr B.A Mokoena, for his comprehensive checking of this study. To Professor G Zide (Vice-Chancellor and Principal), I have always enjoyed your research work, you are my role model, a true legend. You entrusted and allowed me to establish the office of occupational health and safety and to be the highly recognised founder in the history of the university.

There are others that I really need to mention. My former Anglo American plant manager, Ms. Ellie Moshoane and the mine manager Mr Eric Zwane from Sasol coal mine in the Free State province of South Africa. Both have shown interest in this study that forms part of research in mining. To Ms Lizbé Fourie (Senior Manager: Sasol Governance & Assurance) for ensuring that the time was allocated to accomplish this task. I would like to mention Mr Sesenki Moreki, (a former colleague, at VUT), for taking care of the administration processes of this study. I would not have made it on time without his assistance. Mr. Mluleki Siguntu made sure that the study was registered and protected under the NRF Nexus database. Special thanks to Ms Tertia Borgelt, (NDA Training) − her organisation assisted me to realise the power of writing skills.

My thanks go to all my friends who encouraged me, not forgetting Fikile Nkosindini and his family for welcoming me in their home to be closer to the field of Research. To all the mine management, workers, contractors and service providers for taking part and sharing the knowledge in the study. I would have not succeeded without your contribution. Stay safe.

To my creator, Almighty God, for protecting me and providing me with good health, wisdom and the insight to complete this study.

Wa wena hi ku titsongahata! (Yours sincerely)

ABSTRACT

The majority of mine health and safety authorities around the world agree that the quality of safety standards is of increasing importance to the mining industry across the world (Kleyn & du Plessis 2016:309). Mining companies in many countries such as New Zealand, (an island country in the south-western Pacific Ocean), Australia, South Africa and China have taken up the challenges of guaranteeing liability and improving performance of the safety and health of their workers, aware that many workers are injured, if not fatally. These incidents result in production loss. This study provides not only an opportunity to evaluate the status of the safety control measures of the work system in a mining company, but also enables management to pinpoint the causes of poor safety performance and implement efforts that ensure safety improvement.

The primary objectives of this study were to examine factors influencing the adherence and employee perceptions towards safety control measures in a mining company. Furthermore, the governments in many countries have tried to implement legislation to try to curb the scourge of industrial accidents. Safety disclosures of the annual reports from the Department of Mineral Resources (DMR) of South African mining organisations, discloses 10 major mining accidents that happened in 2015 at Northern Cape mining companies. Six of these accidents occurring from a small mining sector and four from a large mining sector, except previous year's safety records as detailed in this study.

A quantitative approach was adopted for the study. The data were collected using a sample of 200 participants in which a survey questionnaire was administered to permanent mine employees and full time contractors in the mine. A simple sampling technique was used and data were then analysed using the Statistical Package for the Social Science (SPSS) version 25.0 to formulate frequency tables and descriptive analysis graphs. Furthermore, one-way analysis of variance (ANOVA) and t-test were utilised to analyse the data and examine significant differences between employee perceptions and attitudes towards safety control measures, age and length of service (Willemse 2009:118-121).

The results reveal that although the mine was considered compliant, with its employees showing a positive attitude towards safety control measures, ANOVA revealed different perceptions of employees based on their age and years of experience. However, no differences were found in relation to gender and occupation. Based on the findings, this study further recommends future studies to be conducted in order to explore the effectiveness of implementing an internal system of self-evaluation as a starting point in any safety improvement process. An effective system of

internal self-evaluation will trademark the mining sector internationally and improve workers' safety by improving effectiveness and assurance of the control measures and the level of control performance criteria. The system should create the awareness of adherence to safety control measures and deal with employee perception towards safety adherence in mining. In addition it should be a system that ensures a structured and standardised approach to learning from incidents and that all necessary steps are followed to safeguard against repeats of incidents and accidents through an effective incident investigation process (Van den Berg 2014:11).

The findings of the study revealed that the leadership in the mine has a strong, positive and significant influence on the performance of safety. In this regard, this study recommends that an effective employee engagement system to be developed and that mine managers establish a safety control charter that must be understood by the mine workers, develop a code of ethics that requires ethical and honest behaviour from all employees in order to improve safety performance and learn from these accomplishments. Mine workers will take their cue from the attitude and example displayed by management, therefore, it is recommended that mine management develop an organisational culture, which assigns authority and responsibility to employees and organises and develops employees with direction provided by management that determines the type of culture in that mine.

To minimise or reduce the risk of health exposure of each activity as highlighted under Regulation 9 of the Mine Health and Safety Act (29 of 1996), it is recommended that mine manager's enforce the use of protective equipment. The leadership and human resources, mine workers and all persons who may be affected by the mining activities in the surrounding area of operation need to be aware of the factors that can impact their well-being. The study also presented managers, mine owner and other decision makers within the mining company with important insight on key areas of factors that may require particular attention in order to enhance their operational strategies towards zero harm in the mine.

Keywords: adherence, culture, employees' perceptions, fatality, legal-framework, mining, safety controls measures.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ANOVA	Analysis of variance and t-test
DMR	Department of Mineral Resources
LTIFR	Lost time injury frequency rate
COP	Mandatory Codes of Practice
MHSA	Mine Health and Safety Act (29 of 1996)
MRC	Medical Research Coucil
NOSA	National Occupational Safety Association
OHSA	Occupational Health and Safety Act (85 of 1993)
PPE	Personal protective equipment
Reg.	Regulations of the Mine Health and Safety Action (29 of 1996)
RSA	Republic of South Africa
SAMRASS	South African Mines Reportable Accidents Statistical System
Sec.	Sections of the Mine Health and Safety Action (29 of 1996)
SHE	Safety, Health and Environment
SPSS	Statistical Package for Social Sciences (version 25.0)

CHAPTER 1
INTRODUCTION AND BACKGROUND OF THE STUDY

1

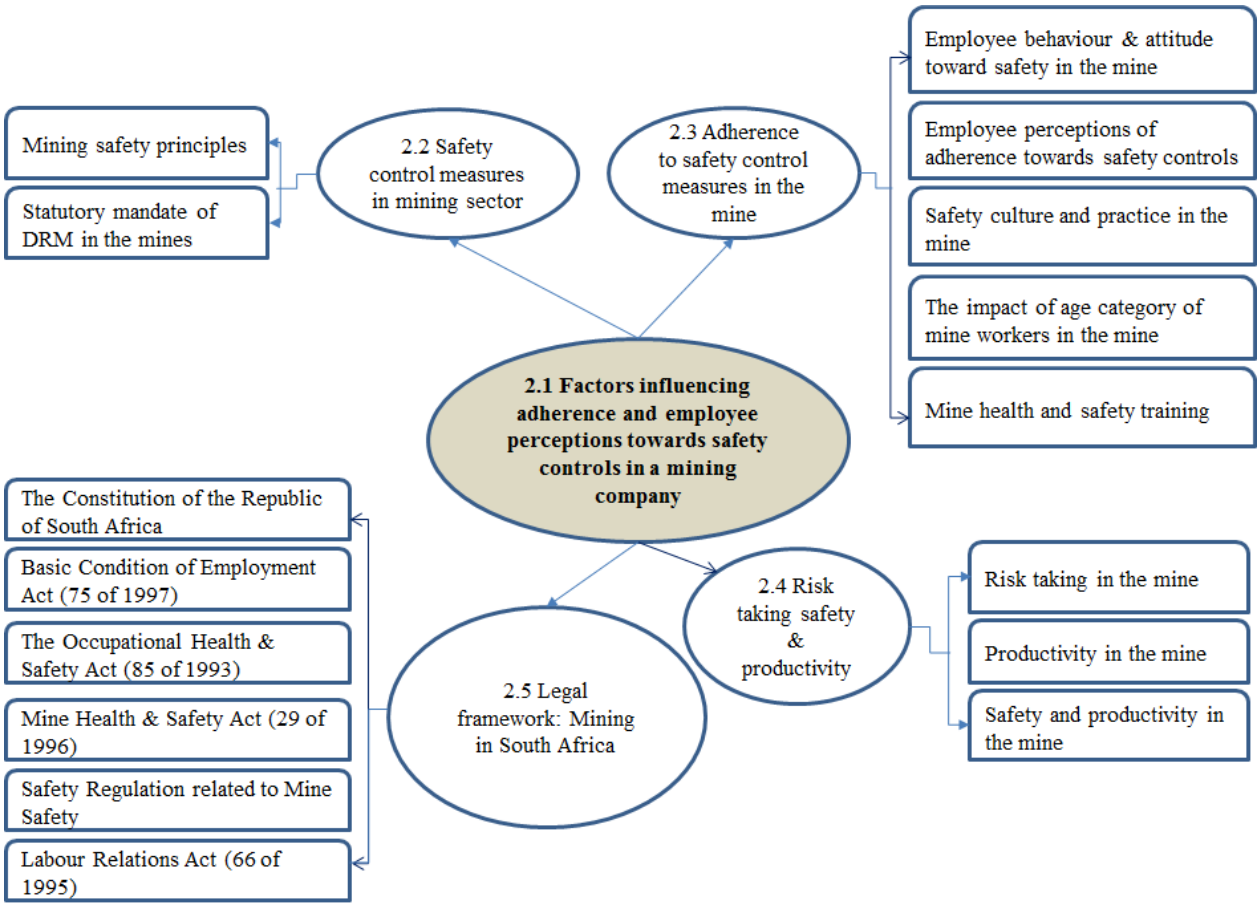
1.1 INTRODUCTION

There have been calls in the mining industry over the years to develop high standards of safety control measures that achieve zero harm and simultaneously allow productivity to be maintained. This requires a focus on person-oriented safety culture construction, supporting the safety culture and meeting worker's mental, economic and fitness needs (Lu & Chen 2015:121). Mlambo and Masiya (2012:136) explain that in South Africa, the negative coefficient of the injury variable shows that injuries have negatively impacted on production levels in the mining sector and every case of injury recorded in a year had the marginal effect of reducing the annual mine production by 10.5 kilograms. In spite of high safety standards in mines in general, the management and control of injuries has always being a challenge. According to Kecojevic, Komljenovic, Groves and Radomsky (2007:793), there is always a degree of uncertainty with regards to the type and extent of adverse impacts that could arise, hence companies can never have zero harm to occupational safety and health of employees. Ehsani, McNeilly, Ibrahim and Ozanne-Smith (2013:14) posit that people are killed as a result of their work and the work of others in the mining industry. For that reason, productivity technology and management need to be further improved so as to predict the accidents in advance and take appropriate measures timeously (Chen, Maa, Wang, Zhang & Ha 2014:146).

In terms of productivity performance, mining companies continue to reinforce safety values on a continuous basis. It is apparent that in South Africa, not much has been done to investigate factors affecting adherence and employee perceptions towards safety control measures in the mining sector. The study provides an opportunity to evaluate the safety status of the work system but also enables management to pinpoint the causes of poor safety performance and efforts that ensure improvement. Asfaw, Mark and Cryan (2013:785) state that "mine operators of financially stressed mines also need to be aware of the association between profitability and occupational injuries, which could imply that they cannot afford to forgo investing in worker safety while striving to improve mine profitability". Financially strong mines can reduce the incidence of occupational injuries by investing more in workers' safety (Asfaw *et al.* 2013:779).

Figure 1.1 provides an illustration of a mind map of how the researcher planned the study. The mind map represents the researcher's concept of research methods on the major aspects, rather than a complete picture of research methods (Crowe & Sheppard 2011:1494).

Figure 1.1 Mind map



Source: Own compilation

1.2 BACKGROUND OF THE STUDY

This study is underpinned by a theory of safety-related violations that occur in practice during normal operations during a risk analysis. Polet, Vanderhaegen and Wieringa (2002:1) in their studies recognised that a higher occurrence of safety-related violations is referred to as barrier crossing. Polet *et al.* (2002:7) elaborate that this barrier crossing is linked with an operational risk, which constitutes a combination of cost in terms of productivity and is "a possible deficit (extreme cost) due to the exposure to hazardous conditions that are created after a barrier or a control measure has been crossed". Human operators are actors of both improvement and degradation of situations when controlling a dynamic process in safety (Polet *et al.*, 2002:7). Francis (1989:16) raised the point that the consideration of a person as a component of a system is a relatively new

concept forced upon engineers, designers and planners of developing technology, which has failed to recognise not only human limitations and liabilities as part of a joint operation in a technological environment, but also human attributes and assets. The study by Valsamakis, Vivian and Du Toit (2003:123), supports this statement and further highlighted the basic methods available for preventing accidents; one of them being engineering control revision. It is essential to consider the "dos and don'ts" that a company must follow in order to operate safely in a legal manner to avoid civil and criminal penalties (Poplin, Miller, Moore, Bofinger, Spencer, Harris & Burgess 2008:1197). This is particularly true for mining operations where decisions to take action are made constantly (Komljenovic, Groves, & Kecojevic 2008:793). "Traditionally, work system safety performance is measured in terms of accident/injury rate, an outcome measure that is caused by other measures such as unsafe conditions or unsafe acts, which are the measures of causes" (Maiti 2010:1370).

Under this study, it is necessary to access the factors influencing adherence to safety which includes the perceptions of employee's attitude towards safety control measures, such as safety policies and procedures as one of the control measures within the mining operations (Laurence 2005:41). Chimamise, Gombe, Tshimanga, Chadambuka, Shambira and Chimusoro (2013:4) posit that there is a need to investigate and develop a worker-friendly safety procedure at mines. Workers' representatives, together with the mine managers, must encourage workers to report incidents. Bajpayee, Rehak, Mowrey and Ingram (2004:51) point out that education, job training and experience play a vital role in a mine safety system. The authors also state that the safety considerations dictate that employees not associated with a specific operational activity should leave the area, for example, during the drilling activities or blasting operations in mining. Page (2009:87) noted that there is substantial evidence that non-participating workers or bystanders, who by definition do not always act in expected ways, contribute substantially to accidents relative to functioning workers. This is due to the lack of awareness, understanding, employee perception or attitude towards safety, ignorance, taking short cuts or deliberate safety violation (Laurence 2004:39).

Lirong, Zhongan, Weimin, Xiuwei, Dawei and Yujing (2011:695) state that safety supervision is necessary for the mining operation as it influences the safety behaviour of workers. The statement illustrates mainly the action of workers, the management of leaders and the productivity of mines and workers' incorrect behaviour in the workplace. Valsamakis *et al.* (2003:121) also maintain that safety working practices must be enforced and employees must be clearly warned of the penalties that will be imposed for failure to comply with safety instructions. Apart from the humanitarian, moral and social responsibilities of management to provide a safe working

environment for employees, there are onerous statutory duties in this regard and intervention in working conditions is regulated mainly by the Occupational Health and Safety Act (85 of 1993) (Valsamakis *et al. 2*003:121). In many instances of safety regulations or other safety measures, safety appliances or clothing usage is ignored (Gomwe 2013:2). Tan, Wang, Chen and Ren (2012:1472) attribute that insufficient investment in safety is one of the most important reasons that lead to frequent accidents and ignorance in the mining industry. Gomwe (2013:1-5) elaborates further that in the mining sector, the production units and the group senior employees currently have risk and change management included in the safety components of their bonus package as a new indicator. The employees, including participating employees in the lower packages, are also required to include a 5 percent mandatory safety objective in their individual performance contracts.

1.3 PROBLEM STATEMENT

Fatal injuries remain an acute problem in the mining company. Three areas related to the problem of the study have been identified and investigated: (a) fatal injuries to employees, their perception toward safety control and adherence, (b) the quality and visibility of management interactions between employees, supervisors and machinery in the workplace and (c) the collaboration of government bodies and mine representatives. These related areas emerged as the literature review unfolded (Bui 2014:11). Work-related injuries are unwelcome by-products of economic activity on average. There is a higher rate of occupational deaths in the mining industry than most other industries in South Africa due to the hazardous nature of working conditions (Tan *et al. 2*012:1472). A theory of safety-related violations maintains that it is evident that a major problem seems to lie in a lack of work organisational flexibility, since the fact that individual physiological capacities are not considered leads to cognitive and behavioural problems, which include risk-taking by workers when fatigued and irresponsibility or recklessness in the workplace (Blank, Laflamme & Andersson, 1997:227).

Mining companies in South Africa play a significant role in the economy of our country. The Chief Executive Officer of Chamber of Mines (Baxter), stated in the report of Chamber of Mines of South Africa (2016:1-12) that the mining industry offers not only employment but also supports the respective provincial economies. In the communities where mining firms operate, they have built schools, clinics and other social infrastructure such as roads and housing for employees, thus improving the quality of life of community members. They have also directly and indirectly supported recreational activities. The availability of credible incident statistics, which paint an accurate picture of how the South African mining sectors perform, are crucial for the Chamber of

Mines. In the past 13 years, the Department of Mineral Resources (DMR) has published a statistical report as indicated in Table 1. The statistics might show a decline in fatal incidents per commodity, however, amongst the mining commodities, gold, platinum and coal, the number of fatalities remains high. Regardless of development in the community or a decline in the number of fatalities in mining commodities, the fact remains that there are still deaths occurring in the mining sector.

Table 1.1: Fatalities by commodity 2004-2016

Number of Fatalities by Commodity, 2004-2016													
Commodity	**'04**	**'05**	**'06**	**'07**	**'08**	**'09**	**'10**	**'11**	**'12**	**'13**	**'14**	**'15**	**'16**
Gold	108	105	114	115	85	81	62	51	53	37	44	33	33
Platinum	65	47	40	53	36	41	34	37	28	28	15	22	27
Coal	20	16	20	15	20	18	12	12	11	7	9	5	4
Chrome	16	6	2	4	*	*	*	*	*	*	*	*	*
Diamonds	15	7	3	12	*	*	*	*	*	*	*	*	*
Copper	2	0	2	1	*	*	*	*	*	*	*	*	*
Clay	3	3	2	8	*	*	*	*	*	*	*	*	*
Iron ore	1	2	2	4	*	*	*	*	*	*	*	*	*
Granite DS	2	0	0	1	*	*	*	*	*	*	*	*	*
Limestone	3	5	5	1	*	*	*	*	*	*	*	*	*
Other	11	10	10	6	30	28	19	23	20	21	16	17	12
Total	**246**	**201**	**200**	**220**	**171**	**168**	**127**	**123**	**112**	**93**	**84**	**77**	**76**

Source: Chamber of Mines of South Africa (2016:11)

The Chief Executive Officer of Anglo American Thermal Coal, Gomwe (2013), in his inaugural speech, said that mining companies are faced with a huge challenge in terms of safety which, as a result, affects productivity. At times of relative calm, tragedy suddenly strikes because of complacency among employees owing to the lack of adherence to safety control measures. Furthermore, the CEO (Gomwe 2013:1-5) articulates that "tragically, after going for a full 12 months without loss of life, Thermal Coal mining has lost three colleagues in a period of three weeks". Injuries worldwide in the mining sector are often related to the loss of work days and wages or to productivity losses (Stojadinovic, Svrkota, Petrovic, Denic, Pantovic & Milic 2011:1).

Stojadinovic *et al.* (2011:1) explain that the monitoring of injury and data analysis can provide mining managers with valuable data on the causes of accidents and can enable them to establish a correlation between the conditions in the work environment and the number of injuries. This may further lead to the implementation of proper preventive control measures. Most workers in developed and developing countries assume their organisations will take all necessary control measures to ensure that employees return home safely at the end of the work day; yet up until now, work-related injuries and deaths continue to occur at an alarming rate (Zacharatos & Barling 2005:77). Over 20 mine workers have died on duty at Sibanye Stillwater's operations in the year 2018 alone, with the latest death confirmed by the CEO (Froneman) during his press release (Pijooe 2018:1).

Reuvid (2013:42) and Zacharatos *et al.* (2005:77) are of the view that high-performance work systems are associated with occupational safety in the workplace, but they do not address the question of how such an effect occurs in terms of its relationship. The employer and the operator of the machinery are both legally responsible for supplying a safe environment, tools and safe methods of working, as laid down in the Occupational Health and Safety Act (85 of 1993), Section No. 16.1 and 16.2, General duties of the employer at work (RSA 1993). From the governance point of view, the management of the company must of necessity discharge these responsibilities in terms of the Mine Health and Safety Act (29 of 1996), Section No. 5(1) to the employer to maintain a healthy and safe mine environment (RSA 1996). Based on the problem statement, there is a need for such a study to take place in a mining sector (Lu & Chen, 2015:121). An effective system of internal self-evaluation will assist to benchmark the mining sector internationally, improve workers' safety and achieve safe productivity in a South African mining environment.

1.4 OBJECTIVES OF THE STUDY

The following objectives were pursued in this study:

1.4.1 Primary objective

The primary objective is to investigate factors that influence the adherence and employee perceptions towards safety control measures in a mining company. A safety control is an act, object (engineered) or system (combination of act and object) intended to prevent or mitigate safety risk in the mine (Kumba Iron Ore Limited 2016:33).

1.4.2 Theoretical objectives

The following theoretical objectives were formulated:

- to conduct a literature review on factors influencing adherence to safety control measures in the mining company;
- to carry out a literature review on safety performance with regard to adherence to safety in a mining company; and
- to conduct a literature review on employee perceptions of their adherence to safety control measures in mines.

1.4.3 Empirical objectives

The empirical objectives were:

- to assess the factors that influence the adherence to safety control measures in the mining company
- to assess employees' perceptions of safety measures in the mining company
- to assess whether there are any significant differences between employees perceptions and attitudes towards safety controls and the age of employees
- to assess whether there are any significant differences between employees perceptions and attitudes towards safety controls and the length of service of employees

1.5 RESEARCH APPROACH

The study follows the quantitative research approach, which uses a survey design in the form of a structured questionnaire. The purpose was to obtain a sample from the population so that the conclusion can be made about characteristics, attitude, or behaviour of the population. The descriptive survey design was selected for this study, as it should assist the researcher in obtaining information from various cases in the sample population and allow the researcher to focus on the exact characteristics under consideration (Maree 2012:263). The chosen research methodology aims to clarify the research methods selected for the study, including the literature review, population, sampling and data collection to be utilised for analysing the data. Welman, Kruger and Mitchell (2007:52) describe a research design as the plan according to which information is collected from research participants. According to Maree (2012:145), quantitative research is a process that is systematic and objective in order to generalise the findings to the population that is being studied. In the quantitative approach, the relationship between the variables could also be analysed.

Zikmund, Babin, Curr and Grifffin (2010:134) describe a quantitative research design as a technique that is intended to produce numerical data about the topic. Quantitative research determines the relationship between the variables, such as gender, occupation, age, length of

service and qualifications within the population and seeks to explain such relationships in numerical expressions.

1.6 LITERATURE REVIEW

Relevant sources in the literature were examined to determine the adherence and employee perceptions towards safety control in a mining company. Safety control measures are actions taken to improve safety in the workplace. These measures assess the safety status of the workplace conditions, operational equipment and machinery with the intention to prevent or mitigate safety (Kumba Iron Ore Limited 2016:33).

In order to establish a theoretical background, the literature was drawn from legislations, textbooks, journals articles and publications. Furthermore, the use of documents, such as industrial profiles, policies, safety procedures, safety statistics and records, media reports, DMR monthly and quarterly regional reports and information available on the Internet were collected and integrated.

1.7 THE SAMPLING DESIGN PROCEDURE

The following sampling design procedure was followed in the study:

1.7.1 Target population

Babbie and Mouton (2003:100) define a population as "a group of people, items, objects, or elements who meet the designated set of criteria for the study and about whom one wants to draw conclusions". For the purpose of this study, the target population was restricted to one mining company in Free State province of South Africa. Personnel in the functional units of the mine such as protection services, safety, health and environment department, training, human resources, finance and procurement department, who visit high risk areas within the mine formed part of the population. The target population also included the following employees: employee safety representatives, employee union representatives, foremen/ supervisors, shift leaders, general workers and contract employees in the mine operations, the most hazardous area in the mine. The current population of this mining company is N=884.

1.7.2 Sampling frame

According to Babbie (2010:208), a sample frame is the list of elements from which a probability sample is selected. The list of all permanent employees and permanent contractors on site was obtained from the safety department of the mine. This list was also verified with the human

resource department of the mine to determine the number of employees in different departments from which the sample was drawn.

1.7.3 Participant selection and sampling size

A probability sampling (simple random) was used for the selection of the sample units. For the purpose of this study, a representative sample size of n=200 employees was set. According to Bless and Higson-Smith (2000:94), it is important to take note when deciding a criterion of a sample size that the attention is exercised to ensure that it is representative of the population. Daniel (2012:239) highlighted about 10 elements as acceptable guidelines when determining a sample size, (1) consider the objectives of the study, (2) consider the ethical issues, (3) consider the nature of the population, (4) availability of resources, (5) consider the type of research design, (6) consider data analysis design, (7) make adjustments and finalise sample size, (8) use statistical methods, (9) use ad-hoc non-statistical methods and (10) consider type of sample design.

1.7.4 Method of data collection and measuring instrument

In the study, the data collection was conducted by means of a structured questionnaire. A pre-test of the questionnaire was undertaken, in which the statistician, the supervisors and five key personnel were given the questionnaire for a review in order to gain comprehensive feedback and clarification on questionnaire-related issues so that the questionnaire could be revised if necessary.

The questionnaire was divided into three sections. Section A was comprised of questions on the demographic profile of the participants: age, gender, years of experience, occupation and qualification, department within the organisation and full-time or contractor employee. Section B encompassed questions relating to factors that influence the adherence to safety controls in the mining company. Section C solicited information on employee perceptions of safety control measures in the mining company.

Section A consisted of multiple-choice and dichotomous questions. Sections B and C comprised Five-point Likert-type questions, with one denoting strong disagreement and five denoting strong agreement to the various statements listed. Questions for sections B and C were developed from the review of the literature, the Occupational and Safety Act, Mine Health and Safety Act, Mine Charter, industrial profile, procedures and policies as there are no previously developed and validated questionnaires. The researcher personally distributed the questionnaire to the participants. The best approach Researcher used was to explain the process to the research participants. All the participants were granted the opportunity to remain anonymous throughout

the duration of the study and that all information collected will remain confidential and strictly be used for research purposes only (Schultz & Schultz 2006:233).

1.7.5 Statistical analysis

The composition of the sample was evaluated using descriptive statistics, in the form of means, standard deviations and percentages. Moreover, a descriptive analysis was undertaken for sections B and C of the questionnaire to assess the level of adherence and perceptions of employees towards safety controls in the mine. Finally, analysis of variance (ANOVA) was computed to examine whether there are any significant differences between employees' perceptions and attitudes towards safety controls and the age and length of service of employees. The Statistical Package for Social Sciences (SPSS), version 25.0 for Windows, was used to analyse the quantitative data.

1.7.6 Reliability and validity

Reliability is the extent to which a measuring instrument is repeatable and consistent (Maree 2012:215). The Cronbach alpha coefficient was used to enhance the reliability of survey instruments. "An additional strength is that, if the questionnaires are properly constructed, a high measurement of reliability and validity is evident" (Maree 2012:215). Furthermore, Martins, Loubser and Van Wyk (2012:46), state that validity assesses whether the instrument used is measuring what it is supposed to measure. Validity deals with the dependability and usefulness of the measuring instrument (Leedy 1989:26). The following types of validity were examined: content and construct validity. Content and construct validity were established through the pre-testing and pilot testing of the survey instrument. Details of the reliability and validity are further elucidated in chapters 3 and 4.

1.8 ETHICAL CONSIDERATIONS

Ethics refer to the rules and the standards that were strictly followed and adhered to, during and after the collection of data to ensure the protection of the participants. The study was carried out with high ethical standards. Details regarding ethical considerations are elucidated in Chapter 3.

1.9 CHAPTER CLASSIFICATIONS

Chapter 1: Introduction and background to the study: This chapter provides an overview of and background to the study. The design of the research are briefly discussed. The statistical analysis, reliability, validity and ethical considerations pertaining to the study are highlighted.

Chapter 2: Literature review: An overview and review of all the information collected regarding adherence to safety control measures is included in this chapter. Factors that influence adherence and employee perception towards safety control measures in a mining company are also discussed.

Chapter 3: Research methodology: The research methodology applied in this study is described and the design and methods of research utilised are explained. Sampling techniques, methods of data collection and analysis re elaborated upon. Attention is given to the techniques used in order to ensure that efficient, effective and reliable results are obtained in the interpretation of the responses.

Chapter 4: Empirical results of the study: An analysis and interpretation of the research findings are provided in this chapter. The results obtained are evaluated against findings from previous studies.

Chapter 5: Conclusions and recommendations: Conclusions are drawn based on the findings. The limitations of the study are noted and recommendations made for further research as well as for improving adherence to safety measures and their influence on productivity in the mining sector.

1.10 CONCLUSION

Chapter 1 provided an overview to this study. The foundational context was established by discussing the introduction and background to the study. The problem statement and the objective of the study were also explained. The literature review, target population, sampling procedure, sampling size and the measuring instrument were briefly outlined. An explanation of the research design was presented, highlighting the statistical analysis, reliability, validity and ethical considerations pertaining to this study.

The following chapter provides a detailed description of the literature pertinent to the study.

CHAPTER 2
ADHERENCE TO SAFETY IN THE MINING COMPANY

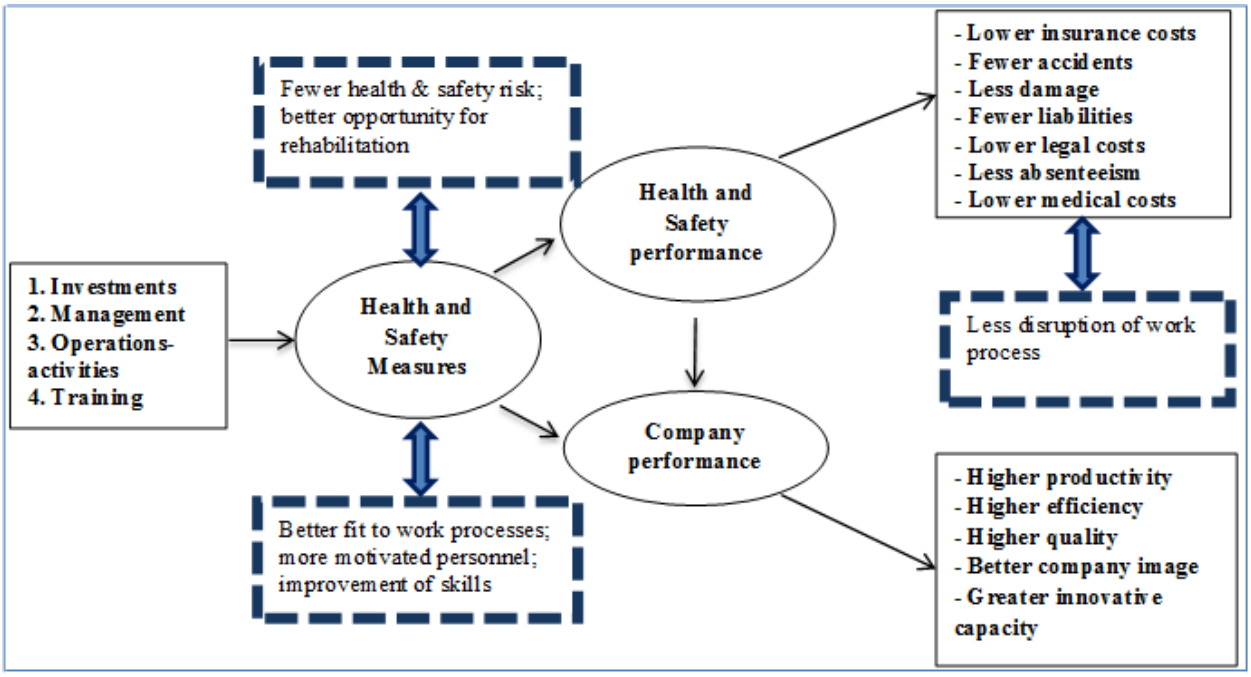
2

2.1 INTRODUCTION

Chapter 1 provided an overview and background of the study. The objective of this chapter is to explore the factors influencing adherence and employee perceptions towards safety control measures in a mining company. Adherence to safety control measures aims at reducing the likelihood and severity of accidents in mining sectors and can also help system designers and administrators to take appropriate action to prevent accidents (Kaihuana & Fuchuana 2012:457).

Figure 2.1 offers an understanding into the relationship between occupational safety and health prevention measures and programmes, the process and the outcomes. The figure provides an overview of the economic effect of health and safety at mining sector level. It can be concluded that advances in safety technology can give rise to substantial improvement in safety performance and productivity. The economic factors of the injuries should not be neglected and must not be the prevailing factor in making decisions on the application of preventive measures (Stojadinovic, Svrkota, Petrovic, Denic, Pantovic & Milic 2011:2001).

Figure 2.1: Economic effects of health and safety at company level

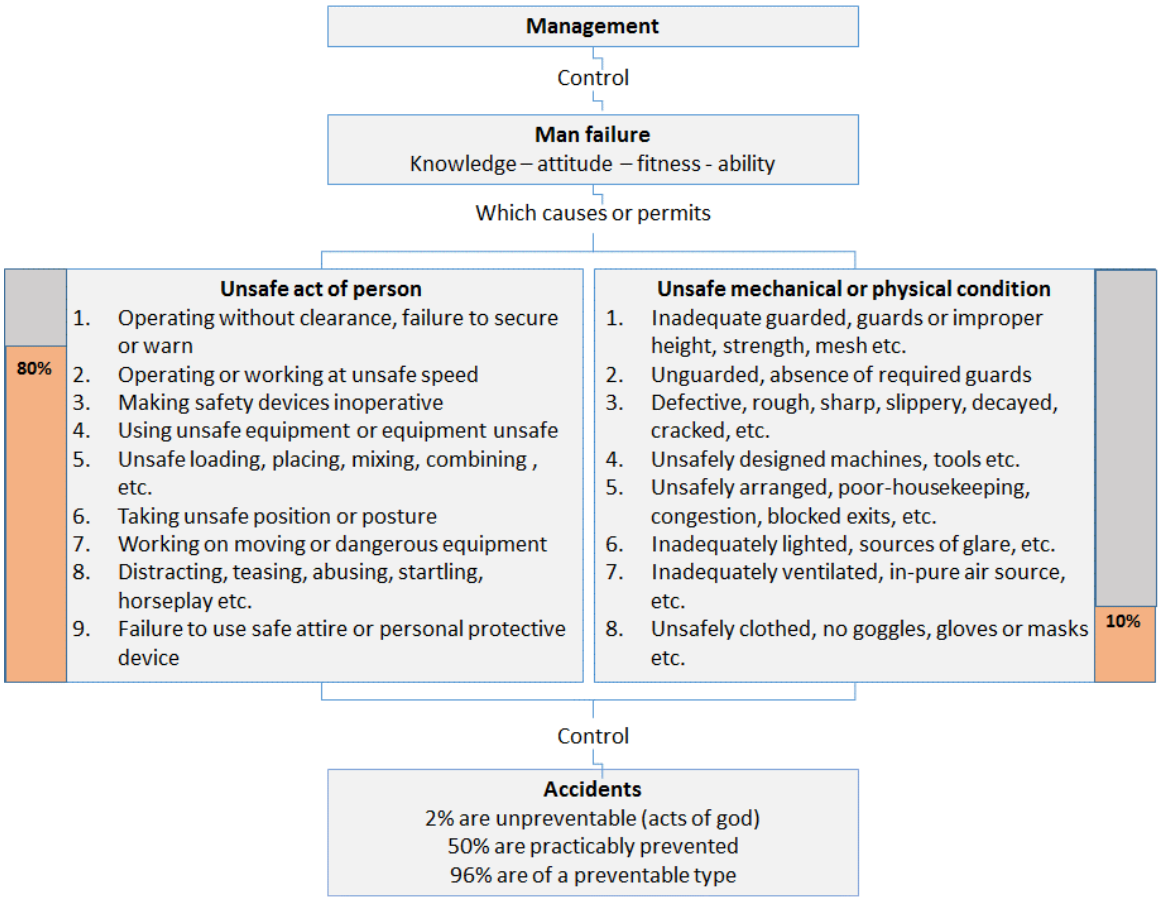


Source: Fernandez-Muniz, Montes-Peon and Vazquez-Ordas (2009:982)

2.2 SAFETY CONTROL MEASURES IN THE MINING SECTOR

Studies have shown that mining workers face a relatively hazardous work environment compared with workers in other industries (Lenne, Salmon, Liu & Trotter 2011:111). Fernandez-Muniz, Montes-Peon and Vazquez-Ordas (2011:752) note that a number of previous studies have tried to identify the factors that improve safety and reduce occupational accidents in mining, but it is still not clear what contributes to the occurrence of accidents or injuries. According to Frazier, Ludwig, Whitaker and Roberts (2012:15), there is still little consensus regarding what the core factors of safety culture are and which factors add meaningful value in safety performance with regard to safety culture in mining. Feng, Teo, Ling and Low (2013:2) argue that efforts to prevent accidents are likely to be shaped by the root causes of the accidents. Heinrich (1931), who developed the domino model of accident causation in late 1920s, concluded that 88 percent of accidents were caused by unsafe acts and only 10 percent by unsafe conditions (Sabet, Aadal, jamshidi, Rad 2013:74). While the costs attached to the mishaps or injuries in the mining company have been quantified, they are regarded as too much or outrageous (Son, Melchers & Kal 2000:187). The theory of accident causation model suggests that lack of management control is the root cause of accidents and thus the accidents could be partially prevented through management efforts (Sabet *et al.* 2013:76). Unsafe acts and mechanical hazards constitute the central factor in the accident sequence. Understanding of accident causation model is key to the success of incident prevention. In Figure 2.2, Heinrich focuses on the human factor, which he termed “Man Failure”, as the cause of most accidents. Damages may result from the loss of control of the energy when there is a failure of the hazard control mechanism (unsafe mechanical/physical conditions) contributing to 10 percent of these incidents.

Figure 2.2: Direct and proximate accident causes according to Heinrich (1931)



Sources: Safety Institute of Australia (2012:6)

Lenne *et al.* (2011:115) suggest that lack of supervision can also be a factor that contributes toward poor safety performance. Section 7 of the Mine Health and Safety Act (29 of 1996) states that the employer must ensure that work is performed under the general supervision of a person trained to understand the hazards associated with the work. Lirong *et al.* (2011:695) argue that "safety supervision organisation" is necessary for the mining operation as it influences the safety behaviour of workers. Lack of supervision can be seen as an inappropriate supervision or poor supervision, which fails to correct the unsafe behaviour of a worker where the supervisor deliberately disregards rules and regulations of the organisation in order to meet the production targets. Failure to provide professional guidance in relation to the performance of tasks in a safe manner and intentionally encouraging the workers to take short cuts puts workers at risk as workers do not know what is expected of them (Lenne *et al.* 2011:2).

Safety control measures must focus on occupational safety, sometimes called personal safety, or process safety. These are terms used in the safety literature, where process safety is referred to as the technical integrity of installations or systems, while personal safety or occupational safety

deals with the slips, trips and falls, which primarily affect workers in each occurrence (Hopkins 2011:9). Failure to apply safety control measures may result in enormous process safety consequences, especially where explosive materials are involved; social and economic repercussions for the injured employee, their dependents, communities as well as the company being affected (Hermanus 2007:531).

Paul and Maiti (2007:455) found that a more severe injury extracts a greater cost from a mining operation than a less severe injury, through workers' compensation payments, reduced productivity rates and social costs such as long periods of physical rehabilitation for severe injuries. Safety control measures help the mining industry more effectively to identify personal safety and/ or process safety risks and more realistically evaluate their safety improvement programmes (Coleman & Kerkering 2007:523). These measures of safety, including the development of worker-friendly safety procedures at mines, are generally accepted and relatively simple forms of benchmarking between mining companies (Chimamise *et al.* 2013:4).

2.2.1 Mining safety principles

Hine, Lewko and Blanco (1999:174) observe that one aspect of safety culture that has received little attention is the general safety principles to guide employee decision making and actions in the workplace. A set of safety principles can be thought of as a broadly defined code of behaviour that everyone in an organisation is expected to follow (Hine *et al.* 1999:174). These principles embody values, beliefs, norms and other actions that have been identified by key decision makers in the mine as being important factors underlying workplace safety.

Table 2.1 illustrates a set of safety principles by evaluating the degree to which employee beliefs, actions and perceptions are aligned to these principles.

Table 2.1: Coding rules for the seven safety principles

Principles	Coding rules
Principle 1: All injuries are preventable	Positive: All accidents, injuries and/or causes of accidents and injuries can be prevented. An injury-free workplace is possible. Negative: Some accidents and injuries are inevitable. An injury-free workplace is not possible.
Principle 2: Employee involvement is essential	Positive: Commitment involvement and/or personal accountability among front-line workers (supervisors) are necessary to improve safety. Negative: Communication, involvement and/or personal accountability is not necessary.

Principles	Coding rules
Principle 3: Management is responsible for safety	Positive: Management must play a central role in improving safety. Management must be perceived as being committed to safety by the work force. Negative: Primary responsibility for safety lies with the workers, not management. Workers' perceptions of management are irrelevant.
Principle 4: Working safely is a condition of employment	Positive: Working safely should be a condition of employment. Occupational Health and Safety Act (85 of 1993) and company rules and procedures should always be followed and/or enforced. Negative: Rules and procedures need not always to be followed. Shortcuts are acceptable in certain circumstances.
Principle 5: All operations exposures can be safe-guarded	Positive: Planning ahead, systematic analysis of potential hazards and/or good housekeeping are necessary to minimise risks and/or increase safety. Negative: Planning ahead, systematic hazard analysis and/or good housekeeping are waste of time.
Principle 6: All operations exposures can be safe-guarded	Positive: Good training prevents injuries and accidents. More time and money should be spent on training. Negative: Formal training is a waste of time and money. Subscribe to a "sink or swim" philosophy of on-the-job-training.
Principle 7: Safety is good business	Positive: Safety and productivity go hand-in-hand. Poor safety adversely affects productivity. Workplace injuries have negative financial and social implications outside of the workplace, for example, home. Negative: Production goals should take precedence over safety. Work safely, for example, wearing safety equipment, following rules and procedures decreases efficiency.

Source: Hine *et al.* (1999:176)

These are principles where the management of leadership in the mining company lead by example in order to adopt these set principles and demonstrate the desired evident leadership behaviours that drive continual improvement in safety performance. The leadership within the mining industry must set non-negotiable, high standards for safety, actively engage with the workforce and correct unsafe behaviours or situations in the workplace. The former Chief Executive Officer of Anglo American Platinum, Carroll (2011:6) articulates on three fundamental safety principles:

- Zero mind-set – where it is believed that all injuries and occupational illnesses are preventable. Everyone is responsible for preventing and correcting unsafe behaviour and work conditions.
- No repeats – where all unsafe practices and incidents are investigated to determine what happened and why. All necessary steps are taken to prevent recurrence.

- Simple non-negotiable standards – where a common, simple set of non-negotiable standards and rules are adopted throughout the organisation. Management has the responsibility of implementing and maintaining the standards and rules.

It is evident that the management at all levels within the organisation has a responsibility to comply by these principles. Management needs to demonstrate the development of a safety culture, which reflects their vision and safety principles.

2.2.2 Statutory mandate of the Department of Mineral Resources (DMR) in the mining sector

The Mine Health and Safety Inspectorate was established in terms of the Mine Health and Safety Act (29 of 1996), as amended, for the purpose of executing the statutory mandate of the DMR to safeguard the health and safety of mine employees and communities affected by mining operations (DMR 2016:1). According to the Annual Report of 2009/2010 published by the DMR under the directorate of Advocate Sandile Nogxina (2009/2010:25), the health and safety track record in the mining industry continues to be a matter of great concern despite a slight year-on-year reduction in mine accident fatalities. .

The impacts on occupational health are not immediately recognisable and are difficult to quantify. The excessive exposure to dust, or silicosis, remains a major cause of premature retirement and death amongst South African miners. Tuberculosis (TB) is also a serious challenge for the mining industry and is exacerbated by HIV and AIDS, while noise-induced hearing loss is also a significant health hazard. The Mine Health and Safety Council remain responsible to implement a comprehensive zero harm research programme in alignment with the TB, HIV and AIDS policies and national health programmes of the Department of Health.

2.2.3 Safety Health and Environment (SHE) incident reporting and investigation in the mining sector

On the ideological role of incident reporting as per DMR instructions, accident rates and employee absenteeism, as a result of these incidents, must be reported. Makela (2012:371) is of the opinion that the most important issue is to report these workplace-related incidents as they affect the well-being of employees. All incidents must be investigated in order to prevent the reoccurrence. The DMR continues to note the improvements made by mining operations with regard to the legal requirement of reporting of accidents in terms of Chapter 23 of the Mine Health and Safety Act. However, the DMR office continues to experience challenges in failure to report or late reporting

of some accidents, particularly from the small mining operations. The DMR continues to encourage the immediate reporting of such accidents, irrespective of the size of the operations. However, there are operations that are still failing to report accidents in terms of regulation 23(2) and corrective measures have been taken against those mines (DMR 2013:8).

All incidents must be reported to the responsible supervisor immediately after the incident has occurred but not later than the end of the shift. When the supervisor is not available, the incidents are reported to the next level of reporting. The incident can be reported to the safety officer, who will then report to the chief safety officer, plant manager, engineer, safety representative and union representative and the incident is logged into the system for statistical purposes. When a serious reportable accident occurs, the mine manager or his/ her delegates notify the Principal Inspector of Mines as soon as possible.

2.2.4 Types of accidents/incidents to be reported to the Department of Mineral Resources (DMR)

Employers that encourage the reporting of incident and accidents gain an opportunity to prevent future incidents. It is stipulated in the Mine Health and Safety Act (29 of 1996), that it is the duty of the employer to report to the Principal Inspector of Mines in the manner prescribed in the Regulation 23 of this Act, any of the following incidents and accidents using SAMRASS forms:

- Accident or dangerous occurrences (SAMRASS 1)
- Injury on duty (SAMRASS 2)
- Rockbursts and fall of ground (SAMRASS 3)
- 1-13 day injuries (SAMRASS 4)
- Explosive incidents (SAMRASS 5)
- Fire Incidents (SAMRASS 6)
- Subsidence (sinking) in coal mines (SAMRASS 7)
- Heat stroke/heat exhaustion (SAMRASS 8)
- Report on date resumed work (SAMRASS 9)
- Motor vehicle accidents while on mine company business
- Undesired environmental events (internal/external)
- Complaints from external sources (community)

2.2.5 Identification of incidents: potential and actual non-conformances

All incidents are identified either as potential or actual non-conformance for the purpose of investigation preparation and allocation. These incidents are captured into an incident register of

either an incident was a near-miss where an injury or damage could have been suffered. Some incidents are captured as non-conformance, where a substandard condition was noted. According to the severity or potential severity of the incident, the investigation team must be informed immediately in order to look into the relevant background factors (Medical Research Council – MRC 2016:30). The investigation team may prepare the following information:

- comments of supervisory staff;
- comments of safety representatives;
- adequacy of training;
- accident reporting processes;
- any previous similar accidents, near misses or non-conformance;
- examination of equipment or plant maintenance records; and
- personal factors, for example, ill health, stress, relationships with other staff

2.2.6 Access to the incident scene

According to the MRC (2016:19), the scene of the work-related incident must not be disturbed, unless there is immediate danger. On being advised of a work-related incident or accident, the following procedure is the guide to attend to the scene of the incident as soon as possible:

- The first person arriving at the incident scene must evaluate the area to determine possible risks of a secondary incident. This person must take the necessary steps to prevent further incidents in the safest way possible in order not to endanger his or her own life or the life of any other person in the vicinity.
- If it is found that his life could be endangered, he must evacuate the scene immediately to a safe distance and warn all other persons in the vicinity, while barricading the area to prevent a secondary incident.
- Under normal circumstances, the incident scene shall not be disturbed, unless a person's life is in danger or to prevent a secondary accident.
- The first person must remain on the scene, if it is safe to do so, until advanced help arrives.
- Isolate all machinery involved in an incident at its energy source.
- Barricade the scene.

2.2.7 Legal appointment of managers appointed in terms of Mine Health and Safety Act (29 of 1996)

According to the DMR, the following measures must be considered by the mining sector in order to reduce reportable injuries:

After five accidents/ incidents reported by a mine in a month, the manager appointed in terms of 3(1) (a) of the Mine Health and Safety Act (29 of 1996) must make an appointment with the Principal Inspector to give a detailed representation regarding shortcomings and proposed corrective measures to be taken to minimise accidents/ incidents in the mine; in this study, this will be the duty of the concentrator manager.

After more than five but less than eight accidents/incidents reported by a mine in a month, the manager appointed in terms of 4(1) of the Mine Health and Safety Act (29 of 1996), must make an appointment with the Principal Inspector to give a detailed representation regarding shortcomings and proposed corrective measures to be taken to minimise accidents/ incidents.

After more than eight accidents/ incidents reported by a mine in a month, the Chief Executive Officer appointed in terms of 2A (1) of the Mine Health and Safety Act (29 of 1996) must certainly make an appointment with the Principal Inspector to give a detailed representation regarding shortcomings and proposed corrective measures to be taken to minimise accidents/ incidents.

However, according to the DMR, if after analysis of any of the repeated incidents listed above, irrespective of the total number of such incidents, the office of the Principal Inspector deems them to be serious with potential to cause harm, the office of the Principal Inspector may give any instruction necessary to protect the health or safety of persons at the mine. Such an instruction may include but not be limited to the withdrawal of legal appointments of managers or any other officials appointed in terms of the Mine Health and Safety Act (29 of 1996), until such time that the employer has made representations to the Principal Inspector on corrective and preventative measures (DMR 2013:13).

The DMR must continue to monitor the individual health or safety performance of managers and any other official appointed in terms of the Mine Health and Safety Act (29 of 1996). The monitoring is done on a monthly basis. This approach is meant to create a safety profile by identifying officials who may appear to be not fully committed to the reduction of repeat incidents or the improvement of health and safety at the mine. According to the Regional Report of the Mine Health and Safety Inspectorate (2013:7), the DMR office views the issue of personal accountability in a strong light. The affected officials may face strict enforcement measures as a result of any negligence, misconduct or non-compliance. The reoccurrence of a transgression may be interpreted as gross negligence. The enforcement measures referred to may include but not be limited to the recommendation to the Chief Inspector of Mines of suspension or cancellation of the Certificate of Competency. Notwithstanding all these legislative practices in place, the South African government is still concerned about the increased rate of injuries and fatalities.

Investigations have revealed that line supervisors often take unsafe decisions as a result of the lack of skills required for the task at hand, whereas other accidents are merely a result of negligence, which puts workers at risk. As highlighted in the discussion, at times, supervisors put pressure on workers, exposing them to risk (Lenne *et al*. 2011:115). Tables 2.2 and 2.3 show the total number of reportable fatal injuries and lost-time injuries from 2011 to 2013 (DMR 2013:10).

Table 2.2: Fatalities and Injuries: 2011-2013

Progressive (Jan - Dec 2011)		**Progressive (Jan - Dec 2012)**		**Jan 2012**		**Jan 2013**	
Fatal	Injuries	Fatal	Injuries	Fatal	Injuries	Fatal	Injuries
34	1 199	25	1 260	0	72	0	73

Source: DMR (2013:10)

Table 2.3: Summary of fatalities, injuries & Accidents: 2008 - 2013

January	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	2	5	0	5	0	0	12
Injuries	105	110	65	90	70	80	520
Accidents	107	112	64	81	69	67	500
February	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	1	3	2	3	4	6	19
Injuries	77	94	91	82	100	112	556
Accidents	79	86	92	71	104	113	545
March	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	3	4	1	2	2	3	15
Injuries	93	112	173	97	92	101	668
Accidents	95	111	149	98	90	97	640
April	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	4	2	1	4	2	2	15
Injuries	126	49	111	61	71	55	473
Accidents	79	50	96	63	72	57	417
May	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	2	3	3	1	3	4	16
Injuries	79	120	111	99	130	85	534
Accidents	80	100	101	89	113	87	570
June	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	2	2	2	4	3	0	13
Injuries	75	85	78	86	133	81	538

Accidents	61	83	75	85	118	81	503
July	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	2	10	8	2	0	3	25
Injuries	91	124	129	121	140	76	681
Accidents	63	117	112	102	121	77	592
August	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	5	1	4	3	1	3	17
Injuries	80	75	126	132	135	62	610
Accidents	84	76	79	118	126	62	545
Total	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Fatalities	16	29	17	21	14	18	132
Injuries	646	694	758	636	733	718	4795
Accidents	564	659	732	589	687	699	4475

Source: DMR (2013:10)

2.3 ADHERENCE TO SAFETY CONTROL MEASURES IN THE MINING COMPANY

According to Smallwood, Haupt and Shakantu (2017:12) mining sector must have quality control practices and procedures, which ensure safety adherence with stated employer requirements. Safety adherence is the extent to which employees comply with safety standards, procedures, legal obligations and requirements. In the light of adhering to the safety control measures in the workplace, there are other significant organisational factors that drive unsafe acts and non-adherence to safety control measures, which lead to workplace accidents. These include, among others, the harsh conditions of the mining industry (Masia & Pienaar 2011:3). A study conducted by Ashworth and Peake (1994) cited by Masia *et al.* (2011:10) suggests that the harsh physical conditions experienced in the mining industry could exacerbate the perception of human error as a causal factor in mining accidents in South Africa. Studies have shown that non-adherence to safety control measures can have negative implications to operational cost, delivery, quality and social responsibility. These studies include the study conducted by Fernandez-Muniz *el al.* (2009:980) where they states that the hazardous nature of mining could result in a large number of miners being exposed to injury or death in the mines, which creates a negative effect on the financial performance of mining companies, as costs are incurred. These costs include cash and disability benefits, as well as medical expenses for the injured employees and damage to property. Minor accidents can interfere with productivity in a variety of ways and a serious accident due to non-adherence to safety control measures can shut down the entire mining sector operations. The results of a study conducted by Brown, Willis and Prussia (2000:445) reveal that safety hazards,

safety culture and productivity pressure can influence safety efficiency, either leading to safe or unsafe work behaviours. Stevenson (2012:287) supports the study conducted by Smallwood *et al.* (2017) that the mining sector must have quality control practices and procedures, which ensure safety adherence with the following stated employer's requirements:

- the use of PPE (hardhats, goggles, earmuffs, gloves, heavy shoes and clothing)
- safety devices (machine guards, dual control switches that require an operator to use both hands)
- emergency equipment (emergency showers, fire-fighting equipment, fire escapes) and thorough instruction in safety procedures and use of regular and emergency equipment. Housekeeping (clean floors, open aisles, waste removal) is another important safety factor.

An effective programme of safety and accident control requires the cooperation of both workers and management to adhere to safety control measures in the workplaces.

2.3.1 Employee behaviour and attitude towards safety in the mine

Employee perceptions lead to a certain behaviour and attitude towards mining safety. These are the primary causes of workplace accidents and are affected by influences from operating and social systems (Brown *et al. 2*000:445). According to Van Rensburg, Barkhuizen and Stan (2012:180) caring support originates from the concept of servant leadership. Therefore, leadership provides caring support in order to contribute to the well-being of employees. Leadership plays an important role in the behaviour of employees in the work situation and contributes to minimising work-related incidents and injuries.

Leadership in the mining sector have a significant role to play in the mine safety context through establishing trustworthy and reliable relationships, creating an environment conducive to safe behaviour and instilling a value and belief system that inspires a safe attitude in employees. These values influence the attitude and behaviour of employees and leaders are responsible for establishing and displaying the values that are to be lived by all employees in the mine to achieve a zero harm culture. Research has indicated that unsafe behaviour contributes 87 percent or more to incidents and injuries including fatalities in a mine (Van Rensburg et al. 2012:179).

2.3.2 Employee perceptions of adherence towards safety control measures in the mining sector

Research on workplace safety perceptions began in the early 1980s with Zohar's study and has since received considerable attention in the organisational and psychological literature (Gyekye

2006:32). A recent study by Cuia, Fanb, Fuc and Zhud (2013:39) support other studies that employees' perceptions about safety are important because the safety climate has been shown to significantly influence a number of safety outcomes, such as safe work behaviours, accidents and injury rates. Workers also have perceptions of the extent to which other people within the organisation, for example, management, supervisors and co-workers, encourage safe work practice (Casey & Krauss 2013:113). Probst and Graso (2013:580), in their study they suggested that under-reporting, in part, may be due to high levels of perceived production pressure. A strong organisational emphasis on production can have a detrimental impact on employee perception about health and safety. Another perception is that, the production pressure may be seen by employees as a reason not to report accidents (Probst *et al. 2*013:582).

One of the adherences to safety control measures is reporting of incidents. The perception by workers regarding production pressure, their attitudes towards reporting accidents, the perceived consequences of reporting accidents and actual reporting behaviours such as types and numbers of accidents experienced hinders the rate in which these incidents are reported. As a result, the actual reporting behaviours such as types and numbers of accidents experienced, compared to those reported, are significantly higher than the number of reported incidents and accidents in the system.

Evaluation of workers' safety perceptions has been useful in this aspect as they provide a powerful proactive management tool for designing an effective safety management system in the mine (Gyekye 2006:32).

2.3.3 Safety culture and practice in the mining sector

Safety culture is understood as an important part of mining safety performance. The purpose of a safety culture assessment is to create an understanding in the organisation about cultural patterns, thereby creating an opportunity to continually identify as well as shape these patterns in support of high safety performance (Alvehus, Doncheva, Fleming, Guldenmund, Haber, Haferburg, Manolov, Paciga, Staples & Watts 2016:3).

Hea, Xub and Fua (2012:249) argue that other studies show factors influencing the adherence to safety control measures and performance and some of these factors are rooted in the organisational culture. Table 2.4 illustrates the safety practices and culture scale on 32 elements.

Table 2.4: Elements of safety culture

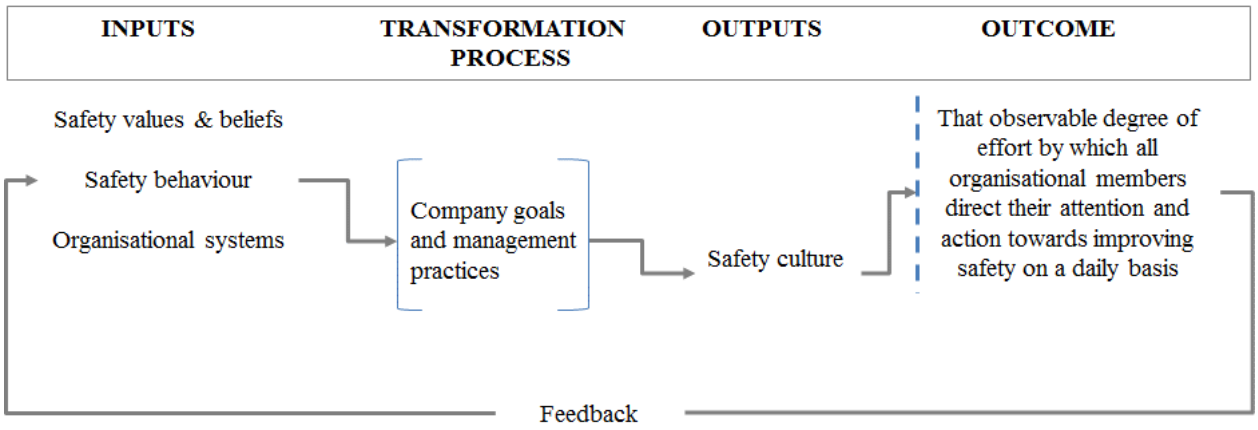
ELEMENTS OF SAFETY CULTURE

1	Relative importance of safety	17	Safety council demands
2	Preventable extent of death and injuries	18	Formation way of safety system
3	Safety creates economic benefits	19	Consistent implementation of safety system
4	Degree of safety into enterprise management	20	Types of investigation accidents
5	Safety depends mainly on safety awareness	21	Types of safety checks
6	Responsibility of work safety	22	Caring for injured workers
7	Awareness of safety input	23	Amateur safety management
8	Role of safety regulations	24	Treatment of safety performance
9	Safety values formation levels	25	Facilities satisfaction
10	Degree of leaders' responsibility	26	Mastering of safety performance
11	Understanding of the role of the safety sector	27	Safety performance and human resources
12	Degree of employee's participation in safety	28	Safety management of subsidiary and co-firms
13	Level of safety training needs	29	Function of safety organisation
14	Degree of the department's safety responsibility	30	Work of safety department
15	Effects of communication safety	31	Overall safety expectations
16	Function of safety management system	32	Emergency response capabilities

Source: Hea *et al.* (2012:247)

These elements should form part of a management system requirements for continuous improvement of safety culture, of which self, peer and independent safety culture assessments constitute an essential part. A study conducted by Samosamo, Marais and Joubert (2014:414) reveals that a health and safety culture affects employee's perceptions as one of the key factors that influences safe and unsafe behaviour within the workplace. Mining companies need to gain a deeper understanding of the perceptions of employees towards safety standards (Mojapelo, Mafini & Dhurup 2016:110). This means that the management in the mine must ask themselves a question about the best ways to manage safety so that workers in the mine will direct their attention and actions towards the improvement of safety on a daily basis. Management in mining company creates the safety culture, whether positive or negative (Manuele 2011:60). Figure 2.3 illustrates the broad attributes that comprise safety culture contrast, where inputs are processed by a combination of the mining company goals and management practices and transformed into safety culture and where output is to create the safety culture product, which is outcome (Cooper 2002:4).

Figure 2.3: Business process model of safety culture



Source: Cooper (2002:4)

2.3.4 The impact of age category of mine workers in the mine

It is believed that persons who grew up in a mining sector tend to have more experience and are likely to be more familiar with safe behaviour at work, leading to fewer injuries. A study conducted by Stojadinovic *et al.* (2011:2002) shows that the youngest workers with the least experience have the highest injury rate; however, the rate decreases as they grow older. Onder (2013:89) has observed that in an open cast mining area, including the workshops and the surface plant, the largest proportion of injuries, abouct 65 percent was found in the age group that ranged from 35 to 44 years. The study has shown that 19.4 percent of injuries occurred in the age group of 45 to 54 years, followed by 15.6 percent in the age group 25 to 34. Erdogan, Ünver, Karpuz, Düzgün and Kestel (2016:31) concludes, however, that the age group with the highest risk of exposure to accidents was 25 to 34. Stojadinovic *et al.* (2011:2002) classifies all of the injured workers into four age groups and the highest number of injuries was found to occur among young workers, as depicted in table 2.5. Age was considered in this study to better understand the impact of age on safety performance in today's mining sector. Table 2.5 illustrates age information within a 10-year period, from the year 2000 to 2009.

Table 2.5: Injury distribution according to the age of the workers

Age (years)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Σ	%
51-60	34	51	61	61	47	35	30	30	30	34	413	7.06
41-50	148	124	179	123	188	143	155	163	217	192	1632	27.90
31-40	187	187	183	208	222	234	196	233	249	210	2109	36.05
20-30	164	180	155	190	194	191	170	132	173	147	1696	28.99
Σ	533	542	578	582	651	603	551	558	669	583	5850	
%	9.11	9.26	9.88	9.95	11.13	10.31	9.42	9.54	11.44	9.97	100	

Source: Stojadinovic *et al.* (2011:2002)

The first group included workers whose age ranged from 20 or less to 30 years. This group included young, inexperienced workers and young workers with several years of experience. The age of workers in the second group ranged from 31 to 40 years and it included young workers with 10 or more years of experience. The third group comprised workers whose age ranged from 41 to 50 years and who had 20 or more years of experience.

Finally, the fourth group included older, experienced workers whose age ranged from 51 to 60 or more years. Nevertheless, experience contributes to a safer behavioural attitude of a worker as they mature; however, aging can also pose a threat against adherence to safety control measures in the mining sector. A study conducted by Fotta and Bockosh (2004:12) suggested that the occupational health and safety programmes need to address the problems of an aging workforce. This is based on the physiological changes associated with aging that may impact the capacity of older workers, which include decreases in the sensory functions particularly auditory and visual senses, motor functions such as muscular strength and endurance, reaction time and in cardio-respiratory functions. Managers must understand generational issues better and invest in technology and strategies that keep focus on assisting generation after generation to comply with adherence to safety control measures in the mining sector. Moreover, it is necessary to enhance policies of occupational health and safety programmes in order to address the issues of an aging workforce and pay attention to increasing employee morale, irrespective of their age (Gursoya, Chib & Karadagc 2013:47).

2.3.5 Mine health and safety training

For the purpose of this study, training is defined as a programme that includes all necessary safety information, adequate practice and consistency (Frazier *et al. 2*012:17). Kaihuana and Kaithuana and Fuchuana (2012:458) affirm that in order to reduce the probability of accidents, human error must be reduced. Education and training is essential to reduce human error. These errors can also be avoided through conscious practice when workers have basic safety knowledge and skills. Workers must be trained in procedures and attitudes and they can, in turn, contribute to a reduction in hazards by pointing out hazards to management (Stevenson 2012:286). Management must enforce safety procedures and use of personal safety equipment. This includes cultural input such as the cultivation of a safety culture in the mining sites. Section 10 of the Mine Health Safety Act (29 of 1996), focuses on training and full compliance would ideally translate into a comprehensive health and safety training system. Tuchten (2011:122) describe roles and responsibilities of the managers and employees regarding mine health and safety training. The onus is on managers, rather than employers, to provide health and safety training to all employees, without the employees being made to pay for such training. The employer is compelled to ensure that all employees are adequately trained to deal with hazards in the workplace. Most of the mines have compiled and submitted the mandatory codes of practice (COP) and these documents generally comply with the guidelines issued by the Chief Inspector of Mines of the DMR. Inspections and audits are conducted by the Inspector of mines. It has been found that the quality of health and safety training in the mining sector has deteriorated, exposing employees to various risks within the mine. One of the recommendations by the Inspector of Mines was that the mine managers need to scrutinise the process by which the requirements of the various COP within the mine are communicated to employees. Mine managers must also ensure that the procedures and rules in which the employees are trained comply with the stipulations of the COP (DMR 2013:3). Stevenson (2012:287) affirms that accidents cannot be completely eliminated. A freak accident may seriously affect worker morale and might even contribute to additional accidents. Noting that the basic causes of the majority of injuries is the carelessness of the workers, some things can be done to increase safety at work and lower the number of injuries. For example, a longer training period for new workers or a simple warning campaign among the workers could increase awareness and prevent some accidents (Stojadinovic *et al.* 2011:2004). The office of the DMR noted that the quality of training rendered at the mine school training centres appears to be inadequate as employers mainly conduct training of employees merely to comply with the inspector's instruction without even assessing such employees' competency (DMR 2013:3). Swuste, Van Gulijk and Zwaard (2010:1007) point out that all occupational accidents are

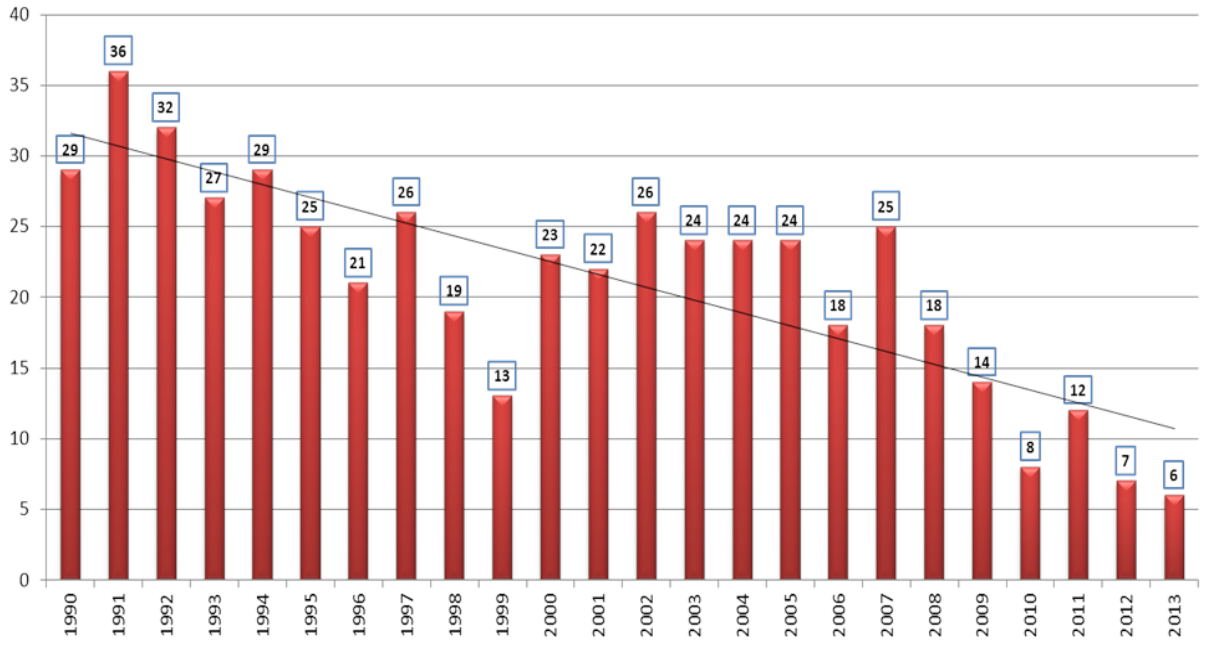
preventable by guarding dangerous parts of machines, while for 60 percent of these accidents, education and training is the route to prevention of such accident and injuries.

2.4 RISK-TAKING, SAFETY AND PRODUCTIVITY

Business is business and the profit motive will always prioritise production over safety if the associated costs are not recognised (Kramer 2013:14). Furthermore, the conflict between production and safety is not a matter of compromising between two extremes, absolute safety and harsh production on the other hand. According to Kramer (2013:15), the real conflict is when the employees, business owners and the economy is moved toward a system that recognises the true costs of injuries and internalises, accept or absorb safety into all aspects of all business models within the organisation. Safety and risk management professionals are on the front lines of this conflict to bring coherence in order to ensure compliance toward minimum requirements of safety control measures in the mining sector.

Studies have shown that the desired operational performances can be achieved by improving workplace safety (Zacharatos & Barling 2005:78). However, mine safety is an important issue for operational managers to achieve safe production. Figure 2.4 shows that there has been no real improvement achieved with regard to zero harm or the prevention of accidents in the South African mining sector. This information was released by the Anglo American mining sector and the figure shows that there has been a decrease in mine-related fatalities. There has been a slight obvious downward trend in fatal injury rate for the period of 23. The reduction of deaths has been gradual owing to the risk and compliance training offered by the company. The rate of fatal injuries has slightly improved by 17 percent, total injuries by 19 percent, lost-time injuries by 15 percent and serious injuries by 20 percent. This fact is supported by an analysis of safety statistics versus production performance in South African Platinum mining sector.

Figure 2.4: Fatal injury rate 1990 - 2013



Source: DMR (2013:15)

When the injury has been classified as a lost-time, it is not considered final until the injured person returns to the workplace or is permanently transferred or terminated. These workplace lost time incidents are recorded in three categories, either as an actual days lost from work, or if statutory days change, or when activity workdays are restricted (Coleman & Kerkering 2007:525). The lost workdays variable can also have a value of zero if no time away from work occurred due to the accident, such as when a roof-fall, or work stoppage for 30 minutes or more but no injury occurs. Lost workdays can also be zero if an injury occurs without death, days away from work, or restricted activity has been granted. The lost-time accidents or lost workdays, for instance, are defined as accidents with a minimum of at least one lost day. In order for the mining company to achieve health and safety goals it is essential that perceptions be regardless of age, experience or race and that relation between employee (unions/safety) representative and management must improve to have the same goal in keeping the workplace incident free. The injury frequency rates are obtained by dividing the total number of accidents by the total number of hours of exposure; these rates are calculated by means of the following formula:

Equation 2: Lost time injury frequency rate (LTIFR)

$$\text{LTIFR} = \frac{\text{(Number of Lost Time Injuries Accounting Period x 1 000 000 Factors)}}{\text{(Total Hours worked in Accounting Period)}}$$

Source: Safety & Health Performance Report of the Australian Minerals (1999 – 2000)

An organisation LTIFR is a proxy measurement of its performance. It is simply one measure that can help the mining company to gauge their safety performance. It should be considered alongside other lagging and leading indicators. It represents the number of lost time injuries that have occurred within a given accounting period, relative to the total number of hours worked in that period. The total hours worked include overtime and training and excludes leave and sickness by employees engaged in the activities of the mine in the period under review (NOSA 2015:5). Table 2.6 shows the total picture of Anglo American mining industry injury rates.

Table 2.6: Anglo American total injury rates

SAFETY					
Anglo American total	**2016**	**2015**	**2014**	**2013**	**2012**
Fatal incidents	11	6	6	15	13
Lost time injuries (LTI)	547	802	609	918	1,043
Medical treatment cases (MTC)	482	783	780	1,088	1,237
First aid cases (FAC)	1,605	2,234	2,387	2,423	2,435
Total recordable cases	1,040	1,591	1,395	2,021	2,293
Total injuries	2,645	3,825	3,782	4,444	4,728
Total employee and contractor hours worked	293,373,908	341,393,909	347,057,639	372,879,521	356,660,067
Injury rates	**2016**	**2015**	**2014**	**2013**	**2012**
Fatal-injury frequency rate (FIFR)	0.007	0.004	0.003	0.008	0.007
Lost time injury frequency rate (LTIFR)	**0.37**	0.47	0.35	0.49	0.58
Total recordable case frequency rate (TRCFR)	0.71	0.93	0.80	1.08	1.29

Source: Sustainability Data Report (LTIFR) Anglo American (2016-2012)

In addition to measuring LTIFR, the mining company must be sure to consider things like injury severity, the frequency of management commitment towards safety in terms of visible felt leadership (walkthroughs), worker participation in safety programmes, frequency of safety audits

and percentage of workers who have completed health and safety training. The mining company leadership will only know how to improve and move the organisation forward if they have the whole picture.

2.4.1 Risk taking in the mine

Masia *et al.* (2011:3) believe that the strong and increasing focus on productivity, deadlines for reaching targets and workplace accidents contribute to a climate of insecurity, if not to actual job losses and retrenchments. This has fuelled a considerable amount of fear about job loss, especially among employees at lower levels. In addition, job insecurity, dissatisfaction, unsafe behaviours and taking a risk/shortcut are related. Therefore, job insecurity is also a major concern in the mining company.

Accidents happen for different reasons. Risk taking are unacceptable attitudes or behaviours of any mine worker been found guilty, such as those listed below.

- Taking a risk of shortcut: some decisions are made with a hope that it will make the job faster and more efficient. Shortcuts that reduce the works' safety on the job are not shortcuts, but an increased chance for injury.
- Being over confident: confidence is a good thing but when one's attitude that "It will never happen to me" is an attitude that can lead to improper procedures, tools or methods used can create harm (Eisenbach & Schmalz 2015:20).
- Starting a task with incomplete instructions: to do the job safely and correctly the first time, the worker requires complete information. Instruction or explanations regarding work procedures and safety precautions are important prior to commencing of any work.
- Poor housekeeping: when clients, managers or safety professionals walk through the work site, housekeeping is an accurate indicator of everyone's attitude about quality, production and safety. Poor housekeeping creates hazards of all types.
- Ignoring safety procedures: purposely failing to observe safety procedures can also endanger co-workers.
- Mental distractions from work: having a bad day at home and worrying about it at work is a hazardous combination.

Masia *et al.* (2011:1) discovered that about 43 people lost their lives in the line of duty in 2003 at a gold mine, while 27 people died at platinum mining operations and in 2008, 34 and 29 people died in gold and platinum operations respectively. This year (2018), over 20 employees have died

at Sibanye mine alone (Pijooe 2018:1). Companies are striving to improve production and in the process, employees are overlooking safety procedures while attempting to reach performance goals.

2.4.2 Productivity in the mining sector

Hine *et al.* (1999:173) state that working safely is good business" and that safety and productivity go hand-in-hand. When the employer involves employees in ensuring working conditions are safe, employee morale tends to be high, as a result employees become productive (Gaither & Frazier 2002:729). In the 2012 regional report, the DMR Inspectorate congratulated all the mines that achieved one million fatality-free shifts (FFS) and fatality-free production shifts including the following mining companies specified in Table 2.7.

Table 2.7: 1 Million fatality-free production shifts

No	Mining	1 Million fatality-free production shifts (FFPS)
1.	Dorstfontein East Colliery	1 000 FFPS
2.	Vuna Colliery	4 000 FFPS
3.	Woestalleen Colliery	4 000 FFPS
4.	Forzando North	12 000 FFPS
5.	Forzando South	6 000 FFPS
6.	Tumelo Mine	2 000 FFPS
7.	Goedehoop Colliery	3 000 FFPS

Source: DMR (2012:11)

This is testimony that mines can operate without fatalities and many other mines must aspire to achieve the same and even better results. In January 2013, the North West Mining sector achieved another fatality-free month, as it did in January 2012. Reflecting on year 2012, though it was a tough year according to the DMR Regional Report, there are mines that have outshone their peers in health and safety performance and in raising productivity. The government recognises such mines by including them on their list of Platinum Top 20 Best Performers (DMR 2013:4). Poor safety adversely affects productivity.

Research has shown that because of absenteeism due to employees' injuries, productivity will be low and one of the most important factors influencing productivity in the mining sector is human

behaviour (Kruger, De Wit & Ramdass 2005:556). Employees are obliged to support the employer's efforts in ensuring a safe and healthy environment in the workplace (Huna, Ben & Mampuru 2013:13). Safety should be addressed as accidents can take a toll on productivity (Stevenson 2005:51).

An injury or occupational disease causes significant disruption to the balance of the work environment in which it occurs. Swuste *et al.* (2010:1000) agree that workplace accidents have created a heavy burden of occupational deaths among workers, therefore, there is ongoing mechanisation, followed by a movement to rationalise production and make it cost effective. The cost of workplace accidents includes a hidden or invisible portion consisting of elements not recognised by employers. Among these are production losses, time lost by fellow workers, time spent managing the case, increased employee turnover and overtime (Swuste *et al. 2*010:1000). These costs, commonly called indirect costs, are borne entirely by the employer, but in most cases, they are either not captured by the company's accounting system or not attributed directly to workplace accidents. On the other hand, visible components comprise direct costs, which the employers easily identify, can be successfully detected in the systems (Criveanu & Taicu 2013:26). Invisible or hidden components are indirect costs, which are more difficult to quantify and which the employers tend to underestimate. Theory of Accident Prevention establishes that for every accident that occurs, there are indirect costs incurred. Many employers are not aware of these costs, therefore, they are not insured (Brody, Letourneau & Poirier, 1990). Invisible or hidden costs have a material and negative effect on productivity (Edelen, Evans & Kadlec 2013:6). Direct costs usually include the following:

- the cost of the accident victim's compensation;
- the costs of hospitalisation and ambulance services; and
- medical expenses, including rehabilitation costs.

Indirect costs are also generated by such factors as production downtime; damage to operational machinery or equipment, time lost by other employees due to the accident and lowered employee productivity upon return to work. None of these costs is insured and, while hard to quantify precisely, they can substantially exceed the direct costs. The main components of indirect costs can be grouped into four broad categories (Jallon, Imbeau & De Mercellis-Warin 2011:150):

- Legal and administration costs: the employer must allocate human and financial resources to set up and monitor the file, enter data in the accident register, compile accident statistics, issue a report and so forth.

- Productivity costs: an accident disrupts workplace equilibrium, which can impact productivity by requiring work shutdowns, overtime, production delays and so forth.
- Replacement costs: an absent employee must be replaced to maintain productivity. Costs will be incurred to transfer, hire and train staff.
- Costs of investigation: these are costs arising from the investigation of the accident's cause and the completion of the associated legal and administrative documentation.

Productivity suffers when the equipment or property damage due to the accident, which causes downtimes are added to the list of indirect costs, but they can also be considered as direct costs when they are insured. The mine has a programme in place to reward employees for working without a lost-time injury and for not being involved in an equipment-damaging accident.

When machinery is broken, no production that depends on the machinery is possible (Kruger *et al. 2*005:516). Workers' safety is one of the most basic issues in job design. This area of safety needs constant attention from management, employees and designers. Workers cannot be effectively motivated if they feel they are in physical danger. From an employer's standpoint, accidents are undesirable because they are expensive (insurance and compensation), they usually involve damage to equipment and/or products, they require hiring, training and make-up work and they generally interrupt work (Stevenson 2012:286).

2.4.3 Safety and production

Safety versus production cannot be set apart. A study conducted by Fernandez-Muniz *et al.* (2009:982) offered an understanding into the relationship between safety and production outcomes. Good safety performance and company performance depends on adherence to effective safety control measures in the mine. Good safety performance affords fewer health and safety risks and better opportunity for rehabilitation and provides better fit to work process, more motivated mine workers and improvement of skills.

Safety performance outcomes can be, but not limited to, lower insurance costs, fewer accidents, less damage, fewer liabilities, lower legal costs, less absenteeism and lower medical costs. On the other hand, company performance can be, but not limited to, higher productivity, higher efficiency, higher quality, better company image and greater innovative capacity and less disruption of work process.

2.5 LEGISLATIVE FRAMEWORK: MINING IN SOUTH AFRICA

Studies on safety and mining operations (Komljenovic, Groves and Kecojevic 2008:792) have revealed that mining is one of the largest industries in terms of its operation by weight, volume and number of active operations. Various physical and psychosocial risk factors can affect mine workers' safety and health. The physical hazards that are emerging from new forms of mining processes, hazards as a result of miners handling heavy equipment and doing heavy work and working in confined and restricted conditions, can also contribute to make the working environment more challenging for miners (Amponsah-Tawiaha, Jainb, Lekac, Hollisc & Coxc 2013:75). These findings emphasise the need for continued efforts to reduce mining injuries and should be helpful in prioritising control strategies. The Mine Health and Safety Act (29 of 1996) provides minimum requirements in order to reduce the number of workers fatally injured at work. The government has safety legislation in place to ensure the safety of mine workers (refer to table 2.8(a) below).

Within this framework, the value of adopting widely accepted standards is recognised. A performance-based internal and external audit arrangement is outlined as a basis for ensuring those selected sections of the mine health and safety law are customised for compliance within the mining company.

Table 2.8 (a): Legislative framework - sections compliance

Legislative framework – MHSA Sec.			
Sec. 11	Manager to asses and respond to risk	Sec. 27	Designation of working places
Sec. 12	Manager to conduct occupational hygiene measurements	Sec. 28	Qualification of representatives
Sec. 13	Manager to establish system of medical surveillance	Sec. 29	Election and appointment of representatives
Sec. 14	Records of hazardous work	Sec. 30	Rights and powers of representatives
Sec. 16	Annual medical surveillance	Sec. 31	Duties to compensate and assist representatives
Sec. 17	Exit certificate	Sec. 32	Duties to inform representatives
Sec. 19	Employee right to information	Sec. 33	Negotiation and consultation on establishing committees
Sec. 20	Employee may dispute finding of unfit to perform work	Sec. 34	Establishment of health and safety committees
Sec. 21	Manufacturer's and supplier's duty for health and safety	Sec. 35	Committee procedures

Sec. 22	Employee's duties for health and safety	Sec. 36	Rights and powers of health and safety committee
Sec. 23	Employee's right to leave dangerous working place	Sec. 37	Duty to support committee
Sec. 25	Health and safety representative and committee	Sec. 38	Disclosure of information
Sec. 26	Negotiation and consultation before appointment of representative	Sec. 39	Disputes concerning disclosure of information
OCCUPATIONAL DISEASES			
Hearing loss; Tuberculosis; Other occupational disease			
CONFINED SPACE			
Lead Regulation; Asbestos Regulation; Explosives; Mine Fires			
Equipment: MACHINERY & EQUIPMENT			
Lifting equipment; Work at heights; General Machinery Regulation (including Scaffolding); Isolation & Lockout			

Source: Mine Health and Safety Act (29 of 1996) Government Gazette 32226 (2009:2)

The Mine Health and Safety Act (29 of 1996) incorporates a set of regulations where the mining companies receive an instruction from the Government to develop a COP in a form of safety control mechanisms. Since the sanctioning of Mine Health and Safety Act (29 of 1996), 23 regulations have been promulgated to realise the provisions of the Act, Table 2.8(b), namely:

Table 2.8 (b): Legislative framework - regulations compliance

Legislative Framework – MHSA Reg.			
Reg. 1	Appointments and administration	Reg. 13	Outlets, ladder ways and travelling ways
Reg. 2	Duties and responsibilities	Reg. 14	Protection of the surface and the workings
Reg. 3	Electricity	Reg. 15	Qualifications and competencies
Reg. 4	Explosives	Reg. 16	Rescue, first aid and emergency preparedness and response
Reg. 5	Fires and explosions	Reg. 17	Surveying, mapping and mine plans
Reg. 6	Health and safety representatives and committees	Reg. 18	Tripartite institutions
Reg. 7	Inspectorate of Mine Health and Safety	Reg. 19	Underwater mining
Reg. 8	Machinery and equipment	Reg. 20	Definitions
Reg. 9	Mine Environmental Engineering and Occupational Hygiene;	Reg. 21	Forms
Reg. 10	Miscellaneous and general provisions	Reg. 22	Schedules

Reg. 11	Occupational medicine	Reg. 23	Reporting of accidents and dangerous occurrences (Acts online 2012)
Reg. 12	Offshore installations		

Source: Mine Health and Safety Act (29 of 1996)

The mining environment was also found to have a negative effect on the safety experience of employees in terms of near misses. This finding is in accordance with Amponsah-Tawiaha *et al.* (2013:80), whose studies revealed that physical risk and hazards such as noise, heat, dust, chemical and hazardous tools and equipment are negatively related to employee involvement in safety activities.

Because of the high risks associated with the mining industry in South Africa, the government has put in place safety legislation in the South African mines: The Mines and Works Act (27 of 1956) and the Occupational Diseases in Mines and Works Act (78 of 1973). These Acts provide for the control of the work environment on the mines. The Acts were formulated to improve and protect the health and safety of mine workers in the workplace. These Acts are not specific to the mining sector; however, they have a direct influence on the provision of mine safety and labour practices. The legislation pertaining to occupational safety in South Africa is as follows:

- The Constitution of the Republic of South Africa (1996);
- Basic Conditions of Employment Act (75 of 1997);
- Occupational Health and Safety Act (85 of 1993);
- Labour Relations Act (66 of 1995); and
- Mine Health and Safety Act (29 of 1996).

2.5.1 The Constitution of the Republic of South Africa

According to section 24(a) of the Constitution of the Republic of South Africa (1996), Chapter 2 (Bill of Rights) states that all people have the right to an environment that is not harmful to health or well-being of employees. The Constitution requires employers to provide mine workers with a working environment that is safe, free from hazard and not harmful to the employees or anyone who is affected by the activities of the mine (RSA 1996:1).

2.5.2 Basic Conditions of Employment Act (75 of 1997)

The Basic Conditions of Employment Act (75 of 1997) was published for general information on 5 December 1997. The purpose of this Act was to give fair effect to the labour practices referred to in section 23(1) of the Constitution by establishing and making provision for the regulation of

basic conditions of employment. Section 1(d), of this Act observes the regulations and the requirements of the Occupational Health and Safety Act (85 of 1993) (RSA 1997:8). Furthermore, Section 7(b) requires the employer to regulate the working time of each employee with due regard to the health and safety of the employees (RSA 1997:14). Section 17 (i) states that the employer may require or permit the employee to perform night work only if so agreed and if the employee is informed in writing or orally and the employee must be informed of any health and safety hazards associated with the work that he/she will be required to perform (RSA 1997:20).

The Act also notes the requirements of Mine Health and Safety Act (29 of 1996) (RSA 1997:72). According to Section 11 of this Act, the government requires the employers to conduct hazard identification and risk assessment with regard to the risks that are associated with the workplace. This will give the employees the opportunity to decide for themselves whether to perform the tasks regardless of the risks involved or to refuse to perform such tasks (Section 22 and 23 of the Mine Health and Safety Act (29 of 1996)). The Act also encourages the employer to training the employees on procedures that have to be followed in order to understand the risks pertaining to the work to avoid any injury, harm, loss or damage to the property.

2.5.3 The Occupational Health and Safety Act (85 of 1993)

The Occupational Health and Safety Act (85 of 1993) and its principle characteristics provides for the health and safety of people at work; the health and safety of people in connection with the use of plant and machinery; and ensures the protection of people other than those at work against hazards to health and safety in connection with the activities of people at work.

This Act took effect on 2 July 1993 with the aim of ensuring that the employers provide a safe working environment for the employees in the mining industry by:

- providing and maintaining a working environment that is safe and without risk to the health and safety of employees;
- maintaining the system of work to ensure that plant and machinery are safe and without risks;
- eliminating or mitigating any hazard or potential hazard to the safety or health of employees before resorting to PPE;
- ensuring safety and absence of risks to health in connection with the production, processing, use, handling, storage or transportation of articles or substances;
- providing information, instructions, training and supervision to ensure the health and safety of employees at work; and
- making employees aware of the hazards attached to any work that the employees have to perform, any article or substance, which has to be produced, processed, used, handled, stored

or transported, any plant or machinery, which employees are required or permitted to use as well as the precautionary measures, which should be taken and observed with respect to those hazards.

In order to ensure that the above requirements of the Act are met, the employer must ensure that the employees adhere to the following:

- take reasonable care with regard to the health and safety of themselves and of other people who may be affected by their acts or omissions;
- cooperate with the employer to enable the duties of the employer as imposed by the Act to be performed or complied with;
- carry out any lawful order given to them and obey the health and safety rules and procedures laid down by their employer or by anyone authorised by the employer in the interest of health and safety;
- report to the employer or the health and safety representative as soon as possible any situation that is unsafe or unhealthy that comes to their attention and any incident, which may affect their health or the health or other employees.

The main objective of this Act is to ensure the provision of a safe working environment, equipment and machinery as well as to establish the rules and the standards to be followed to ensure safety of all people at work.

2.5.4 Mine Health and Safety Act (29 of 1996)

Particular attention has been paid to the following principles in the Act:

The primary responsibility for ensuring a healthy and safe working environment in mines is placed on the mine owner. The Act sets out in detail the steps that employers must take to identify, assess records and control health and safety hazards in the mines. This Act entrenches basic worker rights, most notably, the right of the worker to participate in health and safety decisions, the right to receive health and safety information, the right to training and the right to withdraw from the workplace in the face of danger.

The responsibility for enforcing the Mine Health and Safety Act (29 of 1996) lies with the Mine Health and Safety Inspectorate. The inspectorate's powers have been recast to include the power to impose administrative fines upon employers who contravene the Mine Health and Safety Act (29 of 1996). The Act also contains innovative approaches to the investigation of accidents, diseases and other occurrences that threaten the health and safety of employees.

According to this Act, the aim is to provide the protection of health and safety to employees and other people in the mines by:

- promoting a culture of health and safety;
- providing the enforcement of health and safety control measures;
- providing for appropriate systems of employee, employer and state participation in health and safety matters;
- providing effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- promoting training and human resources development;
- regulating employers' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;
- providing for investigations and inquiries to improve health and safety at mines; and
- giving effect to international law relating to mining health and safety.

Mine managers or owners are required to ensure the implementation of the principle of the Act to provide conditions for safe operations and a healthy working environment. They must ensure that the mine is commissioned, operated, maintained and decommissioned in such a way that employees can perform their work without endangering the health and safety of themselves or of any other person. They must identify relevant hazards and assess the related risks to which employees are exposed and ensure the adequate supply of health and safety equipment to each employee, therefore, make available all the necessary health and safety facilities. These facilities and equipment must be serviceable and kept in a hygienic condition to:

- Ensure the availability of sufficient quantities of all necessary PPE so that every employee who is required to use that equipment is able to do so.
- Determine the capabilities of employees in respect of health and safety before assigning tasks; provide employees with any information, training, instructions or supervision that is necessary to enable them to perform their work safely without risk to health and safety. Supervision must be performed by a person trained to understand the hazards associated with the work and who has the authority to ensure that the precautionary measures laid down by the concentrator manager are implemented.
- Establish a health and safety policy, which describes the organisation of work and the protection of employees' health and safety at work. A copy must be prominently displayed for the employees to read and the health and safety representatives must have a copy of the document.
- Ensure that every employee is familiar with work-related hazards and risks and the measures that must be taken to eliminate, control and minimise those hazards and risks. In so far as the

risk remains: provide PPE; and institute a programme to monitor the risk to which employees may be exposed.

Section 23 of the Act also requires employees to abide by the Act and their duties are laid out as follows:

- Take reasonable care to protect their own health and safety as well as the health and safety of other people who may be affected by any act or omission of that employee.
- Use and take proper care of protective clothing as well as the health and safety facilities.
- Report promptly to the immediate supervisor the situation, which the employee believes presents a risk to the health and safety and which the employee cannot properly deal with.
- Co-operate with any person to permit compliance with the duties and responsibilities placed on that person in terms of this Act.
- Comply with prescribed health and safety control measures and leave any working area whenever circumstances at the workplace appear to pose a serious danger to health or safety (Botha 2003:6-14).

Section 25 of the Mine Health and Safety Act (29 of 1996) requires the appointment of safety representatives and committees who are elected from among the employees (RSA 1996:34). The duties of safety representatives and the committees are:

- to represent the employees on all aspects of health and safety
- to direct employees to leave any working place that appears to pose a serious danger to health and safety of the employees
- identify potential hazards and risks to health and safety
- inspect working places with regard to the health and safety of employees
- investigate complaints relating to health and safety at work and participate in health and safety consultations as well as any health and safety inspection (RSA 1996:34-41).

2.5.5 Safety regulations related to mine safety

Section 98 (1) of the Mine Health and Safety Act (29 of 1996) (RSA 1996:79) gives the Minister the power, after consulting the tripartite institutions indicated in 2.5.2.5, by notice in the Gazette to make regulations in order to ensure safety in the mining industry regarding:

a. the health and safety of persons at mines;
b. health and safety standards, codes of practice and the provision of protective clothing and equipment facilities in connection with health and safety at mines;
c. the performance of work by employees exposed to a health hazard and the measures to eliminate, control and minimise health risks;
d. health and safety management systems at mines;

e. the powers, duties, functions and responsibilities of employees at mines;
f. the issuing of permits for the use of machinery, equipment and material at mines and the accreditation of persons to test machinery, equipment and material for these purposes;
g. the conditions under which machinery, equipment or material may be erected or used at the mines;
h. the elimination, control and minimisation of health and safety hazards;
i. requirements for the use, handling, processing, storage, transport and disposal of hazardous substances used in the mining process and waste produced at the mine;
j. the transport, handling, storage and use of explosives and the mixing of substances to make explosives at a mine;
k. the protection of equipment, structures, water sources and the surface of land;
l. the conditions in which equipment, structures, water sources or the surface of land may be used, and the prohibition on, or restriction of, erection of equipment and structures and the use of water sources or the surface of land in the vicinity of the working places at a mine; and
m. the making safe of undermined ground and of dangerous excavations, tailings, waste dumps, ash dumps and structures of whatever nature made in the course of prospecting or mining operations or which are connected with those operations (RSA 1996:79-80).

The COP has been required by the government in the form of safety control mechanisms in order to make sure that the environment is kept safe, activities are performed safely and the safety of all employees is ensured. A guideline has been provided to the organisations as to what should be done to eliminate, mitigate and control hazards and ensure safety.

2.5.6 Labour Relations Act No.66 of 1995

The Labour Relations Act (66 of 1995) was promulgated on 13 December 1995. This Act also notices the requirements of the Occupational Health and Safety Act (85 of 1993). Section 78 of the Labour Relations Act refers to the constitution of the workplace forum. One or more members of the workplace forum should be health and safety representatives. The employer should consult with the workplace forum whenever there is a need to initiate, develop, promote, monitor and review measures to ensure health and safety at work (RSA 1995:65). The government encourages fair labour practices for all employees as conferred by section 23 of the Constitution. This Act also requires employers to ensure the safety of employees, as required by the Occupational Health and Safety Act (85 of 1993).

These legislations are essential in terms of safety. They afford or provide protection of health and safety to employees and other people in the mines, promote culture and the enforcement of health

and safety measures. They also encourage employee participation in health and safety matters and provide for appropriate systems of employee and employer with regards to an effective monitoring and inspections, investigations and inquiries to improve health and safety in the mining company.

These legislations and/ or acts promote training, human resources development and regulate employers and employees duties to identify hazards and eliminate, control and minimise the risk to health and safety.

2.6 CONCLUSION

The discussion in this chapter provided an overview of various aspects of factors influencing adherence and employee perceptions towards safety control measures. In many industrial mine settings, employees have found themselves torn between compliance with safety rules and support of production quotas. Once the accident has taken place, the investigation of what happened is a very important source of information. There is usually not just one reason for an accident, but a series of causes that are closely related. An adequate investigation of an accident allows all of its causes and their influences to be determined. Thus, if the causes of an accident are known, methods of protection and prevention can be designed and applied to eliminate them and in this way there would be very little or no possibility of recurrence (Sanmiquel, Freijo, Edo & Rossell 2010:2). The employees' perception is that the organisation encourages them to work around safety procedures in order to meet production quotas, keep up with the flow of incoming work and meet important deadlines (Brown *et al. 2*000:448). Furthermore, this study concurs with Manuele (2011:54) who states that mine managers value high profits above safety and tolerate excessive risks.

Chapter 3 provides an overview of the research methodology used in the study. Various aspects of the design of the study, data collection and statistical techniques used to analyse the data are discussed.

CHAPTER 3
RESEARCH METHODOLOGY

3

3.1 INTRODUCTION

In Chapter 2, a literature review was provided. An overview and review of information collected regarding adherence and the perceptions of employees towards safety control measures within the mining company were also reviewed. Research on other studies relating to the topic was also introduced in Chapter 2. The background of the mining company in South Africa was analysed, *inter alia* through a consideration of the origin of mining within the country and the legislative framework that governs mining industry. Accidents and injuries within the industry were also addressed.

The purpose of this chapter is to provide a description of the research methods or procedures followed in order to address the objectives established in Chapter 1, which included the following:

- the research methodology used in this study;
- the geographical area where the study was conducted;
- the study design;
- the population and sample; and
- the instrument used to collect the data, with methods implemented to maintain the validity and reliability of the instrument.

3.2 RESEARCH METHODOLOGY AND DESIGN

A research design is a plan and procedure for research that spans the decision from broad assumption to detailed methods of data collection and analysis (Creswell 2003:3). A quantitative research approach was selected for the study. Quantitative research involves the use of structured questions in which the response options have been predetermined in questionnaires or survey administered to a large number of participants (Shiu, Hair, Bush & Ortinau 2009:170). Quantitative research is the technique that seeks to quantify data and apply some form of statistical analysis (Malhotra & Birks 2007:143).

Three types of research designs have been described in the basic literature, namely exploratory, descriptive and causal research design, which are described as follows:

- the goal of exploratory research is to discover ideas and insights;

- descriptive research is usually concerned with describing a population with respect to important variables; and
- causal research is used to establish cause-and-effect relationships between variables. Experiments are commonly used in causal research designs because they are best suited to determine cause and effect (Yin 2014:7).

A descriptive survey was selected because it can provide an accurate portrayal of the characteristics of data collection. This includes, for example, the behaviour, opinions, abilities, beliefs and knowledge of a particular individual, situation or group (Burns & Grove, 1993:29). This design was chosen to meet the objectives of the study, namely to determine the factors influencing the adherence and employee perceptions towards safety control measures in a mining sector. A survey obtains information from a sample of people by means of self-report, that is, the people respond to a series of questions posed by the researcher (Polit & Hungler, 1993:148).

Primarily, researchers use two research approaches to conduct research, namely a qualitative and a quantitative approach. Qualitative research presents facts in a narration of words, whilst quantitative research presents statistical results represented with numbers (Swarts 2006:8). A quantitative research approach was chosen because the study is descriptive in nature with survey methods and forms of numerical measurement utilised. Descriptive research design is viewed as a survey research method for collecting quantitative data that emphasises asking structured questions from a large group of participants (Shiu *et al. 2*009:226).

3.2.1 Research design process

Creswell (2003:145) states that a research design is the provision of a plan for quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. In order to achieve the aim of the study, it was necessary to conduct a survey based on the available literature, which formed the theoretical basis to describe employee perceptions towards safety control measures in the mine. The information acquired in the literature survey contributed towards the development of a questionnaire, which was utilised in the empirical part of the study. Furthermore, a research design consisted of the following: population, target population, sampling frame, sampling size and sampling methods (Zikmund 2003:367).

An operational sampling process was divided into five steps, explained as follows:

3.2.1.1 Population and sample frame

A population refers to a general group (individuals or objects) from which a sample is selected (Bryman & Bell 2007:182). According to Boyce (2002:232) irrespective of how well the research instrument is designed, the data will lose value if the wrong people are targeted. The population related to this study comprise mine employees and full-time contractors working in the mine in Free State province of South Africa. The total number of employees at the mine, including top management, was 884 and every individual element was regarded as a sampling unit for this study.

Personnel in the functional units of the mine, such as protection services, safety, health and environment department, training, human resources, finance and procurement department, who visit high risk areas within the mine, formed part of the population (N=200). The target population also included the following employees in mine operations, maintenance, technical services and engineering, trade artisan, welding/ boilermaker, mechanical and electrical, foremen/ supervisors, technicians and engineers, mine foremen, mine operators, contractors and general workers as this is the area of main production and the most hazardous area of the mine.

A sample frame refers to a list identifying the selected sample in the study (Kumar 2011:91). Having clearly defined the target population, the researcher proceeded to draw up the sampling frame. Babbie (2010:208) describes a sampling frame as "the list of elements from which a probability sample is selected". A list of all permanent employees and permanent contractors on site was obtained from the mine training centre database. This list was verified by the human resource department of the mine in order to cross check the number of employees in the different departments from which the sample was drawn. In practice, it is difficult to get an exhaustive sampling frame that exactly fits the requirements of a particular research.

3.2.1.2 Sample size

This study similar to any other studies, depends on the sample size as an important feature in which the aim is to make inferences about a population from a sample. A sampling size refers to the number or size of the sample from which the required information is obtained (Kumar 2011:194).

A sample of 200 units was chosen as the primary sampling unit. However, the larger the sample the more it will cost to analyse the data and to administer the survey. Hence, cost and the constraint of time were a major consideration for determining the ultimate sample size. Flin, Mearns, O'Connor and Bryden (1998:180), after reviewing 18 published reports on safety climate, are of the view that the sample size should be greater than 100. Based on the aforementioned, the study

used a total of 200 employees, which equates to over 20 percent of the employees (N=200), including management (Daniel 2012:237).

3.2.1.3 Sampling approach

There are two dominant sampling approaches used in research, namely non-probability and probability sampling (Quinlan 2011:209). Examples of techniques that fall under the non-probability approach include convenience sampling, purposive sampling, judgment sampling, quota sampling as well as snowball sampling (Zikmund *et al.* 2010:395).

The choice of the sampling method was influenced by the objectives of this study, availability of financial resources, time constraints and the nature of the problem to be investigated. Probability sampling relies on the ability to apply the theory of probability to the sample to interpret the results. Advantages of probability sampling include the fact that each member of the population has a known zero chance of being included in the sample as well as its ability to allow for statistical inferences to be made about the target population from which the sample is drawn (Malhotra & Birks 2007:1). Typical examples of probability sampling techniques are simple random, systematic, stratified, cluster and multistage sampling techniques (Zikmund *et al. 2*010:398).

In this study, the probability sampling method was chosen as it yields the best results and the data can be accurately analysed. Within that framework, it was decided to conduct probability sampling (simple random selection) – individuals were randomly chosen in order to select the sampling elements from the target population (employees of the mine and the full-time contract employees working for the mine). This was because probability sampling has been more precise than its counterpart, the non-probability sampling; it is chosen on the basis of statistical factors and probability sampling methods are recommended for its relevance to statistical aspects (Omair 2014:145). Participants who met the sample criteria were identified by the researcher at the mine training centre database/human resource department and then requested to participate.

3.2.1.4 Sample inclusion criteria

Participants included in the sample were randomly selected to meet specific criteria. The full-time mine contractor employees were required to meet all the following criteria to be included in the sample:

They are contract employees:

- who had work experience and are full-time contract mine employee;

- who had been subject to the mine's medical certificate of fitness, site specific induction and safety induction;
- who were willing to participate in the study
- aged 18 years of age and older
- whose contract companies were legally compliant with the mine safety requirements and the requirement of the Mine Health and Safety Act (29 of 1996)
- whose contract companies were registered in the mine data base procurement system
- who are of either gender, any race and earn salaries

The permanent employees of the mine who were included in the sample met the following criteria:

- employed on a permanent basis
- aged 18 years and older
- have undergone annual medical fitness, site induction and safety induction
- hold a certain specified level of occupation and earn a salary
- of both genders and any race.

3.2.1.5 Measuring instrument and data collection

Data were gathered in this study using a structured questionnaire (refer to Appendix A). The questionnaire was divided into three sections (section A; B and C) stimulating information on the view of the mine safety with regard to the adherence and employee perceptions towards safety control measures. The questionnaires were sent to the supervisor, mine manager, safety department and training and the statistician to assess validity in order to ensure content validity of the research instrument.

A pilot study of the questionnaire was undertaken in which personal interviews with a smaller number of selected employees was undertaken prior to the main survey in order to gain comprehensive feedback and clarification on questionnaire-related issues. Based on the feedback received the questionnaire was revised. These employees were not included in the main survey.

Five point Likert Scale was used and the questionnaire was divided into three sections. Section A comprised questions on the demographic profile of the participants: gender, age, length of service, qualification and occupation, within the organisation. Section B encompassed questions related to the factors that influence your adherence to safety control measures in the mine. Section C solicited information on employee perceptions and attitude towards safety control measures in the mine.

3.3 PILOT TESTING THE QUESTIONNAIRE

McDaniel and Gates (2002:57) describe pilot studies as surveys using a limited number of participants and often employing less rigorous sampling techniques than are employed in large quantitative studies. It is advisable that the data collection instrument has to be piloted first, in order to determine whether the procedure and methods the researcher is going to use will actually work. For this project, a pilot study helped to identify further weaknesses in the methodology before it was used on a larger scale and encouraged the researcher to think about aspects such as clarity of the instructions or the questions themselves, wording confusion and the time it took to complete the questionnaire and participants' comments in general. The pilot testing consequently strengthened the reliability and content validity of the questionnaire.

The purpose of the initial pilot testing of the questionnaire was to examine the reliability of the questionnaire for the study. According to Gillham (2000:19), the piloting stage is the first phase of questionnaire development to detect possible errors and to identify unclear items before the researcher can roll out the actual questionnaire (Tustin, Ligthelm, Marins & Van Wyk 2005:413).

A convenient sample of 42 participants, which was excluded in the main study, was selected from the coal mine in Free State province of South Africa for the piloting. Results are reported in Chapter 4.

3.4 DATA PREPARATION

3.4.1 Editing

Editing is a process that improves consistency of the research process. It is the process of checking data for errors such as omissions, illegibility and inconsistency and correcting data where and when the need arises (Khan 2005:2). It improves the quality of the data for coding (Kothari 2008:18). The analysis requires a number of operations such as establishing categories, application of categories to raw data through coding, tabulation and then drawing statistics.

For the purpose of the current study, the researcher used field editing to edit the work. Field editing is a primary form of data editing, which is undertaken by the field researcher on the day of the interview with a view to finding omissions, checking the legibility of handwriting and clarifying responses by participants that are logically or conceptually inconsistent (Abdul-Muhmin 2016:5). The researcher undertook data editing.

3.4.2 Coding

Data coding is a systematic way in which to condense extensive data sets into smaller analysable units through the creation of categories and concepts derived from the data. The process by which verbal data are converted into variables and categories of variables using numbers, so that the data can be entered into computers for analysis (Lockyer, Michael, Lewis, Alan & Timothy 2004:137-138).

Coding is the process of identifying and classifying each answer with a numerical score or other character symbol. The numerical score or symbol is called a code and serves as a rule for interpreting, classifying and recording data (Abdul-Muhmin 2016:8-16). When the data have been entered into the computer, the researcher can always group and regroup the categories. Identifying responses with codes is necessary if data is to be processed by computer. This was done by assigning numerical scores that permit the transfer of data from the questionnaire into Excel. The analysis of data collected for the study was captured into the computer. According to Pallant (2013:506) coding involves assigning numbers or other symbols to ensure that the responses can be grouped into a limited number of classification or categories. Table 3.1 depicts an example of a coded questionnaire.

Table 3.1: Example of a coded questionnaire

Your gender	**Male**	**Female**			
	1	2			
Your racial group	**African**	**White**	**Coloured**	**Indian**	**Other**
	1	2	3	4	5

Source: (Presser, Rothgeb, Couper, Lessler, Martin, Martin & Singer 2004:116)

3.5 STATISTICAL ANALYSIS

Statistical analysis is fundamental to all quantitative studies. Statistical analysis is also a very useful tool to get approximate solutions when the actual process is highly complex or unknown in its true form (Kalla 2011:1). All data collected were sent to a statistician who captured and entered it into the SPSS. SPSS is the statistical package, which is used to code data and to run statistical analysis (Andres 2012:150). Descriptive statistics, frequency analysis, graphs, tables, tabulations, analysis of variance (ANOVA) and t-tests were used in this study

3.5.1 Descriptive statistics

The use of descriptive statistics is a technique that helps to state the characteristics or appearance of sample data (Zikmund, 1999:296). Furthermore, descriptive statistics are used to classify, summarise and extract important information contained in the data in relation to the study (Manoharan 2010:663-665). They enable a researcher to identify profiles, patterns within the responses of participants, relationships and trends, therefore, present quantitative descriptions in a manageable format. According to Mustafa (2010:227), descriptive statistics are techniques that help to state the characteristics or appearance of sample data.

In this study, descriptive statistics were used to summarise and describe the data obtained from the participants. The information was presented in the form of percentages, frequencies, tables and graphs. The findings for sections A, B and C were shown graphically using bar charts and pie charts in Chapter 4.

3.5.2 Analysis of variance (ANOVA) and t-test

Analysis of variance (ANOVA) is a statistical tool that is utilised to establish the differences among the group means (Statistics Solutions 2013:10). If there are any differences found, ANOVA and t-test indicate exactly where the differences are found and the degree to which two (t-test) or more (ANOVA) group means vary or differ.

For this study, ANOVA was applied to compare the means of different strata to determine if there are any significant differences between the responses of employees. In this study, ANOVA tests were conducted to establish the differences in the perceptions and attitudes towards safety control and in terms of age and length of service. The results of one-way ANOVA are confirmed and highlighted in Chapter 4, Section 4.6.

3.6 RELIABILITY AND VALIDITY

3.6.1 Reliability

According to Welman, Kruger and Mitchell (2009:9), reliability indicates the overall consistency of the measuring instrument. A measure is reliable if it produces similar results under the same conditions. Sections B and C were tested for reliability using Cronbach's alpha coefficient (Goddard and Melville 2009:46). Coefficient alpha ranges from zero to one. The value of 0.60 or less designates inadequate reliability while 0.70 and above indicates a good reliability. The results with regard to the reliability of the questionnaire are reported in Chapter 4.

3.6.2 Assessing validity

Churchill, Brown and Suter (2010:257) define validity as the extent to which differences in observed scale scores reflect true differences in what is being measured. Cooper and Schindler (2006:349) state that validity is the ability of a research instrument to measure what is actually being measured. The following measures of validity were discussed, as they were considered in the study, namely content and construct validity.

3.6.2.1 Content validity

According to Churchill *et al.* (2010:257), content validity is the adequacy with which the important aspects of the characteristics are captured by the measure. Zikmund and Babin (2000:320) state that content validity is established when a scale's content logically appears to reflect what it was intended to measure. Question content, language and phrasing were assessed to examine their connection to the relevant frame of reference used in the study (Rabale, Dhurup & Surujlal 2011:69).

3.6.2.2 Construct validity

Construct validity demonstrates the relationship between concepts under study and the relevant theoretical concept. It determines whether the instrument is measuring what it is supposed or expected to measure. McDaniel and Gates (2002:304) view construct validity as the degree to which a measurement instrument represents and logically connects, via the underlying theory, the observed phenomenon to the construct. Construct validity was assessed through the pilot testing of the questionnaire.

3.7 ETHICAL CONSIDERATIONS

According to Berndt and Petzer (2011:294), several ethical codes guide the researchers and provide guidelines and principles for conducting of research with human participants.

The following ethical issues that are relevant for a study were adhered to:

- Written permission was obtained from the management of the mining company under study to conduct research in their organisation;
- The participants were not forced to participate in the study and the researcher informed each participants about the purpose of the survey;
- Personal data of the participants were processed fairly and lawfully by adhering to ethical procedures with regard to confidentiality. The data were used only for the purpose of the study and was not ascribed to any individual;

- Personal responses from individuals were not attributed to any individual. All data were computed in collectively and not linked to any respondent;
- The participants were requested not to write their names on the questionnaire to maintain the anonymity of the participants throughout the study;
- Professional ability in the data collection and analysis was preserved and independent impartiality in the interpretation of the survey findings was upheld;
- The purpose of the study was communicated to the participants to enable them to make an informed decision regarding participation in the study; and
- The information voluntarily disclosed by participants was not disclosed to anyone.

3.8 CONCLUSION

This chapter has described the research methodology applied in this study and a brief overview on the statistical methods used in the collection and analysis of data. The sample design procedure was explained. For this study, a probability sampling was utilised. The methods of data collection, pre-testing and pilot testing were also discussed. Attention was given to the techniques that were used in order to ensure that efficient, effective and reliable results are obtained in the interpretation of the responses. This involved the discussion of the reliability analysis as well as content and construct validity used in verifying the study. The data analysis and statistical procedures that were used in the study were briefly discussed.

Chapter 4 provides an analysis and interpretation of the empirical findings in line with the objectives of the study.

CHAPTER 4
EMPIRICAL RESULTS OF THE STUDY

4

4.1 INTRODUCTION

This chapter presents the findings, analysis and interpretation of the quantitative data collected for the study. The SPSS was used to formulate frequency tables and descriptive analysis graphs. The purpose of this study was to investigate the factors influencing the adherence and employee perceptions towards safety control measures in a mining company. In the previous chapter, quantitative research techniques were employed for gathering data in order to obtain mine workers' perceptions.

4.2 PILOT STUDY

A pilot study was conducted amongst a convenient sample of 42 participants from the mine. The purpose of initially pilot testing of the questionnaire was to detect any flaws in the design of the questionnaire. The reliability of the measuring instrument was determined before it was applied on a larger scale for the mine. The participants from the pilot study were left out purposefully in the final distribution of the questionnaire for the main study so as not to contaminate the sample.

In establishing the reliability of the questionnaire, Cronbach's alpha (α) was computed. Cronbach (α) is the most universally used approach for assessing the reliability of a measurement scale with multi-point items. The value of α, which ranges from zero to one, signifies the level of reliability in the measurement. The aim of conducting the pilot study was to determine whether the items making up each variable showed adequate reliability. The closer the value of α is to one, the higher the level of reliability. The results for internal consistency Cronbach alpha (α) of the scale are reported in Table 4.1. The Cronbach alpha value for Section B was marginally acceptable. However, minor changes were made to the wording of some of the statements in Section B. Cronbach's alpha (α) reliability value of 0.754 for Section C − perceptions and attitudes towards safety control measures was achieved, which exceeded the suggested level of 0.70 (Malhotra & Birks 2007:268). No changes were made to the questionnaire to be used in the main survey.

Table 4.1: Reliability of the pilot questionnaire

Constructs	Cronbach's alpha (α)	No. of items	N
Section B - Factors influencing adherence to safety control measures in the mining company	0.693	23	42
Section C - Perceptions and attitudes towards safety control measures	0.754	25	42

4.3 DESCRIPTIVE ANALYSIS MAIN STUDY

A descriptive analysis incorporating the demographic information regarding the mine employees was conducted. This is followed by a descriptive analysis of the factors influencing the adherence to safety measures and perceptions and attitudes towards safety controls in the mine.

4.3.1 Profile of the mining company

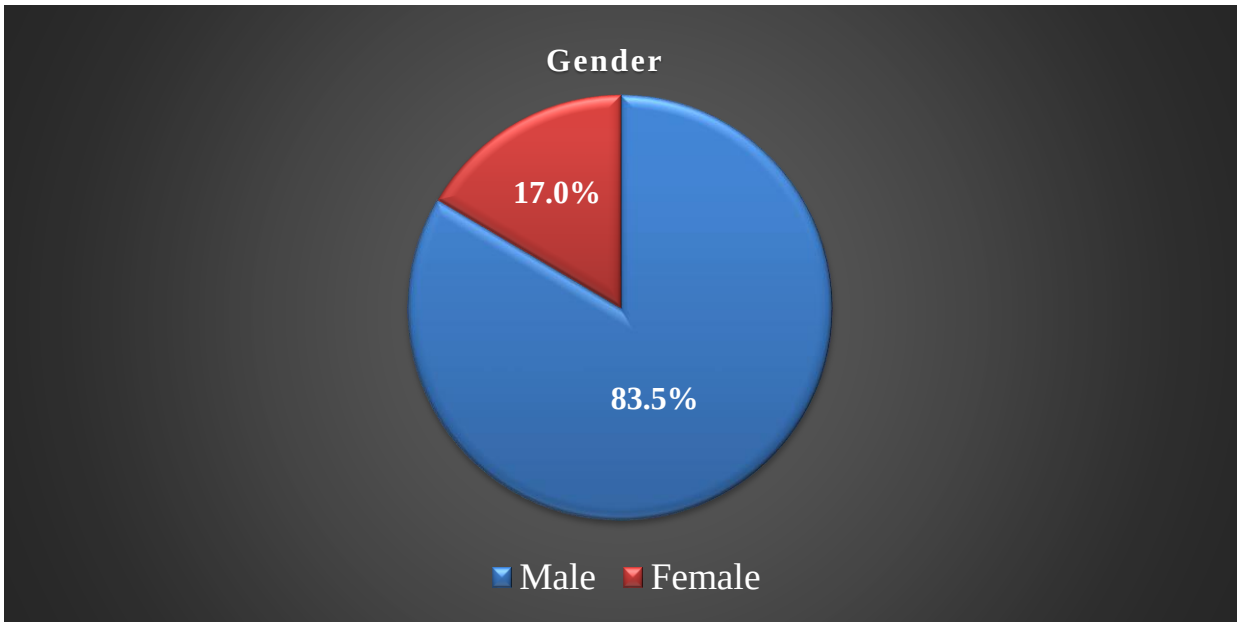
Section A extracted general information on the background of the mine employees working in the coal mine in Free State province of South Africa. The section addressed the following attributes pertaining to the background of the mine employees:

- Participants' gender in mining sector
- Age category of the participants
- Type of occupation within business unit
- Number of years of experience in the current mining company
- Nature of qualification obtained over the years.

4.3.1.1 Participants' gender

The percentages pertaining to the participants' gender are illustrated in Figure 4.1.

Figure 4.1: Gender representation

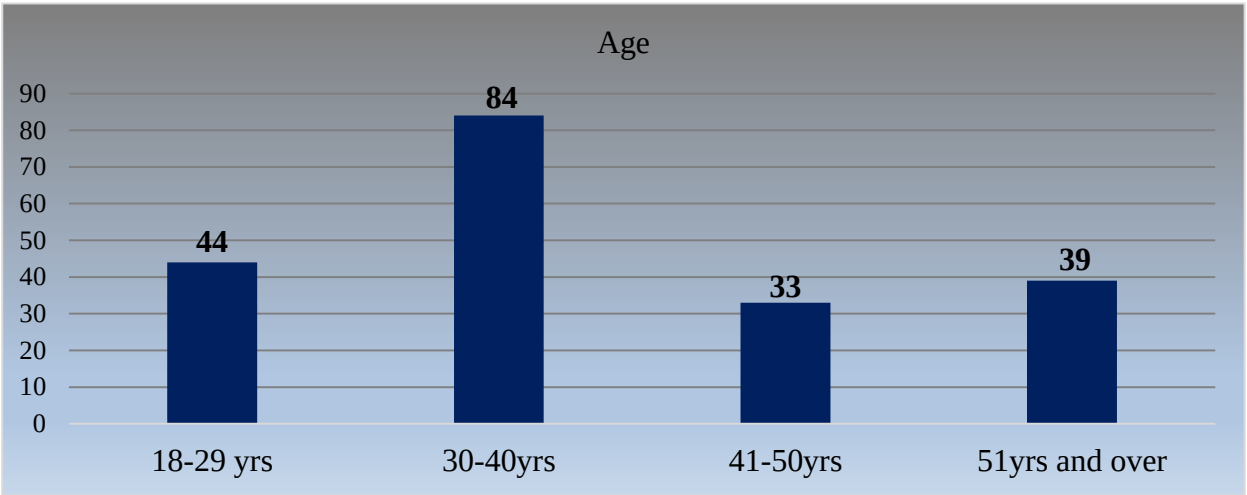


The majority (83.5% n=167) of the participants were males. Study conducted by Martin (2013:1) supports the view that the contribution of females in the mining sector was undervalued and not highly regarded by most male colleagues. Mining is an industry that has always been male-dominated, regardless of geographical location. There have been positive steps, which have helped to integrate women into the industry, but females continue to be under-represented. It is important to note that, almost a decade after the inception of the Mining Charter, studies have shown that the ratio continues to reflect females as a minority in the mining sector. Likewise, the findings of this study are consistent with the findings of Khoza (2015:19) who verify that females are in the minority in the mining sector.

4.3.1.2 Age categories of the participants

The age groups of the participants are illustrated in Figure 4.1.

Figure 4.2: Age group

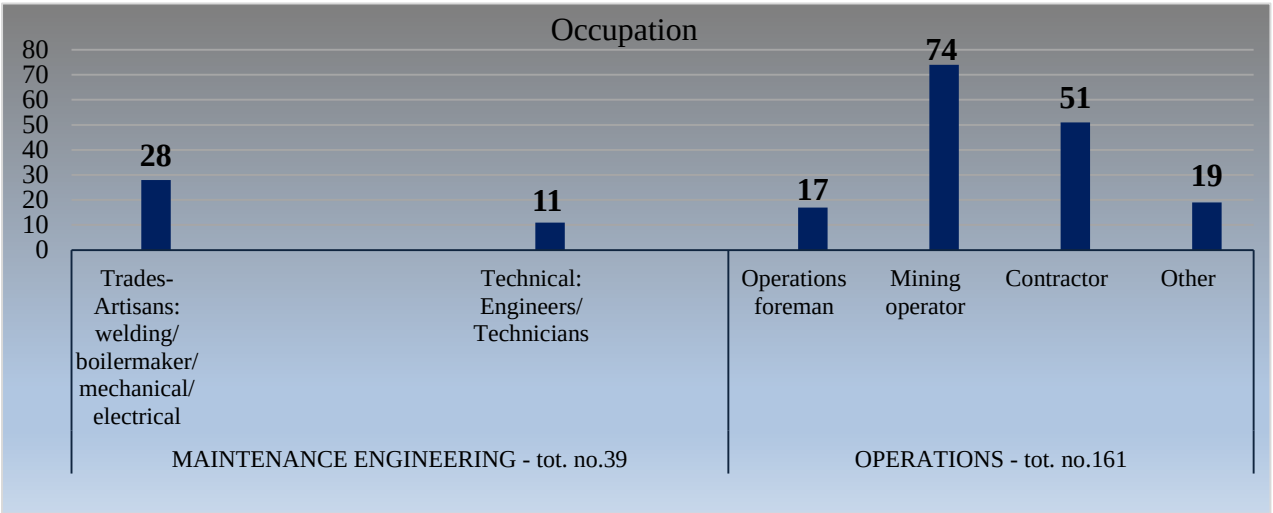


The categories between 30-40 years (42% n=84) were the dominant age group of the participants. This was followed by employees in the age group 18-29 years (22% n=44), the age group above 51 years (19.5% n=39) and the group of 41-50 years (16.5% n=33).

4.3.1.3 Type of occupation within business unit

Figure 4.3 provides information regarding the composition of the sample in accordance with their occupational level.

Figure 4.3: Occupational level

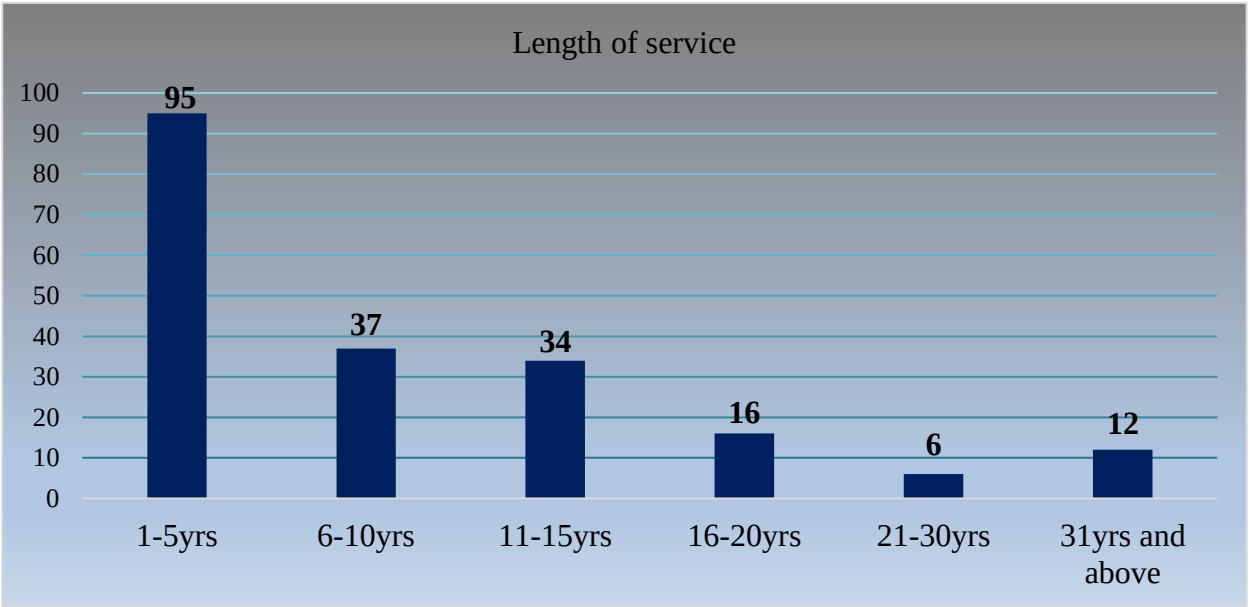


The composition of the sample according to their designation was divided into two categories, of which the 39 (19.5%) participants were from maintenance engineering and 161 (80.5%) were from the mining operations divisions.

4.3.1.4 Number of years of experience in the current mining company

Figure 4.4 illustrates participants' years of experience within the current mining company.

Figure 4.4: Length of service

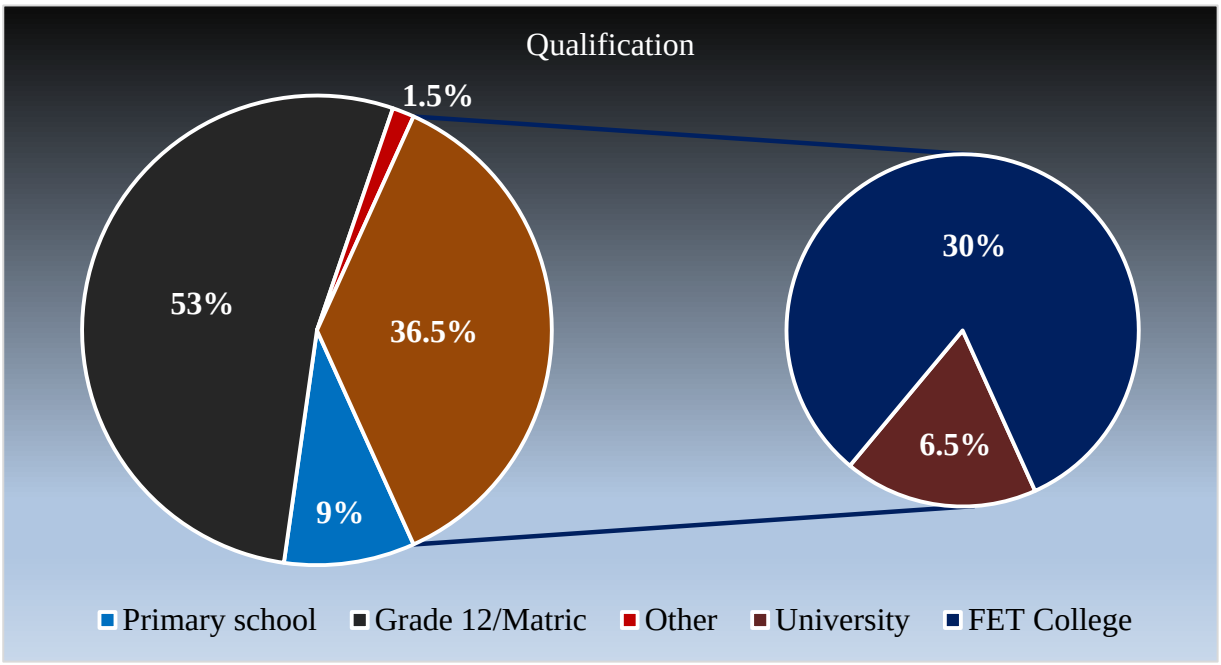


The majority of the participants (47.5%; n=95) in the mining company have between 1-5 years of working experience, followed by those employees who have between 6-10 years of experience (18.5%; n=37), those between 11-15 years of experience (17%; n=34), those with 31 years and above (6%; n=12), those employees who have between 16-20 years of experience (8%; n=16) and those who have between 21-30 years of experience (3%; n=6). Research conducted by Geldart, Smith, Shanon and Lohfeld (2010:563) shows that employees who possess a great deal of work experience in the mining company are faced with lower levels of occupational accidents and illness compared to younger employees with less work experience in the workplace.

4.3.1.5 Nature of qualification obtained over the years

Figure 4.5 displays the participants' level of education.

Figure 4.5 Qualification



Participants with primary school level make up 9 percent (n=18) of the sample. Approximately 53 percent (n=106) of the participants were in possession of a matriculation certificate, while 1.5 percent (n=3) were in possession of other qualifications. The university and FET college participants collectively make up 36.5 percent (n=73) of the participants in the sample of which 6.5 percent (n=13) had a university qualification and 30 percent (n=60) had a FET college qualification.

4.4 DESCRIPTIVE ANALYSIS: SECTION B - FACTORS INFLUENCING ADHERENCE TO SAFETY CONTROL MEASURES IN THE MINING COMPANY

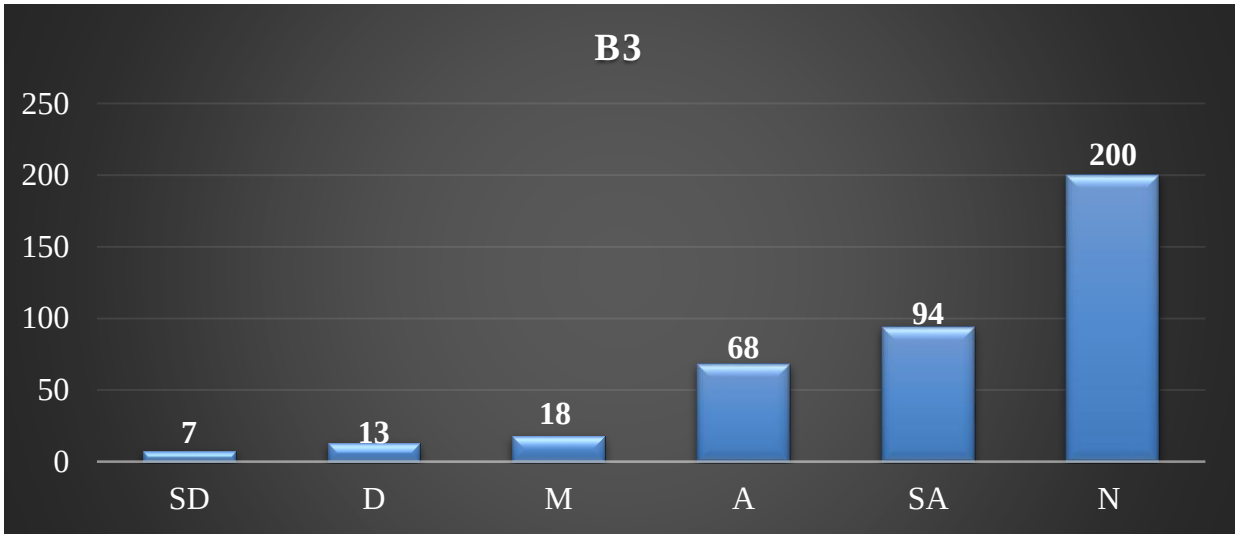
This section encompassed 23 questions relating to adherence to safety and control measures. However, only 14 questions were used for the final analysis of the study as items B1, B2, B4, B6, B9, B10, B14, B16, B19 were removed from the final analysis because they reflected low-inter-item correlation and internal consistency. Internal consistency is the extent to which a group of items measure the same construct or inter-correlate. A high degree of internal consistency enables the researcher to interpret the composite score as a measure of the construct.

A detailed analysis of the results are discussed in Figure 4.6 to Figure 4.19. For the sake of brevity, participants who strongly agreed or agreed to the statement were combined for interpretation purpose. The same procedure was followed for those participants who disagreed or strongly disagreed with the statements.

4.4.1 (Question B3): It is easy for employees to ask questions when there is something that they do not understand

Figure 4.6 illustrates responses to the above question.

Figure 4.6: (Question B3)



SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

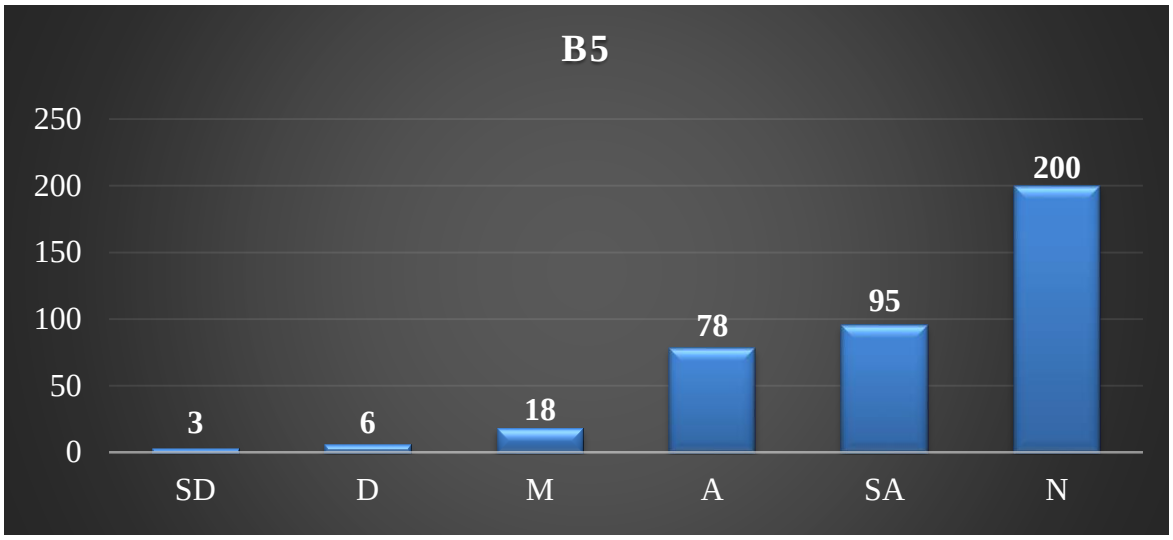
The majority of the participants either strongly agreed or agreed (81%; n=162) that it is easy for employees to ask questions where there is something that they do not understand on the mine plant regarding safety. Very few (10%; n=20) disagreed with this statement. However, it is essential that every employee must understand his/her role in safety in order not to jeopardise a zero harm philosophy. The results show the participants (9%; n=18) moderate agree with the statement.

4.4.2 (Question B5): I know the proper channels to direct questions regarding safety in the workplace

The majority (86.5%; n= 173) of the participants know the proper channels to direct their questions relating to safety. A few participants (4.5%; n=9) in the mining company do not know the channels to follow in order to direct their questions when they are faced with safety challenges in the mine. The employees need to know and understand the channel to be followed when they need to raise their safety concerns or challenges. The results show (9%; n=18) of the participants moderate agree.

Figure 4.7 illustrates responses to the above question.

Figure 4.7: (Question B5)

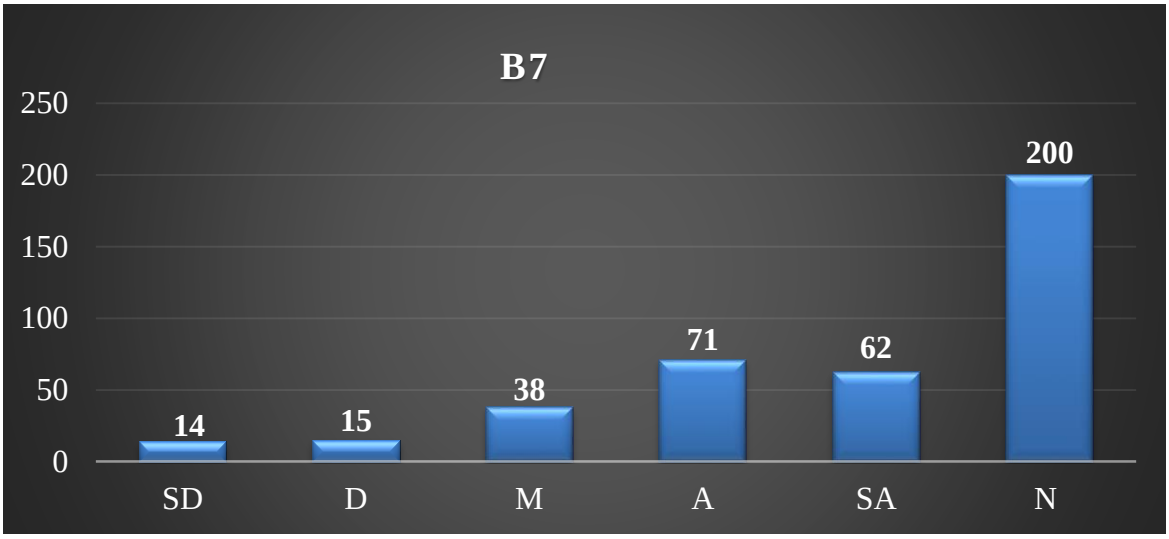


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.3 (Question B7): Employee safety input is well received and acted upon in this mining operation

Figure 4.8 provides responses to the above question. The majority (66.5%; n=133) of the participants agree that employees' safety inputs are taken into consideration to better the safety system within the mine. A few participants (14.5%; n=29) in mining company do not agree with the statement. The results show participants (19%; n=38) moderate agree to the statement.

Figure 4.8: (Question B7)

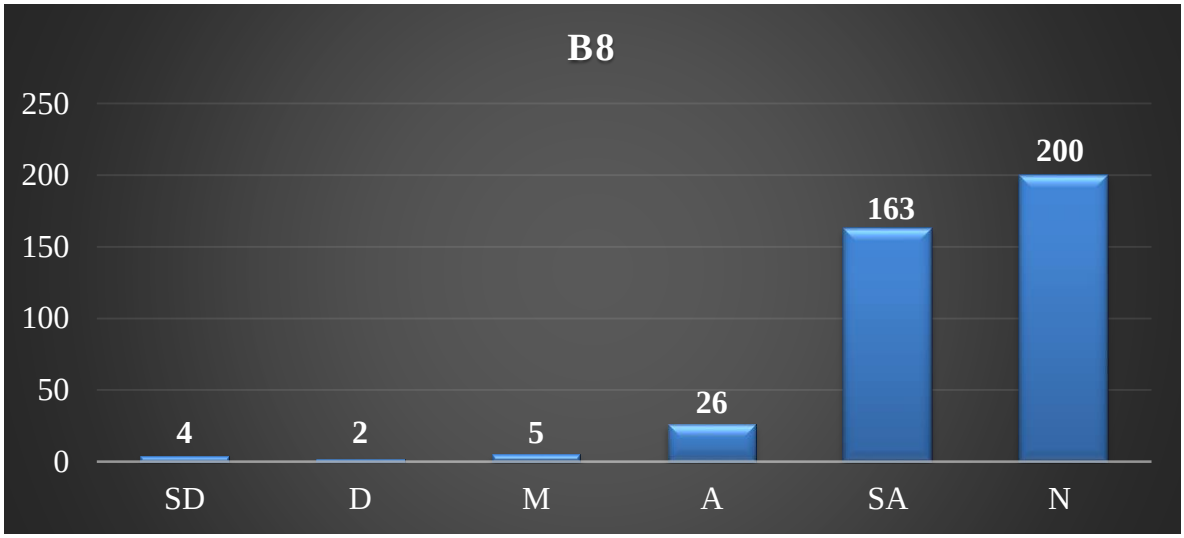


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.4 (Question B8): An occupational health practitioner at the mine clinic has certified that I am medically fit for this job

Figure 4.9 illustrates responses to the above question.

Figure 4.9: (Question B8)



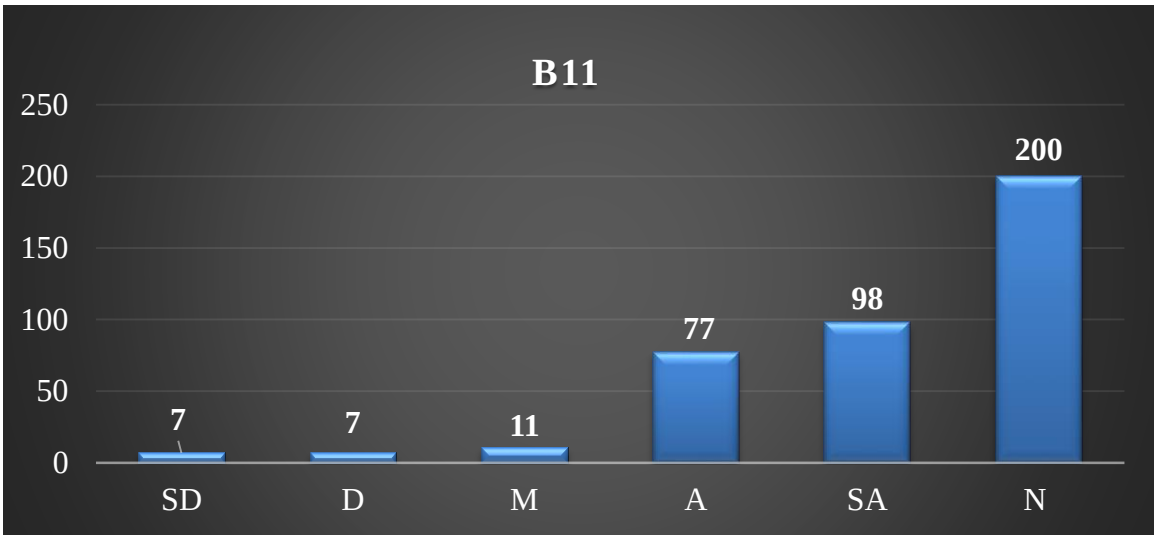
SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

The majority of the participants (94.5%; n=189) agreed that they have been certified by the occupational health practitioner to be medically fit for the job. Only a few of the participants (3.0%; n=6) either strongly disagree or disagree with the statement, followed by (2.5%; n=5) the participants who moderate agree with the statement that an occupational health practitioner at the mine clinic has certified that the employees in the mine are medically fit for job. In South African, mine health and safety legislation requires the mining company to conduct medical health fitness for employees on an annual basis.

4.4.5 (Question B11): An accident can disrupt workplace equilibrium and can impact productivity by causing work shutdowns, overtime and production delays

Figure 4.10 illustrates the above question. The majority of the participants (87.5%; n=175) either strongly agree or agree that an accident can disrupt workplace equilibrium and can impact negatively on production performance causing work shutdowns, overtime and production delays, this is supported by (Figure 2.1). Only a few of the participants (7%; n=14) disagree with the statement. The results therefore conclude that the participants (5.5%; n=11) moderate agree with the statement.

Figure 4.10: (Question B11)

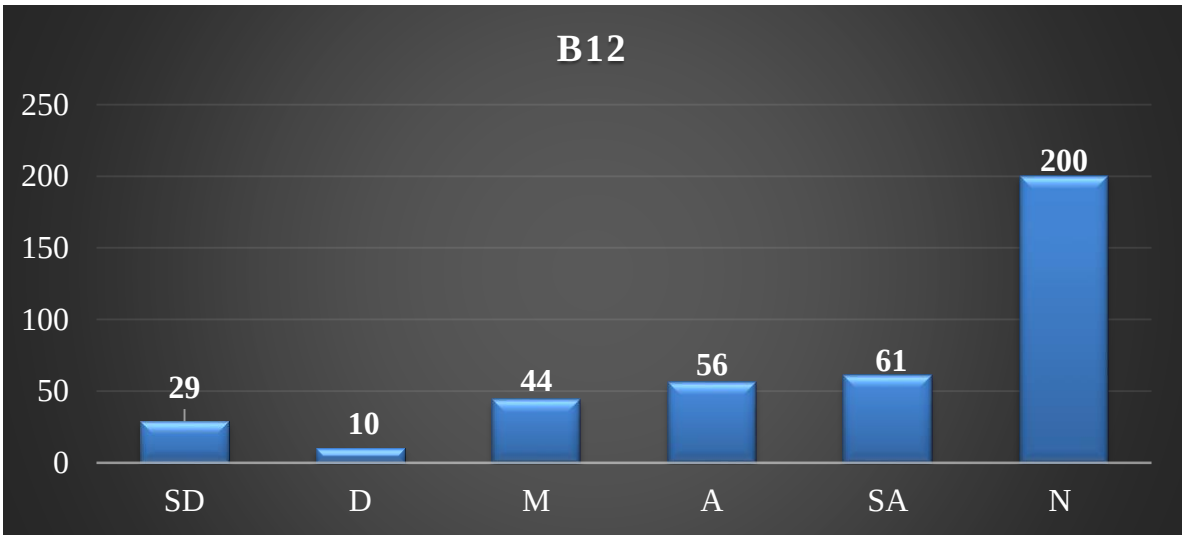


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.6 (Question B12): I know when our next safety milestone/target is for the lost time injury free days (LTI) countdown

Figure 4.11 provides responses to the above question. The majority of the participants (58.5%; n=117) are familiar of the next safety milestone target. However, a few of the participants (19.5%; n=39) either strongly disagree or disagree with the statement that they know the next countdown for safety milestone/target LTI-free days, followed by participants (22.0%; n=44) who moderate agree with the statement.

Figure 4.11: (Question B12)

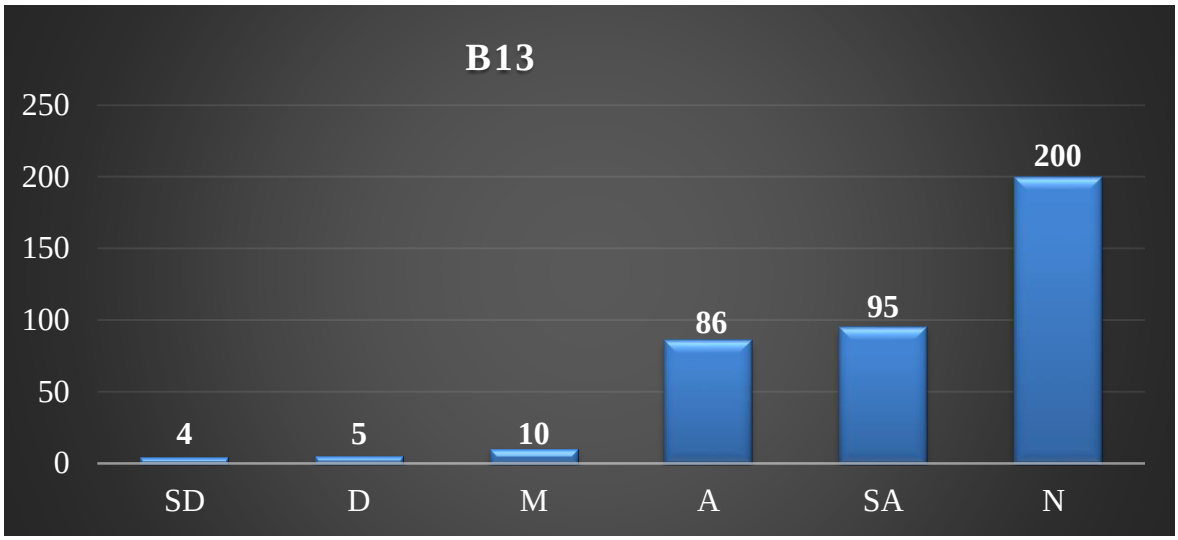


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.7 (Question B13): I am encouraged by my co-workers to report any safety concerns that I may have

Figure 4.12 provides responses to the above question. The majority of the participants (90.5%; n=181) strongly agreed that employees encourages one another to report any safety concerns in the mine. However, a small number of the participants (4.5%; n=9) disagree with the statement. The results is indicating (5%; n=10) participants moderate agreed with the statement.

Figure 4.12: (Question B13)

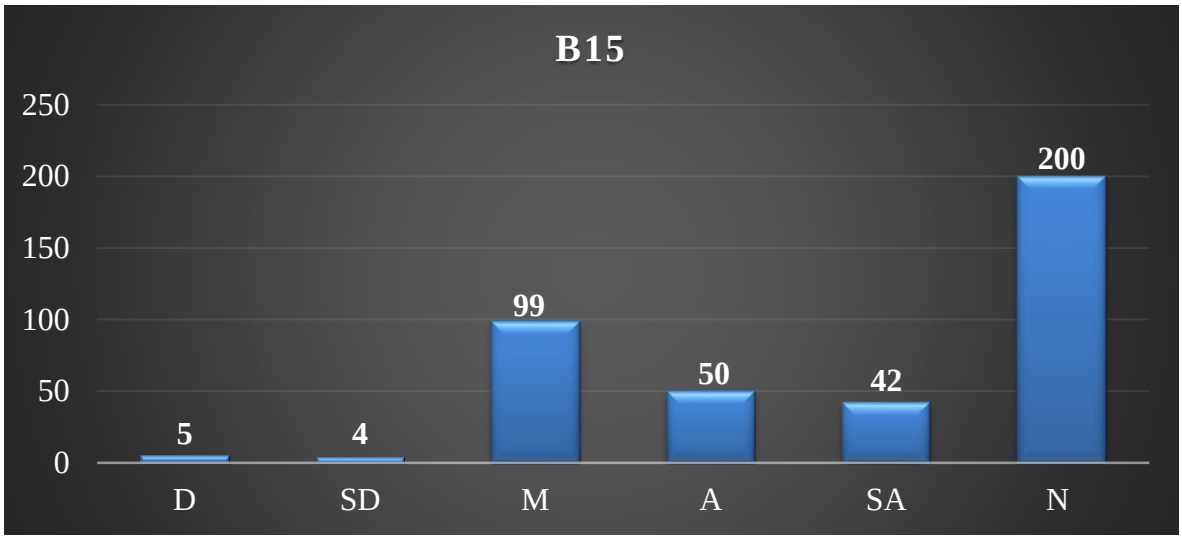


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.8 (Question B15): I know and understand the aim of risk and change management procedure

Figure 4.13 illustrates the responses to the above question. A few participants (4.5%; n=9) disagree with the statement followed by the majority of the participants (49.5%; n=99) moderate agreed with the statement that risk and change management procedure is understood by employees in the mine. This is followed by those participants who agreed that they understand the aim of risk and change management procedure (46%; n=92). The results of the analysis show a weakness in the system when it comes to the issue of risk and change management procedures in the mine. Failure to address issues of risk and management of change processes within the mine may lead to disaster. Risk and change management is the process of introducing technology in the mine, such as new designs or products, new machinery or equipment, changing of geographic layout and so forth, in an attempt to reduce the risk (Hebblewhite 2009:14).

Figure 4.13: Question B15)

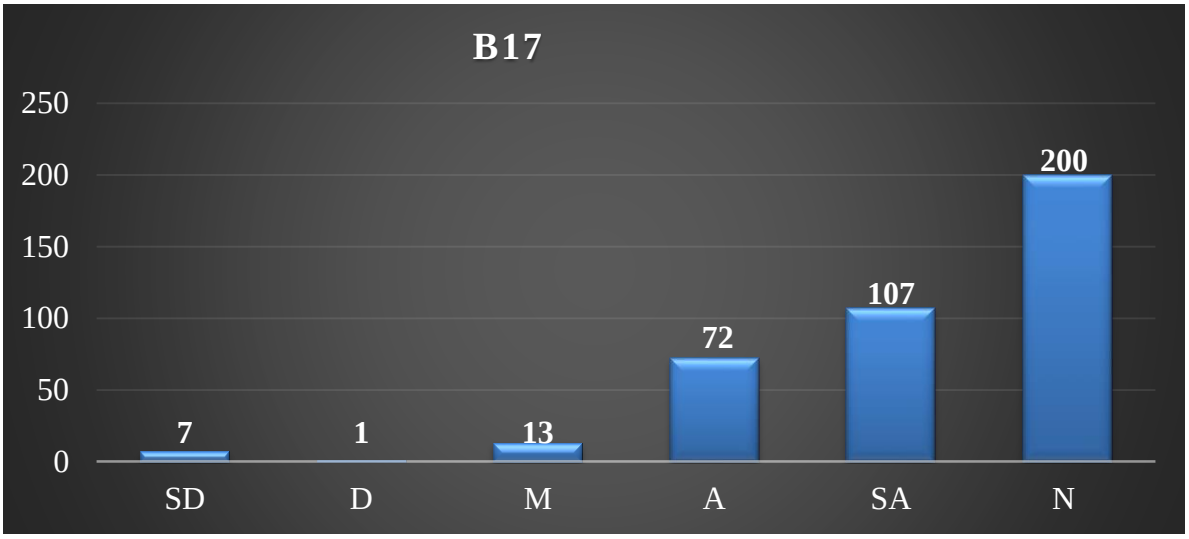


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.9 (Question B17): I know and understand the aim of sections 22 and 23 of the Mine Health and Safety Act (29 of 1996)

Figure 4.14 illustrates responses to the above question. The majority (89.5%; n=179) of the participants were in agreement that they know and understand the aim of section 22 and 23 of the Mine Health and Safety Act (29 of 1996). Fewer participants (4%; n=8) do not understand the concept of section 22 and 23 of the mine Act. The results show (6.5%; n=13) moderate agree.

Figure 4.14: (Question B17)

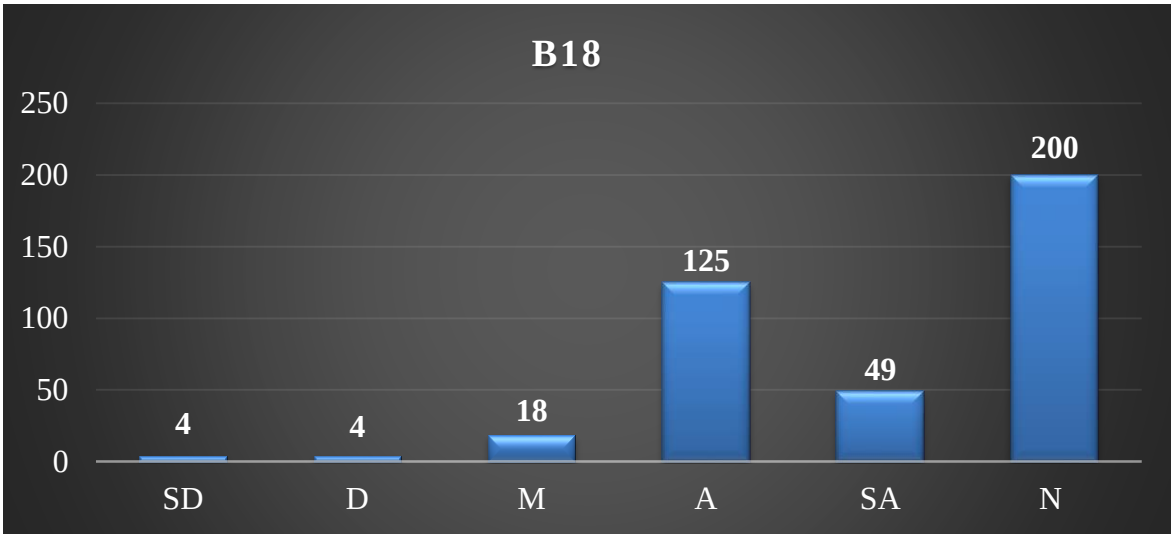


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.10 (Question B18): There is widespread adherence to safety control measures and evidence-based criteria in the mine

Figure 4.15 illustrates responses to the above question. The results of the analysis show that the majority of the participants (87.0%; n=174) were in agreement that there is widespread adherence to safety control measures and evidence-based criteria in the mine. Very few participants (4.0%; n=8) disagreed with the statement. The results therefore show that the participants (9%; n=18) moderate agree with the statement.

Figure 4.15: (Question B18)

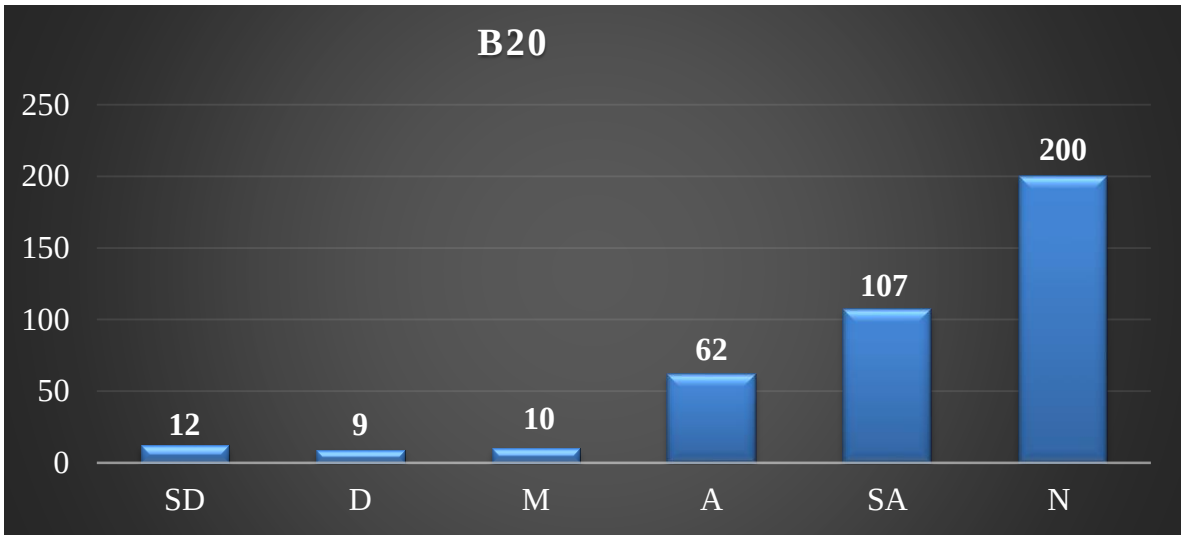


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.11 (Question B20): I always get involved in a risk assessment

Figure 4.16 illustrates on responses to the above question. The majority of the participants (84.5%; n=169) either strongly agree or agree that employees get involved in the process of risk assessment. Few of the participants (10.5%; n=21) either strongly disagree or disagree with the statement. Risk assessment processes aid in predicting risk associated with exposure to hazardous environment and for decision making for regulatory purposes to ensure safety control measures are implemented, maintained and adhered to. The participants (5%; n=10) were moderate agreed to the statement.

Figure 4.16: (Question B20)

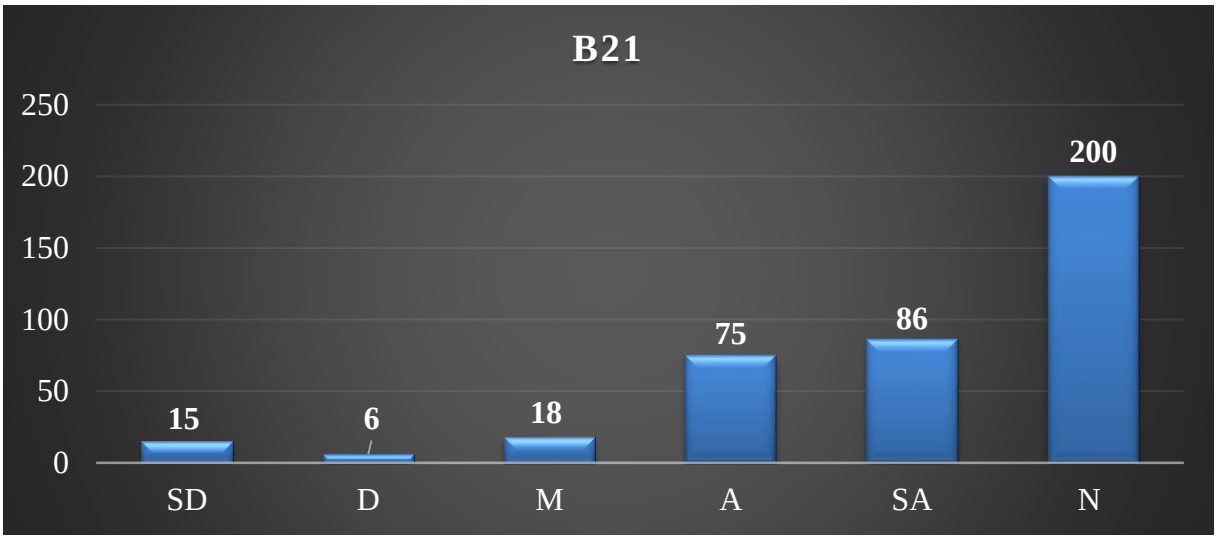


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.12 (Question B21): After the planned task observation process, the supervisor/ foreman always discusses the outcome of the observation results with me

Figure 4.17 illustrates on the responses to the above question. The majority of the participants (80.5%; n=161) were in agreement that the supervisor/ foreman always discusses the outcome results of planned task observations with employees in the mine. Very few participants (10.5%; n=21) disagreed that the supervisor/foreman always discusses the outcome of the planned task observations with the employees. Numerous factors such as competency, experience and behaviour of employees have been suggested to have an influence on employee adherence to the safety control measures (Ismail, Doodstdar & Harun 2011:418). The results therefore conclude that the participants (9%; n=18) moderate agree with the statement, which makes it difficult to confirm whether employees are competent or not.

Figure 4.17: (Question B21)

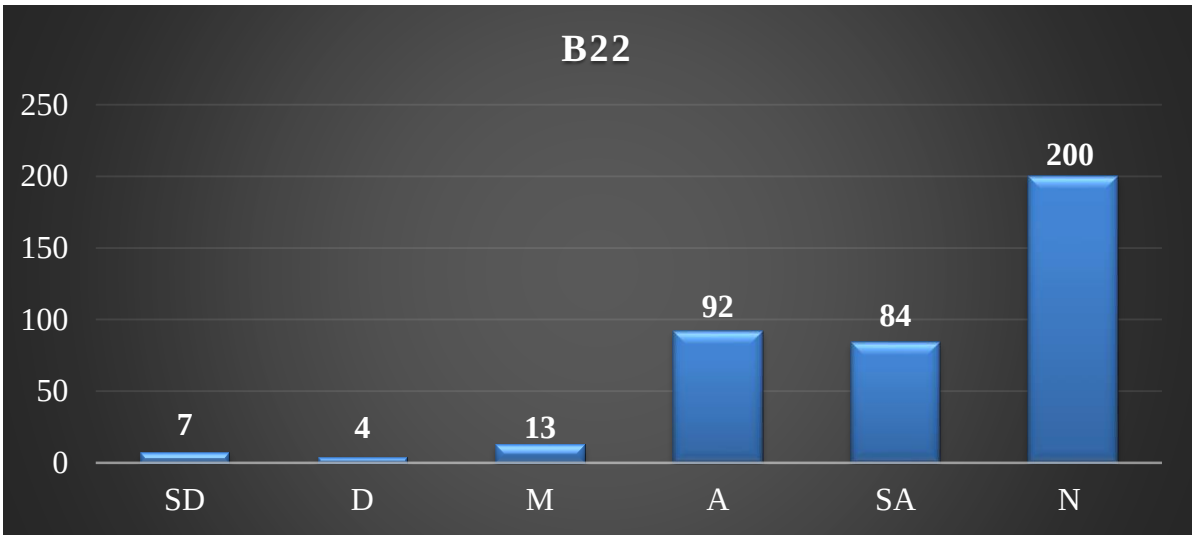


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.13 (Question B22): Safety procedures and instructions are adhered to

Figure 4.18 illustrates on the responses to the above question. The majority of the participants (88.0%; n=176) were in agreement that safety procedures and instructions are adhered to. However, a small percentage (5.5%; n=11) disagreed that safety procedures and instructions are adhered to in the mine. Workers must be trained in procedures so that in turn, contribute to a reduction in hazards by pointing out hazards to management (Stevenson 2012:286). Safety standards and procedures address, amongst other things, evaluation of occupational safety and health risks and hazards in a mine and development of control measures. The participants (6.5%; n=13) moderate agree.

Figure 4.18: (Question B22)

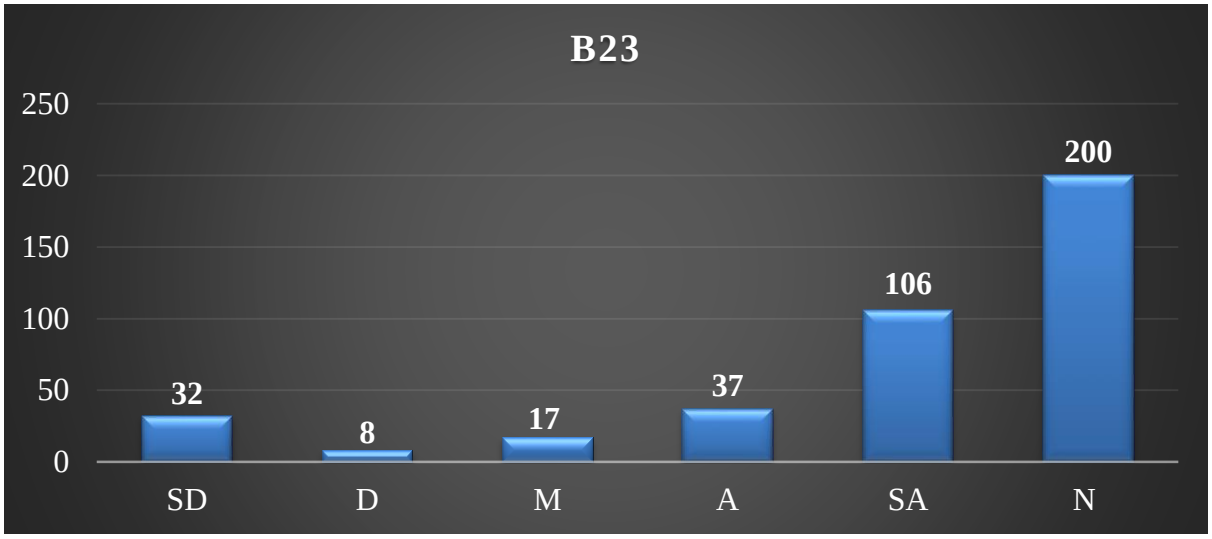


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.4.14 (Question B23): I usually wear my personal protective equipment that are provided by the employer

Figure 4.19 addresses the responses to the above question. The majority of the participants (71.5%; n=143) adhere to the use and maintain their PPE provided to them by the employer. However, a small percentage of the participants disagreed (20.0%; n=40) that employees wear their PPE provided by the employer. This might be due to logistical issues such as the supply of PPE and its availability within the mine, particularly for the mine contract workers. The results therefore conclude that the participants (8.5%; n=17) moderate agree with the statement.

Figure 4.19: (Question B23)



SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

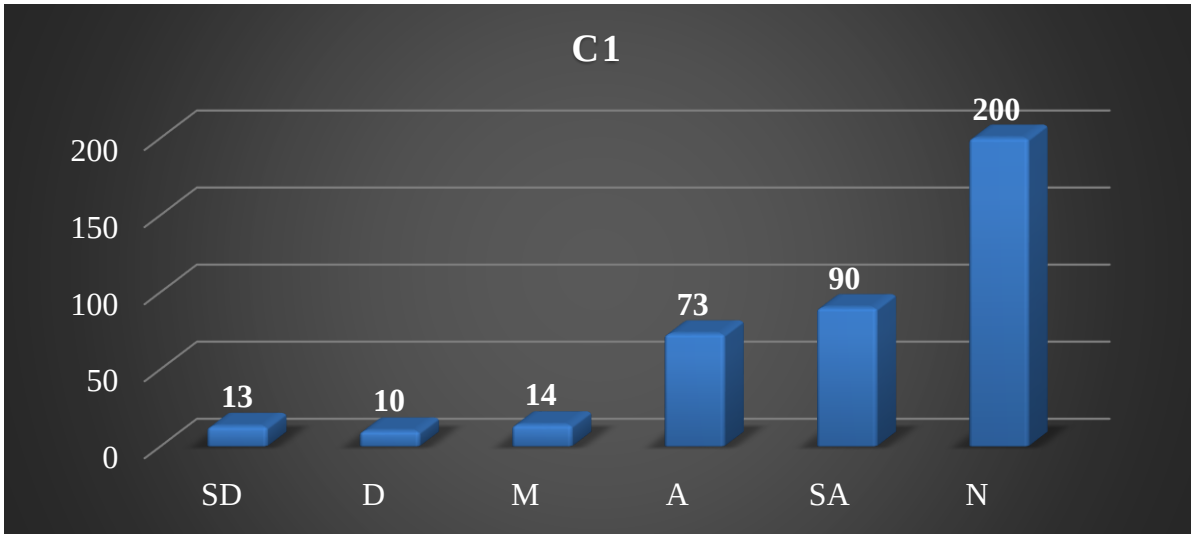
4.5 PERCEPTIONS AND ATTITUDES TOWARDS SAFETY CONTROL MEASURES

This section encompassed 25 questions relating to employee perceptions of safety measures in the mining company were solicited from participants. However, only 24 questions were used for the final analysis of the study as item C4 was removed from the final analysis because it reflected low-inter-item correlation and internal consistency. An analysis of the results is illustrated in figures 4.20 to 4.43. For the sake of brevity, participants who strongly agree or agree to the statement were combined for interpretation purpose. The same procedure was followed for those participants who disagree or strongly disagreed with the statements.

4.5.1 (Question C1): It is easy for employees to ask questions when there is something that they do not understand

Figure 4.20 illustrates the responses to the above question. The analysis of the results revealed that the majority of the participants (81.5%; n=163) either strongly agree or agree with the statement that it is easy for employees to ask questions when there is something that they do not understand. The participants (11.5%; no=23) disagree. The finding in this analysis denotes that there is a regular employee engagement in the mine with regard to safety. Employees ask questions to seek clarity and understanding when something is not clear in the mine. The results show that only (7%; n=14) moderate agree with the statement.

Figure 4.20: (Question C1)

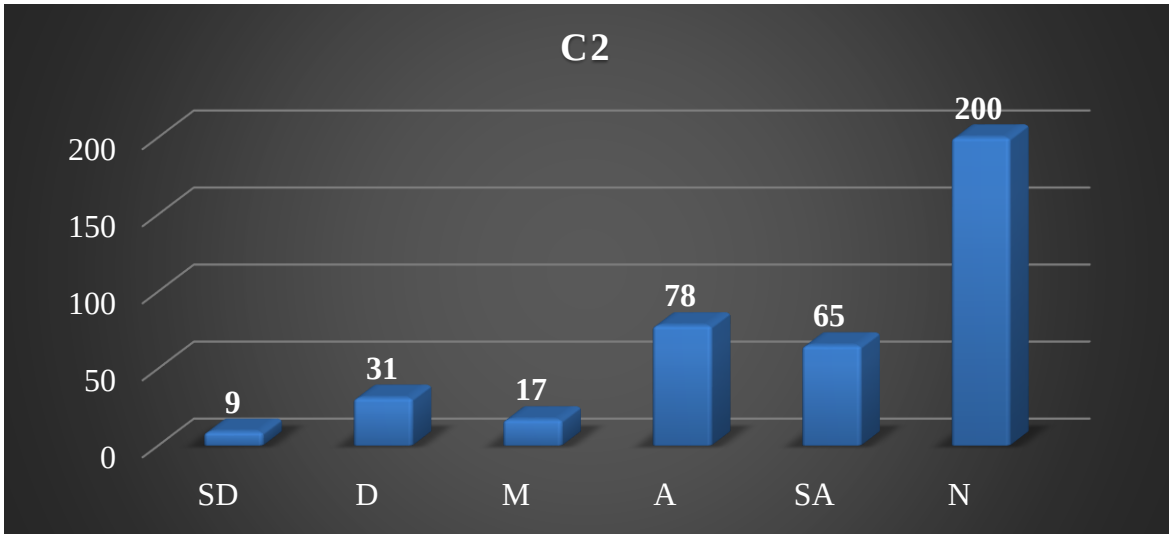


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.2 (Question C2): I have the support that I need from the supervisors/foremen regarding safety

Figure 4.21 illustrates on the responses to the above question. The majority of the participants (71.5%; n=143) were in agreement that they received support from their supervisors/ foremen regarding safety. However, a small percentage (20%; n=40) either strongly disagree or disagreed that they received the necessary support from their supervisors/ foremen regarding safety in the mine. The results therefore conclude that the participants (8.5%; n=17) moderate agree.

Figure 4.21: (Question C2)

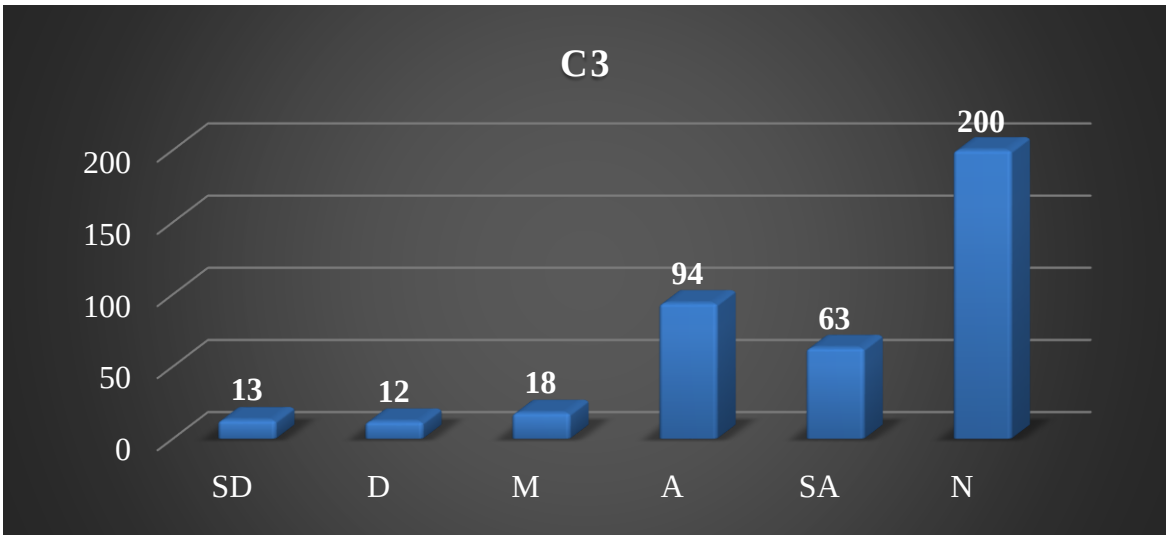


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.3 (Question C3): Work conditions here are favourable and conducive to safe work performance

Figure 4.22 illustrates on the responses to the above question. The majority of the participants (78.5%; n=157) agreed that work conditions in the mine are favourable and conducive to safe work performance. The participants (21.5%; no=43) either strongly disagree or disagree or moderate agree with the statement. Work conditions in this instance refer to the serviceable and hygienic condition of facilities, which the mining company must provide the employee with and provide maintenance of such facilities thereof, as prescribed in section no.6 of the Mine Health and Safety Act (29 of 1996).

Figure 4.22: (Question C3)

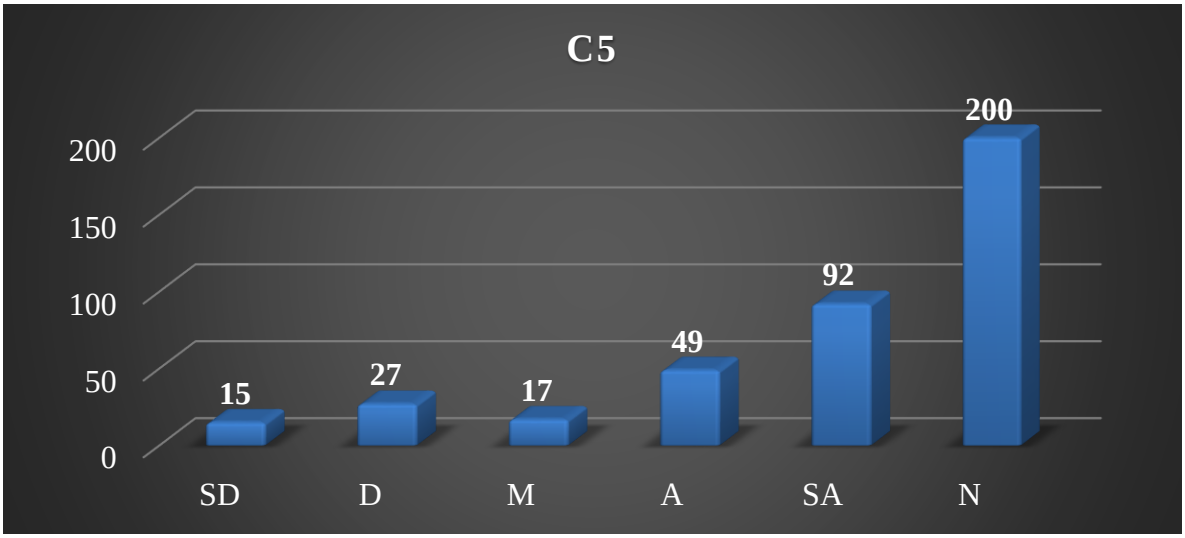


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.4 (Question C5): Working in this mine is like being part of a large family

Figure 4.23 illustrates on the responses regarding the above question. The majority of the participants (70.5%; n=141) were in agreement that working in the mine is like being part of a large family. However, this sentiment was not shared by all participants as a small percentage disagreed (21.0%; n=42) with this statement, percentage (8.5%; n=17) of participants moderate agreed with the statement.

Figure 4.23: (Question C5)

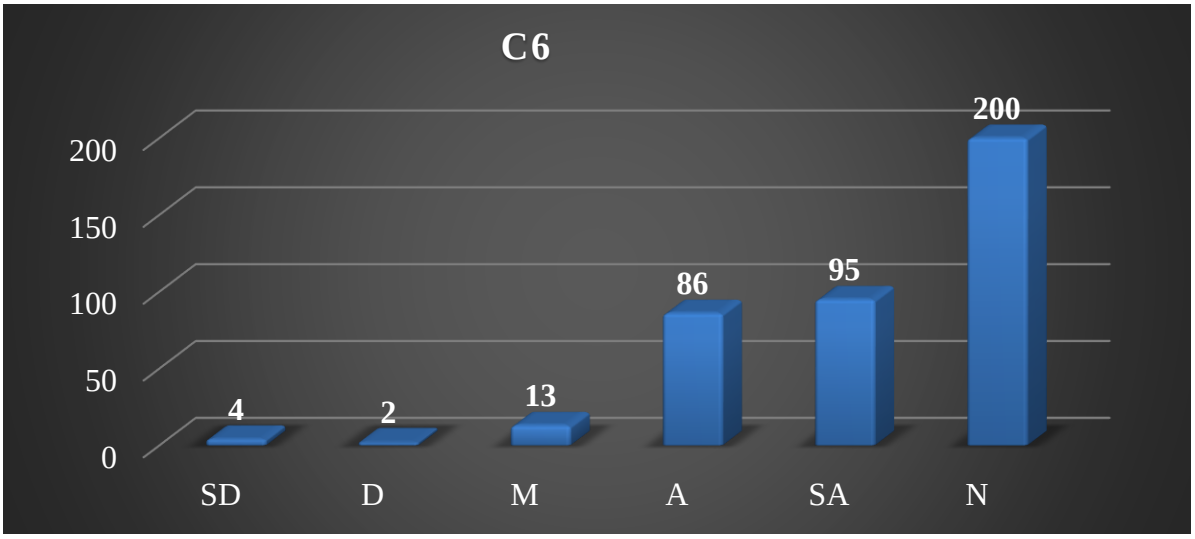


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.5 (Question C6): The mine management encourages teamwork and cooperation among its employees

Figure 4.24 addressed the responses to the above question. The majority of the participants (90.5%; n=181) were in agreement that the mine management encourages teamwork and cooperation among its employees. However, a small percentage of the participants (9.5%; n=19) were of the opinion that mine management do not encourage teamwork and cooperation among its employees.

Figure 4.24: (Question C6)

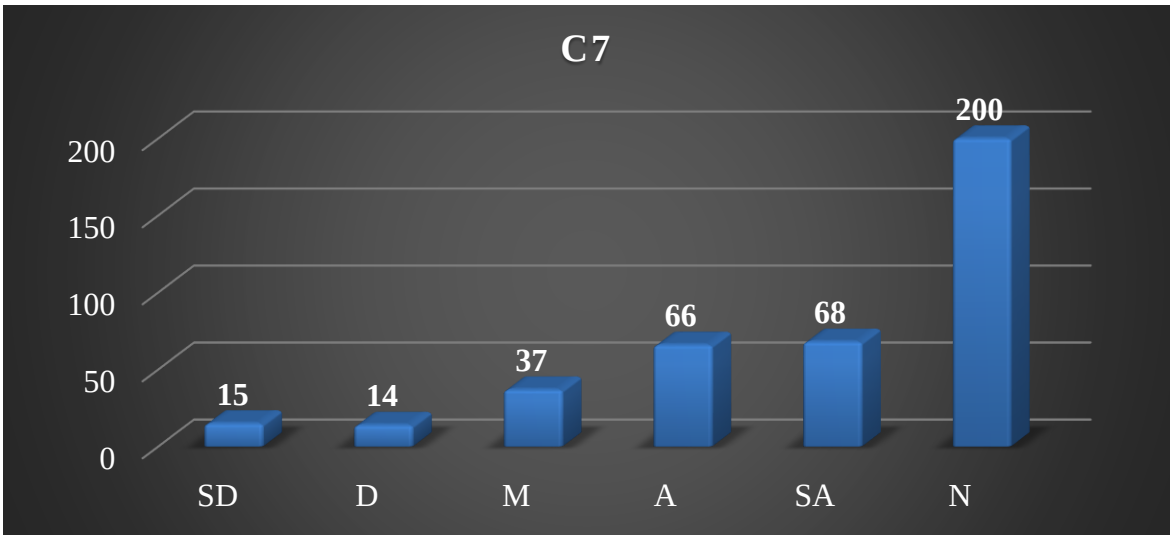


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.6 (Question C7): My suggestions about safety are acted upon when I raise them with management

Figure 4.25 illustrates on responses received for the above question. The majority of the participants (67.0%; n=134) were in agreement that their suggestions about safety are acted upon when raised with management. However, a small percentage of the participants (14.5%; n= 29) were of the view that suggestions made are not acted upon by management. This results show the participants (18.5%; n=37) moderate agree.

Figure 4.25: (Question C7)

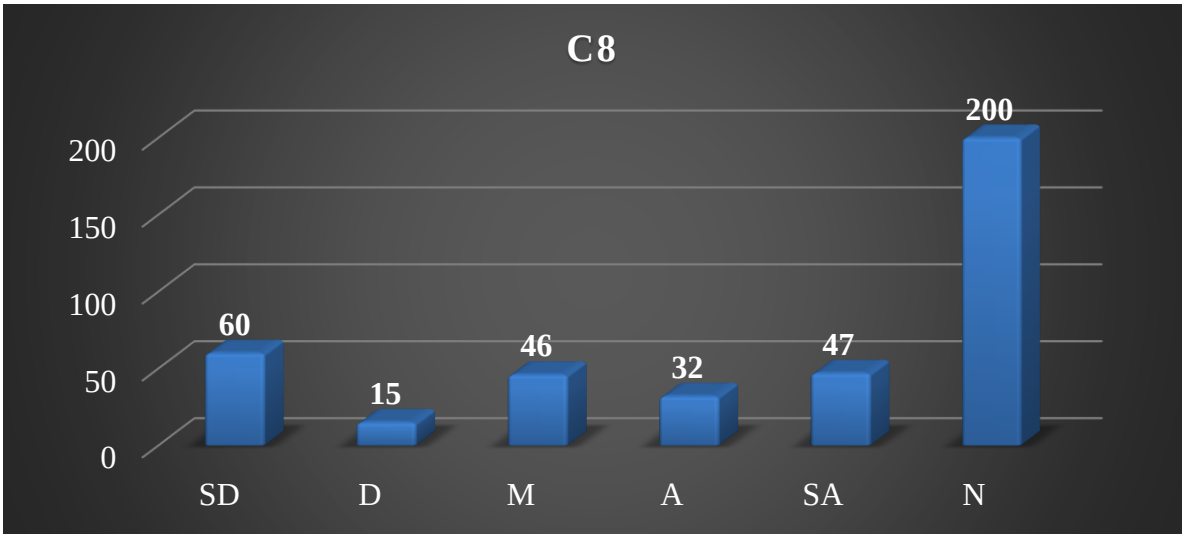


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.7 (Question C8): We have a copy of the OHSA on the employer premises

Figure 4.26 illustrates the responses to the above question. Mixed responses were received regarding the question, some participants (39.5%; n=79) agreed with the statement while there were some (37.5%; n=75) that disagreed with the statement. According to the requirements of the mine Health and Safety Act (29 of 1996), a copy of the Act must be made available on the employers' premises. The participants (23%; n=46) moderate agreed with the statement.

Figure 4.26: (Question C8)

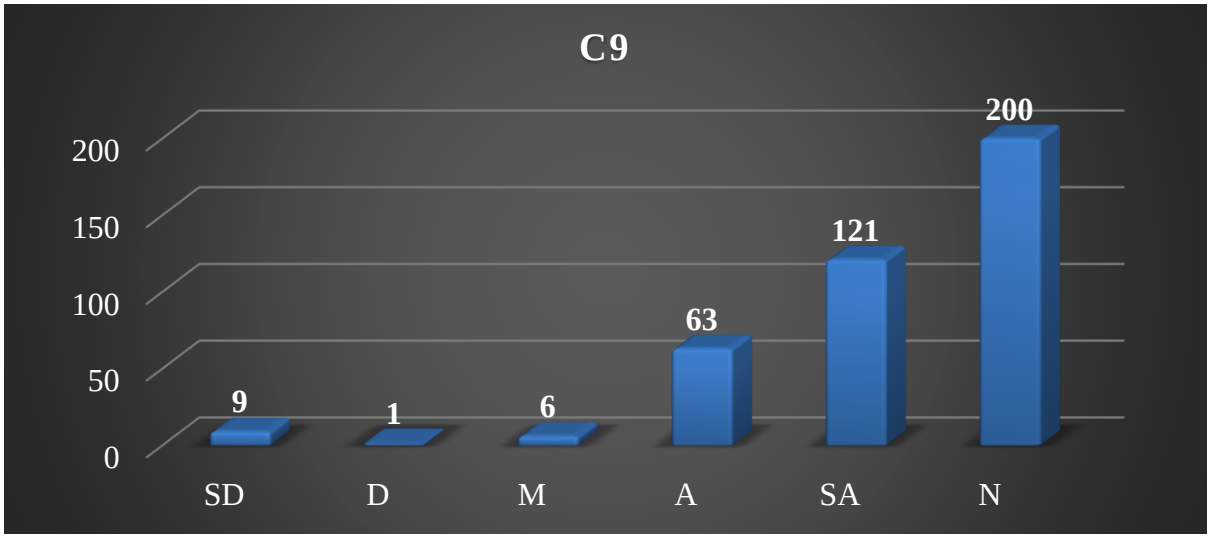


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.8 (Question C9): I know my rights as an employee when it comes to safety

Figure 4.27 illustrates on the responses relating to the above question. The majority of the participants were in agreement (92.0%; n=184) that employees are well attuned to their rights when it comes to safety in the mine. However, a small percentage (5.0%; n=10) were unaware of these rights regarding safety in the mine and (3%; n=6) moderate agreed with the statement.

Figure 4.27: (Question C9)

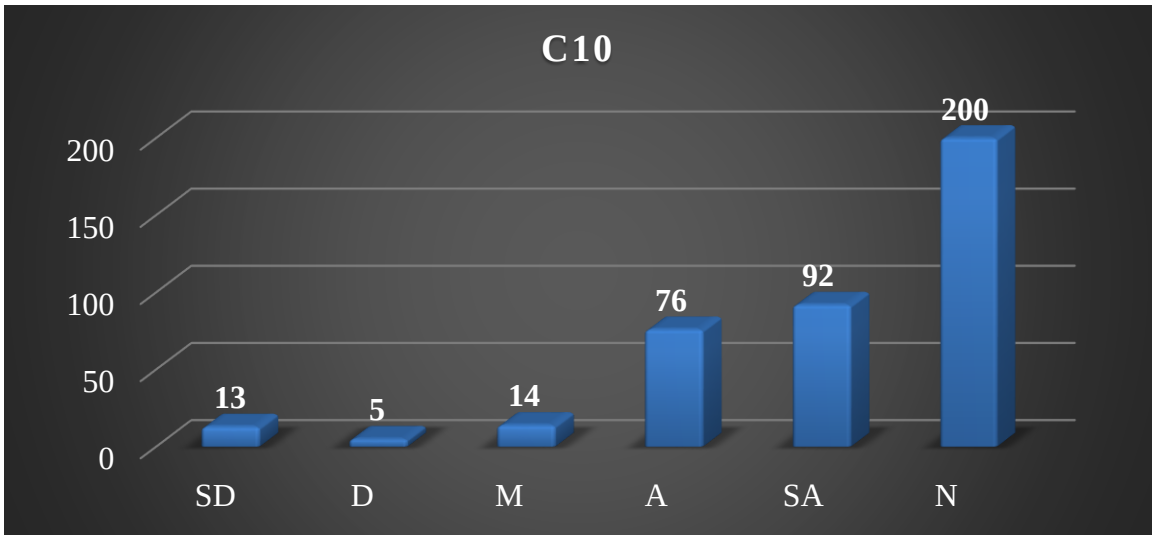


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.9 (Question C10): We are provided with the necessary skills as employees in the organisation to perform our work safely

Participants' responses to the above question are illustrated in Figure 4.28. The majority of the participants (84.0%; n=168) were in either strongly agreed or agreed that the mining company provides employees with the necessary skills to perform their work safely. Only a small percentage (9%; n= 18) were in disagreement that management provides them with the necessary skills to perform their work safely. According to Hlatywayo and Nel (2013:2139) training and competency plays a significant role in the hierarchy of safety control measures, control implementation and technology used in the mine. The results show (7%; n=14) of the participant moderate agree with the statement.

Figure 4.28: (Question C10)

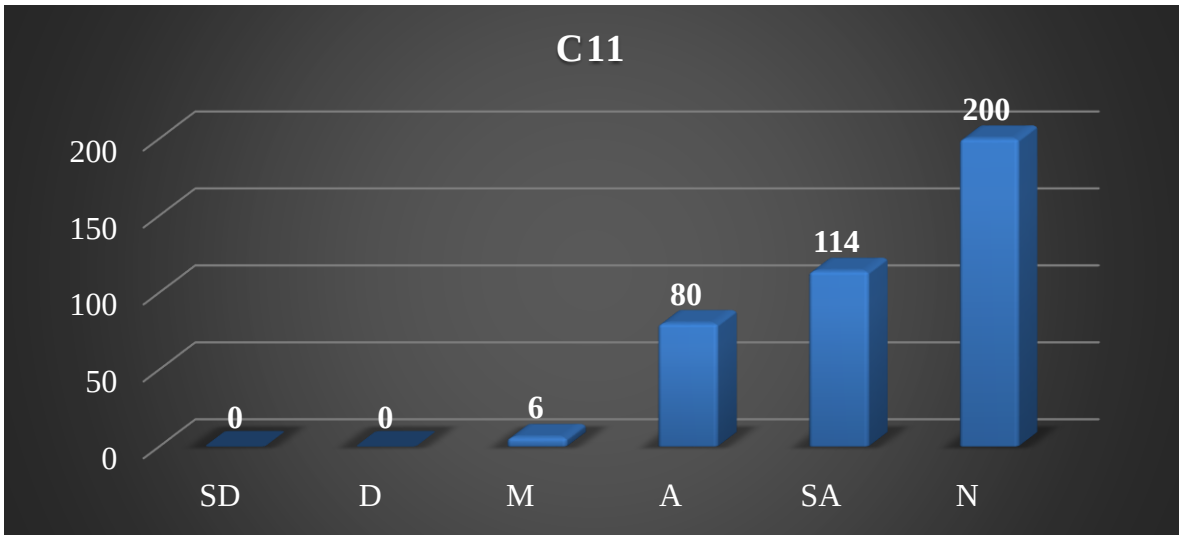


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.10 (Question C11): I usually follow safety procedures at work

Responses to the above question are illustrated in Figure 4.29. The majority of the participants (97%; n=194) strongly agreed that they follow safety procedures at work. Moreover, the planned task observation process carried out in mines often compels employees' behaviour to follow safety work/ operating procedures in the mine. Only the percent (3%; no.6) moderate agreed.

Figure 4.29: (Question C11)

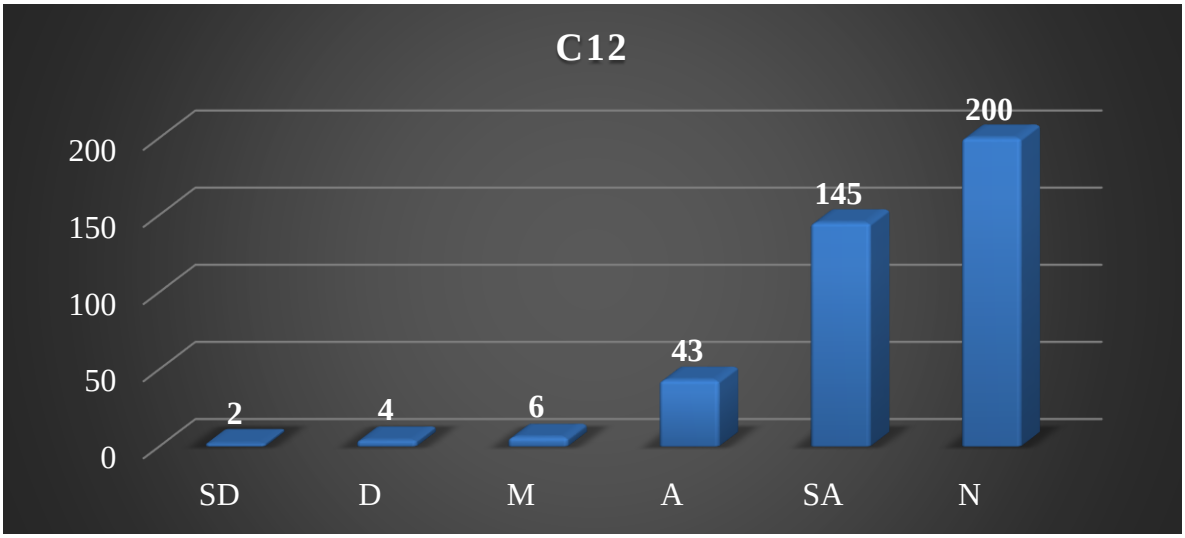


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.11 (Question C12): We have a safety representative in my workplace

Figure 4.30 illustrates the responses to the above question. The majority of the participants (94.0%; n=188) were in agreement that employees have a safety representative in their workplaces. According to the Mine Health and Safety Act (29 of 1996), a health and safety representatives are appointed in terms of MHSA (Reg. 6.9) and Mineral Act (Reg. 2.18.1), to represent employees in mine health and safety committee in the mine. However, a small percentage disagreed with this statement (3%; n= 6).

Figure 4.30: (Question C12)

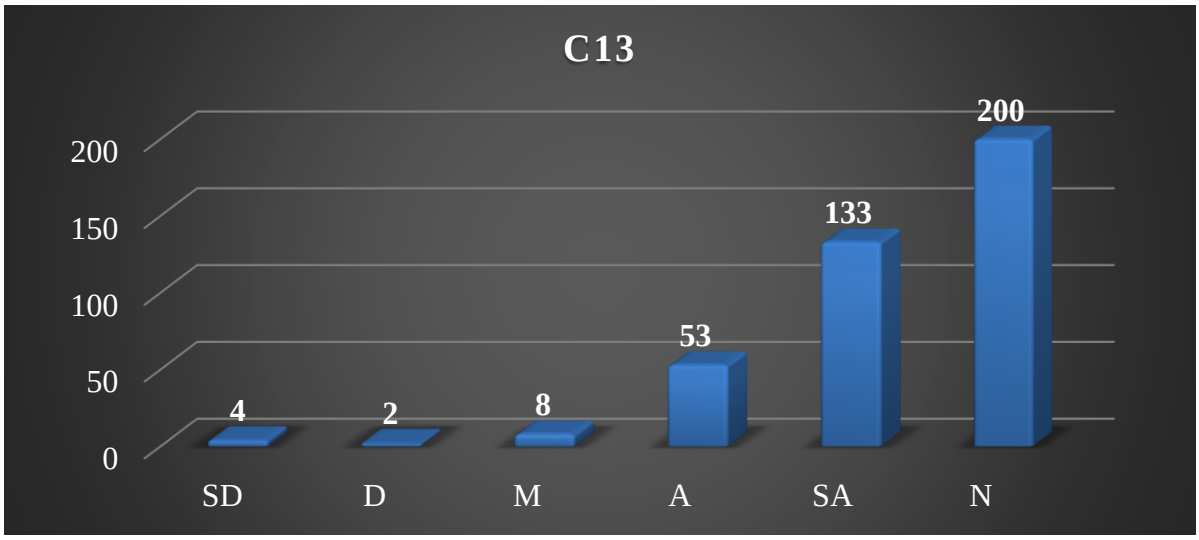


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.12 (Question C13): Safety meetings are held regularly with employees

Figure 4.31 illustrates the responses to the above question. The majority of the participants (93.0%; n=186) were in agreement that safety meetings are held regularly with the employees in the mine workplaces. These meetings create an easy platform for employees to ask questions when they need to understand aspects regarding their own safety. However, it seems that some employees are in disagreement (3%; n=6) and others (4%; n=8) moderate agreed that their divisions hold regular safety meetings.

Figure 4.31: (Question C13)

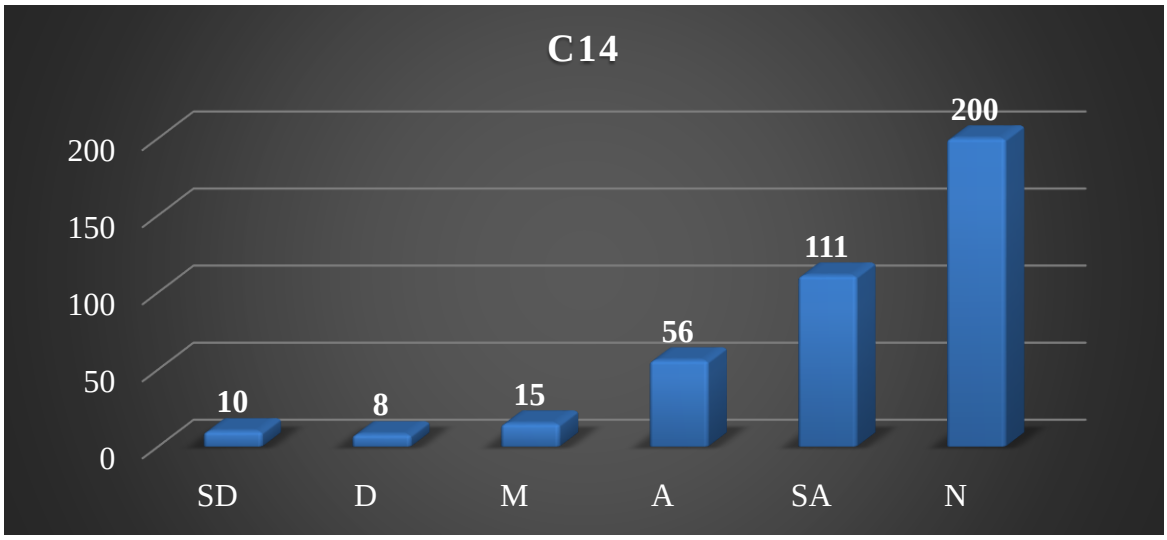


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.13 (Question C14): Safety awareness campaigns are held on a regular basis

Figure 4.32 addresses the responses to the above question. The results of the analysis show that the majority of the participants (83.5%; n=167) agree that safety awareness campaigns are held on a regular basis in the mine. A small percentage (9%; n=18) disagree that regular safety awareness campaigns are held in their divisions. The results show (7.5%; n=15) moderate agree.

Figure 4.32: (Question C14)

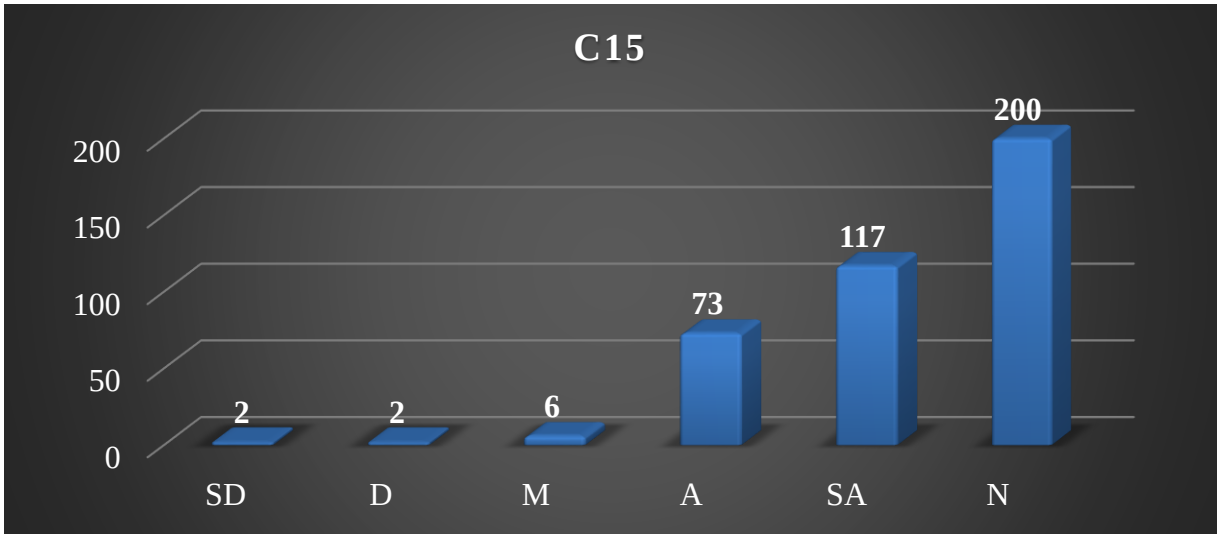


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.14 (Question C15): I usually follow safety procedures when doing my job

Figure 4.33 illustrates the responses to the above question. The majority of the participants (95.0% n=190) were in agreement that employees usually follow safety procedures when doing their job. However, a small percentage (2%; n= 4) and (3%; n=6) were moderate agree and disagree with the statement.

Figure 4.33: (Question C15)

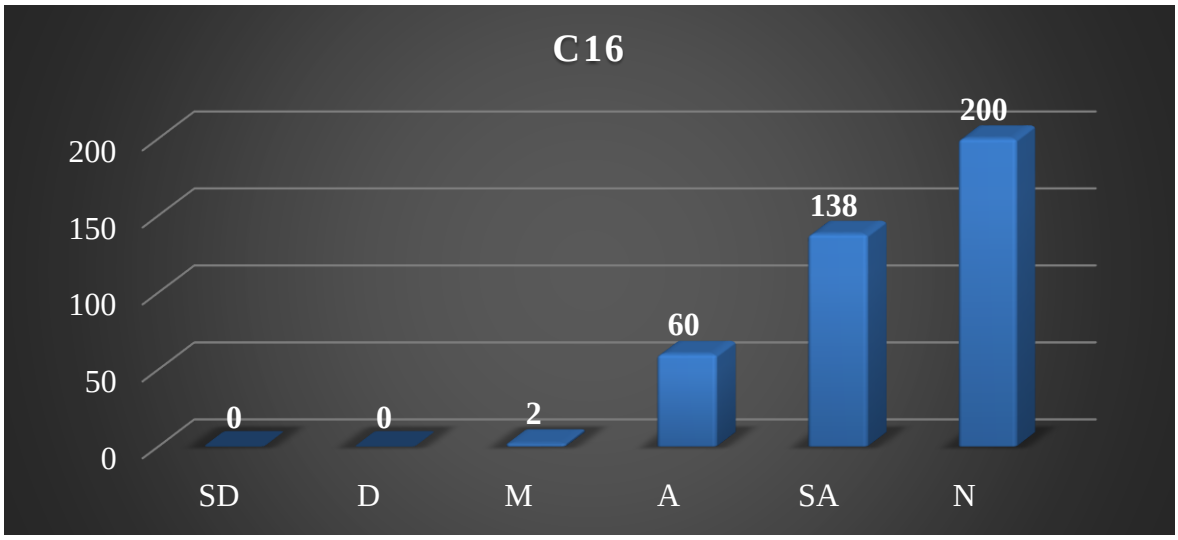


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.15 (Question C16): As an employee I am fully aware of hazards in my daily job

Figure 4.34 illustrates the responses to the above question. A very small amount of participants (1%; n=2) moderate agree with the statement however, the entire participants (99.0%; n=198) strongly agree that they are fully aware of hazards in their daily job. Mine employees may be mindful of the workplace hazards however, production pressure may also be seen by employees as a reason to take short cuts that may lead to injuries or fatalities. This is due to lack of awareness, understanding, their perception and or attitude towards safety control measures, ignorance, taking short cuts or deliberate safety violation (Laurence 2004:39).

Figure 4.34: (Question C16)

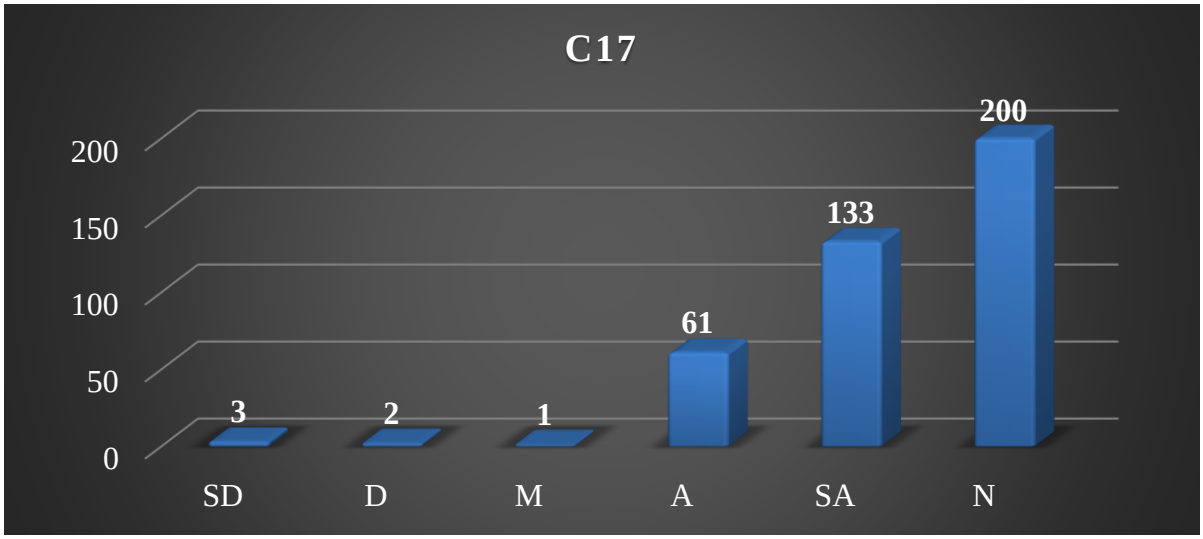


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.16 (Question C17): Every employee is responsible for their own safety in the organisation

Figure 4.35 illustrates the responses to the above question. The majority of the participants (97.0%; n=194) were in agreement that they are responsible for their own safety in the mine. The result is supported by the concept of section 22 of the Mine Health and Safety Act (29 of 1996).

Figure 4.35: (Question C17)

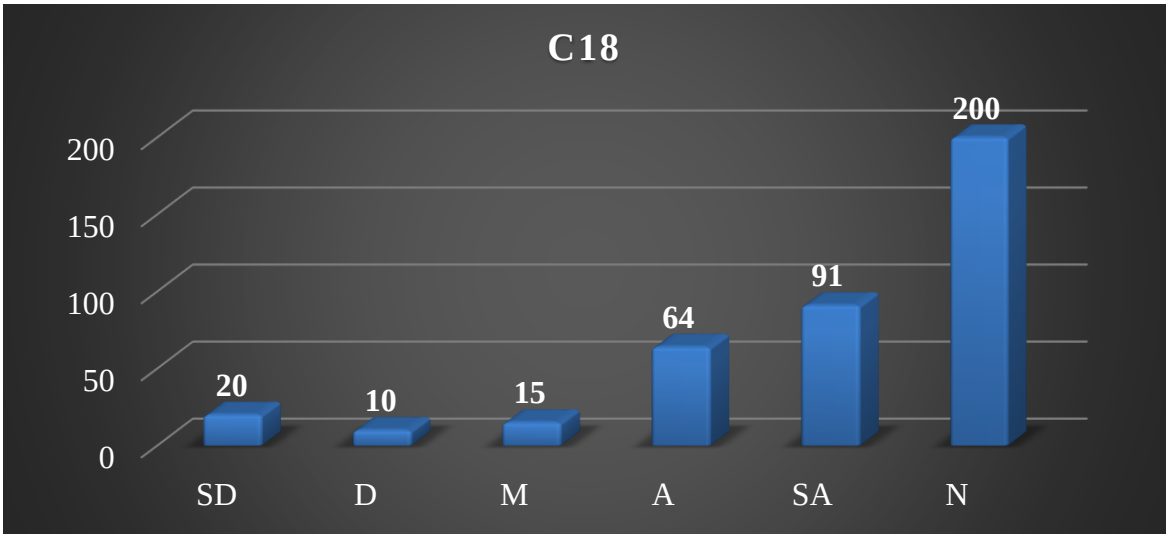


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.17 (Question C18): I receive appropriate feedback about safety performance

Figure 4.36 illustrates the responses to the above question. The majority of the participants (77.5%; n=155) were in agreement that they receive appropriate feedback about safety performance. A small percentage of the participants (15.0%; n=30) were in disagreement that they receive appropriate feedback about safety performance. The results show the percent (7.5%; n=15) moderate agree with the statement.

Figure 4.36: (Question C18)

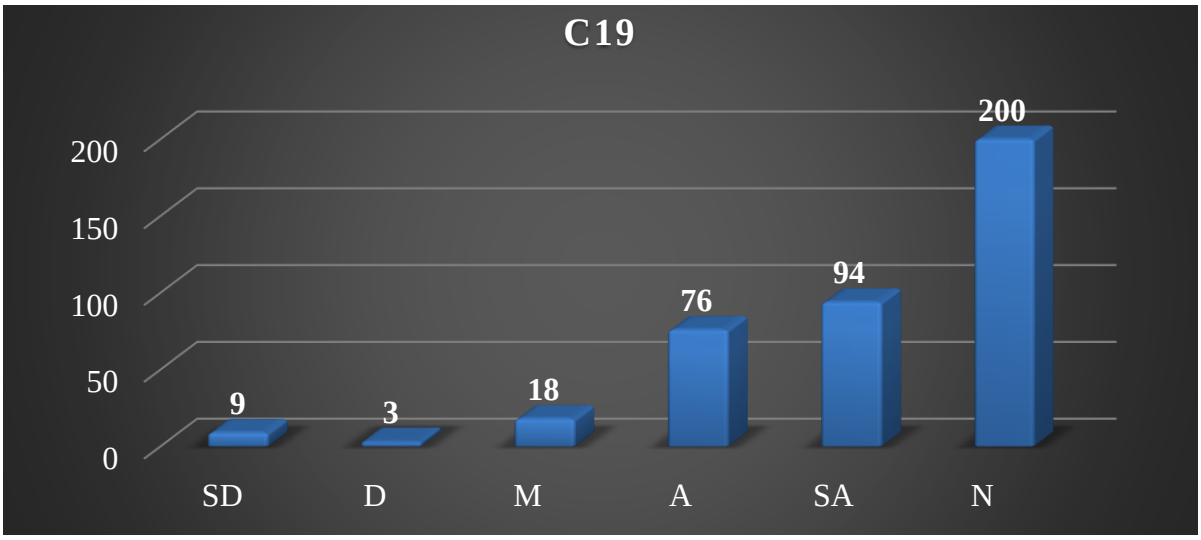


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.18 (Question C19): The culture in this mine makes it easy to learn from the mistakes of others

Figure 4.37 illustrates the responses to the above question. The majority of the participants (85.0%; n=170) agreed that the culture in this mine makes it easy to learn from the mistakes of others. A small percent (9%; n=18) moderate agree and (6%; n=12) disagree with the statement. According to Hea, Xub and Fua (2012:249) factors influencing the adherence to safety control measures and safety performance are rooted in the organisational culture.

Figure 4.37: (Question C19)

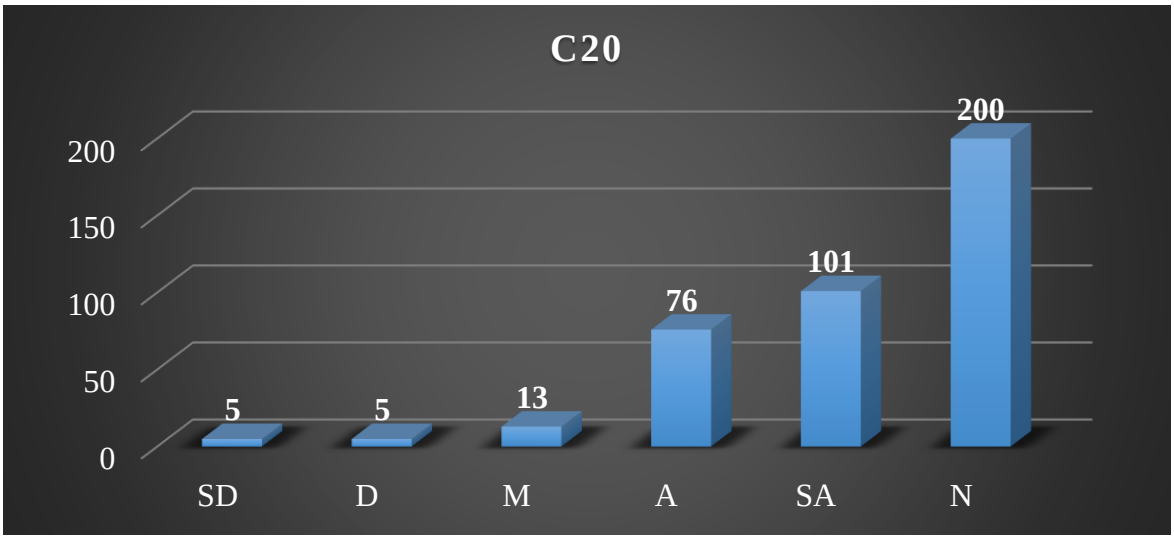


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.19 (Question C20): Important issues are well communicated at shift changes

Figure 4.38 illustrates the responses to the above question. The majority of the participants (88.5%; n=177) agreed that important issues are well communicated at shift changes. Shift change, in this instance, refers to a handover process as one of the critical safety components to prepare the employee during the start of the new shift in the mine. It is evident as was observed during data collection safety communication does take priority in different forms such as, posters, handover meetings and other platforms within the mine. Either the participants (5%; n=10) moderate in agreement or (6.5%; n=13) in disagreement, did not understand the question asked.

Figure 4.38: (Question C20)

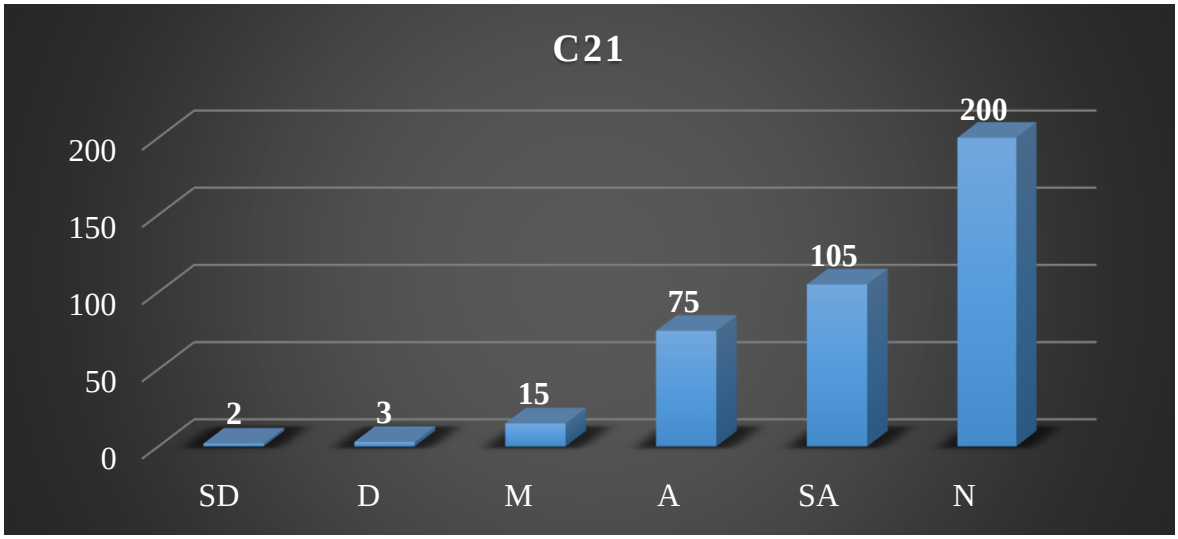


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.20 (Question C21): Leadership is encouraging us to be a safety-centred mining operation

Figure 4.39 illustrates the responses to the above question. The majority of the participants were in agreement (90.0%; n=180) and (7.5%; n=15) moderate agree that leadership encourages employees to be a safety-centred mining operation.

Figure 4.39: (Question C21)

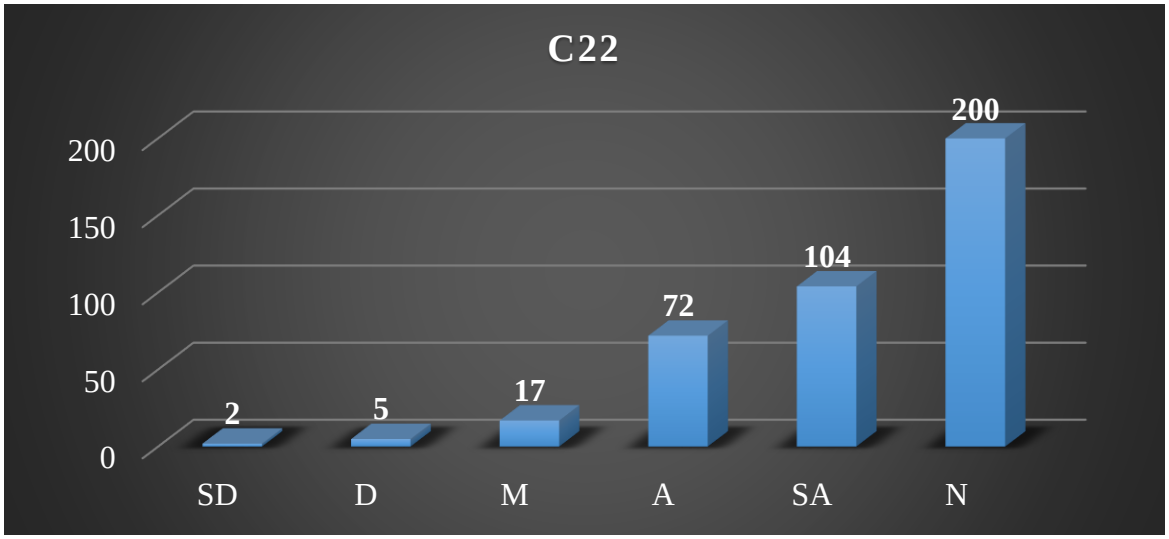


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.21 (Question C22): My employer usually protects employees against risks

Responses to the above question are illustrated in Figure 4.40. The majority of the participants (88.0%; n=176) were in agreement that their employer usually protect employees against risks in the mine. Few participants (8.5%; n=17) moderate agree with the statement.

Figure 4.40: (Question C22)

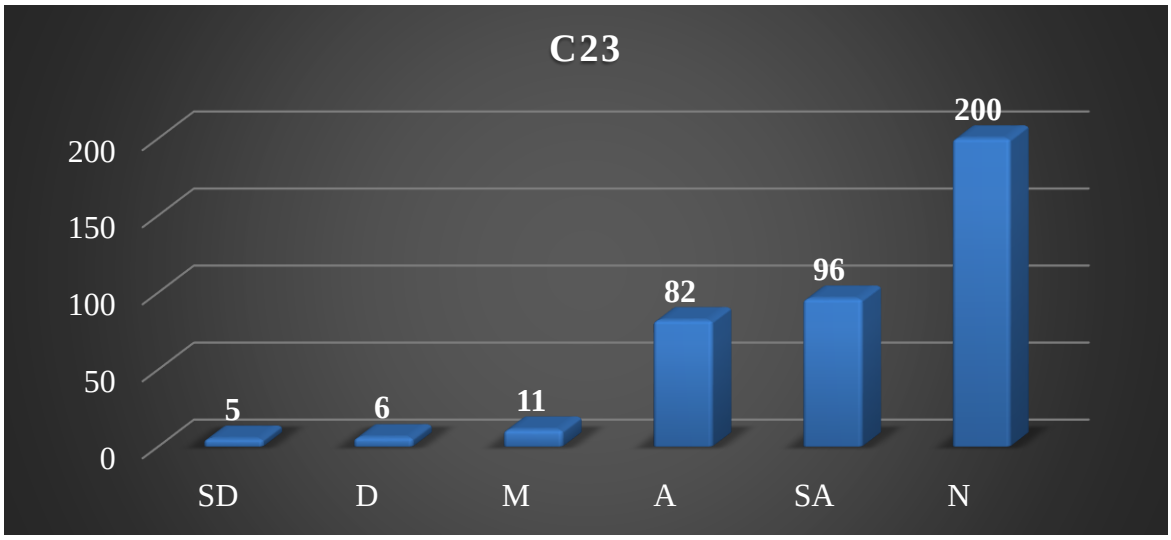


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.22 (Question C23): My employer usually informs me to take precautions to protect myself when I perform my duties

Figure 4.41 illustrates the response to the above question. The majority of the participants (89.0%; n=178) were in agreement that their employer usually informs them to take precautions to protect themselves in the performance of their duties.

Figure 4.41: (Question C23)

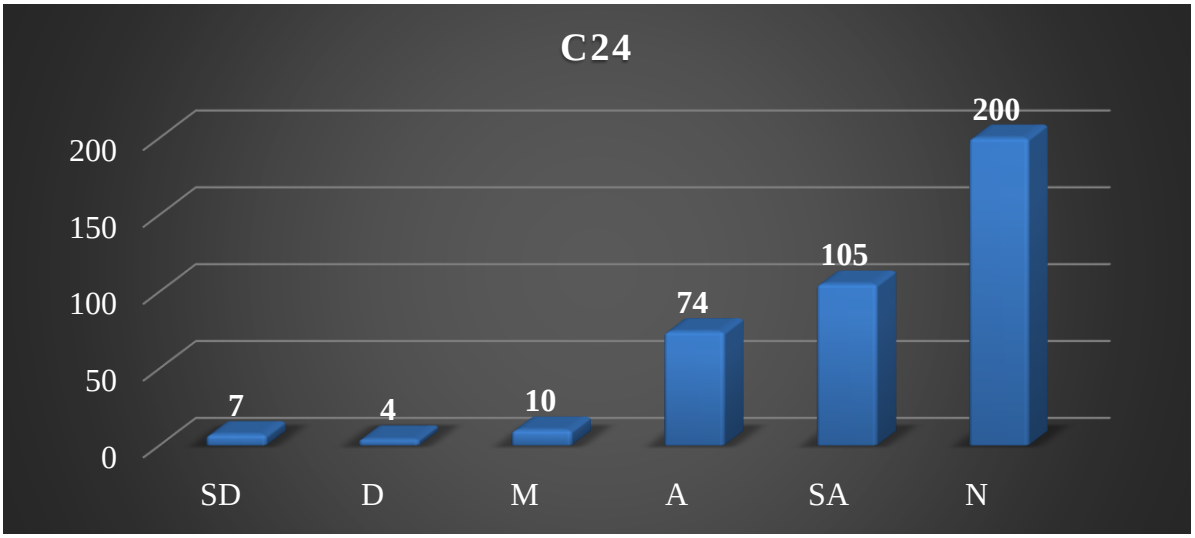


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.23 (Question C24): My employer enforces safety rules at all times

Figure 4.42 illustrates the results of the above question. The majority of the participants (89.5%; n=179) were in agreement that the employer enforces safety rules at all times. However, a small percentage moderate agree with the statement (5.5% n=11).

Figure 4.42: (Question C24)

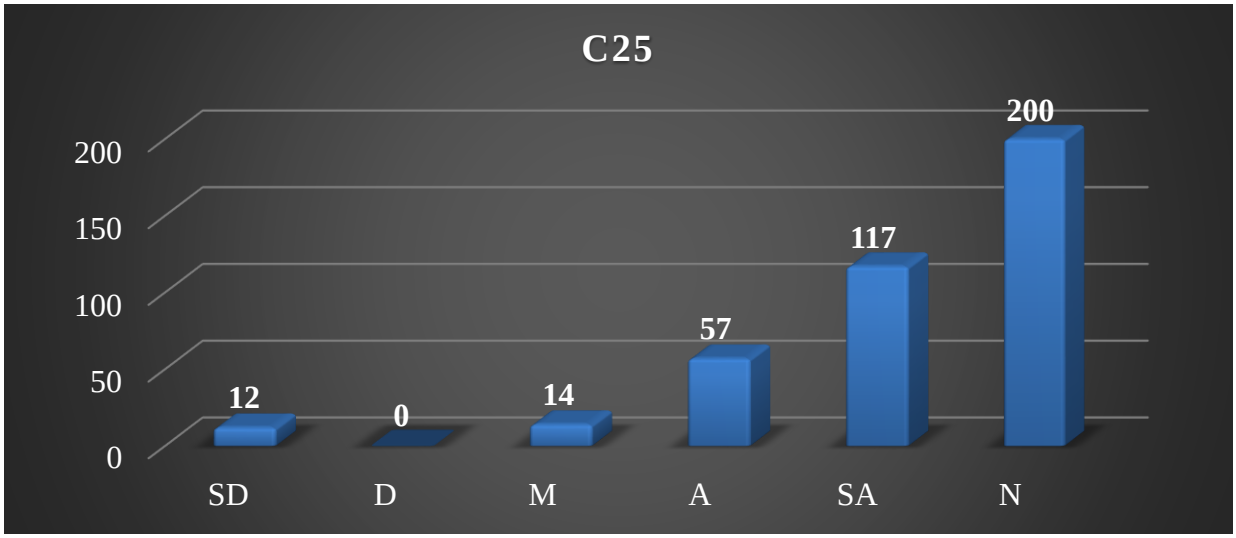


SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.5.24 (Question C25): My employer cares about my well-being and safety at work

Figure 4.43 illustrates the responses to the above question. The results show that the majority of the participants (87.0%; n=174) were in agreement that the employer cares about their well-being and safety at work.

Figure 4.43: (Question C25)



SD= Strong Disagreement; D= Disagreement; M= Moderate Agreement; A= Agreement; SA= Strong Agreement.

4.6 PERCEPTIONS AND ATTITUDES TOWARDS SAFETY CONTROL AND VARIATIONS IN TERMS OF AGE AND LENGTH OF SERVICE

In order to establish whether employees varied in terms of their responses with regard to age and length of service in the mining company, one-way analysis of variance (ANOVA) was computed. ANOVA is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups (Clow & James 2014:410-420). Where they are differences in the mean scores, post-hoc tests are used to find out where the differences lie. These results are reported in the foregoing section. Table 4.2 provides a summary of one-way between groups analysis of variances to explore whether there are any significant differences between the various age groups and employees perceptions and attitudes towards safety controls in the mine.

Table 4.2: Analysis of variance (ANOVA) - perceptions and attitudes towards safety controls with age

Variables		F	Sig.
C1	It is easy for employees to ask questions when there is something that they do not understand.	.372	.773
C2	I have the support that I need from the supervisors regarding safety.	.815	.487
C3	Work conditions here are favourable and conducive to safe work performance.	.500	.683
C5	Working in this mine is like being part of a large family.	.245	.865
C6	This mine management encourages teamwork and cooperation among its employees.	.077	.973
C7	My suggestions about safety are acted upon when I raise them with management.	1.292	.278
C8	We have a copy of the OHSA on the employer premises	2.471	.063
C9	I know my rights as an employee when it comes to safety	1.491	.218
C10	We are provided with the necessary skills as employees in the organisation to perform our work safely	.421	.738
C11	I usually follow safety procedures at work	1.753	.158
C12	We have a safety representative in my workplace	.926	.429
C13	Safety meetings are held regularly with employees	1.738	.161
C14	Safety awareness campaigns are held on a regular basis	1.816	.146
C15	I usually follow safety procedures when doing my job	.892	.446
C16	As an employee I am fully aware of hazards in my daily job	.374	.771
C17	Every employee is responsible for their own safety in the organisation	1.646	.180
C18	I receive appropriate feedback about safety performance.	.857	.464
C19	The culture in this mine makes it easy to learn from the mistakes of others.	1.440	.232
C20	Important issues are well communicated at shift changes.	1.742	.160
C21	Leadership is encouraging us to be a safety-centred mining operation	1.151	.330
C22	My employer usually protects employees against risks	2.963	.033*
C23	My employer usually informs me to take precautions to protect myself when I perform my duties	.279	.841
C24	My employer enforces safety rules at all times	.981	.403
C25	My employer cares about my well-being and safety at work.	1.292	.278
Significant at p<0.05			

Significant differences were found between C22 (My employer usually protects employees against risks) and the various age categories ($F=2.963$; $p<0.05$). Reference to (Table 4.3), Post hoc comparisons using Dunnett T3 test indicated that the mean score for group 1 (between 18-29 years) ($M=4.20$) was significantly different from group 2 (between 30-40 years) ($M=4.50$), group 3

(between 41-50 years) (M=4.48) and group 4 (over 51 years) (M=4.50). These results indicate that the younger cohort of employees feel that management does not do enough to protect employees against risks.

Table 4.3: Post hoc analysis-perceptions and attitudes towards safety controls and age

Dependent Variable:C22	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error
Dunnett T3	1 (Mean=4.20)	2 (Mean=4.50)	-.295*	.167
		3 (Mean=4.48)	-.280*	.172
		4 (Mean=4.50)	.102*	.214
	2 (Mean=4.50)	1 (Mean=4.20	.295	.167
		3 (Mean=4.48)	.015	.118
		4 (Mean=4.50)	.397	.174
	3 (Mean= 4.48)	1 (Mean=4.20	.280	.172
		2 (Mean=4.50)	-.015	.118
		4 (Mean=4.50)	.382	.178
	4 (Mean-4.50)	1 (Mean=4.20	-.102	.214
		2 (Mean=4.50)	-.397	.174
		3 (Mean=4.48)	-.382	.178

Table 4.4 provides the ANOVA results, which compared the perceptions and attitudes of employees towards safety with the length of service that they worked in the mine. Significant differences were found between C2 (I have the support that I need from the supervisors regarding safety) ($F=3.118$; $p<0.05$), C5 (Working in this mine is like being part of a large family) ($F= 3.847$; $p <0.05$), C8 (We have a copy of the OHSA on the employer premises) ($F= 2.880$; $p <0.05$) and the length of service that employees were in the organisation.

Table 4.4: Analysis of variance (ANOVA) - perceptions and attitudes towards safety controls with length of service

Variables		F	Sig.
C1	It is easy for employees to ask questions when there is something that they do not understand.	.407	.844
C2	I have the support that I need from the supervisors regarding safety.	3.118	.010*
C3	Work conditions here are favourable and conducive to safe work performance.	1.847	.106
C5	Working in this mine is like being part of a large family.	3.847	.002*
C6	This mine management encourages teamwork and cooperation among its employees.	1.731	.129

Variables		F	Sig.
C7	My suggestions about safety are acted upon when I raise them with management.	.971	.437
C8	We have a copy of the OHSA on the employer premises	2.880	.016*
C9	I know my rights as an employee when it comes to safety	1.266	.280
C10	We are provided with the necessary skills as employees in the organisation to perform our work safely	1.410	.222
C11	I usually follow safety procedures at work	.728	.603
C12	We have a safety representative in my workplace	2.105	.066
C13	Safety meetings are held regularly with employees	.778	.566
C14	Safety awareness campaigns are held on a regular basis	1.181	.320
C15	I usually follow safety procedures when doing my job	.405	.845
C16	As an employee I am fully aware of hazards in my daily job	.123	.987
C17	Every employee is responsible for their own safety in the organisation	.977	.433
C18	I receive appropriate feedback about safety performance.	1.202	.310
C19	The culture in this mine makes it easy to learn from the mistakes of others.	1.898	.096
C20	Important issues are well communicated at shift changes.	.168	.974
C21	Leadership is encouraging us to be a safety-centred mining operation	1.446	.210
C22	My employer usually protects employees against risks	1.681	.141
C23	My employer usually informs me to take precautions to protect myself when I perform my duties	.567	.725
C24	My employer enforces safety rules at all times	.861	.509
C25	My employer cares about my well-being and safety at work.	.239	.945
Significant at p<0.05			

With regard to C2 (I have the support that I need from the supervisors regarding safety), post hoc comparisons (Table 4.5) using Dunnett T3 test indicated that the mean score for group 1 (between 1-5 years) (M=3.98) was significantly different from group 3 (between 11-15 years) (M=3.15) regarding their perceptions on the level of support that they receive from the supervisors regarding safety. Further, with regard to C5 (Working in this mine is like being part of a large family), the post hoc test show significant differences between the group 1 (between 1-5 years) (M=4.18) and group 3 (M=3.09). Finally, with regard to C8 (We have a copy of the OHSA on the employer premises), the post hoc test show significant difference between group 1 (M=3.29) and group 4 (M=2.13).

Table 4.5: Post hoc analysis-perceptions and attitudes towards safety controls and length of service

Dependent Variable	(I) Service	(J) Service	Mean Difference (I-J)	Std. Error
C2 Dunnett T3	1 (Mean=3.98)	2(Mean=3.89)	.087	.220
		3(Mean=3.15)	.832*	.236
		4(Mean=4.33)	.104	.334
		5(Mean=3.50)	-.354	.352
		6(Mean=3.50)	.479	.432
	2 (Mean=3.89)	1(Mean=3.98)	-.087	.220
		3(Mean=3.15)	.745	.281
		4(Mean=4.33)	.017	.367
		5(Mean=3.50)	-.441	.383
		6(Mean=3.50)	.392	.458
	3 (Mean=3.15)	1(Mean=3.98)	-.832*	.236
		2(Mean=3.89)	-.745	.281
		4(Mean=4.33)	-.728	.377
		5(Mean=3.50)	-1.186	.393
		6(Mean=3.50)	-.353	.466
	4 (Mean=4.33)	1(Mean=3.98)	-.104	.334
		2(Mean=3.89)	-.017	.367
		3(Mean=3.15)	.728	.377
		5(Mean=3.50)	-.458	.458
		6(Mean=3.50)	.375	.523
	5 (Mean=3.50)	1(Mean=3.98)	.354	.352
		2(Mean=3.89)	.441	.383
		3(Mean=3.15)	1.186	.393
		4(Mean=4.33)	.458	.458
		6(Mean=3.50)	.833	.534
	6 (Mean=3.50)	1(Mean=3.98)	-.479	.432
		2(Mean=3.89)	-.392	.458
		3(Mean=3.15)	.353	.466
		4(Mean=4.33)	-.375	.523
		5(Mean=3.50)	-.833	.534
C5 Dunnett T3	1 (Mean=4.18)	2(Mean=4.00)	.179	.251
		3(Mean=3.09)	1.091*	.290
		4(Mean=3.69)	.491	.369

Dependent Variable	(I) Service	(J) Service	Mean Difference (I-J)	Std. Error
		5(Mean=3.83)	.346	.491
		6(Mean=3.67)	.512	.353
	2 (Mean=4.00)	1(Mean=4.18)	-.179	.251
		3(Mean=3.09)	.912	.346
		4(Mean=3.69)	.313	.415
		5(Mean=3.83)	.167	.527
		6(Mean=3.67)	.333	.401
	3 (Mean=3.09)	1(Mean=4.18)	-1.091*	.290
		2(Mean=4.00)	-.912	.346
		4(Mean=3.69)	-.599	.439
		5(Mean=3.83)	-.745	.546
		6(Mean=3.67)	-.578	.426
	4 (Mean=3.69)	1(Mean=4.18)	-.491	.369
		2(Mean=4.00)	-.313	.415
		3(Mean=3.09)	.599	.439
		5(Mean=3.83)	-.146	.592
		6(Mean=3.67)	.021	.483
	5 (Mean=3.83)	1(Mean=4.18)	-.346	.491
		2(Mean=4.00)	-.167	.527
		3(Mean=3.09)	.745	.546
		4(Mean=3.69)	.146	.592
		6(Mean=3.67)	.167	.582
	6 (Mean=3.67)	1(Mean=4.18)	-.512	.353
		2(Mean=4.00)	-.333	.401
		3(Mean=3.09)	.578	.426
		4(Mean=3.69)	-.021	.483
		5(Mean=3.83)	-.167	.582
C8 Dunnett T3	1 (Mean=3.29)	2(Mean=3.00)	.295	.316
		3(Mean=2.47)	.824	.293
		4(Mean=2.13)	1.170*	.359
		5(Mean=3.17)	.128	.763
		6(Mean=2.50)	.795	.506
	2 (Mean=3.00)	1(Mean=3.29)	-.295	.316
		3(Mean=2.47)	.529	.378
		4(Mean=2.13)	.875	.431
		5(Mean=3.17)	-.167	.799

Dependent Variable	(I) Service	(J) Service	Mean Difference (I-J)	Std. Error
		6(Mean=2.50)	.500	.559
	3 (Mean=2.47)	1(Mean=3.29)	-.824	.293
		2(Mean=3.00)	-.529	.378
		4(Mean=2.13)	.346	.415
		5(Mean=3.17)	-.696	.791
		6(Mean=2.50)	-.029	.547
	4 (Mean=2.13)	1(Mean=3.29)	-1.170*	.359
		2(Mean=3.00)	-.875	.431
		3(Mean=2.47)	-.346	.415
		5(Mean=3.17)	-1.042	.818
		6(Mean=2.50)	-.375	.585
	5 (Mean=3.17)	1(Mean=3.29)	-.128	.763
		2(Mean=3.00)	.167	.799
		3(Mean=2.47)	.696	.791
		4(Mean=2.13)	1.042	.818
		6(Mean=2.50)	.667	.892
	6 (Mean=2.50)	1(Mean=3.29)	-.795	.506
		2(Mean=3.00)	-.500	.559
		3(Mean=2.47)	.029	.547
		4(Mean=2.13)	.375	.585
		5(Mean=3.17)	-.667	.892
*** The mean difference is significant at p< 0.05 level.**				

4.7 RELIABILITY AND VALIDITY OF MAIN SURVEY

4.7.1 Reliability

Cronbach alpha (α) coefficient was computed to check the internal consistency of each scale using SPSS. Cant, Gerber-Nel and Kotze, (2003:123) and Feinberg, Kinnear and Taylor (2013:132) state that the acceptable level for measuring reliability of an instrument is 0.70. Table 4.6 indicates the overall reliability for section B and C.

The Cronbach alpha value for Section B - factors influencing adherence to safety control measures in the mining company was 0.702, which comprised 14 items. Section C - perceptions and attitudes towards safety control measures was 0.878 contained 24 items.

Table 4.6: Scale reliabilities

Scale	Number of items	Cronbach's alpha (α)	N
Section B - Factors influencing adherence to safety control measures in the mining company	14	.702	200
Section C - Perceptions and attitudes towards safety control measures	24	.878	200

4.7.2 Content-related validity

Content validity is the adequacy with which the important aspects of the characteristics are captured by the measure (Churchill et al. 2010:257). Zikmund and Babin (2000:320) state that content validity is established when a scale's content logically appears to reflect what it was intended to measure. The content validity of the research instrument, the questionnaires were sent to the supervisor, mine manager, training safety manager and the statistician to assess validation. Items were observed on the questionnaire to ensure relevance of the content covered on the research topic. Question content, language and phrasing were assessed to examine their connection to the relevant frame of reference used in the study.

4.7.3 Construct validity

Construct validity demonstrates the relationship between concepts under study and the relevant theoretical concept. It determines whether the instrument is measuring what it is supposed or expected to measure, in other words, the degree to which the scale measures the theoretical construct (De Vos, Strydom, Fouche & Delport 2009:162). Construct validity was assessed using Cronbach alpha coefficients for the various scales.

According to Leedy and Ormrod (2010:92), the general definition of construct validity is that it refers to the extent to which an instrument measures a characteristic that cannot be directly observed but is assumed to exist in people's behaviour. McDaniel and Gates (2002:304) view construct validity as the degree to which a measurement instrument represents and logically connects, via the underlying theory, the observed phenomenon to the construct. Construct validity was assessed through the pilot testing of the questionnaire.

4.8 CONCLUSION

The primary aim of this study is to determine factors influencing adherence and employee perception towards safety controls in a coal mine in the Free State province of South Africa. The

results of this study add to the existing current knowledge of the literature on safety control measures in the mining sector. In this chapter, emphasis was placed on the empirical results of the study. This entailed a detailed discussion of the pilot study and how the research instrument was purified. Items with low correlations were discarded in order to arrive at a refined scale. A pilot exercise was undertaken and 42 questionnaires were distributed to determine the initial reliability of the questionnaire before the distribution of the final questionnaire. Various methods were employed to present and interpret the results and included charts, graphs and tables. To determine the relationship, various variables were explored including the perceptions and attitude of employees towards safety control measures and adherence to safety in the mine. Validity and reliability assessment procedures were also performed.

In the final chapter, an overview of the study is provided. The theoretical and empirical objectives are re-visited in order to establish the attainment of the objectives. The conclusions, limitations and recommendations emanating from the study and implications for future research are eluded to in the next chapter.

CHAPTER 5
CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5

5.1 INTRODUCTION

The previous chapter reported on the results and analysis of empirical findings of the study. The practical findings of the study, including an analysis and interpretation of the research findings, were presented. A systematic process was followed whereby the problem statement was established, both theoretical and empirical objectives were determined and the study was founded and guided by the theory of accident causation model (1920), Heinrich's Domino Theory, 1920 and the theory of safety related violations of system barriers (Polet, Vanderhaegen & Wieringa 2002:1-9).

This chapter is intended to provide precise conclusions in light of objectives mentioned from the onset of this investigation. Furthermore, this chapter provides recommendations that may be undertaken to ensure that safety in the mine can be improved, based on the findings derived from the study. Finally, the chapter highlights the limitations and implication for future research.

5.2 OVERVIEW OF THE STUDY

The primary purpose of this study was to determine factors influencing adherence and employee perceptions towards safety control measures in a mining company. In order to fulfil this purpose, safety culture, mine incidents, accidents and fatality statistics were discussed, providing objectives of control measures with regards to safety improvement. The research study was divided into five chapters. Chapter 1 introduced the study by discussing the background, the problem statement, the research objectives, the research design, a mind map for the purpose of the content and the context selection and alignment with the literature review and ethical considerations. In the second chapter, a literature review related to the context of study (safety in the mine, adherence to compliance and employee perceptions with regard to safety control measures) was conducted. The chapter provided an extensive literature review focusing on the dynamics of the study, namely quality of information, performance of safety and perceptions of employees towards safety measures, legislation in South Africa mining industry and theories implemented to ground the study, as well as the development of the identified objectives drawn from the conceptual framework of the research. Chapter 3 discussed the literature related to the research methodology that was implemented in the study. Chapter 4 dealt with all aspects related to the data analysis and

interpretation of the findings. This analysis included the usage of charts and graphs. The results of the study were reflected and deliberated upon in this chapter to provide an overall conclusion of each aspect and element discussed throughout the study, suggested some key recommendations and highlighted the limitations of the study as well as the implications for further research.

5.3 THE OBJECTIVIES AND BRIEF SUMMARY OF THE STUDY

South Africa's wealth has been built on its vast mineral resources. The country holds leading positions in the production of numerous mineral resources, including gold, platinum, coal and chrome (Pyoos 2008). Therefore, the research was undertaken using a framework adapted from the actual fatal incidents statistics from these mining companies in South Africa. The research study targeted people working in a specific mine in South Africa. These are mine workers who are exposed to risk of accident, or have accident-related functions as part of their duties. The mine workers were targeted mainly because mining companies are faced with a huge challenge in terms of accidents, which, when compromised, affects the health and safety of the workers. Mining companies, however, do accept that there is certain risk involved in the South Africa's mining companies and accommodate this risk in the business decisions (Beech 2014:1). However, numerous factors such as production pressure, leadership, information, competency, experience and behaviour of employees have been suggested to have an influence on employee adherence to the safety control measures (Ismail, Doodstdar & Harun 2011:418).

5.3.1 Evaluation of the objectives

5.3.1.1 Primary objective

- The primary objective was to investigate the factors influencing adherence and employee perceptions towards safety control measures in a mining company.

Safety adherence is the extent to which employees comply with safety standards, procedures, legal obligations and requirements. Production pressure may be seen by employees as a reason to take short cuts that may lead to injuries or fatalities. This objective was achieved in Chapter 4, Section 4.4.

5.3.1.2 Theoretical objectives

The theoretical objectives for this study were attained through the analysis of the relevant literature. In order to accomplish the main objective of this research the following theoretical objectives were formulated for the study:

- Conduct a literature review on safety control measures in the mining company;

- Carry out a literature review on safety performance in a mining company; and
- Conduct a literature review on employee perceptions of their adherence to safety control measures in mines.

The **first theoretical objective** was addressed in sections 2.2 and 2.3, where an overview on safety control measures in the mine was provided. Safety control measures help the mining industry more effectively to identify safety risks and more realistically evaluate their safety improvement programmes (Coleman & Kerkering 2007:523). It is evident from the literature review that there has been a worldwide campaign focussing on adherence to safety control measures with the attempt to reduce the likelihood and severity of accidents in mining sectors.

The **second theoretical objective** was discussed in Chapter 2. The track record of safety in the mining industry continues to be a matter of great concern despite a slight year-on-year reduction as illustrated in (Figure 2.4). An organisations LTIFR is an alternate measurement of its performance. LTIFR is simply one measure that helps the mining company to gauge their safety performance.

Reference to the **third theoretical objective,** employees' perceptions of their adherence to safety control measures in the mine was reviewed under sections 2.3.1 and 2.3.2.

5.3.1.3 Empirical objectives

The following empirical objectives were formulated to support the primary and theoretical objectives:

- to assess the factors that influence the adherence to safety control measures in the mining company.
- to assess employees' perceptions of safety measures in the mining company.
- to assess whether there are any significant differences between employees perceptions and attitudes towards safety controls and the age of employees.
- to assess whether there are any significant differences between employees perceptions and attitudes towards safety controls and their length of service.

Objective one: to assess the factors that influence the adherence to safety control measures in a mining company

This objective was accomplished in Chapter 4, Section 4.4 (figures 4.6 to 4.19). The assessment in Figure 4.13 on risk and management of change is the process of introducing technology in the mining company, that is, new design or product, new machinery, or equipment, change of

geographic layout and so forth, in an attempt to reduce risk (Hebblewhite 2009:14). The results show that the majority of the participants were moderate in agreement and this may mean that the purpose of risk and change management process in the mine was either not well communicated or understood by the mine workers. Risk and change management process typically are controls or management strategies to communicate risks associated with the change. Adherence to risk and management of change process, deals with identifying new hazards and the threats produced by change.

The assessment in Figure 19.1 in Chapter 4, adherence to PPE by the mines, depends on the knowledge of those involved (employers, employees, contractors and service providers/clients) about the importance of their use, but also the supply and availability of PPE, which is determined by law, to any employer or independent establishment of the activity area within the mine (Garbaccio & De Oliveira 2014:47).

Objective two: to assess employees' perceptions of safety control measures in the mining company

This objective was addressed in Section 4.5 (figures 4.20 to 4.43). Although employee perceptions of work pressure, for example, excessive workload, high work pace, time pressures and so forth, are known to be an underlying factor for both accidents and unsafe work behaviour, work pressure has been found to have a small effect in predicting safety performance, accidents and injuries.

Objective three: to assess whether there are any significant differences between employees perceptions and attitudes towards safety controls and the age of employees

This objective was accomplished in Section 4.6, (Table 4.2) through ANOVA analysis. The analysis of the results indicated that the younger cohort of employees feel that management does not do enough to protect employees against risks. Brijlall and Okharedia (2015:90) cited the study conducted by Chen and Chan (2003) that few research studies have addressed the impact of employee's input into health and safety prevention programmes with the view that employees working at the heart of the operations are more at risk to health and safety hazards.

Objective four: to assess whether there are any significant differences between employees' perceptions and attitude towards safety control measures and their length of service

Table 4.4 provides the ANOVA results, which compared the perceptions and attitudes of employees towards safety with the length of service that they worked in the mine. Significant differences were found between C2 (I have the support that I need from the supervisors regarding

safety) (F=3.118; p<0.05), C5 (Working in this mine is like being part of a large family) (F= 3.847; p <0.05), C8 (We have a copy of the OHSA on the employer premises) (F= 2.880; p <0.05) and the length of service that employees were in the organisation.

5.4 RECOMMENDATIONS

When control measures are effective or not effective (good or poor), every employee knows it (Dinapoli 2010:10). According to Morrison (2017:10), both internal change and external change impacts the environment in which employees work and may affect the mines' ability to achieve its objectives.

The assessment in Section 4.4.8 show weakness in the system when it comes to the issue of risk and change management application within the mine. Risk and change management process is the channel of information by which control policies and procedures can be introduced and reinforced. Although the majority of the participants (88.5%; n=177) in Section 4.5.19 agreed that the communication channels are in place in the mine, there should be more emphases on risk and change of management processes. More often, new technologies, or new equipment, machinery, products, change in geographic layout and so forth, are introduced in the mines without consultation with the stakeholders (mine employees). The employees become aware of management's commitment when consultation takes place to address the information, organisational learning, communication, commitment and involvement (Vassem, Fortunato, Bastos and Balassiano 2017:721). It **is recommended that an effective employee engagement system** needs to be developed. The leadership and human resources, mine workers and all persons who may be affected by the mining activities in the surrounding area of operation need to be aware of the factors that can impact their well-being.

The assessment in Section 4.4.6 (Figure 4) indicates that management needs to improve on the issue of raising awareness of safety performance in the mine. The analysis shows mixed feelings of the participants' responses regarding LTIFR pertaining to safety performance.

According to Everson, Soske, Martens, Beston, Harris, Garcia, Jourdan, Posklensky and Perraglia (2013:12), safe control environment comprises integrity and ethical values of the organisation. **It is recommended that mine managers establish a safety control charter** that must be understood by the mine workers and develop a code of ethics that requires ethical and honest behaviour from all employees in order to improve safety performance and learn from these performances.

Additional factors that influence the mining company to adhere to the set of control measures in the mining environment are influenced by management of leadership style. Whenever aspects related to workplace safety flaws cannot be clarified after investigations, answers are sought in the organisational culture (Vassem *et al. 2*017:720). **It is recommended that mine management develop an organisational culture, which** assigns authority and responsibility to employees and which organises and develops employees with direction provided by the management that determines the type of culture in that mine. Mine workers will take their cue from the attitude and example displayed by management.

The Mine Health and Safety Act (29 of 1996) regulates the management of hazards and their risks as an on-going process in which the mine operator should develop and put into effect control measures to remove or reduce the risks to an acceptable level. More often, employees' perceptions allude that it is the management's role and responsibility to implement control measures. A study conducted by Dinapoli (2010:13) alluded that each employee should understand his or her role in the internal control systems, as well as how their individual activities relate to the work of others in the mine.

Section 4.4.14 related to knowledge and adherence to PPE. Participants (29%; n=57) indicated dissatisfaction on the issue of adherence to PPE. To minimise or reduce the risk of exposure of each activity as highlighted under Regulation 9 of the Mine Health and Safety Act (29 of 1996), **it is recommended that mine manager's enforce the use of protective equipment.** The role of occupational health and hygiene personnel through the sanitary health legislation constitutes a key device for guidance, advice and supervision with regard to activities stipulated in the Regulation 9 for Mine Environmental Engineering and Occupational Hygiene. PPE is meant to protect employees against exposure or use of compressed air; early warning systems; ventilation control devices; working places where work has ceased; occupational hygiene exposures; occupational exposure to health hazards; system of occupational hygiene measurements where mine workers are exposed to airborne pollutants material; thermal and noise stress; exposure to provision of potable and palatable water; provision and maintenance of ablution and change house facilities; and working clothes in the event where the mine worker is not permitted to remove clothes referred to in Regulation 9:2(5)(a) from the mine unless such clothes have been decontaminated and when respiratory protective equipment is applied.

5.5 CONTRIBUTION OF THE STUDY

The findings of the study may assist mining companies, especially coal mining, to understand the factors that motivate organisations to invest in safety. The findings of the study are mostly

important to mine managers and owners as well as the policy makers and government DMRs at large. The findings provides a better understanding on the factors that influence adherence and employee perceptions towards safety control measures in a mining sector. This study will assist mine owners/ managers in decision making, especially on strategies to minimise risk and fatal incidents.

5.6 LIMITATIONS OF THE STUDY

Every part of research is confronted with some limitations and this study is no exception. In addition, it is possible that the study was restricted due to time and sample frame restrictions. Data had to be collected only from a specific coal mine on a day-to-day basis to engage with the mine workers and understand their perceptions with regard to safety control measures. It was not extended to other coal mines and other mining sectors such as platinum or gold. Due to the sample being restricted to a specific mine in the Free State province, South Africa, the broad implications of the findings must be treated with caution. The profile of the mining sector may differ in terms of operating conditions when compared to other provinces of the country. At this stage, it was not possible to compare mine workers from different mining companies because of time constraints and the difficulty in obtaining information on the various categories of the participants in the mine. The third constraint resides on the small eventual sample size used in the study (N=200) as well as the restricted geographic scope, thus making it difficult to generalise the study to other settings beyond as mentioned.

5.7 IMPLICATIONS FOR FUTURE STUDY

An increase of the scope of the study from provincial to countrywide mining at large may be useful for obtaining accurate findings. For the purpose of comparative studies, future studies on the same topic may also be conducted in other mining companies. Since this study used a quantitative approach, other insights may be obtained if future studies make use of the mixed methods, which combine both qualitative and quantitative methods.

Mining is an industry that has always been male-dominated, regardless of geographical location, however, there have been positive steps, which have helped to integrate women into the industry, but females continue to be under-represented. The assessment in Section 4.3.1.1 has revealed a huge imbalance in terms of the gender representation of the participants in the mine, with the female group being only 16.5 percent (n=33) compared to the 83.5 percent (n=167) allocated to their male counterparts. Future research could be conducted either with the majority being females or to test for gender differences with regard to safety in the mine. Even though the study by Martin

(2013:1) has already supported the view that the contribution of women in the mining sector was undervalued and not highly regarded by most male colleagues, tests for gender differences would provide deeper insights on how the same relationships tested in this study are influenced by gender.

To be able to generalise the results across various mining companies, future research should compare mining companies in terms of types of safety control measures and technology used in the mine. Technology may have an impact on employees' perceptions towards safety measures in the mine. A study conducted by Hlatywayo and Nel (2013:2139) discovered that training and competency plays a significant role when it comes to types of safety control measures and technology used in the mine. The assessment in Chapter 4 with regard to change and risk management, as illustrated in Figure 4.13, provides an appetite for further research to be conducted. In general, future research could determine exactly what kind of technology would benefit the mining company most. Further research should examine aspects such as employee/contract mine workers involvement in the implementation of the identified safety critical control measures, its performance criteria for level of assurance and technologies used in the mine to manage risks. Future investigations could focus on the effect of ongoing improvements in incident reporting, monitoring and learning from incident processes in strengthening control management and consequently decreasing the number and severity of the majority of incidents reported.

5.8 CONCLUSION

The number of work-related fatal incidents overshadows the mining sector in South Africa. This investigation has shown that there are a number of important factors driving adherence and perceptions of employees towards safety measures in the mine. The mining companies must continually build and instil a company culture that protects people from harm and improves their health and well-being. Based on the results of this study, it can be concluded that an effective safety leadership at all levels is a vital part of creating a company culture that values safety, employee engagement and consultation. It is also evident that the risk and management of change process is in place. However, employees must be consulted when introducing change with regard to newer technologies, standardisation and simplification of procedures and specifications and review and alignment of training material. The availability of the organisational safety policy, provision of PPE, the rolling out of a standardised contractor management system and safety control measures should be highlighted to ensure safety and prevent accidents, while forming part of the mine workers' development and engagement.

BIBLIOGRAPHY

ABDUL-MUHMIN, A.G. 2016. MKT 345 - Marketing research lecture slides: editing and coding. King Fahd University of Petroleum & Minerals Department of Management & Marketing.

ALVEHUS, J., DONCHEVA, E.A., FLEMING, M., GULDENMUND, F., HABER, S.B., HAFERBURG, M., MANOLOV, M., PACIGA, J., STAPLES, L. & WATTS, G. 2016. OSART: Independent Safety Culture Assessment (ISCA) Guidelines. International atomic agency. Vienna, Austria: IAEA Priced Publishers.

AMPONSAH-TAWIAHA, K., JAINB, A., LEKAC, S., HOLLISC, D. & COXC, T. 2013. Examining psychosocial and physical hazards in the Ghanaian mining industry and their implications for employees' safety experience. *Journal of Safety Research*, 45(10):75-84, February.

ANDRES, L. 2012. Designing and doing survey research. London: Sage publication.

ASFAW, A., MARK, C., & CRYAN, R.P. 2013. Profitability and occupational injuries in U.S underground coal mines. *Journal of Accident Analysis and Prevention*, 50(9):778-786, July.

BABBIE, E. & MOUTON, J. 2003. *The practice of social research*. Cape Town: Oxford University Press.

BABBIE, E. 2010. *The practice of social research*. 12th ed. Belmont: Wadsworth Cengage Learning.

BAJPAYEE, T.S., REHAK, T.R., MOWREY, G.L & INGRAM, D.K. 2004. Blasting injuries in surface mining with emphasis on fly rock and blast area security. *Journal of Safety Research,* 35(11):47-57, July.

BEECH, W. 2014. Challenges faced by the South African exploration and mining industry. Rand Gold Resources. Mining Review Africa. [Online] Available at: https://www.miningreview.com/challenges-faced-by-the-south-african-exploration-and-mining-industry/. Accessed: 15/07/2017.

BERNDT, A. & PETZER, D. 2011. Marketing research. Cape Town: Heinemann.

BLANK, V.L.G., LAFLAMME, L. & ANDERSSON, R. 1997. *The impact of advances in production technology on industrial injuries: a review of the literature*. National Institute of Health, Injury Prevention Programme, Stockholm: Sweden.

BLESS, C. & HIGSON-SMITH, C.H. 2000. Fundamentals of social research methods: *an African perspective*. 3rd ed. Lusaka Zambia: Juta. Typesetting by Zebra Publishers. Cape Town. South Africa.

BOTHA, P. J. A. 2003. Mine Health and Safety Act and Regulations No. 29 of 1996. Pretoria: Van Schaik Publishers.

BOYCE, J. 2002. *Marketing research practice.* Sydney: McGraw-Hill.

BRIJLALL, M & OKHAREDIA, A.A. 2015. An analysis of employee participation in occupational health and safety activities in a cement manufacturing organisation in South Africa. Pretoria. University of South Africa.

BRODY, B., LETOURNEAU, Y. & POIRIER, A. 1990. An Indirect Cost Theory of Work Accident Prevention. *Journal of Occupational Accidents,* 14(13):255-270.

BROWN, K.A., WILLIS, P.G. & PRUSSIA, G. 2000. Predicting safe employee behaviour in the steel industry: development and test of a sociotechnical model. *Journal of Operations Management,* 18(21):445-465, January.

BRYMAN, A. & BELL, E. 2007. *Business research methods.* 2nd ed. Oxford University Press Inc. New York.

BUI, Y.N. 2014. *How to write a master's thesis.* 2nd ed. London: Sage Publications.

BURNS, N. & GROVE, S.K., 1993. *The practice of nursing research: conduct, critique and utilization*. 2nd ed. Philadelphia: Saunders.

CANT, M., GERBER-NEL, C., NEL, N. & KOTZE, T. 2003. Marketing Research. New Africa Books (Pty) Ltd.

CARROLL, C. 2011. The Anglo American safety way - Safety management system standards: Safety and sustainability. London: Carlton House Terrace Publishers. Anglo American plc.

CASEY, T. & KRAUSS, A.D. 2013. The role of effective error management practice in increasing mines' safety performance. *Journal of Safety Research*, 60(11):131-141, July.

CHAMBER OF MINES OF SOUTH AFRICA. 2016. Facts and figures. Johannesburg. Department of Mineral and Resource Publisher. Republic of South Africa.

CHEN, J., MAA, L., WANG, C., ZHANG, H., & HA, M. 2014. Comprehensive evaluation model for coal mine safety based on uncertain random variables. *Journal of Safety Science*, 68(6):146-152, March.

CHIMAMISE, C., GOMBE, N.T., TSHIMANGA, M., CHADAMBUKA, A., SHAMBIRA, G. & CHIMUSORO, A. 2013. Factors associated with severe occupational injuries at mining company in Zimbabwe 2010: Across Sectional Study. *Journal of Pan African Medical*, 14(5):1-5, January.

CHURCHILL, G.A., BROWN, T.J. & SUTER, T.A. 2010. *Basic marketing research.* 7th ed. Cincinati, OH: Thomson Corporation South-Western.

CLOW, K. E. & JAMES, K. E. 2014. Essentials of Marketing Research. Thousand Oaks CA: Sage Publications.

COLEMAN, P.J. & KERKERING, J.C. 2007. Measuring mining safety with injury statistics: lost workdays as indicators of risk. *Journal of Safety Research*, 38(11):523-533, October.

COOPER, D. 2002. Human factors in accidents. *Journal of Health and Safety*, (7):1-7, March.

COOPER, D.R. & SCHINDLER, P. S. 2006. *Business Research Methods.* 9th ed. McGraw-Hill. United State of America.

CROWE, M. & SHEPPARD, L. 2011. Mind mapping research methods. *Journal of Springer Science and Business Media*, 46(10).1494-1504, March.

CUIA, L., FANB, D., FUC, G. & ZHUD, C.J. 2013. An integrative model of organisational safety behaviour. *Journal of Safety Research*, 45(10):37-46, February.

CRESWELL, J.W. 2003. *Research design*: quantitative, qualitative and mixed approaches. London: Sage Publications.

CRIVEANU, M. & TAICU, M. 2013. Visible costs and hidden costs in the banking industry. Annals of the Constantin Brâncuşi University of Târgu Jiu. Romania: Academica BRÂNCUŞI Publishers.

DANIEL, J. 2012. Sampling essentials: Practical guidelines for making sampling choices. Thousand Oaks CA: Sage.

DE VOS, A. S., STRYDOM, H., FOUCHE, C. B. & DELPORT, C. S. L. 2009. *Research at grass roots for the social sciences and human service professions*. 3rd ed. Pretoria: Van Schaik Publishers.

DEPARTMENT OF MINERAL RESOURCES (DMR). 2012. Annual report - 2012/2013 of the Department of Mineral Resources (DMR): Regional monthly newsletter: Mpumalanga - Mine Health & Safety Inspectorate. Department of Mineral Resources Publishers. Sunnyside. Pretoria.

DINAPOLI, T.P. 2010. Management's responsibility for internal controls. Local Government Management Guide. Division of local government and school accountability. Albany: Binghamton Publishers. New York

EDELEN, R., EVANS, R. & KADLEC, G. 2013. Shedding light on "invisible" costs: Trading costs and mutual fund performance. *Journal of Financial Analysis,* (29): 1-29, February 2013.

EHSANI, J.P., McNEILLY, B., IBRAHIM, J.E., & OZANNE-SMITH, J. 2013. Work-related injury among young persons in Australia, July 2000-June 2007. *Journal of Safety Science,* 57(5): 14-18, January.

EISENBACH, T.M. & SCHMALZ, M.C. 2015. Anxiety, overconfidence, and excessive risk-taking. New York: Federal Reserve Bank of New York Publishers.

ERDOGAN, H.H., UNVER, G.D., KARPUZ, C., DUZGUN, S.H. & KESTEL. 2016. A quantitative risk assessment methodology for occupational accidents in underground coal mines: A case study of Turkish Hard coal enterprises. Middle East Technical University.

EVERSON, M.E.A., SOSKE, S.E., MARTENS, F.J., BESTON, C.M., HARRIS, C.E., GARCIA, J.A., JOURDAN, C.I., POSKLENSKY, J.A. &PERRAGLIA, S.J. 2013. Internal control — integrated framework: Executive summary. American Institute of Certified Public Accountants. AICPA Publishers. Asian.

FEINBERG, F.M., KINNEAR, T.C. & TAYLOR, J.R. 2013. *Modern marketing research concepts, methods and cases*. 2nd ed. Canada: Cengage Learning. Library of Congress Cengage Publishes. United States.

FENG, Y., TEO, E.A.L., LING, F.Y.Y., & LOW, S.P. 2013. Exploring the interactive effects of safety investments, safety culture and project hazard on safety performance: An empirical analysis. *Journal of Project Management,* (12):1-12, October.

FERNANDEZ-MUNIZ, B., MONTES-PEON, J.M., & VAZQUEZ-ORDAS, C.J. 2009. Relation between occupational safety management and firm performance. *Journal of Safety Science,* 47(12):980-991, October.

FERNANDEZ-MUNIZ, B., MONTES-PEON, J.M., & VAZQUEZ-ORDAS, C.J. 2011. Safety climate in OHSAS 18001-certified organisation: Antecedents and consequences of safety behaviour. *Journal of Accidents and Prevention,* 45(14):745-758, October.

FLIN, R., MEARNS, K., O'CONNOR, P. & BRYDEN, R. 1998. Measuring safety climate: Identifying the common features. *Journal of Safety Science,* 34 (2000):177-192.

FOTTA, B. & BOCKOSH, G.R 2001.The aging workforce: An emerging issue in the mining industry. National Institute for Occupational Safety and Health. *Journal of Health & Human Service,* (13):1-13, January 2001.

FRANCIS, B. 1989. *Theory and practice*. London: Paul Chapman Sage Publishers.

FRAZIER, C.B., LUDWIG, T.D., WHITAKER, B. & ROBERTS, D.S. 2012. A hierarchical factor analysis of a safety culture survey. *Journal of Safety Research,* 45(14):15-28, December.

GAITHER, N. & FRAZIER, G. 2002. *Operations management*. Cincinnati Ohio: South Western Library of Congress Publication.

GARBACCIO, J.L. & DE OLIVEIRA, A.C. 2014. Adherence and knowledge about the use of personal protective equipment among manicurists. *Journal of Research,* 68(7):46-53, January.

GELDART, S SMITH, C, A. SHANON, H. S. & LOHFELD, L. 2010. Organizational practices and workplace health and safety: A cross-sectional study in manufacturing companies: Safety Science. (44):123-134. [Online]. Available at: < www.elsevier.com/locate/ssci. Accessed: 23/09/2012.

GILLHAM, B. 2000. Developing a questionnaire. London: Continuum Publishers.

GODDARD, W. & MELVILLE, S. 2009. *Research methodology: an introduction*. 2nd ed. Lausdowne: Juta.

GOMWE, G. 2013. *Statement of the Chief Executive Officer, Godfrey Gomwe, Inauguration speech*: CEO of the Anglo American Thermal Coal South Africa, Newsletter and Publications, 13 March 2013.

GURSOYA, D.G., CHIB, C.G. & KARADAGC, E. 2013. Generational differences in work values and attitudes among frontline and service contact employees. *Journal of Hospitality Management,* 32(9):40-48.

GYEKYE, S.A. 2006. Workers' perceptions of workplace safety: An African perspective. *Journal of International Occupational Safety and Ergonomics (JOSE),* (12):31-42.

HEA, A., Xub, S. & FUA, G. 2012. International symposium on safety science and engineering in China, 2012 (ISSUE-2012): Study on the basic problems of safety culture. *Journal of Procedia Engineering,* 43(5):245-249.

HEBBLEWHITE, B. 2009. Mine safety – through appropriate combination of technology and management practice. *Journal of Procedia Earth and Planetary Science,* 1:13-19.

HERMANUS, M.A. 2007. Occupational health and safety in mining – status, new developments, and concerns. *Journal of the Southern African Institute of Mining and Metallurgy,* 107:531-538.

HINE, D.W., LEWKO, J. & BLANCO, J. 1999. Alignment to workplace safety principles: An application to mining. *Journal of Safety Research,* 30(13):173-185.

HLATYWAYO, C.K. & NEL, A. 2013. Employer and employees' perceptions on implementation of health and safety regulations in the platinum mining sector of South Africa. *African Journal of Business Management,* 7(8):2142-2142, June.

HOPKINS, A. 2011. Management walk-around: Lessons from the Gulf of Mexico Oil Well Blowout. The Australian National University.

HUNA, B., BEN, E. & MAMPURU, B. 2013. Wholesale and guide to health and safety in industry. RSA: Department of Labour Publishers.

ISMAIL, Z. DOODSTDAR, S. & HARUN, Z. 2012. Factors influencing the implementation of a safety management systems for construction sites. *Journal of Safety Science,* (50):418-423. [Online]. Available at: hhtp>www.elsevier.com. Accessed: 15/03/2017.

JALLON, R., IMBEAU, D, & De MERCELLIS-WARIN, N. 2011. Development of an incident-cost calculation model suitable for workplace use. *Journal of Safety Research,* 42(16):149-164, July.

KAIHUANA, Z. & FUCHUANA, J. 2012. International symposium on safety science and engineering in China, 2012 (ISSU-2012): Research on intrinsic safety method for open-pit mining. *Journal of Procedia Engineering,* 43(6):453-458.

KALLA, S. 2011. Statistical Analysis. *Journal of Psychology Experiments,* (50): 1-50, April.

KRAMER, W. 2013. The battle between production & safety: Safety in the modern do-more-with-less economy. *Journal of Professional Safety Article,* (2):14-15, June 2013.

KECOJEVIC, V., KOMLJENOVIC, D., GROVES, W. & RADOMSKY, M. 2007. An analysis of equipment-related fatal accidents in U.S. Mining operations: 1995-2005. *Journal of Safety Science,* 45(11):864-874, August.

KHAN, Z.A., 2005. MBA III research methodology - Course instructor. *Journal of Comsats Institute of Information Technology,* (72): 1-72, August.

KHOZA, N. 2015. Women's career advancement in the South African mining industry: Exploring the experiences of women in management positions at Lonmin Platinum Mine. University of KwaZulu-Natal.

KOMLJENOVIC, D., GROVES, W.A. & KECOJEVIC, V.J. 2008. Injuries in U.S. mining operations – A preliminary risk analysis. *Journal of Safety Science,* 46(10):792-801, January.

KOTHARI, C.R. 2008. *Research methodology: methods and techniques.* Delhi: New Age International.

KRUGER, D., DE WIT, P. & RAMDASS, K. 2005. *Operations and management.* Cape Town: Oxford University Press.

KUMAR, R. 2011. *Research methodology*. 3rd ed. City Road London: Saga Production.

KUMBA IRON ORE LIMITED. 2016. Sustainability Report 2016. People: ensuring a safe workplace. *Journal of Safety Research,* (7):29-35. [Online] Available at: file:///C:/Users/modibat1/Desktop/RESEARCH.2017/articles/turbo%20work%20progress/ensuring-a-safe-workplace.pdf. 06/12/2017.

LAURENCE, D. 2004. Safety rules and regulations on mine sites – the problem and a solution. *Journal of Safety Research,* 36(12):39-50, November.

LEEDY, P.D. 1989. *Practical research planning and design*. 4th ed. New York: Collier MacMillan Publishers.

LEEDY, P, D. & ORMROD, J, E. 2010. *Practical research planning and design.* 9th ed. New Jersey: Pearson Education.

LENNE, M.G., SALMON, P.M., LIU, C.C. & TROTTER, M. 2011. System approach to accident causation in mining: An application of the HFACS method. *Journal of Accident Analysis and Prevention,* 48(7):111-117, May.

LIRONG, W., ZHONGAN, J., WEIMIN, C., XIUWEI, Z., DAWEI, L. & YUJING, Y. 2011. Major accidents and prevention of coal mines China from the Year of 1949 to 2009. *Journal of Mining Science and Technology,* 21(8):693-699, November.

LOCKYER, S., MICHAEL, S., LEWIS, B., ALAN, B. & TIMOTHY, F.L. 2004. *Coding qualitative data*: In the Sage encyclopedia of social science research methods, 2nd ed. Thousand Oaks, Califonia: Sage Publication.

LU, H. & CHEN, C. 2015. Does a people-oriented safety culture strengthen miners' rule-following behavior? The role of mine supplies-miners' needs congruence. *Journal of Safety Science,* 76(11):121-132, February.

MAITI, J. 2010. Development of work system safety capability index (WSCI). *Journal of Safety Science,* 48(11):1369-1379, May.

MAKELA, H. 2013. On the ideology role of employee reporting. *Journal of Critical Perspectives on Accounting,* 24(19):360-378, November.

MALHOTRA, N.K. & BIRKS, D.F. 2007. *Marketing research.* 3rd ed. Pearson Education. Sydney Tokyo.

MAREE, K. 2012. *First steps in research*. Pretoria: Van Schaik Publishers.

MARTIN, P.G. 2013. *The experiences of women in male-dominated professions and environments in South Africa*. Pretoria: University of South Africa.

MARTINS, L.M., LOUBSER, M. & VAN WYK, H.D.J. 1996. *Marketing research: a South African approach*. Pretoria: UNISA Press.

MANOHARAN, P. K. 2010. Research methodology. New Delhi: A P H Publishing Corporation

MANUELE, F.A. 2011. Reviewing Heinrich dislodging two myths from the practice of safety. *Journal of Professional Safety and Development,* (10):52-61, October.

MASIA, U. & PIENAAR, J. 2011. Unravelling safety compliance in the mining industry: examining the role of work stress, job insecurity, satisfaction and commitment as antecedents. *Journal of Industrial Psychology,* 37(10):1-10, November.

McDANIEL, C. & GATES, R. 2002 *Marketing research: the impact of the internet*. 5th ed. Cincinnati: Thomson Learning.

MEDICAL RESEARCH COUNCIL (MRC). 2016. Best practice guidance on the reporting and investigation of accidents and incidents. Best practice guidance version 2. London: Rose Court & Southwark Bridge Publishers.

MINE HEALTH AND SAFETY INSPECTORATE. 2013. Regional Newsletter - North West (Rustenburg) Region. Republic of South Africa: Department of Mineral Resources Publishers.

MLAMBO, L. & MASIYA T.T. 2012. The pattern of mining injuries in Zimbabwe (2000-2002) and their impact on production: A statistical approach. *Journal of Business and Finance Proceedings,* 7(5):133-137.

MOJAPELO, J., MAFINI, C. & DHURUP, M. 2016. Employee perceptions of occupational health and safety standards in the steel industry. *Journal of International Social Sciences and Humanity Studies,* (15):106-121.

MORRISON, M. 2017. Internal and external factors that impact the employment relationship. [Online] Available at: https://rapidbi.com/internal-and-external-factors-that-impact-the-employment-relationship/. Accessed: 15/07/2017.

MUSTAFA, A. 2010. Research methodology. New Delhi: AITBS Publishers.

NOSA. 2015. National Occupational Safety Association - HSE qualifying criteria and classification of incidents. Published by NOSA (PTY) LTD. South Africa. [Online] Available at: www.nosa.co.za. Accessed: 18/07/2017.

NOGXINA, S. 2009/2010: Department of Minerals and Energy Annual Report. RP69/2010 ISBN: 978-0-621-39345-3. Pretoria: The DME DMR Republic of South Africa Publishers.

ONDER, S. 2013. Evaluation of occupational injuries with lost days among opencast coal mine workers through logistic regression models. *Journal of Safety Science,* 59(7): 86-92, May.

OMAIR, A. 2018. Sample size estimation and sampling techniques for selecting a representative sample. *Journal of Health Specialties,* 2(5):142-147, October.

PAGE, K. 2009. Blood on the coal: the effect of organisational size and differentiation on coal mine accidents. *Journal of Safety Research,* 40(11):85-95, March.

PALLANT, J. 2013. SPSS Survival Manual: *A step by step guide to data analysis using IBM SPSS.* 5th ed. Chicago, Illinois: SPSS.

PAUL, P.S. & MAITI, J. 2007. The role of behavioural factors on safety management in underground mines. *Journal of Safety Science,* 45(23):449-471.

PIJOOE, I. 2018. Sibanye-Stillwater CEO 'Traumatised' by surge in mine deaths. [Online]. Available at: https://m.news24.com/SouthAfrica/News/sibanye-stillwater-ceo-traumatised-by-surge-in-mine-deaths-20180702. Accessed: 13/10/2018.

POLET, P., VANDERHAEGEN, F. & WIERINGA, P.A. 2002. Theory of safety related violations of system barriers. *Journal of Cognition, Technology & Work,* 4(9):171-179.

POLIT, D.F. & HUNGLER, B.P. 1993. *Nursing research: principles and methods.* 3rd ed. Philladelphia: Lippincott.

POPLIN, G.S., MILLER, H.B., MOORE, J.R., BOFINGER, C.M., SPENCER, M.K., HARRIS R.B. & BURGESS, J.L. 2008. International evaluation of injury rates in coal mining: a comparison of risk and compliance based regulatory approaches. *Journal Safety Science,* 46(9):1196-1204, June.

PRESSER, S. ROTHGEB, J. M. COUPER, M. P. LESSLER, J. T. MARTIN, E. MARTIN, J. & SINGER, E. 2004. Methods for testing and evaluating survey questionnaires. New Jersey: Wiley.

PROBST, T.M. & GRASO, M. 2013. Pressure to produce = pressure to reduce accident reporting? *Journal of Accident Analysis and Prevention,* 59(8):580-587, July.

PYOOS, H.D.J. 2008. The impact of organisational culture on safety management in a South African thermal coal mining operation. Gordon Institute of Business Science. Pretoria: University of Pretoria.

QUINLAN, C. 2011. *Business research methods.* United Kingdom: South-Western Cengage Learning.

RABALE, E., DHURUP, M. & SURUJLAL, J. 2011. Sponsorship effectiveness: Consumer recall, recognition and perceptions of official sponsorship and ambush marketing in the 2010 FIFA World Cop. Vaal University of Technology.

REPUBLIC OF SOUTH AFRICA. 1997. Basic Conditions of Employment Act, No. 75 of 1997. Pretoria: Government Printer.

REPUBLIC OF SOUTH AFRICA. 1996. Constitution of South Africa, Pretoria: Government Printer.

REPUBLIC OF SOUTH AFRICA. 1995. Labour Relations Act, No. 66 of 1995. Pretoria: Government Printer.

REPUBLIC OF SOUTH AFRICA. 1996. Mine Health and Safety Act No. 29 of 1996, No. 29 of 1996. Pretoria: Government Printer.

REPUBLIC OF SOUTH AFRICA. 2009. Mine Health and Safety Act, No. 29 of 1996 Amendment. Pretoria: Government Printer.

REPUBLIC OF SOUTH AFRICA. 1973. The Mines and Works Act No. 27 of 1956. Union Gazette Extraordinary, 4th May, 1956. Printed in the Union of South Africa by Cape Times Limited, Parow. [Online] Available at: https://www.gov.za/sites/default/files/Act%2027%20of%201956_0.pdf. Accessed: 15/07/2016.

REPUBLIC OF SOUTH AFRICA. 1973. Occupational Diseases in Mines and Works Act No. 78 of 1973. Government Gazette, No. 1170, 6th July. Cape Town. [Online] Available at: https://www.gov.za/sites/default/files/Act%2078%20of%201973s.pdf. Accessed: 20/10/2016.

REPUBLIC OF SOUTH AFRICA. 1993. Occupational Health and Safety Act, No. 85 of 1993. Pretoria: Government Printer.

REUVID, J. 2013. *Managing business risk: a practical guide to protecting your business*. 9th ed. UK: Kogan Page.

SABET, P.G.P., AADAL, H., JAMSHIDI, M.H.M. & RAD, K.G. 2013. Application of Domino Theory to Justify and Prevent Accident Occurance in Construction Sites. *Journal of Mechanical and Civil Engineering*, (5):72-76, March.

MINERALS COUNCIL OF AUSTRALIA MINING INDUSTRY. 2000. Safety & Health Performance Report. 1999-2000. Northbourne Ave. Braddon Act 2612.

SAFETY INSTITUTE OF AUSTRALIA. 2012. Core body of knowledge for the generalist OSH Professionals: Models of Causation Safety. *Journal of OSH Body of Knowledge,* (34):1-35, April.

SAMOSAMO, M., MARAIS, C. & DR JOUBERT, P. 2014. Employee perceptions of the effectiveness of health and safety induction at ArcelorMittal, Vanderbijlpark, South Africa. *Journal of Mediterranean Social Sciences,* (8):412-420, November 2014.

SANMIQUEL, L., FREIJO, M., EDO, J. & ROSSELL, J.M. 2010. Analysis of work related accidents in the Spanish mining sector from 1982-2006. *Journal of Research,* 41(7):1-7, January.

SCHULTZ, D.P & SCHULTZ, S.E. 2006. *Psychology & work today.* 9th ed. New Jersey: Pearson Prentice Hall.

SON, K.S., MELCHERS, R.E., & KAL, W.M. 2000. An analysis of safety control effectiveness. *Journal of Reliability Engineering & System Safety,* 68(8):187-194, January.

SMALLWOOD, J., HAUPT, T. & SHAKANTU, W. 2017. Construction health and safety in South Africa. Construction research education & training enterprises. Commissioned by CIDB Publishers.

Statistics Solutions. 2013. ANOVA: Advancement through clarity. [Online]: Available at: http://www.statisticssolutions.com/academic-solutions/resources/directory-of-statisticalanalyses/anova/. Accessed: 11/10/2018.

STEVENSON, W.J. 2005. *Operations management*. 8th ed. New York: McGraw-Hill Library of Congress Publishers.

STEVENSON, W.J. 2012. *Operations management.* 11th ed. New York: McGraw-Hill Library of Congress Publishers.

STOJADINOVIC, S., SVRKOTA, I., PETROVIC, D., DENIC, M., PANTOVIC, R., & MILIC, V. 2011. Mining injuries Serbian underground coal mines – a 10 year study. *Journal of Injury,* 43(5):2001-2005, August.

SHIU, E., HAIR, J, BUSH, R. & ORTINAU, D. 2009. *Marketing research.* New York, NY: McGraw-Hill.

SWARTS, K.J. 2006. *Management of human resource development by heads of department in primary schooling the Free State*. Bloemfontein: University of the Orange Free State.

SWUSTE, P., VAN GULIJK, C. & ZWAARD, W. 2010: Safety metaphors and theories, a review of the occupational safety literature of the US, UK, and The Netherlands, till the first part of the 20th century. *Journal of Safety Science,* 48(19): 1000-1018.

TAN, H., WANG H., CHEN, L., & REN, H. 2012. Empirical analysis on contribution share of safety investment to economic growth: a case study of Chinese mining industry. *Journal of Safety Science,* 50(7):1472-1479, January.

TERRELL, M. 2014. Passages Post. NYC Department of Education. *Journal of Passages Academy,* (11):1-11, October.

TUCHTEN, G. 2011. Concept development for facilitating the health and safety efficacy of South African mine workers. Pretoria: University of Pretoria.

TUSTIN, D. H. LIGTHELM, A. A. MARTINS, J. H. & VAN WYK, H. D. J. 2005. Marketing research in practice. Pretoria: Unisa Press.

VALSAMAKIS, A., VIVIAN, R.W. & DU TOIT, G.S. 2003. *Risk management.* 2nd ed. Sandton: Heinemann Higher and Further Education.

VASSEM, A.S., FORTUNATO, G., BASTOS, S.A.P. & BALASSIANO, M. 2017. Factors that make up safety culture: a look at mining industry Fatores constituintes da cultura de segurança: olhar sobre a indústria de mineração. *Journal of Business Finance and Economy,* (12):719-730, July.

VAN DEN BERG, L.R. 2014. Leaning from incidents: Immediate actions and incident investigation. Anglo American field reference guide.

VAN RENSBURG, N.J., BARKHUIZEN, E.N. & STANZ, K.J. 2012. Exploring the safe human mind-set of production leaders of a Platinum Mine. Johannesburg: University of Johannesburg.

WELMAN, C., KRUGER, F. & MITCHELL, B. 2007. *Research methodology.* 3rd ed. Cape Town: Oxford University Press.

WELMAN, C., KRUGER, F. & MITCHELL, B. 2009. *Research methodology*. 3rd ed. Cape Town; Oxford: Oxford University Press.

WILLEMSE, I. 2009. Statistical Methods and Calculation Skills. 3rd Ed. Cape Town: Juta.

YIN, R.K. 2014. *Case study: design and methods.* 5th ed. London: Sage Publications.

ZACHARATOS, A. & BARLING, J. 2005. High-performance work system and occupational safety. *Journal of Applied Psychology,* 90(17):77-93.

ZIKMUND, W.G. 1999. Essentials of marketing research. Forth Worth: Dryden Press.

ZIKMUND, W.G. 2003. *Business research methods.* 7th ed. Ohio: Thompson Learning-South-Western.

ZIKMUND, W.G. & BABIN, B.J, 2000. *Exploring marketing research*. 7th ed. Fort Worth: Dryden Press.

ZIKMUND, W.G., BABIN, B.J, CURR J.C & GRIFFIN, M. 2010. *Business research methods.* 8th ed. Canada: Nelson Education.

ANNEXURE A

PRESENTATION OF QUESTIONNAIRE

FACTORS INFLUENCING ADHERENCE AND EMPLOYEE PERCEPTIONS TOWARDS SAFETY CONTROLS IN A MINING COMPANY

Dear Sir/Madam

I am a master's degree student at the Vaal University of Technology. This questionnaire seeks to establish factors influencing adherence of workers to safety measures at the mine. I, am therefore requesting you to complete the questionnaire below. The reseach is purely for academic purposes and all information will be kept confidential. It will take approximately 15 minutes of your time to complete responding to the items in the questionnaire.

Researcher: Modiba Thani Malcolm

Email address: nnalemi@gmail.com

2018/02/20 Physical address: 19824 Zone 14 Sebokeng

Cell phone number: 063 251 8136/084 868 3040

SECTION A: DEMOGRAPHIC PROFILE

Please answer each question by circling the appropriate shaded box that describes your personal circumstances.

A1	Gender	Male	Female

A2	Age category			
	Between 18-29 years	Between 30-40 years	Between 41-50 years	Over 51 years

A3	Occupation				
	Engineering	Supervisor/ Foreman	Operators	Contractors	Other (Specify) ……

A4	Length of service in the current organisation					
	Between 1-5 years	Between 6-10 years	Between 11-15 years	Between 16-20 years	Between 21-30 years	31 years and above

A5	Qualification				
	Primary school	Grade 12/Matric	University	FET College	Other (Specify) ……

SECTION B: FACTORS INFLUENCING YOUR ADHERENCE TO SAFETY MEASURES

We would like to find out a little more about the factors that influence your adherence to safety control measures in the mine. Please indicate the extent to which you agree or disagree by circling the corresponding number between **1 (Strongly disagree) and 5 (Strongly agree);** 3 Moderate agreement.

B1	I have seen others take short cuts or cause damage that had the potential of production loss.	Strongly disagree	1	2	3	4	5	Strongly agree
B2	Employees are not penalised for damages reported through incident reports.	Strongly disagree	1	2	3	4	5	Strongly agree
B3	It is easy for employees to ask questions when there is something that they do not understand.	Strongly disagree	1	2	3	4	5	Strongly agree
B4	Stress from personal problems does not adversely affect my performance at work influencing productivity.	Strongly disagree	1	2	3	4	5	Strongly agree
B5	I know the proper channels to direct questions regarding safety in the workplace.	Strongly disagree	1	2	3	4	5	Strongly agree
B6	I believe a disciplinary hearing should be taken against those employees who deviate from the safety measures.	Strongly disagree	1	2	3	4	5	Strongly agree
B7	Employee safety input is well received and acted upon, in this mining operation.	Strongly disagree	1	2	3	4	5	Strongly agree
B8	An occupational health practitioner at the mine clinic has certified that I am medically fit for this job.	Strongly disagree	1	2	3	4	5	Strongly agree

B9	I have been previously injured at work and have been booked off duty by the mine occupational health practitioner, as a result affect operations.	Strongly disagree	1	2	3	4	5	Strongly agree
B10	I am able to carry on with my work normally even when I am tired / fatigued.	Strongly disagree	1	2	3	4	5	Strongly agree
B11	An accident can disrupt workplace equilibrium and can impact productivity by causing work shutdowns, overtime, production delays, etc.**).**	Strongly disagree	1	2	3	4	5	Strongly agree
B12	I know when our next safety milestone/target is for LTI Free-days (Lost Time Injury Free-days) count down	Strongly disagree	1	2	3	4	5	Strongly agree
B13	I am encouraged by my co-workers to report any safety concerns that I may have.	Strongly disagree	1	2	3	4	5	Strongly agree
B14	Employees frequently disregard safety rules in the workplace.	Strongly disagree	1	2	3	4	5	Strongly agree
B15	I know and understand the aim of risk and change management procedure	Strongly disagree	1	2	3	4	5	Strongly agree
B16	Management does not knowingly compromise the safety of employees.	Strongly disagree	1	2	3	4	5	Strongly agree
B17	I know and understand the aim of Sections 22 and 23 of the Mine Health and Safety Act no.29 of 1996.	Strongly disagree	1	2	3	4	5	Strongly agree
B18	There is widespread adherence to safety control measures and evidence-based criteria in the mine.	Strongly disagree	1	2	3	4	5	Strongly agree
B19	The application of Section 54 of the Mine Health and Safety Act no. 29 of 1996 in mine operations increases the level of productivity of the mine.	Strongly disagree	1	2	3	4	5	Strongly agree
B20	I always get involved in a risk assessment.	Strongly disagree	1	2	3	4	5	Strongly agree
B21	After planned task observation, the supervisor/foreman always discuss the outcome of the observation results with me	Strongly disagree	1	2	3	4	5	Strongly agree
B22	Safety procedures and instructions are adhered to	Strongly disagree	1	2	3	4	5	Strongly agree
B23	I usually wear my personal protective equipment that are provided by the employer.	Strongly disagree	1	2	3	4	5	Strongly agree

SECTION C: PERCEPTIONS AND ATTITUDES TOWARDS SAFETY CONTROLS

We would like to find out a little more about your perceptions and attitude towards adherence to the safety control measures in the mine. Please indicate the extent to which you agree or disagree by circling the corresponding number between **1 (Strongly disagree) and 5 (Strongly agree);** 3 Moderate agreement.

C1	It is easy for employees to ask questions when there is something that they do not understand.	Strongly disagree	1	2	3	4	5	Strongly agree
C2	I have the support that I need from the supervisors/foremen regarding safety.	Strongly disagree	1	2	3	4	5	Strongly agree
C3	Work conditions here are favourable and conducive to safe work performance.	Strongly disagree	1	2	3	4	5	Strongly agree
C4	When I perceive a problem in the workplace I find it difficult to report.	Strongly disagree	1	2	3	4	5	Strongly agree
C5	Working in this mine is like being part of a large family.	Strongly disagree	1	2	3	4	5	Strongly agree
C6	The mine management encourages teamwork and cooperation among its employees.	Strongly disagree	1	2	3	4	5	Strongly agree

C7	My suggestions about safety are acted upon when I raise them with management.	Strongly disagree	1	2	3	4	5	Strongly agree
C8	We have a copy of the OHSA on the employer premises	Strongly disagree	1	2	3	4	5	Strongly agree
C9	I know my rights as an employee when it comes to safety	Strongly disagree	1	2	3	4	5	Strongly agree
C10	We are provided with the necessary skills as employees in the organisation to perform our work safely	Strongly disagree	1	2	3	4	5	Strongly agree
C11	I usually follow safety procedures at work	Strongly disagree	1	2	3	4	5	Strongly agree
C12	We have a safety representative in my workplace	Strongly disagree	1	2	3	4	5	Strongly agree
C13	Safety meetings are held regularly with employees	Strongly disagree	1	2	3	4	5	Strongly agree
C14	Safety awareness campaigns are held on a regular basis	Strongly disagree	1	2	3	4	5	Strongly agree
C15	I usually follow safety procedures when doing my job	Strongly disagree	1	2	3	4	5	Strongly agree
C16	As an employee I am fully aware of hazards in my daily job	Strongly disagree	1	2	3	4	5	Strongly agree
C17	Every employee is responsible for their own safety in the organisation	Strongly disagree	1	2	3	4	5	Strongly agree
C18	I receive appropriate feedback about safety performance.	Strongly disagree	1	2	3	4	5	Strongly agree
C19	The culture in this mine makes it easy to learn from the mistakes of others.	Strongly disagree	1	2	3	4	5	Strongly agree
C20	Important issues are well communicated at shift changes.	Strongly disagree	1	2	3	4	5	Strongly agree
C21	Leadership is encouraging us to be a safety-centred mining operation	Strongly disagree	1	2	3	4	5	Strongly agree
C22	My employer usually protects employees against risks	Strongly disagree	1	2	3	4	5	Strongly agree
C23	My employer usually informs me to take precautions to protect myself when I perform my duties	Strongly disagree	1	2	3	4	5	Strongly agree
C24	My employer enforces safety rules at all times	Strongly disagree	1	2	3	4	5	Strongly agree
C25	My employer cares about my well-being and safety at work.	Strongly disagree	1	2	3	4	5	Strongly agree

Thank for your time and cooperation. This survey is for the purpose of improving your safety in the workplace and the report will be made available when finalised. Your responses are completely confidential.

ANNEXURE B

SAMPLE POPULATION ENDORSEMENT

To : To Whom It May Concern
From : Sasol Mining Human Resources: Sigma Colliery
Date : 16 May 2018
Subject : Employer confirmation of total employees

I/We, the undersigned:	EB Scholtz
Full Names	Edwina Barbara Scholtz
Control Number	40148
On behalf of	
Name of Business	Sasol Mining Sigma Colliery
Registration no.	ZA98
Business Address	Sigma – Monikraal Shaft Wolwehoek 1949

Hereby confirms that, as at 16 May 2018, Sigma Colliery has approximately 514 permanent employees and 370 service providers on site

Signature: Date: 16.05..2018

Authorised representative: MRS EB SCHOLTZ (HRC)
Tel: 016 970 6201
Email: Edwina.scholtz2@sasol.com

Date: 16.05.2018

ANNEXURE C

NRF LITERATURE SEARCH ENDORSEMENT

Vaal University of Technology

Your world to a better future

VUT

To whom it may concern

This letter serves to inform, that a thorough literature search has been performed for: *Thami Malcolm Modiba, 20135556.* On the topic:

Factors influencing adherence and employee perceptions towards safety controls in a mining company.

The search has been carried out on *17 May 2018* by *Ms. Rebecca Fani* (Employed in the Gold Fields Library)

Per my knowledge, there is currently no indication of this research being carried out before.

Regards

Telephone: 016 950-6627

e-mail:rebeccaf@vut.ac.za

Fax to email: 086 614 1300

Private Bag X021 - Vanderbijlpark - 1911 - Andries Potgieter Blvd
South Africa - Tel: +27 16 950 9000 - Fax: +27 16 950 9999 - www.vut.ac.za

ANNEXURE D

UNIVERSITY PERMISSION LETTER TO CONDUCT RESEARCH

VAAL UNIVERSITY OF TECHNOLOGY

FACULTY OF MANAGEMENT SCIENCES

Permission to conduct research

Permission is hereby requested to conduct research at your organisation. Details of the researcher and research project are as follows:

Research/Student: TM Modiba

Propose of Research: Factors influencing adherence and employee perceptions towards safety controls in a mining company

Procedure to be followed: Respondents/participants at your organisation will be requested to complete a questionnaire independently and honesty within the allocated timeframe. By completing the questionnaire it is assumed that the respondent/participant is aware of the study and has given consent to participate in the study

Risk Involved: The risk involved in participating in this research is minimal. If any of the questions are found embarrassing, offensive nature, the respondent may choose not to answer them. However, the answers to the questionnaires are confidential (see confidential section)

Benefit Involved: The information that is obtained from the study will be used for academic purposes only. It is expected to continue to the body of knowledge and create opportunities for further research.

Confidentiality: Questionnaires are completed anonymously, and the researcher and his/her statistician are the only persons who will see the results of the questionnaires. The researcher will not have knowledge of which scores belong to which person as aggregate scores will be analysed. The data from this study will be presented in the dissertation/thesis. However, at no time will the name of the organisation, respondent or any identifying information be reported in the presentation of this research unless permission is obtained in writing to do so.

Participants Withdrawal: Participation in this study is completely voluntary and participants are free to withdraw or terminate at any time.

Contact Person: Prof Roy Dhurup Executive Dean – Tel: +27 16 950 6886

Signature and Acknowledgement: My signature below indicates that I have read the above information gathered from these questionnaires will be used for the purpose of research only. In acknowledge having received a copy of this agreement.

Executive Dean: M. DHURUP

Signature:

Company Stamp is available:

Vaal University Of Technology
Office of the Executive Dean
Faculty of the Management Sciences
Private Bag X021
VANDERBIJLPARK
1900
Tel: 016 950 9500

ANNEXURE E

LETTER FROM THE MINE TO CONDUCT RESEARCH

RESEARCH LETTER OF PERMISSION TO CONDUCT ACADEMIC SURVEY

To whom it may concern;

Date: 12 April 2018

With compliance to the company confidential policies and procedure, and the university research ethics, Sasolburg Sasol Mining has agreed to award Mr T.M Modiba ID no. 760601 5 709 087 to conduct on site, his academic research project for the proposed study.

Please be advised that, the company has a right to request and review the progress of this research project when need be.

Failure to abide by the company rules, ethics, policies and or procedures may result in termination of the proposed research project.

This research project will be piloted on the interest of the said individual only and shall not form part of his existing job contract agreement signed between Sasol and the said individual. Good luck

Mr Eric Zwane — Date: 12/04/18

(Mine Manager, Sigma – Sasol Mining: Sasolburg)

I hereby acknowledge the above condition of the letter and confirm that I understand and shall fully comply with the mine requirements in the fulfillment of the proposed study.

Mr Themi Malcolm Modiba — Date: 12-04-2018

(Research Student – Vaal University of Technology

Co-signature: _____ Date: 12/04/2018

Ms Lizbé Fourie: Line Supervisor (Senior Manager: GAR)

ANNEXURE F

GOLD FIELDS LIBRARY ENDORSEMENT

Vaal University of Technology

GOLD FIELDS LIBRARY

To : Executive Director: Library and Information Services
Unisa

Date : 03 February 2014

Request for special borrowers privileges

Mr. Thami Malcolm Modiba is a registered (M Tech: Business Administration) student number: **2013556** at the Vaal University of Technology for the year **2014**.

Please grant him special borrower's privileges as per agreement. The person undertakes to adhere to the rules of your Library.

Thank you for your kind cooperation.

Sincerely

(Mrs) N Roberts
Executive Director: Library & Information Services

Private Bag X021, Andries Potgieter Boulevard, Vanderbijlpark, 1900, South Africa, Tel: 27 16 950 9000, Fax: 27 16 950 9999, Website: www.vut.ac.za