

**THE IMPACT OF TRANSFORMATIONAL LEADERSHIP ON  
THE DELIVERY OF SAFETY AND PRODUCTIVITY  
EXCELLENCE AT IMPALA PLATINUM**

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## **DECLARATION**

I declare that “The Impact of Transformational Leadership on the Delivery of Safety and Productivity Excellence at Impala Platinum” is my own work. All the sources used or quoted have been indicated and acknowledged by means of complete references.

Patrick Francis O’Toole .....

Date .....

## **DEDICATION**

This work is dedicated to the following late family members; father John, mother Nora, and son Seán.

## **ACKNOWLEDGEMENTS**

I wish to thank my promoter Professor Okharedia and co-promoter Professor Serumaga-Zake for their invaluable help and guidance during the process of completing the Doctor of Business Leadership (DBL) degree. I would also like to thank the faculty of the Graduate School of Business Leadership for their suggestions and insights during the various colloquium presentations. Thanks to Impala management for giving their support throughout. Finally, I would like to give special thanks to my wife and family for supporting and encouraging me through this long journey.

## **ABSTRACT**

The underground hard rock mining industry in South Africa is faced with the challenge of simultaneously delivering both safety and productivity excellence. Frontline supervisors need to manage the inherent trade-off between safety and productivity to achieve excellence in both. Previous research suggests that supervisors with a transformational leadership style have delivered safety and productivity in separate studies. This study examined the relationship between the transformational leadership style of underground mining supervisors at Impala and the simultaneous delivery of both safety and productivity. It also investigated the mediating effect of group safety climate on the relationship between transformational leadership and injury rate, and the mediating effect of group cohesiveness on the relationship between transformational leadership and productivity. The relationship between transformational leadership and the perception of leader effectiveness was also investigated in the study context.

The research design was a case study using mixed methods in the form of a sequential explanatory design. In the first quantitative main phase of the study, survey questionnaires were completed by respondents to determine the leadership style of the mine overseers who were the unit of analysis. Data was also collected using survey questionnaires for group safety climate and group cohesiveness. The injury rate and productivity data for the mine overseer sections was recorded for a one year period prior to the survey. In the second qualitative phase of the study selected mine overseers were interviewed and a focus group of mine overseers was conducted. Also, underground observations were carried out and documents were scrutinised. The focus of the qualitative research was to interpret and explain the results that were obtained in the quantitative first phase of the study.

The results indicate that transformational leadership is related to the perception of supervisors' effectiveness. This relationship is partially mediated by group safety climate and group cohesiveness. The relationship between transformational leadership and the objective measures of injury

rate and productivity were not supported in the quantitative results. This may indicate that these measures were too narrow to determine supervisors' leadership effectiveness, and/or were contaminated by confounding variables as was suggested in the qualitative phase of the study. The qualitative findings indicated that supervisors' perception was that transformational leadership style is effective in delivering safety and productivity excellence.

The overall conclusion of this study is that in the context of Impala or similar operations, that the effective supervisor should employ the full range of leadership. This behaviour includes maintaining discipline and using contingent reward to motivate the achievement of goals. The effective supervisor also uses the transformational leadership style giving meaning to work and creating a feeling of team membership. Transformational leadership inspires the diverse workforce to deliver safety and productivity excellence in the difficult and risky mining conditions. Furthermore, supervisors' behaviour is greatly influenced by management's priorities.

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## ACRONYMS/ABBREVIATIONS

- ANOVA** – Analysis of Variance
- C** – Group Cohesiveness
- CEO** – Chief Executive Officer
- CFA** – Confirmatory Factor Analysis
- CR** – Contingent Reward
- DMR** – Department of Mineral Resources
- DOD** – South African Department of Defence
- EE** – Extra Effort
- EFA** – Exploratory Factor Analysis
- EFF** – Effectiveness
- FRLT** – Full Range Leadership Theory
- GLOBE** – Global Leadership and Organisational Behaviour Effectiveness
- II (A)** – Idealised Influence (Attributed)
- II (B)** – Idealised Influence (Behaviour)
- IC** – Individual Consideration
- IM** – Inspirational Motivation
- Impala** – Impala Platinum (Rustenburg)
- Implats** – Impala Platinum Holdings Limited
- IR** – Injury Rate
- IS** – Intellectual Stimulation
- LF** – Laissez-Faire
- LMP** – Leader Motive Profile
- LMX** – Leader-Member Exchange
- LTI** – Lost Time Injury
- LTIFR** – Lost Time Injury Frequency Rate
- M** – Mean
- MBEA** – Management-By-Exception-Active
- MBEP** – Management-By-Exception-Passive
- MBL** – Master of Business Leadership
- MHSA** – Mines Health and Safety Act No. 29 1996 as Amended
- MLQ** – Multifactor Leadership Questionnaire (Form 5X)



**MSA** – Measure of Sampling Adequacy  
**P** – Productivity  
**PA** – Passive-Avoidant  
**PGM** – Platinum Group Metals  
**POS** – Perceived Organisational Support  
**R<sup>2</sup>** – Coefficient of Multiple Determination  
**SAS** – Statistical Analysis System  
**SAT** – Satisfaction  
**SC** – Group Safety Climate  
**SD** – Standard Deviation  
**SDWT** – Self Directed Work Teams  
**SIMRAC** – Safety in Mines Research Advisory Committee  
**TA** – Transactional Leadership  
**TF** – Transformational Leadership  
**UK** – United Kingdom  
**US** – United States of America  
**VIF** – Variance Inflation Factor

## DEFINITION OF OPERATIONAL TERMS

### **Development**

Development includes all tunneling, drives, cross-cuts, raises, and winzes.

### **Effectiveness (EFF)**

Effectiveness is defined as meeting organisational requirements and leading an effective group (Avolio and Bass, 2004).

### **Group Cohesiveness (C)**

Group cohesiveness is defined as the perceived degree to which group members are attracted to and motivated to stay with a group (Pillai and Williams, 2003).

### **Group Safety Climate (SC)**

Group safety climate is defined as the level of shared perceptions among the group concerning the priority of safety (Zohar, 2002).

### **Lost Time Injury Frequency Rate (LTIFR)**

The LTIFR is calculated as follows:

$$\text{LTIFR} = \frac{\text{number of lost time injuries (LTI) in the period} \times 1000\ 000}{\text{number of hours worked in the period}}$$

LTI (Lost Time Injury) = all injuries that cause an employee to lose one or more full days other than the day that the injury occurred.

### **Passive-Avoidant Leadership (PA)**

Passive-avoidant behaviour includes laissez-faire and management-by-exception-passive (Avolio and Bass, 2004):

- *Laissez-faire (LF)* constitutes a complete absence of leadership.
- *Management-by-exception-passive (MBEP)* involves the leader avoiding making specific agreements, not clarifying expectations, and not providing goals and standards for followers to achieve. He/she only acts after a major problem has developed.

## **Productivity (P)**

Productivity is defined as the percentage of production target met.

## **Shaft**

A shaft is defined as any tunnel having a cross-sectional dimension of 3, 7 metres or over and –

- (a) Having an inclination to the horizontal of 15 degrees or over; or
- (b) Having an inclination to the horizontal of less than 15 degrees but more than 10 degrees where the speed of traction may exceed two metres per second.

## **Stoping**

Stoping is the mining of ore solely for the purposes of extraction and production of platinum group metals (PGM).

## **Transactional Leadership (TA)**

Transactional leadership is associated with the leader displaying corrective and constructive behaviour. Corrective behaviour involves management-by-exception-active, while constructive behaviour is called contingent reward (Avolio and Bass, 2004):

- *Management-by-exception-active (MBEA)* is achieved by the leader specifying the standards for compliance, including what constitutes ineffective performance. Followers may be reprimanded for not achieving those standards. This involves closely monitoring performance and taking corrective action when mistakes occur.

- *Contingent reward (CR)* involves the leader clarifying expectations and giving recognition when goals are achieved.

## **Transformational Leadership (TF)**

Transformational leadership style is composed of five factors; idealised influence (attributed), idealised influence (behaviour), inspirational motivation, intellectual stimulation, and individual consideration (Avolio and Bass, 2004):

- *Idealised influence (attributed) (II (A))* of a leader is associated with instilling pride, respect for the leader, going beyond self-interest for the good of the group, and displaying a sense of confidence and power.
- *Idealised influence (behaviour) (II (B))* involves the leader talking about his/her most important values, emphasising a collective sense of mission, considering the ethical consequences of decisions, and having a strong sense of purpose.
- *Inspirational motivation (IM)* involves the leader motivating those around him/her by providing meaning and challenge in their work. The inspirational leader arouses individual and team spirit by displaying optimism, enthusiasm, and encouraging followers to envision an attractive future which eventually they can envision for themselves.
- *Intellectual stimulation (IS)* by leaders is achieved when followers are stimulated to be innovative and creative by reframing old problems and challenging beliefs, values, and assumptions. Mistakes are not publicly criticised and followers are encouraged to generate and implement creative solutions to problems.
- *Individual consideration (IC)* is achieved by leaders mentoring and coaching followers to achieve and grow as individuals. Followers are given new learning opportunities and are developed to successively higher levels of potential. The transformational leader focuses on establishing congruence between individual and organisational needs.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background to the Study

The chief executive officers (CEO's) of more than 30 South African mining companies have committed themselves to get mine safety on a par with other major industrialised countries by 2013 (Creamer, 2010). Frankel (2011) casts doubt on the attainment of the 2013 safety target, believing that there is something wrong with the existing safety culture on South African mines. Frankel (2011) further states that many South African mining companies have not managed to align safety and productivity values into a single paradigm.

Platinum mining in South Africa takes place on the Bushveld Complex. The Bushveld Complex comprises a suite of igneous rocks of a wide range of composition occupying a pear-shaped area. It extends east-west 480 km from Ohrigstad east into Botswana. It extends NNW to SSE 350 km from Villa Nora to north of Bethal, but is covered in part by younger rocks. If the younger rocks were stripped off it would have an outcrop area of 60 000 km<sup>2</sup> (Lurie, 1994). Impala Platinum Holdings Limited (Implats) is the second biggest producer of platinum group metals (PGM) in the world. Its main operation, Impala Platinum Rustenburg (Impala), is located in South Africa on the western limb of the Bushveld Complex centered on Rustenburg. Implats has smaller operations on the eastern limb of the Bushveld Complex located in the Limpopo province. Implats also has operations in Zimbabwe on the Great Dyke (Implats, 2010). The Bushveld Complex in South Africa and the Great Dyke in Zimbabwe are the two most significant PGM-bearing ore bodies in the world (Implats, 2010).

This study is based in the steady state underground conventional hard rock mining operations of Impala. The mining process involves drilling holes in the rock face using hand-held rock drills and then blasting the rock using explosives. The broken rock is moved to ore-passes using mechanical

scraper winches and then transported to the shaft with locomotives. It is hoisted to surface by rock hoists and transported by surface rail to the nearby plant for processing. The underground conventional mining process is labour intensive. The underground environment is usually quite harsh, and can include high ambient temperatures, darkness, confined working spaces, and loud noise. In addition the exposure to hazards is high especially to rock fall-of-ground incidents, operating machinery, flooding, and gassing. Production is measured in area (m<sup>2</sup>) of rock broken for stoping operations and in meters advance (m) for development work. The unit of analysis in this study (mine overseer) is set a monthly target by management for productivity. This target is based on Impala mining best practices and also taking cognisance of localised mining conditions. Productivity achievements are independently measured and recorded by the survey department on a monthly basis. The objective measure of safety is the lost time injury frequency rate (LTIFR). The LTIFR is independently recorded monthly by the safety department based on injury and work attendance information.

The underground mining industry in South Africa is undergoing major changes. Several pieces of legislation have been enacted by government including equity ownership, employment equity, safety, health, environment, and worker participation in decision making. Underground hard rock conventional mining is an unpredictable environment where informal work practices are prevalent, and bureaucratic rules and procedures are sometimes not strictly followed (Gouldner, 1954; Phakathi, 2002). In addition, the mining workforce is diverse which requires diversity management (Denton and Vloeberghs, 2002). Meanwhile, mines are under pressure to be productive while at the same time delivering excellence in safety. This challenge of simultaneously delivering safety and productivity excellence is proving very difficult to achieve in practice. The Department of Mineral Resources (DMR) who is tasked with enforcing health and safety on the mines in terms of the Mines Health and Safety Act No. 29 1996 (MHSA) is stopping mining operations when violations are found, to pressurise the mining industry to comply with the legislation.

A crucial question to be answered is what leadership style helps supervisors deal with the trade-off (Carrillo, 2005) required to simultaneously deliver both safety and productivity excellence in this context. Bass (1985) argues that transformational leadership galvanise groups to persist when conditions are difficult, stressful, and unpredictable. Bass (1985: 154) further argues that:

Transformational leadership is more likely to reflect social values and to emerge in times of distress and change, while transactional leadership is more likely to be observed in a well-ordered society.

Previous research done in different contexts established that transformational leadership is related to injuries through the mediating effect of perceived safety climate (Barling, Loughlin and Kelloway, 2002; Zohar, 2002; Zacharatos, Barling and Iverson, 2005; Kelloway, Mullen and Francis, 2006). Other scholars support the claim that effective leadership plays a major role in delivering safety excellence (Hidley, 1998; Krause, 2005; Jones, 2006). Separate empirical studies conducted in different environments found support for a relationship between transformational leadership and productivity mediated by group cohesiveness (Pillai and Williams, 2003; Bass, Avolio, Jung and Berson, 2003). Krause (2005) argues that when senior management assigns safety priority and supervisors employ transactional leadership augmented by transformational leadership, it results in safety and productivity excellence. Senior management assigning safety priority leads to safety excellence by fostering cultural unity among the various stakeholders. Consequently, productivity also improves as operational parameters appear to be correlated (Krause, 2005). Peters (1989) found evidence to support the claim that organisations with clear safety goals were more productive. Gaertner, Newman, Perry, Fisher and Whitehead (1987) also concluded that companies with better safety records tended to have better productivity.

Ryan (2006) accredits the success that Steve Kearney (Implats' former CEO) had in leading the transformation of the company's safety and productivity delivery in the late 1990s to focusing on the human element of mining. Ryan (2006: 165) states that Kearney:

Shattered the fustian pretensions of authority and spoke directly, in common language, to those at the stope face. He bypassed the chain of command as a matter of routine. He spoke to those underground, canvassed their opinions, and filled them with hope for a better tomorrow.

This case study contributes to the body of knowledge by examining the effect of supervisors' transformational leadership style on simultaneously delivering both safety and productivity excellence, which has not been previously done. This study also investigates the effect of management's priorities on safety and productivity. The researcher assumed that Impala was representative of underground conventional hard rock mining in South Africa.

The practical application of the new knowledge gained could be used to inform the selection procedures for supervisors and the training of supervisors to improve their leadership skills in the mining industry, and possibly similar industries. The phenomenon of leadership is universal, and therefore the findings of this case study may be generally applicable, subject to confirmation by further empirical research comprising a bigger and broader sample.

## **1.2 Problem Statement**

Hermanus (2007) states that South Africa's mining sector safety record lag behind international standards. The South African government, trade unions, and investors are putting pressure on the mining industry to improve its safety record. There is also pressure on the mining industry to improve productivity to stay economically viable and to earn a return for investors. Consequently, a dilemma facing mine management is to determine what leadership style by supervisors will be successful in dealing with the trade-off (Carrillo, 2005) required to simultaneously deliver both safety and productivity excellence. Underground mining operates in an unpredictable environment where informal work practices are prevalent (Phakathi, 2002), with a diverse workforce (Denton and Vloeberghs, 2002), challenging mine supervisors to discipline, motivate and inspire the workforce.

It is unknown if transformational leadership by supervisors will lead to the



simultaneous delivery of safety and productivity excellence in the context of underground mining, as no empirical studies to support this claim could be found.

Therefore, the research question is:

Does supervisor's transformational leadership style positively impact the simultaneous delivery of both safety and productivity excellence in the context of underground conventional hard rock mining?

### **1.3 Research Objectives**

Empirical data was collected from supervisors in the mining department at Impala. The population for the study consisted of Impala's mine overseers (unit of analysis) on steady state production shafts. Mine overseers are responsible for the safety and productivity of an underground section consisting typically of 300-400 mining employees.

The objectives of this case study in testing a leadership model (Figure 1.1) in the context of Impala were:

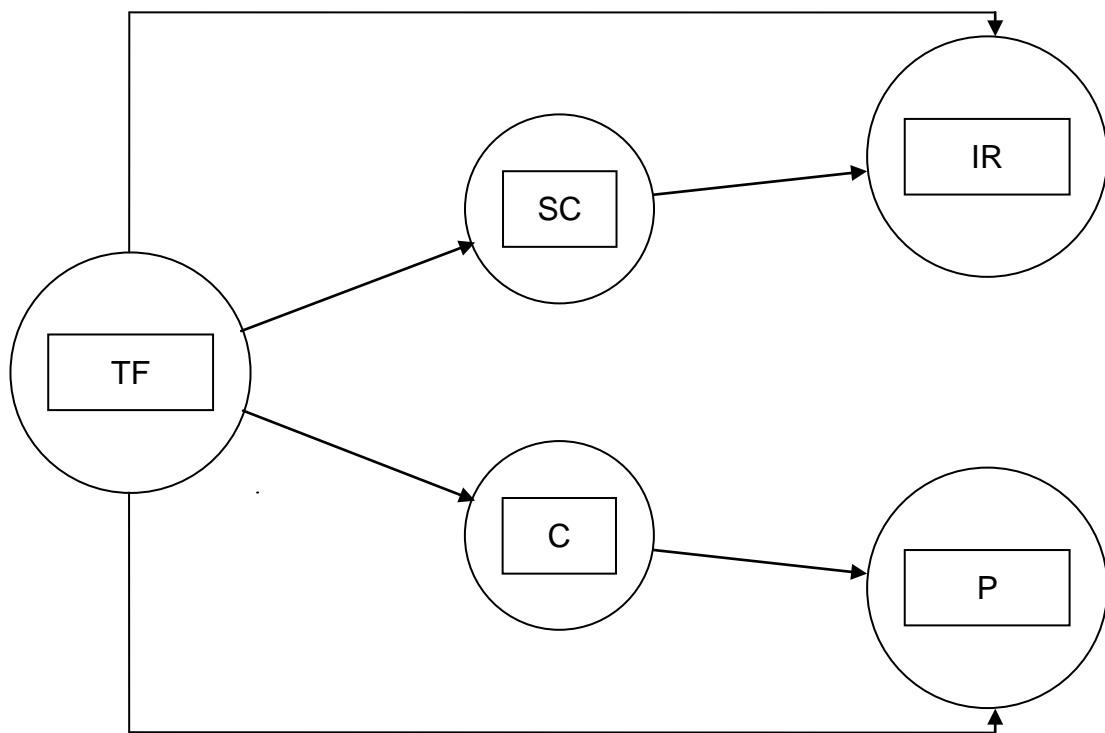
- To determine the relationship between transformational leadership and injury rate.
- To establish the relationship between transformational leadership and group safety climate.
- To find out if the relationship between transformational leadership and injury rate is partially mediated by group safety climate.
- To determine the relationship between transformational leadership and productivity.
- To establish the relationship between transformational leadership and group cohesiveness.
- To find out if the relationship between transformational leadership and productivity is partially mediated by group cohesiveness.
- To determine if supervisors' using a transformational leadership style simultaneously deliver both safety and productivity excellence.
- To determine the validity of the multifactor leadership questionnaire

(MLQ) in the context of Impala.

- To establish if transformational leadership augments the effect of transactional leadership on leader effectiveness.
- To determine if group safety climate mediates the relationship between transformational leadership and group cohesiveness.
- To investigate the effect of management's priorities on the delivery of safety and productivity.

#### 1.4 Model and Hypotheses

Figure 1.1 shows the proposed model that was tested as part of this case study. Three hypotheses are listed below which predict the relationship between the variables in the model.



**Figure 1.1: Leadership Model**

##### Legend

TF: Transformational Leadership

SC: Group Safety Climate

C: Group Cohesiveness

IR: Injury Rate (LTIFR)

P: Productivity (% production target met)

$H_0$ : Null Hypothesis

$H_1$ : Alternative Hypothesis

The hypotheses that were tested in the study are detailed below:

**Hypothesis 1:**

$H_0$ : There is no relationship between transformational leadership and either injury rate or productivity.

$H_1$ : Transformational leadership is positively related to both injury rate and productivity.

**Hypothesis 2:**

$H_0$ : The relationship between transformational leadership and injury rate is not partially mediated by group safety climate.

$H_1$ : The relationship between transformational leadership and injury rate is partially mediated by group safety climate.

**Hypothesis 3:**

$H_0$ : The relationship between transformational leadership and productivity is not partially mediated by group cohesiveness.

$H_1$ : The relationship between transformational leadership and productivity is partially mediated by group cohesiveness.

The testing of these hypotheses provided answers to the research question, producing knowledge on the direct and indirect relationships between transformational leadership and both injury rate and productivity.

**1.5 Delineations of the Study**

This study was delineated as follows:

- This case study was based on steady state underground mining operations at Impala.

- The study was restricted to transformational leadership and did not include the consideration of other leadership behaviours.
- The measurement of safety was restricted to injury rate measured by the lost time injury frequency rate (LTIFR).
- The measurement of productivity was restricted to the percentage of production target met (% production target met).

## **1.6 Limitations of the Study**

The limitations of this study are as follows:

- As this was a case study, the external validity of the findings is limited until validated by a bigger and broader based study.
- This study was restricted to investigating the affect of transformational leadership style of supervisors on the delivery of safety and productivity and did not consider the many other alternative leadership theories.
- The selected objective organisational measures of safety (LTIFR) and productivity (% production target met) are narrow measures of leader effectiveness and may have been affected by the specific circumstances in a mine overseer's section. These confounding variables included; mining conditions, experience of crews, setting of productivity target, non-reporting of accidents, relationship with the unions, and the poor health of some employees. These variables were not included in the study as they could not be easily measured and/or would have taken an excessive amount of time to acquire.

## **1.7 Assumptions of the Study**

The following assumptions were made for this study:

- The respondents honestly completed the questions in the survey questionnaires.
- The respondents' knowledge of the English language did not adversely affect the results.
- Impala is representative of underground hard rock conventional mining in South Africa.

- There is homogeneity between mine overseer sections (clusters) at Impala and heterogeneity within each mine overseer's section.
- Injury rate and productivity data of mine overseers' for the year prior to the study was an adequate period for the study purposes.
- A mine overseer must have worked in a section for a minimum of three months to generate useful injury rate and productivity data.
- The measured perception of leadership effectiveness (EFF) serves as a proxy for the delivery of safety and productivity.
- The researcher's knowledge of Impala and some of the respondents, did not bias the data collected and the interpretation thereof.

### **1.8 Significance of the Study**

The South African mining industry has set a target of reaching safety levels on par with international standards by 2013 (Creamer, 2010). Given the unpredictable nature of mining, creating bureaucratic rules and procedures may not be adequate to achieve this target (Gouldner, 1954; Phakathi, 2002). Also, South African mines must achieve productivity excellence to generate returns for shareholders and survive as a business.

Many studies have been undertaken to determine the relationship between transformational leadership style and leader effectiveness. These studies have been conducted in a variety of different situations across many countries. They mainly used quantitative research designs and subjective measurement of the criterion variables (Lowe, Kroeck and Sivasubramaniam, 1996). Some studies support the theory that transformational leadership is negatively correlated with injuries (Zohar, 2002; Barling, *et al.*, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006). Separate studies have found support for a relationship between transformational leadership and productivity (Yammarino, Spangler and Bass, 1993; Thite, 1999; Masi and Cooke, 2000; Dvir, Eden, Avolio and Shamir, 2002; Bass, *et al.*, 2003; Pillai and Williams, 2003). However, empirical studies could not be found where the direct and indirect effects of transformational leadership on the simultaneous delivery of objectively measured injury rate and productivity

excellence were investigated in a single study. Also, this study used a mixed method research design in the context of underground conventional hard rock mining at Impala.

This study adds to the body of leadership knowledge by investigating the following issues in the context of underground mining which has not been done previously:

- Is the transformational leadership style of supervisors effective in dealing with the trade-off required to simultaneously deliver both injury rate and productivity excellence?
- Does group safety climate mediate the relationship between transformational leadership and injury rate?
- Does group cohesiveness mediate the relationship between transformational leadership and productivity?
- Does group safety climate mediate the relationship between transformational leadership and group cohesiveness?
- Does transformational leadership augment the effect of transactional leadership in relation to the perception of supervisor effectiveness?
- Examines the validity of the multifactor leadership questionnaire (MLQ) in the context of Impala.
- Do management's priorities affect the delivery of safety and productivity?
- Employs a mixed methods research design to investigate the effect of leadership on injury rate and productivity, whereas most previous studies in the field of leadership have used only quantitative methods.

These findings could possibly be used by underground hard rock mining companies to inform the selection criteria for supervisor recruitment and the course content for the training of supervisors. The findings of this case study may be generalised to other underground conventional hard rock mining sectors in South Africa and possibly other unpredictable and changing environments. This is based on leadership being a universal phenomenon and subject to validation by way of further empirical research studies.

## **1.9 Plan of the Thesis**

This thesis contains eight chapters.

### **Chapter One: Introduction**

The background and context of the study are discussed. It also covers the following topics; problem statement, research objectives, model and hypotheses, delineation, limitations, assumptions, and the significance of the study.

### **Chapter Two: Theoretical Foundation**

The history of the development of leadership theory is described with an emphasis on leadership effectiveness. The full range of leadership theory (FRLT) is detailed and the basis for the formulation of the study hypotheses explained.

### **Chapter Three: Literature Review**

The extant literature on the link between leadership and safety and productivity is critiqued. Empirical studies examining the relationship between leadership and both safety and productivity are reviewed for various contexts around the world. A gap in the body of knowledge is identified and the contribution of this study to the body of knowledge motivated.

### **Chapter Four: Research Design and Methodology**

An overview of possible study research designs is described. The basis for choosing an explanatory sequential mixed method case study (Impala) is justified. The methodology used to collect and analyse the phase one quantitative data and the phase two qualitative data is documented. The limitations and ethical aspects of the methodology used are discussed for both phases of the study.

### **Chapter Five: Quantitative Results**

The quantitative results from phase one are documented. These results include; demographics, exploratory factor analysis of the multifactor leadership questionnaire (MLQ), intercorrelations of the MLQ factors,

intercorrelations of the study variables, and multiple regression analysis of the proposed hypotheses.

### **Chapter Six: Qualitative Findings**

The qualitative findings based on a content analysis of the data collected for the themes are given. Evidence in support of the themes is supported by several quotations from the respondents. Findings linking leadership with the following variables are furnished; group safety climate, group cohesiveness, safety, and productivity. The effect of section managers' priorities and confounding variables on the relationship between leadership and both safety and productivity are also investigated.

### **Chapter Seven: Interpretation of Data**

The results from the quantitative first phase and the qualitative second phase of the study are combined and the collected evidence concerning the research hypotheses interpreted.

### **Chapter Eight: Conclusions and Recommendations**

The conclusions of the study are summarised including the contribution to the body of knowledge. Recommendations are made for the practical application of the study findings. Finally, suggestions for future research are proffered.

#### **1.10 Conclusion**

The South African mining industry is facing a major challenge to simultaneously deliver both safety and productivity excellence in the face of pressure from the government to reach international safety standards and shareholder demands for a return on investment. A review of the literature suggests that the leadership style of supervisors play a significant role in the delivery of safety and productivity excellence. However, no empirical studies could be found where the effect of transformational leadership on the simultaneous delivery of both safety and productivity was investigated. This study fills a gap in the body of knowledge in the context of underground conventional hard rock mining, by examining the relationship between transformational leadership and the simultaneous delivery of both safety and



productivity. The findings of the study may have practical implications for the recruitment and training of supervisors in underground conventional hard rock mining and possibly in similar uncertain and diverse contexts.

The modern history of leadership theory development and the theoretical basis for linking the transformational leadership of supervisors to the simultaneous delivery of both safety and productivity excellence is discussed in chapter two.

## CHAPTER TWO

### THEORETICAL FOUNDATION

#### 2.1 Introduction

The question of what makes a person an effective leader still challenges leadership scholars despite several decades of scientific study. This review documents the evolution of leadership theory, focusing on leadership effectiveness, which establishes the theoretical foundation for the study. Firstly, the evolution of behaviour in organisations is reviewed to provide a background to the development of leadership theory. Then the role of power and influence in leadership effectiveness is examined to explain the mechanisms of how leadership is exercised. The modern history of leadership theory development is documented focusing on the seminal theories of traits, behaviour, contingencies, leader-member exchange (LMX), explicit, neo-charismatic, and current theories. Finally, motivation is provided for the use of the theory of transformational leadership to formulate the hypotheses that were tested in the study.

#### 2.2 Organisations and Bureaucracy

In the early 19<sup>th</sup> century, the enlightenment era supported by such thinkers as Voltaire, held the belief that people could control their destiny by reason alone. This belief suggested that behaviour in an organisation could be controlled by bureaucracy. Frederick W. Taylor supported this view in developing the theory of scientific management which was spelt out in his book published in 1911 called, *The Principles of Scientific Management*. Taylor believed that scientific management would maximise productivity through the scientific planning of tasks, selection and training of suitable workers to execute these tasks, and a carrot-and-stick system of financial incentives (Haralambos and Holborn, 2000). Two of the assumptions that underpin Taylor's ideas have been particularly criticised (Haralambos and Holborn, 2000):

- Taylor assumed that employees' main reason for work was economic,

and therefore they would respond positively to financial incentives. This view is considered to be over simplistic.

- He viewed workers as individuals and not as members of a social group. He failed to account for the influence of informal work groups on the behaviour of individual workers.

By the end of the 19<sup>th</sup> century work by Weber and Freud had ushered in the modernism era which ended the belief in rationality and progress. This highlighted the dehumanising effect of the bureaucratic organisation and launched the quest to understand leadership (Nkomo, 2003). Elton Mayo conducted the Hawthorne studies (1927-1932) and found that workers belonged to informal work groups which satisfied their social needs. These groups developed their own norms and values which in turn influenced productivity (Haralambos and Holborn, 2000). Haralambos and Holborn (2000) states that the Hawthorne studies moved the focus from the individual worker to the worker as a member of a social group. Peer pressure from the informal work group forced workers to conform to informal work norms as they have a basic need to be part of a social group to gain approval, recognition, and status. These findings spawned the central ideas of the human relations school of thought that rejected Taylor's view of scientific management. Taylor's theory of scientific management espoused that productivity was driven by detailed job descriptions, training, and monetary incentives. Instead, it was postulated that workers' social needs at work and fulfilling their full potential (self-actualisation) were important factors in boosting productivity (Haralambos and Holborn, 2000).

The progression of the managerial tradition from scientific management through to the human relations school of thought contextualises the development of leadership theories which attempt to explain effective leadership.

### **2.3 Power and Influence**

Power is classified into position power and personal power (Yukl, 2002).

Position power consists of:

- *Legitimate power* – target person has the obligation to comply.
- *Reward power* – compliance in order to obtain rewards.
- *Coercive power* – compliance in order to avoid punishment.
- *Information power* – control of important information.
- *Ecological power* – control over the physical environment, technology, and organisation of the work.

Personal power is classified as:

- *Expert power* – includes potential influence derived from task experience.
- *Referent power* – involves potential influence based on friendship and loyalty.

Yukl (2002) states that research show that effective leaders rely more on personal power than on position power. Effective leaders wield power carefully allowing followers to influence them and empowering followers to discover and implement new and better ways of doing things.

Influence is at the core of leadership. The effective leader must be able to influence the behaviour of subordinates, peers, and superiors in order to achieve his/her organisational goals. This in turn increases the leader's power as a track-record of delivery on promises is established (Yukl, 2002). A leader's attempt to influence a target can result in various possible outcomes such as resistance, compliance, or commitment depending on the success of the influence attempt (Yukl, 2002). The most common influence behaviour in an organisation is a request based on legitimate power. However, for more difficult and unpleasant tasks a more proactive influence tactic is required. Yukl (2002) describes 11 proactive influence tactics that are relevant for influencing followers, peers, and superiors in large organisations. These are:

- *Rational persuasion* – give a logical argument.
- *Apprising* – highlight personal gain.
- *Inspirational appeals* – arousal of the targets' emotions.

- *Consultation* – encourage the target to suggest improvements.
- *Exchange* – suggest an exchange of favours.
- *Collaboration* – offer to provide relevant resources and assistance.
- *Personal appeals* – appeal to the target based on friendship.
- *Ingratiation* – use of praise or flattery.
- *Legitimizing tactics* – refer to rules, policies, or official documents.
- *Pressure* – subject the target to demands, threats, or persistent reminders.
- *Coalition tactics* – seek the support of others to persuade the target.

A leader can also use reactive influence behaviour such as praising to support desirable behaviour. The leader can use guiding influence behaviour including; modeling the desired behaviour, coaching, setting performance goals, and providing the required resources.

Studies using survey questionnaires have shown that power and influence tactics are separate constructs (Yukl, 2002). While some influence tactics appear to be more successful than others, the selection and sequencing of influence tactics depend on the situation and the power relationship between the leader and the target (Yukl, 2002).

## **2.4 Modern History of Leadership Theory Development**

### **2.4.1 Trait Theory**

In the early 20<sup>th</sup> century, mainly between 1930 and 1950, leadership theorists focused their research on the trait theory of leadership. Yukl (2002) states, that underlying this approach is the assumption that some individuals have natural traits that predispose them to leadership roles. Several personal characteristics were investigated such as physical energy, height, and gender. Psychological traits were also investigated such as need for power, intelligence, and need for achievement (House and Aditya, 1997). Most of the studies were based on supervisors and lower level managers. The studies lacked valid measurement instruments and investigations varied greatly on

the traits studied and the way they were operationalised. Empirical research at that time was not able to identify a set of traits/skills that would consistently predict effective leadership in all situations. It appeared to scholars at the time that there were not universal traits that could predict effective leaders (Yukl, 2002).

Since the 1970s researchers have taken a renewed interest in identifying traits/skills that appear to predict effective leadership. Casimir and Waldman (2007) in a study of low-level and high-level Chinese and Australian leaders found that there are cultural differences with regards to which traits are regarded as important for effective leadership. These results indicate that the perceived significance of specific leadership traits is determined partly by the requirements of the leadership role and partly by culturally acceptable interpersonal norms.

There is some empirical support for the following four trait perspectives. These are (House and Aditya, 1997): Kenny and Zaccaro's Leader Flexibility and Sensitivity Constructs; House's Theory of Charismatic Leadership; McClelland's Achievement Motivation Theory; and McClelland's Leader Motive Profile.

#### *Leader Flexibility and Sensitivity*

The constructs of social sensitivity and leadership flexibility have been introduced to leadership trait literature by Kenny and his associates to explain the emergence of leaders' in groups. Leaders' that demonstrate social sensitivity are aware of changes in the environment and follower group, while flexible leaders have ability to adapt to the situation (Kenny and Zaccaro, 1983). Zaccaro, Foti and Kenny (1991) found empirical evidence to support the emergence of leaders in a group when the leader demonstrates social perceptiveness and behavioural flexibility.

#### *Charismatic Leadership*

House (1977) suggests that charismatic leaders have a high need for power, are self-confident, and hold strong beliefs and ideals. Charismatic leaders

arouse commitment and enthusiasm in their followers by articulating their vision and expressing confidence that the followers will achieve it. Charismatic leaders appear extraordinary to their followers and have a major influence on their behaviour (Yukl, 2002). However, charismatic's can be positive or negative. Negative charismatics possess a personalised power orientation emphasising devotion to them, whereas positive charismatics have a socialised power orientation and emphasise devotion to ideological goals (Yukl, 2002).

#### *Achievement Motivation Theory*

McClelland's Achievement Motivation Theory states that achievement motivated individuals set challenging goals, persistently pursue goals, take calculated risks in goal achievement, and assume personal responsibility. Such individuals are reluctant to delegate and are more effective with small task-oriented groups than functioning as higher level executives in big organisations. Researchers have found some empirical evidence to support this theory (House and Aditya, 1997).

#### *Leader Motive Profile*

McClelland's Leader Motive Profile (LMP) theory argues that high power motivation, moral exercise of power, and power motivation higher than affiliative motivation are predictive of leader effectiveness. This is especially true for middle and high-level managerial positions. The LMP theory is supported with empirical studies (Winter, 1991; House, Shane and Herold, 1996). Further research is still required on the LMP theory regarding the boundary conditions where the theory holds and the manifestations of the LMP behavioural motives (House and Aditya, 1997).

From the research work done to date, the following traits appear to differentiate effective leaders. Effective leaders display the managerial motivation characteristics of socialised power orientation, moderately strong need for achievement, and a relatively weak need for affiliation. The effective leader needs to possess considerable ability in cognitive, interpersonal, and technical skills whose relative importance changes depending on the level of

management and type of organisation (Yukl, 2002). The situation in which the leader functions influences the effect of the leader's traits on effectiveness, with more bureaucratic organisations providing fewer opportunities to express dispositional tendencies (House and Aditya, 1997). Judge, Piccolo and Kosalka (2009), conducted a review and theoretical extension of the leader trait paradigm. They suggest that recent advances in personality research have rekindled interest in trait approaches, for understanding leadership effectiveness and leader emergence.

Although interest in the relationship between traits and effective leadership has re-emerged recently, in the 1950s leadership scholars moved their focus to leaders' behaviour to explain effective leadership. This happened as empirical studies of the trait theory of leadership at that time were not yielding consistent results.

#### ***2.4.2 Behaviour Theory***

As the trait theory of leadership was not yielding consistent empirical results, researchers started to investigate how leaders' behaviour affected their effectiveness.

The well-known Ohio State University leadership studies identified two main types of behaviour that leaders practiced, namely; consideration (behaviours include supporting, developing, and recognising) and initiating structure (behaviours include planning, clarifying, and monitoring). Hundreds of studies using the Ohio State leadership questionnaires have been conducted. In general, the results have been inconsistent for most leadership effectiveness criteria (Fisher and Edwards, 1988).

At around the same time the University of Michigan was also conducting research on leadership behaviour. Their research found three types of behaviour differentiated effective from ineffective leaders. The behaviour of effective leaders included; task-oriented behaviours of planning, scheduling, and setting realistic targets; relations-oriented behaviour of giving support and help to subordinates; and participative leadership where the leader



facilitates the participation of subordinates in conflict resolution and decision making. These studies used questionnaires and interviews to collect information about leaders' behaviour. Again, the results from empirical studies were inconclusive (Yukl, 2002).

Several other studies were done on the behaviour of effective leaders using critical incidents (Yukl and Van Fleet, 1982), laboratory experiments (Sims and Manz, 1984), and field experiments. These studies found that relations-oriented behaviour delivered better productivity and subordinate satisfaction, while task-oriented behaviour gave mixed and inconclusive results. The overall conclusion is that effective leaders show concern for both task and people in their behaviour (Yukl, 2002). Descriptive research suggests that effective leaders employ task oriented behaviour to guide and facilitate subordinates to achieve task objectives, while at the same time nurturing teamwork and cooperative relationships (Yukl, 2002).

Leadership behaviour alone is not adequate to explain effective leadership. Other factors include specific demands of a leader's job, different contextual constraints that the leader encounters in the field, or different dispositions of leaders/followers (House and Aditya, 1997). It became evident to leadership scholars that there was not a general theory of effective leadership applicable to all situations, and that effective leadership behaviour was contingent on the leadership context.

### ***2.4.3 Contingency Theories***

From the 1960s onwards, researchers realised that there was not a universal set of behaviours that a leader displayed which were effective in all situations. They began to formulate theories of effective leadership that were contingent on the situation. Several contingency theories emerged that explained effective leadership in terms of situational moderator variables. Some of these theories included intervening variables which explain why the effects of leadership behaviour vary across situations (Yukl, 2002). Some of the main contingency theories of effective leadership are; Fielder's, Contingency Theory; House's, Path-Goal Theory; Hersey and Blanchard's,

Life Cycle Theory; Kerr and Jermier's, Leadership Substitutes Theory; and Fielder's, Cognitive Resources Theory.

### *Fielder's Contingency Theory*

Fielder's contingency theory was one of the earliest contingency theories of leadership and describes how the favourability of the situation moderates the relationship between the leader's behaviour and effectiveness. A favourable situation exists when followers trust and respect their leader, the task is structured, and the leader has control over punishments and rewards. The interpretation of the model is that a task-oriented leader is more effective in highly favourable and highly unfavourable control situations. Whereas, people-oriented leaders' are more effective when operating in intermediate favourability control situations (Yukl, 2002). A meta-analysis of the many empirical studies carried out using this model (Peters, Hartke and Pohlmann, 1985) found some support for the model, with the support being stronger for laboratory studies than field studies. However, Fielder's contingency theory has some conceptual weaknesses, such as no intervening variables and neglect of leaders with medium scores for task and people behaviour. Hence, interest in the theory over the years waned due to the development of better situational theories (Yukl, 2002).

### *Path-Goal Theory*

House's path-goal theory was developed to explain how a leader's behaviour influences subordinates satisfaction and effort. The leader's behaviour and the situational moderator variables of the task, environment, and subordinate characteristics, affect the intervening variables of the subordinate's "expectancy" and "valence" to influence their satisfaction and effort. The subordinates' view on the probability of a task outcome is called expectancy while the desirability of the outcome is called its valence. The path-goal theory defines leaders' behaviour in four categories namely supportive, directive, participative, and achievement-oriented. These leadership behaviours and the situational moderator variables interact with the intervening variables (valence and expectancy) to influence the outcomes of subordinate effort and satisfaction. Subordinates will choose their level of

effort depending on their perception of the probability of successfully completing the task and satisfaction with the rewards on offer. House (1996) recognised non-reducible uncertainty and stress as boundary conditions of path-goal theory. Under these conditions, subordinates were unlikely to make accurate expectancy estimates. Meta-analyses of the results of many studies that have tested the path-goal theory have been inconclusive (Wofford and Liska, 1993; Podsakoff, MacKenzie, Ahearne and Bommer, 1995). However, the path-goal theory has made a contribution to the study of leadership, guiding researchers in finding relevant situational variables (Yukl, 2002).

### *Life Cycle Theory*

Hersey and Blanchard developed a situational leadership theory that postulated four leadership styles of; telling, selling, participating, and delegating. The theory is analogous to a parent-child life-cycle model where the parent reduces control as the child matures. A given style would be employed depending on the situation, premised on the maturity of the subordinates (House and Aditya, 1997). Hence, inexperienced subordinates lacking knowledge would be “told” what to do which is high-task/low-people leadership behaviour. More mature subordinates would be “sold” what needs to be done where high-task/high-people leadership behaviour would be employed. The “participating” leadership behaviour would involve a low-task/high-people style. The “delegating” style used for the most experienced and knowledgeable subordinates, would involve leaders using low-task/low-people leadership behaviour. Few empirical tests of the theory have been conducted (House and Aditya, 1997). A study carried out by Vecchio (1987) found that the theory may only hold for certain subordinate types.

### *Leadership Substitutes Theory*

Kerr and Jermier developed the Leadership Substitutes Theory. This theory postulates that there are two kinds of situational variables that reduce the importance of leadership by formal leaders, substitutes and neutralisers. Organisations with an environment where subordinate characteristics, tasks, and organisational characteristics are favourable to performance excellence, will act as a substitute for leadership behaviour. On the other hand, if the

characteristics of the subordinates, task, and organisation are unfavourable to performance outcomes, this situation will act as a neutraliser to the leader's behaviour. Improving leadership in a given situation may involve removing neutralisers and increasing substitutes (Yukl, 2002). Empirical support for this theory has been limited as its ambiguity and complexity makes it difficult to test. However, this theory showed that the organisational situation of work design, informal peer leadership, reward systems, and self-management could reduce the formal leader's role in motivating subordinate effort and satisfaction (Yukl, 2002).

### *Cognitive Resources Theory*

Fielder developed another situational theory of leadership called the Cognitive Resources Theory. This theory examines how the leader's cognitive resources of intelligence and experience affect group performance. The main argument of this theory is that under conditions of high stress, experience is more beneficial than intelligence for performance. While in low stress situations, intelligence is superior to experience for achieving results (Yukl, 2002). The implication is that bright individuals perform worse than experienced people under high stress conditions. This theory has found considerable empirical support from both field and laboratory studies (Frost, 1983; Fielder, 1995). A conceptual weakness that limits the usefulness of this theory is the use of general intelligence and not a more specific cognitive skill relevant to the task (Yukl, 2002).

### *Summary*

The various contingency theories explain leadership effectiveness in terms of situational moderator variables. Each of these theories provides some insight into the reasons for effective leadership in different situations, but they all have conceptual weaknesses that limit their utility. The contingency theories have a major limitation in that they do not give attention to some leadership processes that transform the way followers view their work and themselves (Yukl, 2002).

#### **2.4.4 LMX Theory**

The ambiguous findings of the early contingency theories led scholars to propose several new theories to explain different aspects of the leadership phenomenon (House and Aditya, 1997). The Leader-Member Exchange (LMX) theory was proposed by Graen and his associates in the 1970s based on the relationship between a leader and individual subordinates. The main feature of this theory is a focus on dyadic relationships rather than traits, behaviours, or situations. The relationship between a leader and individual followers falls into two broad categories classified as the “in-crowd” and the “out-crowd”. The “in-crowd” is a small number of the leader's most trusted followers who influence each other for mutual benefit. From the followers' perspective the benefits include being assigned interesting tasks, given greater responsibility, furnished with more information, participation in decision making, personal support, rewards, and better career opportunities. The “out-crowd” are handled in a more formal low-exchange relationship and there is a low level of mutual influence. They only need to meet the formal requirements of the job to receive standard company benefits. There are benefits for the leader from his association with his most loyal subordinates. These include special effort for important work, more commitment to objectives, and help with administrative duties. However, there is also some downside for the leader resulting from his relationship with the “in-crowd”. This includes providing them with attention and having to use the time consuming process of influence techniques to get assignments done, as he may damage the special relationship if he uses his formal authority (Yukl, 2002).

In an extended version of the LMX theory, the dyadic relationship between the leader and subordinate is described as going through three stages of development. The relationship progresses through transactional stages (stage 1 and stage 2) to one that is more transformational (stage 3). There is an initial testing phase (stage 1), followed by the development of loyalty, mutual trust and respect (stage 2), and finally mutual support for the unit's mission and objectives (stage 3) (Graen and Uhl-Bien, 1991). Outcomes of more role clarity, greater commitment, greater satisfaction, and higher

subordinate performance were found to positively correlate with a favourable LMX downward exchange (Yukl, 2002). Yukl, O'Donnell and Taber (2008) found that the relations-oriented behaviours of supporting, recognising, consulting, and delegating were strongly related to the LMX relationship. Graen and Uhl-Bien (1995) revised the LMX theory based on the positive correlation between performance and a favourable LMX dyadic relationship, positing that effective leaders should endeavour to have a special exchange relationship with as many followers as possible. Studies have also shown that a leader's relationship with his/her supervisor directly impacts the leader's relationship with subordinates.

The overall conclusion of the LMX theory is that the satisfaction and performance of subordinates are usually better when the LMX relationship is favourable. A differential relationship with some subordinates may be beneficial to the leader, but if done excessively it may have negative consequences by causing hostility between group members (Yukl, 2002).

#### ***2.4.5 Implicit Leadership Theory***

An alternative leadership theory was proposed by Lord and his associates called the theory of Implicit Leadership, which is described as the process of being recognised by others as a leader (Lord and Maher, 1991). This theory postulates that subordinates have a stereotype/prototype of what relevant skills, traits, or behaviours are possessed by effective leaders. This implicit theory of leadership is developed by the subordinate over a period of time from interacting with leaders, reading literature on effective leaders, and other social-cultural influences. It is also influenced by individual personality traits and values, in addition to cultural beliefs and values about leaders (Yukl, 2002). It is likely that some differences in implicit theories exist within countries with diverse cultures (Yukl, 2002). Lord and Maher (1991) argue that implicit leadership theories determines what types of leadership behaviour is perceived as effective and suggest that different stereotypes exist for leaders in different contexts and roles. Laboratory studies carried out on students testing for implicit leadership theories have produced evidence for the existence of leader stereotypes (House and Aditya, 1997).

MacDonald, Sulsky and Brown (2008) in a recent study of implicit leadership theory found support for the idea that the self-identity of study participants can be primed to influence evaluations of effectiveness for prototypical leadership.

Leaders also use cognitive processes to explain subordinate's performance, called attribution theory. Martinko, Harvey and Douglas (2007) found empirical support for the argument that attribution accounts for significant amounts of variance in leader's behaviour towards subordinates. Leaders' credit work achievements either to the situation or the individual, depending on their view of the individual.

#### ***2.4.6 Neo-charismatic Theories***

In the mid 1970s a major paradigm shift took place where researchers became interested in the emotional and symbolic aspects of leadership. This led to the neo-charismatic genre of theories, which transform the way subordinates view themselves and their work. The neo-charismatic theories include: Charismatic Leadership Theory (House, 1977); Transformational Leadership Theory (Bass, 1985); Attributional Theory of Charismatic Leadership (Conger and Kanungo, 1987); and Visionary Theories (Bennis and Nanus, 1985; Kouzes and Posner, 1987).

All these theories share a common paradigm (House and Aditya, 1997):

- These leaders are able to achieve extraordinary results.
- Followers of these leaders have high levels of trust, respect, commitment, and loyalty for the leader.
- These leaders emphasise emotionally appealing behaviours.
- Followers put the needs of the mission or organisation above their self-interests and operate with high levels of satisfaction and performance.

#### ***Attributional Charismatic Leadership***

Follower's attribution of charismatic qualities to a leader is linked to the

leader's skill, behaviour, and the leadership context (Conger and Kanungo, 1998). Some of the traits and behaviours that result in the leader being attributed with charisma include, having a vision that is highly different from the status quo, acting in unconventional ways, taking personal risks, making self-sacrifices, and risking substantial personal loss to achieve the espoused vision. Leaders attributed with charisma appear confident about the success of their vision. They use persuasive appeals, are trusted by their followers, create a sense of urgency, and employ the influence processes of personal identification where followers want to become like them. Consequently, their followers internalise new values and beliefs (Yukl, 2002). The context is also important for the emergence of attributed charisma. Followers are more likely to attribute charisma to a leader when they are disenchanted with the status quo or there is a crisis, and they perceive that conventional approaches are no longer working (Yukl, 2002).

#### *Visionary Leadership*

Visionary leaders base their leadership on having an inspiring positive picture of the future and a clear sense of direction in getting there (Bennis and Nanus, 1985; Kouzes and Posner, 1987). They are committed to spiritual values and have personal integrity, morality, energy, and vitality. They create a shared sense of vision and meaning by using a partnership approach, characterised by respectful empowering relationships. Followers' mental models are transformed by visionary leaders. They focus on opportunities and craft innovative strategies for achieving their vision (Dwivedi, 2006).

Many studies using a variety of different research methods have been completed to test the different neo-charismatic theories. They generally concluded that followers of charismatic leaders show great commitment and deliver superior performance, especially in uncertain conditions and crisis situations (House and Aditya, 1997).

#### **2.4.7 Current Leadership Theories**

The latest currents in leadership theory which have as a backdrop the reality of leading in a post-Newtonian world characterised by feelings of complexity



and chaos include Authentic Leadership, Ethical Leadership, and Spiritual Leadership. These three theories overlap with transformational leadership, all addressing the moral potential of leadership (Brown and Trevino, 2006).

#### *Authentic Leadership*

Authentic leaders are those who are aware of how they behave and think. They know their own and others' values, strengths, knowledge, and the context in which they operate. They also are hopeful, optimistic, confident, resilient, and of good moral character (Avolio, Gardner, Walumbwa, Luthans and May, 2004). Zhu (2006) in an empirical study found some support for authentic leadership and transformational leadership having a positive effect on follower moral decision making and follower moral identity.

#### *Ethical Leadership*

Proponents of the Ethical Leadership paradigm such as Heifetz (1994) and Covey (2004) champion the belief that ethics, values, and principles must govern leadership. The key role of leaders is to help subordinates to confront conflict and to deal with it productively. The leader must work with people in changing perspective, facing challenges, and learning better ways to work together effectively. Ethical leaders act as role models for ethical conduct, and are known for their principles, honesty, and caring. They communicate with their subordinates on ethical issues, set ethical standards, and use incentives and punishments to get compliance (Brown and Trevino, 2006). Van Aswegen and Engelbrecht (2009) in a study of employees from various companies found that transformational leadership had a positive effect on ethical climate.

Greenleaf's Servant Leadership supports the idea that a leader must serve his/her followers and organisation as opposed to the power-wielding authority of the command and control leader (Greenleaf, 1977). The servant leader puts workers welfare on a par with the production of products and services. Social responsibility becomes a major objective for organisations and their board of directors. Russel and Stone (2002) argue that the prime motivation for leadership should be that of the servant leader, serving and meeting the

needs of others.

### *Spiritual Leadership*

Spiritual leadership comprises attitudes, values, and behaviours that are needed to motivate yourself and others, to have a sense of “spiritual survival” (Fry, 2003: 695). Spiritual survival is characterised by (Fry, 2003: 695):

- Followers experiencing a “calling” that their life is meaningful and makes a difference.
- The establishment of an organisational culture that gives followers a sense of “membership” of the group and a feeling that they are appreciated and understood.

Reave (2005), describes spiritual leadership occurring when a leader demonstrates honesty, humility, and integrity. This creates the impression of somebody who can be admired, trusted, and relied upon. Moxley (2000) posits that spiritual leadership is rooted in the idea that the effective leader should endeavour to nurture the inner-self of subordinates, as the essence of human existence includes spiritual elements in addition to the physical, emotional, and logical aspects. The organisational work environment needs to engage the whole person to ultimately give real meaning to work. This promotes follower satisfaction and performance in an environment of trust and respect (Fry, 2003).

Authentic, ethical, and spiritual leadership theories are recent theories that are presently being empirically researched.

### **2.4.8 Full Range Leadership Theory (FRLT)**

The Full Range of Leadership Theory (FRLT) consists of passive-avoidant, transactional, and transformational leadership factors. Bass’s (1985) full range leadership theory postulates that transactional leadership forms the basis for effective leadership and motivates followers to perform to expectation, while transformational leadership motivates followers to perform beyond expectation. Organisations characterised by a bureaucratic

transactional leadership style focus on getting expected results through the implementation of rules, policies, procedures, and contingent reward structures. Empirical research suggests that organisations that perform above expectation augment the transactional leadership style with transformational leadership which inspires, develops, and empowers followers (Sarros and Santora, 2001; Higgs, 2003; Tucker and Russell, 2004). Transformational leadership results in extra effort by followers, a perception that the leader is effective, and more work satisfaction compared to transactional leadership alone (Seltzer and Bass, 1990; Howell and Avolio, 1993).

#### ***2.4.8.1 Passive-Avoidant Leadership***

Passive-avoidant leadership consists of the passive leadership style of management-by-exception-passive, and laissez-faire which is an absence of leadership. Management-by-exception-passive and laissez-faire both have a negative impact on subordinates and associates (Avolio and Bass, 2004).

##### *Management-By-Exception-Passive*

Management-by-exception-passive involves the leader avoiding making specific agreements, not clarifying expectations, and not providing goals and standards for followers to achieve. The leader only acts after a major problem has developed (Bass, *et al.*, 2003).

##### *Laissez-Faire*

Laissez-faire constitutes a complete absence of leadership.

#### ***2.4.8.2 Transactional Leadership***

Transactional leadership is associated with the leader displaying both constructive and corrective behaviour. The constructive behaviour is called contingent reward while the corrective behaviour is management-by-exception-active (Avolio and Bass, 2004).

##### *Contingent Reward*

Contingent reward involves the leader clarifying expectations and giving

recognition when goals are achieved. This behaviour by the leader should result in individuals and groups performing to expectation (Bass, et al., 2003).

#### *Management-By-Exception-Active*

Management-by-exception-active is achieved by the leader specifying the standards for compliance, including what constitutes ineffective performance, and may reprimand followers for not achieving those standards. This involves closely monitoring performance and taking corrective action when mistakes occur (Bass, et al., 2003).

#### **2.4.8.3 Transformational Leadership**

The transformational leadership style is composed of five factors; idealised influence (attributed), idealised influence (behaviour), inspirational motivation, intellectual stimulation, and individual consideration (Avolio and Bass, 2004). Idealised influence manifests itself as trust, admiration, and respect for the leader by followers. Followers want to emulate their leader and are committed to the leader's vision. The leader considers followers' needs above his/her own, shares risks with followers, and conducts himself/herself with underlying principles, ethics, and values (Avolio and Bass, 2004). Transformational leaders, who possess a social orientation and limit their use of power, achieve better long term results by developing their subordinates to higher levels of performance (Avolio and Bass, 2004).

#### *Idealised Influence (Attributed)*

The idealised influence (attributed) of a leader is associated with instilling pride, gaining respect, going beyond self-interest for the good of the group, and displaying a sense of confidence and power.

#### *Idealised Influence (Behaviour)*

The idealised influence (behaviour) involve the leader talking about his/her most important values, emphasising a collective sense of mission, considering the ethical consequences of decisions, and having a strong sense of purpose (Avolio and Bass, 2004).

### *Inspirational Motivation*

Inspirational motivation involves the leader motivating those around him/her by providing meaning and challenge in their work. The inspirational leader arouses individual and team spirit by displaying optimism, enthusiasm, and encouraging followers to envision an attractive future which eventually they can envision for themselves (Avolio and Bass, 2004).

### *Intellectual Stimulation*

Intellectual stimulation by leaders is achieved when followers are stimulated to be innovative and creative when the leader reframes old problems and challenges beliefs, values, and assumptions. Mistakes are not publicly criticised and followers are encouraged to generate and implement creative solutions to problems (Avolio and Bass, 2004).

### *Individual Consideration*

Individual consideration is achieved by leaders mentoring and coaching followers to achieve and grow as individuals. Followers are given new learning opportunities and are developed to successively higher levels of potential. The transformational leader focuses on establishing congruence between individual and organisational needs (Avolio and Bass, 2004).

### *Organisational Level*

Research has shown that transformational leadership is effective for leaders' at all organisational levels (Lowe *et al.*, 1996). This suggests that leaders at the top, middle, or bottom of the organisation can employ the transformational leadership style to improve their effectiveness.

### *Domino Effect*

Bass, Waldman, Avolio and Bebb (1987) argue that the effects of transformational leadership cascades from the leader to associates, which results in them also using transformational and transactional leadership techniques. As a result of the cascading effect of transformational leadership, followers have a sense of taking charge and feel capable of exercising effective leadership with their own colleagues and followers. As a

consequence of the cascading effect of transformational leadership, the target leader has more opportunity to plan ahead, rather than spending time solving routine problems linked to followers. This in turn makes the leader more effective. The cascading effect of transformational leadership results in followers who are more capable of self leadership and taking responsibility for their actions. Eventually followers become like their leaders and model their leaders' transformational style (Avolio and Bass, 2004).

### *Training*

There is empirical evidence which suggests that training leaders in transformational leadership leads to significant effects on followers' perception of the leader's transformational style. Also, this training leads to improved delivery of injury rate (Mullen and Kelloway, 2009), and productivity (Barling, Weber and Kelloway, 1996; Dvir, Eden, Avolio and Shamir, 2002), in various contexts.

#### **2.4.8.4 Transformational Leadership Linkages**

Research has been done linking various constructs with some of the transformational leadership factors.

### *Emotional Intelligence*

Emotional intelligence is the ability to effectively recognise and manage our emotions, understand others' emotions, and effectively manage relationships (Goleman, 2000). Goleman (2000) states, that leaders use six different leadership styles based on emotional intelligence. The six leadership styles are; coercive (demands immediate compliance); authoritative (mobilises people towards a vision); affiliative (creates emotional bonds and harmony); democratic (builds consensus through participation); pacesetter (expects excellence and self-direction); and coaching (develops people for the future). Goleman (2000) indicates that effective leaders seamlessly move between these styles depending on the leadership requirements of the situation. Studies have shown that emotional intelligence correlates with the idealised influence, inspirational motivation, and individual consideration factors of transformational leadership (Barling, Slater and Kelloway, 2000; Palmer,

Walls, Burgess and Stough, 2000; Leban and Zulauf, 2004).

### *Influence Tactics*

Charbonneau (2004) in a study of military personnel tested the correlation of the influence tactics of rational persuasion, inspirational appeals, consultation, and collaboration with the five factors of transformational leadership. The results of the study showed that the influence tactic of rational persuasion is linked to all five of the transformational leadership factors, while the influence tactic of inspirational appeals is linked to the transformational factors of idealised influence and inspirational motivation. No correlation between the influence tactics of consultation and collaboration with any of the five transformational leadership factors could be found. Krishnan (2003) using a sample of 281 managers from different organisations in India found that transformational leadership is positively related to the influence tactics of friendliness and reasoning, and is negatively related to the influence tactic of authority.

### *Personality*

Research has been done trying to link personality traits to transformational leadership. Judge and Bono (2000) showed in a study based on 14 samples of leaders from over 200 organisations that the personality traits of extraversion and agreeableness positively predicted transformational leadership. The personality trait of openness-to-experience was positively correlated to transformational leadership but once the influence of other traits was controlled its effect disappeared. No relationship between the personality traits of neuroticism and conscientiousness, and transformational leadership was found.

### *Mediating Variables*

Studies in different contexts have shown that the correlation between transformational leadership and productivity is mediated by many variables including; the emotions of frustration and optimism (McColl-Kennedy and Anderson, 2002); self-efficacy and cohesiveness (Pillai and Williams, 2003; Stashevsky and Koslowsky, 2006). Several studies in different environments

have also established that safety climate mediates the relationship between transformational leadership and injuries (Barling, *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006).

## **2.5 Conclusion**

A justification based on the theory of transformational leadership is provided for the formulation of the proposed leadership model (Figure 1.1), with associated hypotheses which were tested in the study.

### *Transformational Leadership – Group Safety Climate – Injury Rate*

The four components of transformational leadership are relevant to improving occupational injury rate (Barling, *et al.*, 2002). Idealised influence encourages managers to focus more on occupational safety as a core value and not to pursue short-term productivity gains. Leaders use inspirational motivation to convince followers to act for the common good and to achieve higher safety levels by using stories and symbols to clarify their mission. Intellectual stimulation is used by leaders to challenge followers to examine long-held assumptions, and to come up with new ways of improving safety and sharing information about occupational safety and risks. Leaders demonstrate individualised consideration for their subordinates by taking an interest in their personal safety and well-being. Gouldner (1960) suggests that high-quality relationships are reciprocal and result in a balanced social exchange (Blau, 1964). Yukl (1998) posits that reciprocity involves the values of openness, trust, and loyalty resulting in value-based relationships characteristic of transformational leadership and high leader-member exchange (LMX). Pate-Cornell (1990) suggests that such values help supervisors not to succumb to production pressures and sacrifice safety.

Zohar (2002: 76) states that, “safety climate perceptions refer to those attributes of supervisory action which indicate the priority of safety in a subunit, or the importance of acting safely while performing a job”. Studies have shown that a positive relationship exists between safety climate and behaviour (Hofmann and Stetzer, 1996; Zohar, 2000). Zohar (2002) further proposes a mediation model whereby transformational leadership is linked to



safety climate which in turn is related to behaviour and ultimately to injuries. Previous research in various contexts has established a link between transformational leadership and injuries through the mediating effect of perceived group safety climate (Barling *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006).

Based on theory and previous empirical research there is justification to propose and test for a relationship between transformational leadership and injury rate which is partially mediated by group safety climate, in the context of underground conventional hard rock mining at Impala.

#### *Transformational Leadership – Group Cohesiveness – Productivity*

Research has shown that considerate leaders cause followers to become more attached to the group (Korsgaard, Schweiger and Sapienza, 1995). Transformational leaders appear to be successful in encouraging group members to stay attracted to the group and work towards a common goal while making personal sacrifices. It appears that transformational leaders facilitate the formation of cohesive groups which operate at higher levels, whilst being committed to the group and the organisation (Pillai and Williams, 2003). Transformational leaders transform the self-concepts of their followers, building their personal and social association with the mission of the leader and organisation (Shamir, House and Arthur, 1993). Consequently, the followers' feelings of commitment, cohesiveness, potency, and productivity are increased (Bass, *et al.*, 2003). Previous empirical studies have found support for group cohesiveness mediating the relationship between transformational leadership and productivity in different contexts (Pillai and Williams, 2003; Bass, *et al.*, 2003).

There is justification on the basis of theory and previous empirical research to propose and test a relationship between transformational leadership and productivity which is partially mediated by group cohesiveness, in the context of underground conventional hard rock mining at Impala.

Chapter three will review the literature on transformational leadership to establish the gap in the body of knowledge. This relates to how supervisors' transformational leadership style handle the trade-off required to simultaneous delivery both safety and productivity excellence.

## **CHAPTER THREE**

### **LITERATURE REVIEW**

#### **3.1 Introduction**

The underground hard rock mining sector in South Africa is finding it difficult to balance the delivery of both safety and productivity excellence, resulting in many fatalities and serious injuries being sustained annually in the quest to produce metals (Frankel, 2011). The application of transformational leadership in the South African context is reviewed. Safety and productivity leadership is explored to gain understanding of these areas of leadership. Several empirical studies on safety and productivity leadership are documented and discussed. The gap in the body of knowledge is established as no empirical studies could be found where the relationship between transformational leadership and the simultaneous delivery of both safety and productivity was investigated. The literature was examined to identify the methodologies that have been used to study the effect of leadership, and motivation is provided for the choice of a mixed method case study.

#### **3.2 Transformational Leadership and South Africa**

South Africa is a very diverse society consisting of many ethnic groups. All these ethnic groups come together in the melting pot of the workplace. Denton and Vloeberghs (2002) point out that affirmative action has considerably changed the demography of the South African workplace, with a resultant emphasis on diversity management. Avolio and Bass (2004) argue that a transformational leadership style will be effective in such a diverse workplace. Avolio and Bass (2004) suggest that transformational leaders are better at valuing and adapting to diversity among their subordinates. Transformational leaders are expected to envisage a culturally adapted organisation, to inspire its achievement, use intellectual stimulation to promote new ways of handling diversity, and to exercise empathy with followers differing needs (Avolio and Bass, 2004).

Den Hartog, House, Hanges and Ruiz-Quintanilla (1999) in a study of 62 national cultures as part of the Global Leadership and Organisational Behaviour Effectiveness (GLOBE) study, concluded that specific aspects of transformational leadership are universally and strongly endorsed across cultures. These include characteristics such as being dynamic, positive, motivational, having foresight, encouraging, being trustworthy, and communicative. Beukman (2005) conducted a study on the South African Department of Defence (DOD) to determine if the effectiveness of leadership behaviour is culture specific. He recommended that transformational leadership be employed in South Africa's diverse organisations as the preferred leadership style for competitive advantage in the future. Avolio and Bass (2004: 20) support this view stating that for South Africa "there are perhaps few other places in the world where transformational leadership is so much required, and the benefits are so enormous and visible". Handford and Coetzee (2003) states, that South African leaders should use three essential transformational skills. These are creating a shared vision, aligning people towards the vision, and creating a motivating climate to mobilise subordinates.

### **3.3 Safety**

#### **3.3.1 Accidents**

Heinrich (1936) conducted empirical research and concluded that 88% of accidents were caused by the unsafe acts of the injured. The DuPont organisation suggests that as high as 96% of accidents are caused by the unsafe acts of the injured (Broadbent, 2007). Heinrich (1936), viewed events leading up to the accident as a "domino effect" in which a sequence of human failures led to the eventual accident taking place.

Reason (1990) came up with a different way of looking at how an accident takes place in "The Swiss Cheese" model of human error accident causation. In this model it is postulated that failures in four different areas contribute to incidents including unsafe acts, preconditions for unsafe acts, unsafe supervision, and organisational influences. When a combination of latent and

active failures in these four layers aligns, a hazard can result in an incident. The system as a whole fails when individual system failures in each layer align, so that a hazard passes through all the holes in the integrated system, leading to an incident.

Hermanus (2007) argues that incidents may have many causes including ergonomics, the work environment, work organisation, process safety, abnormal working situations, and the employer's responsibilities to ensure that safe working environments and safe systems are provided. Hermanus (2007: 537) further states that internationally, interest has shifted to using systems theory for accident causation investigation, where accidents are seen as, "flawed processes involving interactions among system components including people, societal and organisational structures, engineering activities, and physical system components".

### **3.3.2 Key Safety Success Factors**

Stewart (1995) in analysing the role of legislation and regulation in safety and health in mines concluded that some of the key factors in achieving safety in mines include; the use of the safest mining methods, employment of technology that are reasonably practicable, implementation of good work practices, and creating an attitude and approach in the mine manager and his staff that encourage safety. Zohar (2000) further states that evidence for the existence of a relationship between managerial practices and injury rate suggests, that this may be the missing link to further reduce injury rates beyond levels achieved by improved engineering and site monitoring. Jones (2006) supports these arguments stating that world class safety performance is achieved by reducing risk exposure in the workplace by a combination of culture, leadership, equipment, and systems to control the work processes. Krause (2005: 11) further states that organisations that are successful at managing safety give attention to "designing and influencing systems that reduce and eliminate exposure". Krause (2005) proposes an organisational safety model involving leadership influencing the organisational culture, safety enabling systems, and organisational sustaining systems to reduce exposure to hazards in the working interface (comprising of workers,

equipment, facilities, and procedures). Table 3.1 lists the elements of safety enabling and organisational sustaining systems.

**Table 3.1: Safety Enabling and Organisational Sustaining Systems**

<b><i>Safety Enabling Systems</i></b>	<b><i>Organisational Sustaining Systems</i></b>
<ul style="list-style-type: none"> <li>• Hazard recognition and mitigation</li> <li>• Skills, knowledge, and training</li> <li>• Regulations and procedures</li> <li>• Safety improvement mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>• Accountability</li> <li>• Selection and development</li> <li>• Organisational structure</li> <li>• Performance management</li> <li>• Employee engagement</li> <li>• Management systems</li> </ul>

Source: Krause (2005)

O'Dea and Flin (2003: 26) list some of safety policies and procedures that have been linked to better safety performance:

- Work planning and organisation.
- Accident investigation and record keeping.
- Selection, promotion, and training.
- Housekeeping, environment, and plant design.
- Reduced turnover and absenteeism.
- Use of praise, rewards, and avoidance of blame.
- Safety program development.
- Safety rules and procedures.

These measures work, as the workforce see evidence that management is openly and consistently supporting safety (O'Dea and Flin, 2003).

### **3.3.3 Safety Culture**

One of the challenges of safety leadership is to create the right culture in the organisation that encourages workers to circumvent the conditions necessary for an accident to take place. Krause (2005: 13) states that “an injury-free

culture is one that doesn't tolerate exposure to hazards". Schien (1990: 111) describes culture as:

A pattern of basic assumptions invented, discovered, or developed by a given group, as it learns to cope with its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore is to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

Some aspects of culture can be seen as being for a group, what defence mechanisms are for the individual (Schein, 1990). Carrillo (2010) acknowledges that changing culture is extremely difficult, and suggests that findings from major incident investigations resulting in increased rules and procedures will not achieve the desired culture change. Instead it would be more fruitful that a discussion takes place with the workforce to find a solution based on divergent views. This will allow them to make sense of the problem and consequently form new beliefs and transform the culture that led to the incident.

Krause and Weekley (2005) identify nine cultural characteristics shown to be predictive of excellent safety:

- *Teamwork* – The effectiveness of workgroups in meeting targets and deadlines.
- *Workgroup relations* – The degree to which coworkers respect each other.
- *Procedural justice* – The level at which workers rate the fairness of first-level supervisors.
- *Perceived organisational support* – The level at which employees' feel the organisation is concerned for their overall well-being.
- *Leader-member exchange* – The strength of the relationship that workers feel they have with their supervisors.
- *Management credibility* – The perception of consistency and fairness of management in dealing with workers.
- *Organisation value for safety* – The perceived level of the organisation's commitment to safety.
- *Upward communication* – The adequacy of upward messages about

safety.

- *Approaching others* – Probability that workers will speak to each other about performance issues.

Organisations with high levels of these characteristics tend to have better performance in critical business areas than companies who score low in these factors (Krause and Weekley, 2005).

Erickson (1997) did a study to examine the relationship between corporate culture and safety excellence. The study results indicated that higher safety performance is achieved by continual visible management support for the safety and health effort, and management concern and support for the employees. Management shows its support for safety by (Erickson, 1997):

- Being committed to the safety and health effort.
- Managing safety and health in the same manner that productivity and quality are managed.
- Integrating safety and health into all organisational functions, including strategic planning.
- Becoming personally involved in the safety and health effort.
- Assuming accountability for safety.
- Visibly supporting the safety and health effort.

### **3.3.4 Safety Leadership**

O'Dea and Flin (2003: 2) state that the outcome of inquiries into a number of major disasters such as Three Mile Island, Chernobyl, the Clapham Junction rail crash, the sinking of the Herald of Free Enterprise, Piper Alpha, the Kings Cross fire, and the Esso Longford gas plant explosion found that managerial failures "were at least as important as technical failure and human error, in causing the accidents". O'Dea and Flin (2003) in a review of the literature on the role of managerial leadership on organisational safety outcomes found that organisational cultural artefacts such as mission statements have a powerful impact on the priorities of senior management. Senior management's priorities in turn have a direct impact on middle



management's behaviours and attitudes. This includes the priority of safety versus productivity, commitment to safety, and the relationship they develop with supervisors and workers.

Carrillo (2002) proposes that achieving safety excellence is chiefly about building relationships, where followers believe that the leader is sincere and cares about their welfare. Carrillo (2002: 41) claims that "safety is 90 percent about people", and proposes a safety leadership model comprising the following elements:

- Trust as a way of doing business.
- Fundamental belief that people do not want to get hurt.
- Shared leadership as opposed to command and control.
- Everyone holding themselves and each other accountable.
- Safety as an ongoing process.

Loubser (2009) supports the argument that management should promote caring relationships with employees. This will help gain the trust and respect of the workforce which he believes is the secret of achieving safety excellence. Hermanus (2007) suggests that the quality of interactions between managers, supervisors, and workers is one of the key constraints to improving occupational health and safety in the South African mining sector.

Krause and Weekley (2005) suggest that there are four elements of effective leadership that achieve balance between the task and people aspects of leadership to deliver excellent safety. These are personality and values, best practices, influence style, and organisational culture. The "big five" characteristics of personality namely; emotional resilience, learning orientation, conscientiousness, collegiality, and extroversion when combined with the leaders values, defines the leader and are difficult to change. Krause and Weekley (2005) describe a set of best practices that successful safety leaders use daily:

- Convey a vision of safety excellence.
- Are credible.

- Collaborate with others.
- Give feedback and recognition.
- Are accountable for safety performance in their section.
- Are good communicators.
- Are proactive in addressing safety issues.

These best practices by the leader strongly influence safety culture. The influence style describes the leader's leadership style. There is empirical evidence to suggest that a transformational leadership style is effective in achieving superior safety results. Supervisors with a transformational leadership style talk and listen to their subordinates and take action on safety issues, which results in lower injury rates (Krause and Weekley, 2005).

Grubbs (1999) states that transformational safety leadership is effective and suggests four basic strategies:

- Have a safety vision.
- Communicate that vision to everyone in the organisation.
- Build trust by remaining consistent, persistent, and dependable in relation to safety management.
- Demand a proactive rather than reactive approach to meeting organisational goals.

Broadbent (2004) advocates that frontline supervisors use the transformational leadership style to improve safety performance. Broadbent (2007) has taken the nine full range leadership factors and given them descriptive names to better explain their meaning in relation to safety. The comparison is as follows:

- *Laissez-faire*: The invisible man – a person that never gets involved.
- *Management-by-exception-passive*: The fireman – a person that only gets involved after a safety incident has occurred.
- *Management-by-exception-active*: The policeman – a person who is always looking for breaches of the law and standards.
- *Contingent reward*: The dealer – a person who is seeking rewards for

safety performance.

- *Individual consideration*: The carer – a person who is considerate and genuinely interested for the individual safety needs of subordinates.
- *Intellectual stimulation*: The innovator – a person who actively encourages and promotes a culture of learning amongst followers.
- *Inspirational motivation*: The motivator – a person who is very positive about safety issues, and inspires his/her follower's commitment to safety.
- *Influence behaviour*: The missionary – a person who encourages a team approach to safety and convinces followers that safety goals are achievable.
- *Influence attributed: The knight* – a person who is ethical, leads by example, and practices what he/she preaches.

### **3.3.5 Empirical Studies: Transformational Leadership and Safety**

This section reviews several empirical studies which examine the relationship between transformational leadership and safety, including the effect of mediating and moderating variables on the relationship. Various empirical studies have been undertaken around the world where the effect of transformational leadership on safety has been investigated in different contexts. Only a few studies have dealt with the relationship between transformational leadership and safety in unpredictable environments. No empirical studies could be found where the relationship between transformational leadership style and objectively measured injury rate was investigated in the context of underground conventional hard rock mining. The empirical leadership studies discussed in this section are grouped geographically and listed chronologically.

#### **3.3.5.1 United States of America**

##### *Manufacturing Plant*

In the United States a study linking leadership and safety results was conducted by Hofmann and Morgeson (1999). In this study the links between

leader-member exchange (LMX) and perceived organisational support (POS) to safety communication, safety commitment, and accidents were investigated. The study was conducted in a manufacturing facility where data was collected from 49 supervisor – group-leader dyads. Survey instruments were administered to the group leaders to measure POS, LMX, and safety communication, while the supervisors completed the safety commitment questionnaire. The objective organisational measurements of reported accidents were recorded for a year after administering the survey. The study findings indicated that perceived organisational support (POS) and leader-member exchange (LMX) were significantly related to safety communication, safety commitment, and accidents. The findings of this study indicate that the quality of subordinates' relationship with supervisors and the support organisations show for their employees are linked to safety-related communication. Communication is significantly related to safety commitment, ultimately predicting accidents. Hofmann and Morgeson (1999) suggest that safety-related behaviours and consequent accidents are linked to the nature of social exchanges in organisations. This suggests that the messages sent to employees by organisations and supervisors' leader-member relations play a significant role in employee safety.

This study had some limitations. All the survey measures were collected at a single point in time, which precludes determining causality. The measurement of accidents may have been subjected to reporting bias due to the non-reporting of minor accidents, and the sample was relatively small.

### **3.3.5.2 Canada**

#### *Service Industry*

Two related studies were conducted in Canada by Barling, Loughlin and Kelloway (2002) to determine the relationship between safety-specific transformational leadership and occupational safety.

The first study involved 174 restaurant workers who were administered survey instruments. The survey instruments measured their direct

supervisors' safety-specific transformational leadership behaviours, the perceived safety climate, safety consciousness, safety-related events, and occupational injuries. The findings of this study provided support for a relationship between safety-specific transformational leadership and occupational injuries through the mediating effects of safety consciousness, perceived safety climate, and safety-related events.

The second study comprised 164 young workers from diverse jobs. This group was administered survey questionnaires as per the first group but in addition they completed a questionnaire to measure work overload. The results of this study showed that work overload and safety-specific transformational leadership are linked to occupational injuries through the effects of, safety consciousness, perceived safety climate, and safety-related events. This study suggests that safety-specific transformational leadership plays a role in creating a positive perceived safety climate in the workplace. Work overload creates a negative safety climate, which in turn predicts safety related events, ultimately predicting work related injuries.

The limitations of this study were as follows; mono-source bias due to the self-report of occupational injuries, small sample size for structural equation modeling, and possible item overlap between the instruments used to measure safety-specific transformational leadership and safety-related outcomes.

#### *Undergraduate Students*

Kelloway, Mullen and Francis (2006) conducted a survey questionnaire study on 158 undergraduate students working in Canada. The study determined the impact of safety-specific transformational leadership and safety-specific passive leadership on safety outcomes. The participants completed questionnaires on safety-specific passive leadership, safety-specific transformational leadership, safety climate, and safety consciousness. Sustained injuries and safety related events were recorded. The results suggest that passive leadership and transformational leadership have opposite effects on safety consciousness and safety climate, which in turn

predict safety related events and injuries. These findings suggest that leaders who do not get involved in workplace safety and ignore safety issues have a negative effect on safety performance beyond the lack of positive effects.

The possible limitations of this study were mono-source bias due to a reliance on self-report data and the results may have been impacted by organisational rather than individual differences, as the data was collected from a variety of organisations.

### *Health Care*

Mullen and Kelloway (2009) in an experimental study in Canada, assessed transformational leadership based interventions using a pre-test, post-test, and control group design. Randomly assigned training was given on general transformational leadership, safety-specific transformational leadership and a control group, to 54 leaders from 21 long-term health care organisations. Survey questionnaires were administered to the study participants to measure a range of leadership and safety outcome variables. The results of the study showed that the safety attitudes of leaders were highest among those who participated in the safety-specific transformational leadership training, compared to managers who received the general transformational training or the control group. Employees' perception of safety climate and the rating of the safety-specific transformational leadership of their managers both increased as a result of the training intervention. This study's contribution to occupational safety and leadership literature is that it is one of the first known evaluations of transformational leadership based training on safety results.

Possible limitations to this research were non-response bias as the perceptions of non-respondents may have been different from respondents. Also, attrition during the study due to summer vacation leave, the internal validity of self-report injury data, and the small sample size.

### **3.3.5.3 United Kingdom**

#### *Offshore Oil and Gas*

O'Dea and Flin (2001) conducted a survey questionnaire study of 200 offshore installation managers from 157 offshore oil and gas installations belonging to 36 organisations. The study included investigating the relationship between managers' experience and leadership style with their safety attitude and behaviour. The questionnaires gathered data regarding the managers' leadership style, level of experience, accident causation, safety climate, and safety leadership. The study findings suggest that experience is not the main factor in determining leadership style or safety attitude. However, managers with a more directive style and less experienced were found to overestimate their ability to motivate and influence the workforce. Furthermore, the results of this study suggest that managers believe that participative management is most effective in safety leadership. However, while managers may have good intentions of employing a participative style with subordinates, most managers still employ a directive leadership style.

### **3.3.5.4 Israel**

#### *A Manufacturing Plant*

Zohar (2000) conducted a study involving 53 work groups in a single manufacturing company. He used survey questionnaires to collect data to test a group-level model of safety climate. The model specifies that safety climate perceptions relate to supervisory practices indicative of concern for subordinates well-being. The criterion variable was an objective organisational measure that recorded behaviour dependent minor injuries that required medical attention (micro-accidents). This study found a link between supervisory practices and perceptions of safety climate, which in turn predicted injuries. The results indicated that during the five month period following the climate measurement, that the perception of safety climate significantly predicted micro-accidents.

#### *A Metal Processing Plant*

Zohar (2002) did a study involving workers in a metal processing plant. The 411 workers were divided in work groups, 42 of which participated in the study. Two survey questionnaires were administered to determine the safety climate, and the leadership style of the supervisors. The study examined if safety climate mediates the relationship between leadership and injury rate. The results indicated that transformational leadership and contingent reward predicted injury rate. The relationship between leadership style and injury rate was mediated by safety climate. A possible limitation of this study was the use of a small sample.

#### *Several Manufacturing Plants*

Zohar and Luria (2010) conducted a study to test the moderating effect of transformational supervisory leadership on the relationship between organisational and group safety climates in risky operations. The sample consisted of 3953 production workers in 401 work-groups nested in 36 manufacturing plants. The study findings indicated that when organisational commitment to safety was limited, transformational leaders achieved a higher group safety climate than the prevailing organisational safety climate. The results of the study also indicated that when company employees had limited consensus regarding the priority of organisational safety, transformational leaders achieved a greater consensus among group members regarding the organisational safety climate. These results indicate that transformational leaders achieve better group safety climate under conditions of low organisational safety climate. They also better inform their subordinates of organisational priorities, influencing their organisational climate perceptions.

A possible limitation of this study was mono-source bias as climate and leadership data were both sourced from group members.

#### **3.3.5.5 South Africa**

##### *SIMRAC Mining Study (1998)*

Schutte (1998) in a study done on behalf of the Safety in Mines Research



Advisory Committee (SIMRAC) developed a success factor model to achieve safety excellence. Schutte (1998: ii) states that the leadership challenge is:

To change the worker's poor perception of safety to an excited, empowered, valued employee who is continuously committed to the achievement of high levels of health, safety and conformance.

Some of the recommendations of this study to achieve a safety committed workforce were (Schutte, 1998):

- The human factor is pivotal to safety and safety related matters.
- Successful companies world-wide increasingly use:
  - A culture of openness and involvement.
  - Strategies of empowerment and people development.
  - Teamwork to enhance their safety performance.
- Excellence in safety lies at the foundation of a healthy morale, positive attitudes, constructive behaviour, and an involved workforce.
- In behaviour based safety, effective and efficient safety management is a process which begins with human behaviour.

The key recommendations of this study to accomplish an incident free workplace are focused on providing high involvement leadership. Also, the entire workforce needs to be convinced of the safety vision and shared safety values, and a supportive and safety conscious culture needs to be developed.

#### *SIMRAC Mining Study (2005)*

Hill (2005) in another study commissioned by SIMRAC conducted a survey of the health and safety culture in the South African mining industry. Some recommendations from this study are the following:

- Focus on safety culture.
- Foster a culture of learning.
- Go beyond compliance and systems as a driver of safety and health to assessing and managing risk exposure.
- Develop a forum where consultations between the three key stakeholders (owners, workers representatives, and government)

regarding safety issues can take place.

- Leadership at management and supervisory level needs to be improved through training. Management and employees need to work on improving their trust relationship.
- Mines to be managed in smaller business units to achieve a more positive safety culture.
- The role of government and regulators to focus more on behaviours and culture rather than systems and engineering only.
- Safety and production to be managed as an integrated single entity.

#### *Impala Mining Study*

Dunne and Andrews (2010) conducted a qualitative study on Impala by conducting interviews with a cross section of management and the workforce. The study investigated the drivers of sustainable safety performance that will allow Impala to achieve its 2012 goal of zero lost time injuries. They concluded by examining areas of the organisation that had achieved success in safety performance that leadership plays a vital role in creating the culture and mindset required for safety success. They highlighted several aspects of leadership that is required to create the right safety culture and mindset. These included genuine care for people, leading by example, consistent communication on safety issues, and firm but fair application of discipline. This study also concluded that production pressures had an adverse impact on safety outcomes as it caused the workforce to prioritise productivity over safety.

#### *Impala Mining Study (DuPont)*

DuPont Safety Resources (2010) conducted a safety benchmarking assessment of Impala by means of a survey questionnaire that was completed by 4400 employees including managers, supervisors, and workers. Some of the key recommendations from this study to achieve safety excellence included; management to exercise discipline, provide positive recognition for successes, leaders to convince workers that injuries are preventable, and safety and productivity to be managed as a single entity.

### *Summary*

Hofmann and Morgeson (1999) found that perceived organisational support and leader-member exchange are both linked to injury rate. Transformational leadership appears to moderate the relationship between organisational safety climate and group safety climate (Zohar and Luria, 2010). The empirical studies done in various contexts suggest that transformational leadership is negatively related to injuries and that this relationship is mediated by safety climate (Zohar, 2000; Zohar, 2002; Barling, *et al.*, 2002; Kelloway, *et al.*, 2006). While most leaders want to use participative leadership they often use a directive leadership style (O'Dea and Flin, 2001). Some qualitative studies suggest that both transactional and transformational leadership are required for the delivery of safety excellence (Dunne and Andrews, 2010; DuPont Safety Resources, 2010). It is important to manage safety and productivity as a single entity (Hill, 2005; Dunne and Andrews, 2010; DuPont Safety Resources, 2010). Training leaders in the use of transformational leadership appears to improve group safety climate and increases the followers' perception of the leaders' transformational leadership style (Mullen and Kelloway, 2009).

## **3.4 Productivity**

### ***3.4.1 Productivity Leadership***

Several empirical studies in different contexts have found evidence supporting the relationship between transformational leadership and productivity (Yammarino, *et al.*, 1993; Thite, 1999; Masi and Cooke, 2000; Bass, *et al.*, 2003; Pillai and Williams, 2003).

As the underground mining process on Impala is labour intensive and operates in a harsh underground environment, leadership is vital in motivating the crews to deliver safety and productivity excellence. Gouldner (1954) and Phakathi (2002) found that in the uncertain environment of underground mining, some workers were inclined not to follow bureaucratic rules and relied more on nonstandard work practices and improvisation to guide their behaviour in the production process.

Ryan (2006) states that in the late 1990s, under the leadership of the then CEO Steve Kearney, Impala achieved major improvements in productivity. Ryan (2006) in describing the details of Kearney's leadership style provides examples of a leader who applied both transactional and transformational leadership. Kearney applied transactional leadership by holding subordinates accountable for productivity while handsomely rewarding the performers with bonuses and share options. He also used transformational leadership (Ryan, 2006):

- He espoused a vision for the future and used charisma to sell this vision to the organisation.
- Inspired the workforce by both engaging and listening to them on equal terms.
- Applied intellectual stimulation by challenging conventional thinking to get the mechanisation of mining on Impala implemented.
- Showed individual consideration by identifying and developing talented people at Impala.

Ryan (2006: 173) attributes much of this success to the humanism that Kearney brought to "Impala's mine culture that was previously conspicuously absent", and quotes from Kearney's Master in Business Leadership (MBL) thesis:

Although conclusions of researchers has been mixed with regard to the link between pay and productivity, it appears that changing the way workers are treated may boost productivity more than changing the way they are paid and combined with worker participation, may be the best system of all.

### ***3.4.2 Empirical Studies: Transformational Leadership and Productivity***

This section reviews several empirical studies conducted in various parts of the world in different contexts, which investigated the relationship between transformational leadership and various measures of productivity. In general, the results of the many empirical studies suggest a positive relationship between transformational leadership and productivity. In addition, various variables mediate the relationship between transformational leadership and productivity. The empirical leadership studies discussed in this section are grouped geographically and listed chronologically.

### **3.4.2.1 United States of America**

#### *Mining*

Gouldner (1954) conducted a study in a gypsum mine in the United States of America (US). He found that in the underground environment of a mine, working conditions are unpredictable and that bureaucracy did not function well. His study showed that in the underground environment, the workforce instituted their own informal work practices and resisted bureaucratic rules and procedures. Haralambos and Holborn (2000: 278) in reviewing the study concluded that since the problems encountered underground, “did not follow a standard pattern, a predetermined set of rules was not suitable for their solution”.

A factory located on the surface of the mine which processed the ore from the mine into wallboards, worked in a more bureaucratic system since the operation was more predictable (Gouldner, 1954). Haralambos and Holborn (2000: 279) concluded that, “bureaucratic administration is more suited to some tasks than others. In particular, it is not well suited to non-routine, unpredictable operations”.

#### *Army Recruiting Command*

Masi and Cooke (2000) studied the effects of transformational and transactional leadership on organisational productivity in a military setting of the US Army Recruiting Command. A sample of 3274 mid-level leaders, station commanders, and recruiting personnel were administered survey questionnaires to measure commanders' leadership style. Objective measures of productivity were obtained from organisational records. The results of the study showed that transformational leadership was positively, but not significantly related to productivity while transactional leadership was negatively significantly related to productivity. Masi and Cooke (2000) concluded that in this military context, transformational leaders positively impacted productivity while transactional leaders tended to suppress subordinates productivity.

Possible limitations of this research included generalisation as the study only included the military. Also, self-report questionnaires which may have affected accuracy, and the use of a cross-sectional design which ruled out the establishment of causality.

#### *Fire Department*

Pillai and Williams (2003) tested a model proposing that transformational leaders created committed and high performing work groups by increasing employee self-efficacy and cohesiveness. The sample used was 271 fire department personnel in the south-eastern US. Survey questionnaires were administered to measure transformational leadership, group cohesiveness, self-efficacy, organisational commitment, and perceptions of unit performance. No objective measures of unit performance were available. The study found that in the constantly changing environment of a fire and rescue organisation, that transformational leadership was related to perceptions of unit performance and commitment, both directly and through the mediating variables of self-efficacy and cohesiveness.

Possible limitations of this research included the use of cross-sectional data which means that causality cannot be inferred. Also, the use of self-reports introducing mono-source bias which may have affected accuracy, and a lack of objective measures of performance.

#### *Army Combat Simulation*

Bass, *et al.* (2003) conducted research in the US Army, where they studied 72 platoon leaders and sergeants. They measured their leadership style while operating under stable conditions. These leadership ratings were used to predict subsequent performance of their platoons operating under conditions of high stress and uncertainty, participating in combat simulation exercises. A number in excess of 1300 respondents filled out the survey questionnaires. There were survey questionnaires for leadership, potency, and cohesion measurements. The 72 platoons had their performance rated by military experts during the combat simulation exercises. The results of the study showed that both transformational and transactional contingent reward

leadership ratings of platoon leaders and sergeants positively predicted unit performance in the context of challenging and uncertain conditions. The relationship of platoon leadership to performance was partially mediated by the unit's state of potency and cohesion.

Possible limitations of this study were; the effect of new members joining the group during the research period; not taking into account the effect of experience in predicting performance; feedback between missions affecting future performance; non measurement of the collective leadership of platoon leaders and sergeants; and the collection of ratings of potency and cohesion from the same source at the same point in time.

### **3.4.2.2 Canada**

#### *Banking*

Barling, Weber and Kelloway (1996) conducted a field experiment using a pretest – posttest control-group design. The study examined the effects of transformational leadership training on attitudinal and financial performance of 20 branch managers, for one region of a Canadian bank. Training consisted of a one day group session and four individual booster sessions done on a monthly basis thereafter. The results of the study showed that subordinates of the managers who received transformational training, perceived their supervisor as being higher on charisma, intellectual stimulation, and individual consideration than subordinates of managers' in the control group that did not receive training. The subordinates of the managers who received transformational leadership training showed improved organisational commitment. There was also evidence that they produced better financial results. This study suggests that a transformational leadership style improves productivity and can be taught to leaders.

A limitation of this study was the small sample size which mitigated significant findings.

### **3.4.2.3 Australia**

#### *Project Management*

Thite (1999) conducted a study in Australia investigating the key characteristics of technical project leadership. A sample of 36 organisations representing a variety of industries participated in the research. The majority of the participating organisations belonged to the computer service industry. Each participating organisation included two project teams in the survey, one considered successful and another less successful. Survey questionnaires were administered to measure leadership style, technical leadership, and three contingency factors (project mission, top management support, and technical tasks). Leadership outcomes were measured as individual and group effectiveness, extra effort by followers, and satisfaction with the leader. The study found that a combination of transformational and technical leadership behaviours augments the effectiveness of transactional leadership, leading to high project success. This study also found support for a positive relationship between the contingency factors of clear project mission, top management support, and better availability of technical resources with project success. This study gives further support for the full range leadership theory, that a transformational leadership style augments transactional leadership.

Possible limitations of this study were external validity as it mainly involved the information technology industry, and only examined limited critical success factors for projects.

### **3.4.2.4 South Africa**

#### *Deep-level Gold Mining Study*

Phakathi (2002) conducted a case study using qualitative methods of self-directed work teams (SDWT) in a deep-level South African gold mine. The study found that in this uncertain environment that the workers had to balance safety and productivity pressures to tackle the “endemic uncertainties and organisational dysfunctions of mining” (Phakathi, 2002:



284). Organisational dysfunctions of material shortages, machinery breakdowns, budgetary constraints, and compliance to mining standards in this uncertain environment often led workers to engage in risk-taking and improvisation. This involved “often circumventing standard work rules” to meet their productivity targets, which sometimes led to injuries (Phakathi, 2002: 284). The study recommends that workers’ practical experience be incorporated into training programmes. This includes the critical concept of teamwork to achieve both safety and productivity excellence. These findings give support to Gouldner's (1954) research, that bureaucratic rules do not work well in an underground mine environment due to the inherent uncertainties of the mining process.

### *Platinum Man*

Ryan (2006) in his book *Platinum Man* details the transformational work that Steve Kearney did at Impala during his term as chief executive officer (CEO). Significant improvements in both safety and productivity took place under Kearney’s leadership. Ryan (2006) mainly attributes Kearney’s success to his charismatic visionary leadership, humanism, exceptional motivational ability, technical ability, and his strong belief in teamwork.

### *Impala Mining Study*

Podgaetz (2010) conducted a study at Impala to determine the factors that affect safety and productivity delivery. The study involved conducting interviews and observing the workforce in the underground working environment. A key recommendation from this study was to reward the desired behaviours of supervisors for both safety and productivity delivery. Also, the provision of leadership training to supervisors, so that they can handle people and communication issues more effectively.

### *Summary*

The empirical results indicate that an unpredictable underground mining environment does not lend itself to bureaucratic leadership, and instead fosters improvisation and risk taking (Gouldner, 1954; Phakathi, 2002). Some studies suggest that transformational leadership is linked to productivity

through the mediating effect of cohesiveness (Pillai and Williams, 2003; Bass, *et al.*, 2003). Charismatic leadership predicts productivity in an uncertain environment (Waldman, Ramirez, House and Puranam, 2001; Pillai and Williams, 2003; Bass, *et al.*, 2003). Transformational leadership was found to augment transactional leader in the delivery of project success (Thite, 1999). Steve Kearney achieved improved safety and productivity delivery at Impala by using charisma, vision, humanism, motivation, technical knowledge, and teamwork (Ryan, 2006). Training leaders in transformational leadership leads to subordinates' perceiving higher transformational traits in their leader and having greater organisational commitment and productivity (Barling, *et al.*, 1996). Potgaetz (2010) recommends the use of contingent reward and leadership training to achieve the simultaneous delivery of safety and productivity excellence.

### **3.5 Safety and Productivity**

#### **3.5.1 Safety versus Productivity**

Frankel (2011) states that many South African mining companies have not managed to align safety and productivity values into a single paradigm. O'Dea and Flin (2003) state that evidence from investigations on accident causation suggests that managers balance safety with other organisational requirements. Consequently, they balance safety against other responsibilities, including pressure to achieve high productivity and meet the schedule (Wright, 1986; Pate-Cornell, 1990). Decisions made by senior management will affect the attitudes, behaviours, and priorities of employees and managers at lower levels, and will greatly influence the emphasis they give to the competing values of safety and productivity (O'Dea and Flin, 2003). Wright (1986), in his investigations into accident causes in the United Kingdom's (UK) offshore oil industry found that perceptions of productivity pressure can convince workers that taking short cuts is expected in carrying out their work. Hence, they focus their attention on completion rather than the safety aspects of the job.

Carrillo (2005: 31) describes the trade-off between safety and productivity as

a paradox, “sets of opposites that appear to be in conflict, but are both needed for success”. She argues that it is essential for leaders to be able to understand and explain paradoxes. This enables them to be effective in addressing the associated ethical and moral dilemmas that can cause conflict between safety and productivity priorities. It is inevitable that in the course of running an organisation that decisions based on balancing productivity and safety will have to be made. Carrillo (2005) states that the first step to address paradoxes is to be aware of their existence. Then acquiring the skills to balance and discuss these situations so that an organisation can deliver productivity, safety, quality, and cost-effectiveness. Carrillo (2005) argues that leaders who are able to sensibly talk about the ethical issues that underlie paradoxes are better able to motivate and inspire employee commitment to safety. Carrillo (2010) states that the challenge for a leader to overcome the paradox of safety and productivity is to be able to communicate in a way that helps followers recognise that productivity and safety are interdependent rather than contradictory.

### **3.5.2 Leading with Safety**

Krause (2005: 2) advocates “leading with safety” which involves mobilising the organisation behind the prevention of workers being injured or killed, at work or off the job. Krause (2005) argues that occupational safety is a common value for both management and workers alike and by making safety the top priority, demonstrates to workers that the organisation cares about them. Consequently, through the principle of reciprocity, the culture of the workforce unifies around safety, resulting in improved safety results. A spin-off of achieving improved safety is that other operational parameters, such as productivity, also improve. It appears that operational excellence in different areas is correlated (Krause, 2005). O’Dea and Flin (2003: 13) support this view, stating that “the basic elements of building a safer and healthier workplace environment are congruent with the criteria important to achieving excellence in quality and productivity”. Peters (1989) states that organisation’s with clear safety objectives also tend to be more productive. Gaertner, *et al.* (1987) also found evidence to suggest that companies with better safety records tended to have better productivity.

Krause (2005) highlights the pivotal role supervisor's play in delivering safety and productivity excellence. He argues that the supervisor is very close to the workers and consequently their perception of the organisation's priorities is filtered through his/her behaviour. Supervisors play a key role in addressing workplace hazard exposure, communicating organisational priorities and values, and influencing the climate of the workgroup. The effective supervisor has good communication skills, develops strong working relationships with subordinates, and exercises fair decision making. He/she incorporates the organisation's priorities and values into daily activities and regularly interacts with the workforce on addressing hazard exposures in the workplace (Krause, 2005).

O'Dea and Flin (2003: 37) suggest that effective supervisors have the following characteristics:

- A supportive style of leadership.
- Prioritised teamwork.
- Exhibited fairness leading to good safety climate.
- Involved employees in decision making.
- Less inclined to push hard for production or to cut corners on safety.
- High quality relationship with subordinates.

These findings suggest that supervisors who demonstrate care for employees create a positive safety climate and ultimately deliver both safety and productivity excellence.

### **3.6 Leadership Study Methods**

Quantitatively based surveys have been the method of choice in the study of leadership in organisations (Conger, 1998; Berson, 1999; Friedrich, Byrne and Mumford, 2009). Friedrich, *et al.* (2009) argue that surveys are an important means for researchers to collect data from leaders as it is very difficult to use experimental methods. Also, most of the major theories of leadership have already got associated questionnaires. Quantitative surveys allows for hypotheses to be tested, the results can be discussed and

published, and possibly generalised to the population. However, there has been some criticism of the limitations of survey designs and quantitative methodologies used in leadership studies (Bryman, Stephens and Campo, 1996; Conger, 1998; Berson, 1999; Friedrich, *et al.*, 2009). These limitations include:

- Common method bias.
- Failure to measure relevant control variables.
- Not testing alternative models of the data.
- Not demonstrating the incremental theoretical contribution.
- Respondents falling back on implicit models of leadership.
- Response bias like the halo effect lowering the discriminant validity of survey measures.
- Not taking the leadership context into consideration.
- Levels of analysis classification.
- Inconsistencies in the factor structure of some survey instruments.

An argument has been put forward for more leadership studies to use the mixed method research design. The triangulation of multiple methods will lead to better understanding of the deeper structures of leadership phenomena and the leadership context (Conger, 1998; Berson, 1999; Antonakis, Avolio and Sivasubramaniam, 2003). Berson (1999) argues that triangulation of mixed methods will improve leadership measurements at the levels of analysis, context, and content identification. The problems tackled by social science researchers are complex, and using either quantitative or qualitative methods alone is inadequate in addressing this complexity. Furthermore, more insight can be gained from the combination of both quantitative and qualitative research than either form by itself (Creswell, 2009). Hence, the researcher decided to use a sequential explanatory mixed methods research design to investigate supervisor leadership in the context of Impala underground mining. This triangulation method uses data from the qualitative second phase to better explain the quantitative results from the first phase of the study.

Neuman (2006: 40) defines a case study as, “research that is an in-depth examination of an extensive amount of information about very few units or cases for one period or across multiple periods of time”. Yin (2009: 48) states that a valid rationale for a single case study is the “representative or typical case”. The researcher believes that Impala is a representative case for the underground conventional hard rock mining industry in South Africa. This assumption is based on the fact that the mining methods employed are broadly similar. Also, the management structures are comparable as the supervision structures in underground mining is regulated by the Mines Health and Safety Act No. 29 1996 (MHSA). There are further advantages to a single case study compared to multiple cases as argued by Dyer and Wilkins (1991: 634):

A multiple case study research places too much emphasis on general constructs, they tend to neglect the more tacit and less obvious aspects of the setting under investigation. They are more likely to provide a rather distorted picture or no picture at all, of the underlying dynamics of the case.

While case study research is mainly qualitative, the use of survey instruments to study effective leadership will generate data that lends itself to numerical representation (Gustafson, 2001). Gustafson (2001: 126) states that the use of case studies “is considered a valid way of developing or refining existing theories”. Gustafson (2001: 127), further states that:

Case studies examining multiple aspects of a phenomenon within a single organisation are considered viable in providing deeper understanding of a theoretical phenomenon in actual application and contribute to the generalisability of findings in similar settings or under similar conditions.

Yin (2009) argues that a weakness of the case study method is that it does not provide a credible basis to generalise the results. However, the results of this case study may have inferences for other mining organisations and other organisations operating in an uncertain environment. This assertion is based on theoretical groundwork as the phenomenon of leadership is universal.

Therefore, the chosen research design for this study was a case study based on Impala using a sequential explanatory research design.

### **3.7 Conclusion**

The literature review suggest that supervisors' transformational leadership style is related to injuries through the mediating effect of group safety climate in various contexts (Barling *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006). There is also evidence to suggest that transformational leadership is related to productivity through the mediating effect of group cohesiveness in different environments (Pillai and Williams, 2003; Bass, *et al.*, 2003). Transformational leadership seems to be particularly effective in uncertain environments (Waldman, *et al.*, 2001; Bass *et al.*, 2003). However, no studies could be found where the effect of supervisor's transformational leadership style in dealing with the trade-off required in the simultaneous delivery of both safety and productivity excellence was investigated in the same study. Finding the answer to this question is important because the literature suggests that leaders have difficulty in managing the trade-off between safety and productivity (Wright, 1986; O'Dea and Flin, 2003; Carrillo, 2005; Frankel, 2011). Several authors have noted that the delivery of safety excellence is correlated with higher productivity (Gaertner, *et al.*, 1987; Peters, 1989; O'Dea and Flin, 2003; Krause, 2005). Krause (2005) further suggests that leaders should prioritise safety to build cultural unity with the workforce and consequently productivity and quality will also improve. However, no empirical evidence for a relationship between transformational leadership and the delivery of both safety and productivity was provided.

This study was undertaken to fill the gap in the body of knowledge regarding the relationship between transformational leadership and the simultaneous delivery of both safety and productivity excellence. Investigating these relationships in the context of underground conventional hard rock mining in South Africa has not been done previously and the results may have important theoretical and practical applications. Furthermore, most empirical leadership studies that have been undertaken have used quantitative research designs and used respondents' perception to measure the leaders' effectiveness. This study used a mixed method research design to triangulate the findings from different sources. The literature suggests that mixed

methods are more appropriate to explore the deeper structures of leadership phenomena and the leadership context (Conger, 1998; Berson, 1999; Antonakis, *et al.*, 2003). Objective organisational measures of both injury rate and productivity were used in the study which helped address the problem of mono-source bias common in previous empirical leadership studies (Binning, Zaba and Whattam, 1986; Lowe, *et al.*, 1996).

The choice of a sequential explanatory mixed method research design and the methodology used in the study is motivated in chapter four.



# CHAPTER FOUR

## RESEARCH DESIGN AND METHODOLOGY

### 4.1 Introduction

Phillips (1971) defines research design as:

The blueprint for the collection, measurement, and analysis of data. It aids the scientist in the allocation of his limited resources by posing crucial choices: Is the blueprint to include experiments, interviews, observation, the analysis of records, simulation, or some combination of these? Are the methods of data collection and the research situation to be highly structured? Is an intensive study of a small sample more effective than a less intensive study of a large sample? Should the analysis be primarily quantitative or qualitative?

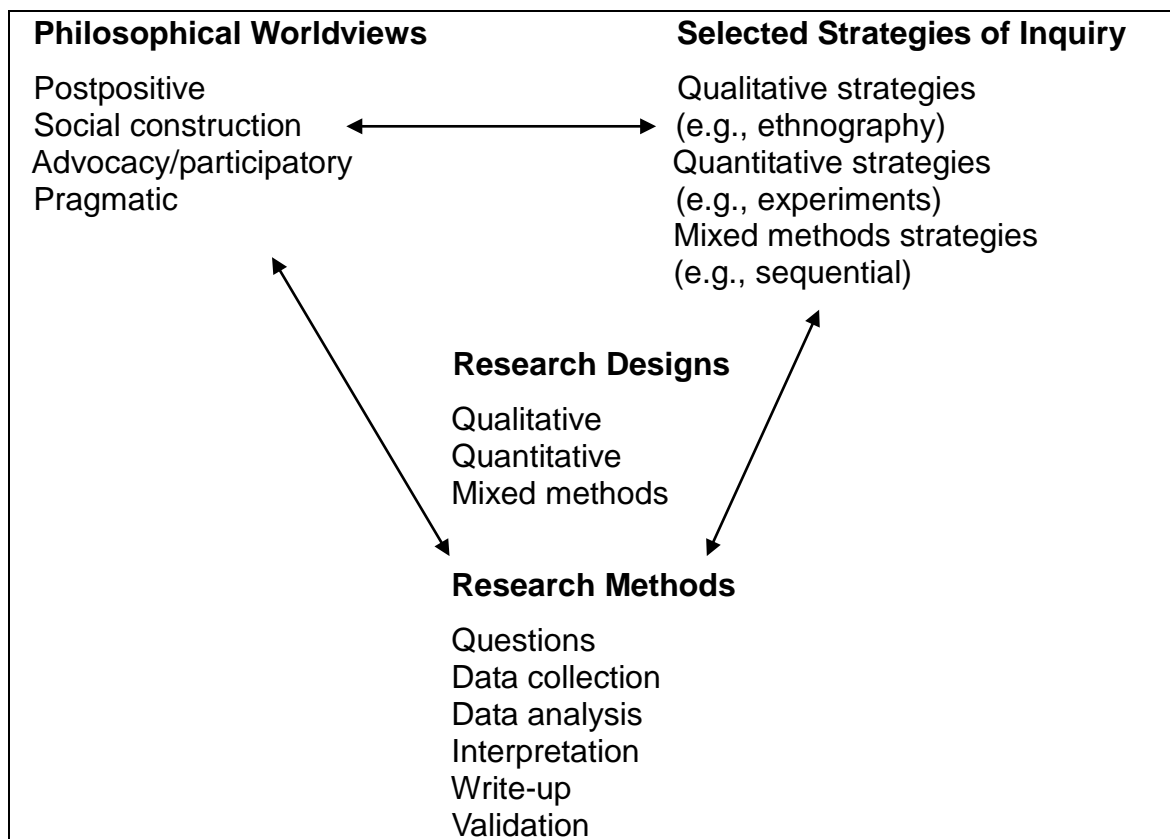
Taking all these aspects into account, the researcher needed to choose a research design in order to reach reliable conclusions about the thesis posed. Creswell (2009: 6) uses the term worldview to describe the researcher's "general orientation about the world and the nature of research". Creswell (2009) describes the four worldviews that influence researchers in selecting quantitative, qualitative or mixed methods approaches in their research as, postpositivism, constructivism, advocacy/participatory, and pragmatism. The major elements of these worldviews are summarised in Table 4.1 below.

**Table 4.1: Four Worldviews**

<b>Postpositivism</b>	<b>Constructivism</b>
<ul style="list-style-type: none"><li>• Determination</li><li>• Reductionism</li><li>• Empirical observation and measurement</li><li>• Theory verification</li></ul>	<ul style="list-style-type: none"><li>• Understanding</li><li>• Multiple participant meanings</li><li>• Social and historical construction</li><li>• Theory generation</li></ul>
<b>Advocacy/Participatory</b>	<b>Pragmatism</b>
<ul style="list-style-type: none"><li>• Political</li><li>• Empowerment issue-oriented</li><li>• Collaborative</li><li>• Change-oriented</li></ul>	<ul style="list-style-type: none"><li>• Consequences of actions</li><li>• Problem-centered</li><li>• Pluralistic</li><li>• Real-world practice oriented</li></ul>

Source: Creswell (2009)

Creswell (2009: 5) states that researchers need to consider the “philosophical worldview assumptions” that they use in a study, the related strategy of inquiry, and the methods of research that translate the approach into practice. Creswell (2009: 5) suggests a framework to show the interaction of these three components as shown in Figure 4.1 below.



**Figure 4.1: A Framework for Research Design**

Source: Creswell (2009)

The qualitative research strategy is used to investigate a phenomenon in depth while the quantitative method is used to test hypotheses and making the study more objective. Mixed methods use both qualitative and quantitative strategies, where both methods triangulate to support each other in an integrated framework (Creswell, 2009).

There are several qualitative research designs that can be used depending on the type of study being undertaken (Leedy and Ormrod, 2010):

- Case study
- Ethnography study
- Phenomenological study
- Grounded theory study
- Content analysis.

Quantitative research designs are mostly experiments, cross-sectional surveys, and longitudinal surveys (Creswell, 2009).

Mixed methods use the qualitative and quantitative strategies either concurrently, sequentially or transformative (where the researcher uses either the concurrent or sequential approach depending on the chosen theoretical lens) (Creswell, 2009). Creswell and Plano Clark (2007) state mixed methods research has evolved through four phases from its formative phase in the 1950s through the paradigm debate (could quantitative and qualitative data be combined) and the procedural period (procedures for designing a mixed method study) to the emerging recent interest phase.

These alternative strategies of inquiry are summarised in Table 4.2 below (Creswell, 2009: 12).

**Table 4.2: Alternative Strategies of Inquiry**

Quantitative	Qualitative	Mixed Methods
<ul style="list-style-type: none"> <li>• Experimental designs</li> <li>• Non-experimental designs, such as surveys</li> </ul>	<ul style="list-style-type: none"> <li>• Narrative research</li> <li>• Phenomenology</li> <li>• Ethnographies</li> <li>• Grounded theory studies</li> <li>• Case study</li> </ul>	<ul style="list-style-type: none"> <li>• Sequential</li> <li>• Concurrent</li> <li>• Transformative</li> </ul>

Source: Creswell (2009)

Creswell (2009: 16) states that “the worldviews, the strategies, and the

methods” all influence the selection of a research design that tends to be qualitative, quantitative or mixed. A comparison of the three research strategies is shown in Table 4.3, which summarise distinctions that are useful in selecting an approach (Creswell, 2009: 17).

**Table 4.3: Qualitative, Quantitative, and Mixed Methods Approaches**

<b>Tend to or Typically...</b>	<b>Qualitative Approaches</b>	<b>Quantitative Approaches</b>	<b>Mixed Methods Approaches</b>
<ul style="list-style-type: none"> <li>• Use these philosophical assumptions</li> </ul>	<ul style="list-style-type: none"> <li>• Constructivist/ advocacy/ participatory knowledge claims</li> </ul>	<ul style="list-style-type: none"> <li>• Post-positivist knowledge claims</li> </ul>	<ul style="list-style-type: none"> <li>• Pragmatic knowledge claims</li> </ul>
<ul style="list-style-type: none"> <li>• Employ these strategies of inquiry</li> </ul>	<ul style="list-style-type: none"> <li>• Phenomenology, grounded theory, ethnography, case study, and narrative</li> </ul>	<ul style="list-style-type: none"> <li>• Surveys and experiments</li> </ul>	<ul style="list-style-type: none"> <li>• Sequential, concurrent, and transformative</li> </ul>
<ul style="list-style-type: none"> <li>• Employ these methods</li> </ul>	<ul style="list-style-type: none"> <li>• Open-ended questions, emerging approaches, text or image data</li> </ul>	<ul style="list-style-type: none"> <li>• Closed-ended questions, predetermined approaches, numeric data</li> </ul>	<ul style="list-style-type: none"> <li>• Both open- and closed-ended questions, both emerging and predetermined approaches, and both quantitative and qualitative data and analysis</li> </ul>
<ul style="list-style-type: none"> <li>• Use these practices of research as the researcher</li> </ul>	<ul style="list-style-type: none"> <li>• Positions him- or herself</li> <li>• Collects participant meanings</li> <li>• Focuses on a single concept or phenomenon</li> <li>• Brings personal values into the study</li> <li>• Studies the context or settings of participants</li> <li>• Validates the accuracy of findings</li> <li>• Makes interpretations of the data</li> <li>• Creates an agenda for change or reform</li> <li>• Collaborates with the participants</li> </ul>	<ul style="list-style-type: none"> <li>• Tests or verifies theories or explanations</li> <li>• Identifies variables to study</li> <li>• Relates variables in questions or hypotheses</li> <li>• Uses standards of validity and reliability</li> <li>• Observes and measures information numerically</li> <li>• Uses unbiased approaches</li> <li>• Employs statistical procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Collects both quantitative and qualitative data</li> <li>• Develops a rationale for mixing</li> <li>• Integrate the data at different stages of inquiry</li> <li>• Presents visual pictures of the procedures in the study</li> <li>• Employs the practices of both qualitative and quantitative research</li> </ul>

Source: Creswell (2009)

This study investigated the relationship between transformational leadership and the delivery of both injury rate and productivity excellence at Impala. The mediating effects of group safety climate on injury rate and group cohesiveness on productivity were also investigated. Motivation is provided for the selection of a sequential explanatory mixed methods case study research

design. A self-administered survey questionnaire method was used for the quantitative first phase, and the qualitative second phase consisted of a focus group, individual interviews, observations, and documents analysis. The population for the study is described. The use of cluster sampling to get a representative random sample of the case population for the quantitative phase, and purposive sampling for the qualitative phase is discussed. The selection of the survey questionnaires is motivated, their validity and reliability discussed, and the objectives of the pilot-study explained. The statistical analysis of the collected data for the quantitative phase is explained, and the possible generalisation of the findings discussed. The analysis of the qualitative data from the second phase of the study is described. The limitations of the chosen method are expounded, and ethical issues associated with the quantitative and qualitative phases of the study are discussed.

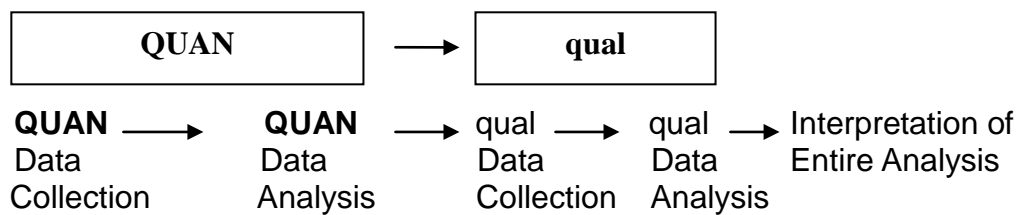
## **4.2 Research Design**

### ***4.2.1 Case Study: Sequential Explanatory Design***

The research design selected for this leadership study was a mixed methods case study that employed a sequential explanatory design (Creswell, 2009). The chosen research design provided empirical evidence to answer the research questions and test the hypotheses. Creswell and Plano Clark (2007: 5) define mixed methods research as:

A research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.

A visual model of the sequential explanatory design is shown below in Figure 4.2 (Creswell, 2009: 209):



**Figure 4.2: Sequential Explanatory Design**

Source: Creswell (2009)

Note

- A → indicates a sequential form of data collection.
- Capitalisation in Figure 4.2 indicates that an approach or method is emphasised.
- Boxes highlight the quantitative and qualitative data collection and analysis.
- “Quan” and “qual” stand for quantitative and qualitative respectively.

The sequential explanatory design involved a two phase research approach. The collection and analysis of quantitative data was done in the first phase, followed by the collection and analysis of qualitative data in the second phase, which helped explain and interpret the quantitative results (Creswell, 2009). The strengths of this design were that it was easy to implement and report as the steps fall into clear separate stages. Possible weaknesses of this design were that it required extensive data collection, took a long time to execute having two separate phases, and required that the researcher be familiar with both quantitative and qualitative forms of research (Creswell, 2009). The sequential explanatory research design was suitable for this study as the proposed leadership model was based on established theory. This lent itself to quantitative analysis and the second phase qualitative analysis helped with interpreting the quantitative findings in the context of underground conventional hard rock mining at Impala. The qualitative data and analysis explored participants’ views in more depth, helping to interpret the quantitative findings (Creswell and Plano Clark, 2007).

## *Survey Method*

Creswell (2009: 145) states that:

A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. From sample results, the researcher generalises or makes claims about the population.

Chadwick, Bahr and Albrecht (1984: 442) define the survey research method as, “a research technique that puts questions to a sample of respondents by means of a questionnaire or an interview”. Babbie (1990), states that there are three general reasons for conducting surveys; description (what questions), explanation (why questions), and exploration (initial search). Babbie (1990: 56) describes a cross-sectional survey as, “data collected at one point in time from a sample selected to describe some larger population at that time”. This mixed methods case study was explanatory in nature as it attempted to establish why the relationships between the study variables exist. Phase one of this study used a cross-sectional survey with the questionnaires for leadership style, group safety climate, and group cohesiveness completed at one point in time. The two outcome variables of injury rate and productivity were objective organisational measures which were accessed from Impala records for a one year period immediately prior to the completion of the cross-sectional survey. This study employed self-administered survey questionnaires, completed under the direct supervision of the researcher at each shaft complex on Impala.

The main reasons for choosing a sequential explanatory mixed methods case study research design for this study are summarised below:

- Transformational leadership is a well established theory (Avolio and Bass, 2004).
- The proposed measurement instrument to measure leadership style, the Multifactor Leadership Questionnaire (MLQ) has been extensively used in leadership studies and has been successfully tested for both validity and reliability in various contexts around the world (Avolio and Bass, 2004).
- Instruments already existed to collect empirical data on the study's

mediating variables (group safety climate (Zohar and Luria, 2005); group cohesiveness (Podsakoff, *et al.*, 1993)), which meet the requirements of validity and reliability.

- Several empirical studies using the MLQ instrument have been completed in different contexts around the world linking transformational leadership with injuries and productivity, in separate studies (Zohar, 2002; Barling, *et al.*, 2002; Bass, *et al.*, 2003; Pillai and Williams, 2003). Therefore, it was possible to compare the results with the existing body of knowledge.
- The criterion variables of injury rate and productivity were measured quantitatively on a ratio scale and therefore lend themselves to quantitative statistical analysis. These variables were measured independently, using organisational objective measures, which helped eliminate the problem of mono-source bias.
- A case study of Impala was done as it is believed by the researcher to be representative of underground hard rock conventional mining in South Africa. It would also have been very difficult due to confidentiality and time constraints, to obtain objective measurements of injury rate and productivity from mining companies outside of Impala.
- Measuring the relationship between transformational leadership and various outcome variables in a single company allowed contextual relevant conclusions to be drawn from the study findings.
- This study facilitated the testing for the existence of the nine leadership factors measured by the MLQ instrument in a South African underground mining context.
- The qualitative data collected using a focus group, interviews, observations, and documents analysis are used to explain the results from the quantitative data analysis to give a deeper interpretation of the leadership phenomenon in the context of underground mining at Impala.



Phase one of this study used a quantitative survey method to test the proposed statistical model. Weight was given to the quantitative data, which informed the secondary qualitative data collection. Phase two used the qualitative methods of a focus group, individual interviews, observations, and documents analysis to get a deeper understanding of the results from the quantitative phase. The two forms of data were separate but connected, as the quantitative results were used to guide the data collection in the qualitative second phase of the study.

### **4.3 Research Methodology**

#### **4.3.1 Quantitative – Phase 1**

##### ***4.3.1.1 Survey Instruments***

This section provides motivation for the use of the three survey instruments used to collect the empirical data in phase one of the study. These survey instruments were used to measure leadership style, group safety climate, and group cohesiveness. The organisational objective measures of injury rate and productivity are also discussed.

##### *Multifactor Leadership Questionnaire (MLQ)*

The survey instrument used to assess leadership style was the Multifactor Leadership Questionnaire Form 5X (MLQ) (Avolio and Bass, 2004) (Appendix 3). The MLQ consisting of 45 items is the latest version of the original MLQ survey questionnaire developed by Bass in 1985. The MLQ measures nine leadership factors, namely Idealised Influence (Attributed II(A)), Idealised Influence (Behaviour II(B)), Inspirational Motivation (IM), Intellectual Stimulation (IS), Individual Consideration (IC), Contingent Reward (CR), Management-By-Exception-Active (MBEA), Management-By-Exception-Passive (MBEP), and Laissez-Faire (LF). The MLQ also measures three leadership outcomes, namely Extra Effort (EE), Effectiveness (EFF), and Satisfaction (SAT). The nine factors of leadership are grouped into three typologies of leadership behaviour: transformational (II (A), II (B), IM, IS, IC), transactional (CR, MBEA), and passive-avoidant (MBEP, LF), which together constitutes the Full Range Leadership Theory (FRLT) (Avolio and Bass, 2004).

Respondents used a five point rating scale on the MLQ to rate how frequently their leaders displayed different leadership behaviours, ranging from “not at all” (0) to “frequently, if not always” (4). The respondents produced a score for each of the nine leadership factors.

Avolio and Bass (2004) tested the MLQ factor structure with normative data collected in the United States of America (US). Table 4.4 shows the intercorrelations among the MLQ factor scores, the factor scale reliability scores, and the descriptive means and standard deviation for each leadership scale.

**Table 4.4: Intercorrelations among MLQ Factor Scores (US Sample)**

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EEF	SAT
II(A)	(.75)											
II(B)	.64**	(.70)										
IM	.68**	.68**	(.83)									
IS	.64**	.59**	.59**	(.75)								
IC	.71**	.60**	.60**	.68**	(.77)							
CR	.67**	.61**	.61**	.61**	.68**	(.69)						
MBEA	-.07**	.02**	.02**	-.01	-.12**	.01	(.75)					
MBEP	-.36**	-.27**	-.27**	-.33**	-.32**	-.32**	.10**	(.70)				
LF	-.49**	-.34**	-.34**	-.39**	-.42**	-.44**	.08**	.61**	(.71)			
EE	.71**	.57**	.57**	.62**	.68**	.63**	-.06**	-.33**	-.42**	(.83)		
EEF	.73**	.56**	.56**	.63**	.67**	.67**	-.06**	-.43**	-.56**	.72**	(.82)	
SAT	.75**	.54**	.54**	.62**	.70**	.64**	-.12**	-.40**	-.52**	.71**	.79**	(.79)
M	2.94	2.77	2.92	2.78	2.85	2.87	1.67	1.03	0.65	2.74	3.07	3.08
SD	0.76	0.72	0.76	0.71	0.78	0.70	0.88	0.75	0.67	0.86	0.72	0.83

Source: Avolio and Bass (2004)

N = 27 285 \* p < .05 \*\* p < .01

Numbers in parentheses are reliability scores.

## Legend

### *Transformational Factors:*

*II (A):* Idealised Influence (Attributed)

*II (B):* Idealised Influence (Behaviour)

*IM:* Inspirational Motivation

*IS:* Intellectual Stimulation

*IC:* Individual Consideration.

### *Transactional Factors:*

*CR:* Contingent Reward

*MBEA:* Management-By-Exception-Active.

### *Passive-Avoidant Factors:*

*MBEP:* Management-By-Exception-Passive

*LF:* Laissez-Faire.

### *Outcomes:*

*EE:* Extra Effort

*EFF:* Effectiveness

*SAT:* Satisfaction.

### *Descriptive:*

*M:* Mean

*SD:* Standard Deviation.

Referring to Table 4.4 the Cronbach's alpha reliability score (this is a measure based on the correlations between different items on the same scale) for all factors are shown, indicating that all these scales are reliable. Table 4.4 shows that there are positive correlations between the five transformational leadership scales, and between the contingent reward scale and each of the five transformational leadership scales. Avolio and Bass (2004) argue that high correlations between the transformational leadership scales and contingent reward are expected for the following reasons:

- Transactional and transformational leadership embody positive, active

forms of leadership.

- Several studies have shown that leaders are both transactional and transformational.
- Consistent honouring of transactional agreements builds consistency and trust with leaders which form a basis for transformational leadership.

Management-by-exception-active (MBEA), a corrective form of leadership had either low positive or negative correlations with the transformational and contingency reward scales. MBEA was positively correlated with management-by-exception-passive and laissez-faire leadership. Avolio and Bass (2004) argue that these results were expected in support of the FRLT.

A common problem in the social sciences is to determine valid and accurate measures of human behaviours and performance (Lowe, *et al.*, 1996). The MLQ also experiences this problem. The MLQ measures the respondent's perception of the leader's effectiveness which can lead to mono-source bias, having a strong impact on findings concerning the leadership style – effectiveness relationship (Binning, Zaba and Whattam, 1986). However, in this study objective measures of safety and productivity were also measured and compared with the perception of the leader's effectiveness. Lowe, *et al.* (1996) found that the relationship between transformational leadership and subjective perceptions of leader effectiveness measured by the MLQ instrument were much higher than leader effectiveness measured by organisational objective measures. Lowe, *et al.* (1996: 418) states that:

It is also likely that organizational measures tend to attenuate the relationship between subordinate ratings of leader behavior and leader effectiveness by focusing the dependent variable on a more narrow perspective of performance (score on a test, percent of goals met, financial indicators) than the constellation of outcomes that might be included in subordinate perceptions (individual development, organizational learning, more ethical practices).

Antonakis *et al.* (2003) in a study examining the nine-factor FRLT using the MLQ, recommends that future research should:

- Report the factor means, factor standard deviations, scale reliabilities, and interfactor correlations to provide for a more comprehensive test

of the FRLT.

- Determine the validity of the FRLT within different national culture settings.
- Measures of leadership and criterion data should be collected separately to determine whether contextual factors alter the nature of the relationship between the leadership factors and criterion variables.

These research issues concerning the FRLT are investigated in this case study. Antonakis *et al.* (2003) found that the current version of the MLQ (Form 5X):

Is a valid and reliable instrument that can adequately measure the nine components comprising the full-range theory of leadership. Although the MLQ (Form 5X) and indeed, any leadership survey instrument, will never account for all possible leadership dimensions, it represents a foundation from which to conduct further research.

#### *Group Safety Climate*

*Group safety climate* was measured using a 16-item scale developed by Zohar and Luria (2005) (Appendix 3). The questionnaire covers various interactions between supervisors and subordinates where supervisors indicate their priority given to safety versus productivity (Zohar and Luria, 2005). This scale measures a wide range of climate indicators concerning supervisory practice in an environment of competing demands (Zohar and Luria, 2005). This scale does not include negatively worded items due to the reluctance of respondents to complete negatively worded statements (Zohar and Luria, 2005). Respondents used a Likert type interval scale ranging from one (strongly disagree) to seven (strongly agree) to indicate their agreement with the statements. This 16-item scale has been successfully used in previous studies (Zohar and Luria, 2005; Zohar and Luria, 2010). In both these studies the Cronbach's alpha measure for internal consistency reliability of the scale was  $\alpha = 0.95$ .

#### *Group Cohesiveness*

Group cohesiveness was measured using a 6-item scale developed by Podsakoff, Niehoff, MacKenzie and Williams (1993) that measures individual perceptions of group cohesiveness (Appendix 3). Respondents used a seven

point Likert type interval measurement scale ranging from “strongly disagree” (1) to “strongly agree” (7) to rate the perceived level of trust and cooperation among group members. Podsakoff, *et al.* (1993) obtained a Cronbach’s alpha internal consistency reliability of  $\alpha > 0.7$  for their study. The same scale was successfully used in a study by Pillai and Williams (2003) where a Cronbach’s alpha internal consistency reliability of  $\alpha = 0.93$  was obtained.

### *Injury Rate*

The organisational objective measurement of safety was the Lost Time Injury Frequency Rate (LTIFR) for each mine overseer’s section, recorded over a period of one year prior to conducting the case study. The LTIFR is an internationally recognised method of recording safety performance in industry (Gardener, 2011).

The LTIFR is calculated as follows:

$$\text{LTIFR} = \frac{\text{number of lost time injuries (LTI's) in the period} \times 1000\ 000}{\text{number of hours worked in the period.}}$$

LTI (Lost Time Injury) = all injuries that cause an employee to lose one or more full days other than the day that the injury occurred.

### *Productivity*

The organisational objective measurement of productivity was the percentage of production target met (% production target met). Productivity is measured in terms of an area ( $\text{m}^2$ ) of rock blasted underground for a mine overseer’s stoping section and metres (m) advanced for a mine overseer’s development section compared to set targets. Mine overseers are set monthly productivity targets by management. These targets are based on best practice benchmarks in addition to the local circumstances in an individual mine overseer’s section. Accurate measurements of the mine overseers’ productivity are independently recorded by the survey department on a monthly basis. These measurements are required in terms of mining

legislation and therefore are believed to be accurate.

### *Pilot-Testing*

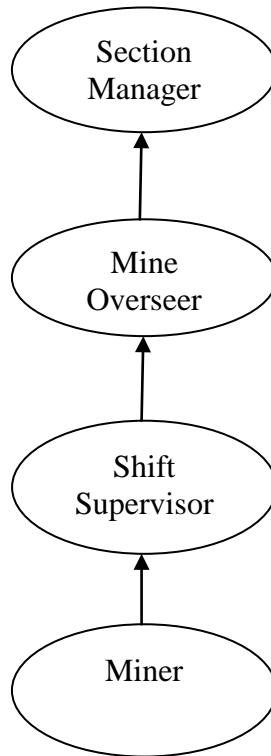
Pilot-testing of the self-administered questionnaires was carried out to ensure that any issues concerning the completion of the questionnaires were identified and addressed prior to administering the survey. The following issues identified by (Fink, 1995: 119) were investigated during the pilot-testing:

- Are the instructions for completing the survey clearly written?
- Are questions easy to understand?
- Do the respondents know how to indicate responses?
- Is privacy respected and protected?
- Do respondents have any suggestions regarding the addition or deletion of questions, the clarification of instructions, or improvements in the format?

### **4.3.1.2 Data**

#### *Target Population*

The context for the case study is underground conventional hard rock mining at Impala. Impala has sixteen managers' sections. The mining management structure in each section is very similar (Figure 4.3). Each section has an appointed responsible manager. The various functional departments report to the section manager including mining, engineering, finance, human resources, geology, rock engineering, safety, ventilation, and survey. This study focuses on the mining department which is responsible for the safety and productivity of the mining personnel who constitute the vast majority of the underground workforce.



**Figure 4.3: Typical Structure of Impala Mining Department**

Babbie (1989: 170) defines a study population as, “that aggregation of elements from which the sample is actually selected”. The population for this case study were Impala’s mine overseers who are engaged in conventional mining (stopping and development) operations at steady state production shafts. In the management hierarchy the shift supervisor level reports to the mine overseer level, who in turn reports to the section manager. The staffing levels of Impala’s mining department supervisory levels are shown in Table 4.5.

**Table 4.5: Impala Mining Department**

<b>Mine</b>	<b>Section Managers</b>	<b>Mine Overseers</b>	<b>Shift Supervisors</b>
Impala	16	52	349

Typically, each section manager has three mine overseers reporting to him, with six shift supervisors reporting to each mine overseer. The unit of analysis in this study is a mine overseer. The mine overseer supervisory level



was chosen to be studied because it is a key position in the mining department and Impala keep records of their injury rate and productivity achievements.

### *Sampling Procedure*

The structure of Impala's mining department constitutes 52 clusters, each cluster consisting of the mine overseer, shift supervisors (subordinate) and section managers (superior) as shown in Figure 4.3.

A random sampling procedure was used in this study to select a representative sample of clusters. Cooper and Schindler (2001: 187) describe the process of cluster sampling as follows:

1. Divide the population into many subgroups, each with a few elements in it. The subgroups are selected according to some criterion of ease or availability in data collection.
2. Try to secure heterogeneity within subgroups and homogeneity between subgroups.
3. Randomly choose a number of the subgroups, which are typically studied in depth.

The conditions for cluster sampling were met in this case study by treating each mine overseer section as a subgroup cluster and randomly selecting a representative sample of clusters. Each subgroup mine overseer section is an underground mining section using the same mining method in the same ore body, operating at Impala. The researcher believes that there is homogeneity between the subgroups and heterogeneity within subgroups.

Data was collected from the selected mine overseer sections in a controlled manner using the following procedure:

- Each of the sixteen manager sections' was surveyed separately.
- The researcher personally supervised the completion of all the questionnaires. There were several advantages to using this approach (Cooper and Schindler, 2001):

- Ensured that the participants understood the objectives of the study.
- Ensured a high response rate.
- Researcher was available to answer any questions regarding the questionnaires, which is believed to have improved the quality of the data collected.
- This method was cost effective.
- The researcher and one assistant were able to coordinate the survey.
- Rapid data collection was achieved.
- A low-distraction environment was provided for the survey completion.

The possible disadvantages of this sampling method:

- Had to convince respondents that their responses would be kept confidential (Appendix 2).
  - The literacy level of some of the respondents in the English language was suspect as English was not their first language.
- The Multifactor Leadership Questionnaire (MLQ) was completed by the section manager for each of the mine overseer's reporting to him.
  - All of the shift supervisors for each section manager's section were assembled together at a suitable venue. The researcher explained the objectives of the study to them and what they needed to do to complete the survey questionnaires. Any questions regarding the process to be followed or the completing of the questionnaires were answered. The shift supervisors completed the MLQ questionnaire (Appendix 3) for their mine overseer. They also completed the group cohesiveness (C) and group safety climate (SC) questionnaires (Appendix 3) for their mine overseer's section. The researcher issued the respondents a signed letter guaranteeing confidentiality (Appendix 2) while questionnaires were completed anonymously and placed in a box provided by the researcher.

- A similar process of administering the questionnaires was followed for the mine overseers. The mine overseers on each manager's section completed the MLQ for themselves and one of their peers. Each mine overseer also recorded demographic information consisting of his age, ethnicity, highest educational qualification achieved, and the number of year's experience as a mine overseer.

By following this process it is believed that quality data was collected and a high response rate was achieved. This process resulted in a 360 degree assessment of the mine overseer's leadership style. In addition, the perceived group safety climate, and group cohesiveness for each mine overseer's section was determined. The objective organisational measures of productivity and injury rate of each selected mine overseer for the year prior to the survey was accessed from Impala records. Mine overseers who had worked for three months or less during the year prior to the survey were excluded from the study. Three months is considered by the researcher as too short a period to obtain reliable injury rate and productivity data.

#### ***4.3.1.3 Data Analysis Techniques***

The data was analysed using both descriptive and inferential statistical techniques as described by (Cooper and Schindler, 2001; Gravetter and Wallnau, 2000).

The data collected from the survey questionnaires used in the study and the dependent variables data was coded and cleaned (Babbie, 1990), before being entered into the statistical analysis system (SAS version 9.2) statistical computer program.

The objective of the quantitative data analysis was to reach conclusions about the hypotheses tested in the case study.

#### ***Descriptive Statistics***

Neuman (2006: 347) defines descriptive statistics as, "a general type of simple statistics used by researchers to describe basic patterns in the data".

Frequency tables and histograms were constructed to show the demographics of the population including number of respondents, and the mine overseers' age, educational qualifications, ethnicity, and years of experience. Descriptive statistics based on the mean and standard deviation were calculated for all measured variables in the study.

All scales used in the study were checked for internal consistency reliability by calculating their Cronbach's alpha statistic. The Cronbach's alpha is a measure of the internal consistency or reliability of a set of items. This is a measure based on the correlations between different items on the same scale. An alpha of between 0.6 and 0.7 is regarded as acceptable reliability, and 0.8 or higher indicates good reliability (Gravetter and Wallnau, 2000). A reliable instrument (questionnaire) is one where similar items are internally consistent, but each of the items contributes unique information to the proposed construct (Gravetter and Wallnau, 2000).

Scatter plots indicating the visible relationship between the various variables were included to show the nature and strength of the association.

Pearson product moment correlation coefficients were calculated to establish the intercorrelations between the measured variables. Gravetter and Wallnau (2000: 531) define the Pearson correlation as, "measures the degree and direction of linear relationships between two variables".

Pearson correlation:  $r = \frac{\text{covariability of X and Y}}{\text{variability of X and Y separately}}$

A correlation score of -1.00 means that there is a perfect negative association between the two variables while a correlation score of 1.00 means there is a perfect positive association between the two variables. A correlation score of 0.00 means that there is no relationship between the two variables (Gravetter and Wallnau, 2000).

### *Aggregation of MLQ Data*

The MLQ was completed by four groups of respondents, namely the section managers, the mine overseers, the mine overseer colleagues, and the shift supervisors. The individual items were measured on a five point Likert scale and were tested for normality using Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-Von Mises, and Anderson-Darling tests. It was detected that the sample data was not normally distributed and therefore the analysis of variance (ANOVA) procedure could not be used to check for differences between the various groups. The nonparametric Kruskal-Wallis test was conducted in order to determine whether the data could be aggregated across the different levels of respondents. The nonparametric Kruskal-Wallis test is based on the analysis of independent random samples from three or more populations (Gravetter and Wallnau, 2000). The Kruskal-Wallis procedure tests the following hypotheses:

$H_0$ : All populations are identical.

$H_1$ : Not all populations are identical.

The Kruskal-Wallis test statistic is based on the sum of ranks for each of the samples and this statistic is used to decide whether the null hypothesis can be rejected or not. When the p-value <  $\alpha$ -value, the null hypothesis is rejected (Gravetter and Wallnau, 2000). The  $\alpha$ -value chosen for this study was 0.05. Descriptive statistics based on the mean and standard deviation were calculated for each of the 45 items of the MLQ for each group of respondents. These means were compared to each other to detect if significant differences existed, as a precursor to aggregating this data to the group level of analysis.

The transformational factors (II (A), II (B), IM, IS, IC) were combined based on prior evidence that they represent a higher order construct (Bass, *et al.*, 2003).

### *Factor Analysis of MLQ*

Factor analysis is an interdependence technique in which all variables are simultaneously considered to generate a matrix of intercorrelations (Cooper

and Schindler, 2001). Due to the violation of the assumption of normality, standard confirmatory factor analysis (CFA) could not be conducted to confirm the nine leadership factors of the MLQ in the context of underground mining at Impala. Since distribution free methods require very large samples (more than a thousand cases), it was decided to perform an exploratory factor analysis (EFA) (Hair, *et al.*, 2006).

Kaiser's Measure of Sampling Adequacy (MSA) was used to quantify the degree of intercorrelation among the observed variables entered into the EFA. An index number between 0 and 1 (inclusive) is calculated. An index number of 1 indicates that the variable can be perfectly predicted without error by the other variables and an index of 0 indicates that the variable cannot be predicted by the other variables (Hair, *et al.*, 2006). A MSA minimum value of 0.6 is recommended to conduct an EFA (Kaiser, 1974).

Exploratory factor analysis is a statistical method one can apply when it is necessary to describe the data structure of a number of observed variables ( $p$ ) in terms of a smaller number of unobserved variables ( $m$ ), called latent variables or factors. Principle components analysis was used where the observed variables were modeled as linear combinations of the possible factors and error terms. The dependencies between the observed variables were used to reduce the original data set from  $p$  observed variables to  $m \leq p$  latent variables or factors (Cooper and Schindler, 2001). The factor loadings on the variables were determined using varimax (orthogonal) rotation, indicating the correlation between the specific variable (item) with the factor. Varimax rotation was chosen because with this technique the factors load heavily on some variables and more lightly on others, which simplifies interpretation of the results (Abdi, 2003).

### ***Inferential Statistics***

Neuman (2006: 370) describes the purpose of inferential statistics as using:

Probability theory to test hypotheses formally, permit inferences from a sample to a population, and test whether descriptive results are likely to be due to random factors or to a real relationship.

The statistical significance of the bivariate intercorrelations of the measured variables was tested for significant relationships.

Multiple regression analysis was done to determine the goodness of fit of the proposed leadership model with the empirical data (Cooper and Schindler, 2001). Based on the proposed model the logical method to use would have been path analysis, but since the final data set consisted of only 39 observations it was not possible to use path analysis and obtain reliable results. Two stage least squares (2SLS) was also considered, but the endogenous variables in the model were tested for simultaneity by making use of Hausman's specification test, and no simultaneity problems between the endogenous variables in the analysis were found. Under these circumstances it was better to use ordinary least squares (OLS) since it provides consistent and efficient estimators of the coefficients (Gujarati, 1995).

The basic assumptions and description of ordinary least squares (OLS) and the testing procedures associated with the analysis (Gujarati, 1995) are discussed below.

The general multiple regression model is:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon_i; \quad i = 1, 2 \dots n; \quad \beta_0, \beta_1 \dots \beta_k$$
 are unknown fixed parameters to be estimated; and  $\varepsilon_1 \dots \varepsilon_n$  are unknown random errors. All multiple regression models are developed under specific model assumptions. The model assumptions for multiple regression models are given below:

- The error terms  $\varepsilon_i$  are independent and normally distributed with mean zero and constant variance  $\sigma^2$ .
- The explanatory variables are uncorrelated with one another, which imply that there is no multicollinearity present in the model.
- When working with time series data the error terms are uncorrelated with one another.

The variance inflation factor (VIF) is a statistic that can be used to identify multicollinearity (Gujarati, 1995). Accordingly, the VIF is a function of the coefficient of multiple determination from the regression of each explanatory variable on all the other explanatory variables.

The VIF is calculated using the formula:  $VIF_i = \frac{1}{1 - R_i^2}$

$R_i^2$  is the coefficient of multiple determination in a regression of the  $i^{\text{th}}$  explanatory variable on all other explanatory variables.  $VIF_i$  is the variance inflation factor associated with the  $i^{\text{th}}$  explanatory variable. If the  $i^{\text{th}}$  explanatory variable is independent of the other explanatory variables, then the VIF is one. If the  $i^{\text{th}}$  explanatory variable can almost be perfectly predicted from other explanatory variables, the VIF approaches infinity. Multicollinearity is considered to be a problem when the VIF of one or more explanatory variables is greater than 10. In the presence of multicollinearity the standard errors will be inflated which will increase the chance of not rejecting the null hypothesis (increasing Type II error).

The hypotheses tested for the individual  $\beta$  coefficients are given below:

$H_0: \beta_i = 0$ : No linear relationship between  $X_i$  and  $Y$  where  $i = 1, 2 \dots k$ .

$H_1: \beta_i \neq 0$ : A linear relationship exists between  $X_i$  and  $Y$  where  $i = 1, 2 \dots k$ .

The test statistic:  $t = \frac{\hat{\beta}_i}{se(\hat{\beta}_i)}$

When the p-value of the individual tests for significance is less than 0.05 the null hypothesis is rejected.

A stepwise regression (Cooper and Schindler, 2001) was conducted to find the best predictors of effectiveness (EFF) from the nine leadership factors measured by the multifactor leadership questionnaire (MLQ). Stepwise regression first includes in the model the predictor variable that contributes



the most to explaining the criterion variable. During subsequent stages predictor variables are added or removed from the model subject to meeting the level of significance set for entry or removal (Cooper and Schindler, 2001).

The mediation effect of group safety climate and group cohesiveness was tested using the three-step procedure based on Baron and Kenny (1986). Partial mediation is based on three conditions (Baron and Kenny, 1986):

1. The independent variable is significantly related to the dependent variable and mediator.
2. The mediator variable is significantly related to the dependent variable.
3. When the independent variable and the mediator are considered simultaneously, the direct relationship between the independent and dependent variable decreases by a magnitude that is statistically significant.

The Sobel test was used to determine if the indirect mediation path from the independent variable to the dependent variable was statistically different from zero (Preacher and Hayes, 2004).

#### **4.3.1.4 Limitations**

The researcher has identified possible limitations to the quantitative phase of this study:

- As this was a case study inferences based on the quantitative findings of the study are limited. However, the phenomenon of leadership is universal and therefore generalisations based on theoretical groundwork are plausible.
- The organisational objective measure of injury rate was collected for the year prior to administering the survey. It would be better to get this information for a longer period of time to prevent a possible skewed data distribution (Zohar, 2002). However, this would have been difficult to achieve as the mine overseers may have moved to a different

section and mining conditions may have changed over a longer time period, which could have distorted the findings.

- The selected objective measure for safety was the internationally recognised lost time injury frequency rate (LTIFR). The accuracy of this figure depends on honest reporting of accidents, which may not always be the case. The LTIFR may have been contaminated by confounding factors such as the experience of the crews and the mining conditions where the work took place.
- The selected objective measure for productivity was percentage of production target met (% production target met). The production target set by management was based on Impala best practices applied at management's discretion depending on the mining conditions in a particular section. Hence, production target setting was subject to management's discretion and could result in soft or hard targets.
- The sample size of 39 was relatively small, which means that any findings from this case study would need to be repeated with a larger sample and using data from several underground mines for external validity.
- Some of the respondents filled in more than one questionnaire which may have introduced mono-source bias. However the criterion variables were measured independently using objective organisational data.
- The literacy level of some of the respondents in the English language may have been lacking. The researcher and his assistant were available to handle any queries and therefore believe that this potential problem was controlled.

#### **4.3.1.5 Ethical Considerations**

Neuman (2006: 130) defines scientific misconduct as:

When someone engages in research fraud, plagiarism, or other unethical conduct that significantly deviates from the accepted practices for conducting and reporting research established by the scientific community.

Creswell (2009: 93) states that, "with consideration for participants, research

sites, and potential readers, studies can be designed that contain ethical practices”.

Basic principles of ethical social research that the researcher observed for this case study are as follows (Neuman, 2006: 142):

- Researcher did not exploit subjects for personal gain.
- Informed consent was obtained.
- All guarantees of privacy, confidentiality, and anonymity were honoured.
- Participants were not coerced or humiliated.
- Ensured that there were no undesirable consequences for participants.
- Anticipated repercussions of the research and publication of results.
- Made interpretations of results consistent with the data.
- Used high methodological standards and strived for accuracy.

Specific actions taken by the researcher concerning ethical issues for this study were as follows:

- Participation in the survey was on a voluntary basis and respondents were informed of this right before completing the survey questionnaires by the researcher.
- Confidentiality of information supplied was guaranteed so that respondents did not suffer any harm by supplying sensitive information concerning their supervisors. Respondents were given guarantees concerning the confidentiality of supplied information by the researcher who personally supervised the survey administration (Appendix 2).
- The researcher got permission from Impala to conduct the survey and gave assurances to safeguard sensitive and confidential operational information.

#### **4.3.2 Qualitative – Phase 2**

The researcher has worked on Impala for 24 years in various roles in engineering, mining, and project management. The researcher is familiar with

the mining process and the challenges that Impala faces in terms of safety and productivity delivery.

#### **4.3.2.1 Research Instruments**

The research instruments that were used for the qualitative phase of the sequential explanatory study included a focus group, individual interviews, observations, and documents analysis (Creswell, 2009).

The focus group and individual face-to-face interviews involved the researcher asking unstructured and open-ended questions that sought to explain and interpret the quantitative findings from the first phase of the study. The researcher conducted underground observations of mine overseer sections and interacted with their subordinates at the work face as an observer, and recorded field notes. Safety officer reports on the conditions in the mine overseer sections were scrutinised to determine the priority given to safety.

#### **4.3.2.2 Data**

##### *Target population*

The target population was the mine overseers on Impala's steady state operating shafts that had participated in the first phase of the study.

##### *Sampling Procedure*

Purposive sampling was used in selecting mine overseers who had more than five years experience, to participate in a focus group and individual interviews. The mine overseers who participated in the focus group were different from the mine overseers who participated in the individual interviews. The nine underground visits to mine overseer sections were purposely selected to cover different managers sections at Impala and to include mine overseers with a broad range of safety and productivity delivery records.

### *Interviews*

Following the findings of the quantitative data analysis, three mine overseers with more than five years experience were purposely selected from the group who participated in the first phase. They were individually subjected to unstructured open-ended interviews to provide an interpretation of the quantitative results in the context of underground mining on Impala. The open-ended questions that were used in the unstructured individual interviews and focus group covered the following issues:

- The relationship between leadership style and safety excellence.
- The relationship between leadership style and productivity.
- The trade-offs required for the simultaneous delivery of both safety and productivity.
- The effect of group cohesiveness on productivity.
- The effect of group safety climate on injury rate.
- The effect of the section managers' priorities on the mine overseers' behaviour.
- What factors besides leadership affect the delivery of safety and productivity excellence?

### *Focus Group*

A focus group consisting of six mine overseers with more than five years experience was purposely selected from the phase one respondents. Open-ended questions were asked to better interpret and explain the findings from the quantitative data analysis.

### *Observations*

The researcher observed nine mine overseers in the underground environment interacting with their workforce. This allowed the researcher to witness first-hand what style of leadership they used and the response of the workforce to the various leadership styles. The conditions maintained in their work environment were also observed.

### *Documents Analysis*

The safety officer reports for the mine overseer sections which are produced on a monthly basis were scrutinised as indicators of the conditions in their sections. This information gave a good indication of their safety priority, and the discipline and behaviour of their workforce.

#### **4.3.2.3 Data Analysis**

A six step process (Creswell, 2009) was followed to analyse and interpret the collected qualitative data from the focus group, individual interviews, underground observations, and documents analysis as follows:

1. In the first step the recorded data from the individual interviews and focus group was transcribed. Notes were taken on the underground visits and documents analysis.
2. In the second step all the collected data was read to assess the overall meaning.
3. Following this, the collected data was coded using content analysis to themes that examined the quantitative results in more detail (Krippendorff, 2004). A systematic analysis of the textual data was conducted to identify statements relating to the themes. The themes include the factors that constitute the full range of leadership, group cohesiveness, group safety climate, section managers' priorities, and confounding variables that affect safety and productivity delivery.
4. Step four involved using the coding to generate themes and subthemes for analysis.
5. In step five the identified themes and subthemes were presented supported by quotations.
6. Finally, an interpretation of the qualitative data was made.

#### **4.3.2.4 Validity and Reliability of Findings**

The validity of the findings was ensured using several strategies (Creswell, 2009) including triangulation. The themes were examined using triangulated data from a focus group, individual interviews, observation, and safety officer reports, to build a coherent justification for the themes (Creswell, 2009). The

triangulating of the respondents perspectives from the several converging sources gave support to the themes and added to the validity of the study (Creswell, 2009). The identified themes in the findings were discussed with and checked by one of the interviewed mine overseers who was satisfied that they accurately reflected their views. Thick descriptions of the findings were conveyed by recording several quotations from the participants. Although the researcher has worked on Impala for twenty four years, every effort was made to ensure that an accurate representation of the respondents' responses was detailed without bias, and supported by quotations. The researcher spent prolonged time in the field on this study including nine underground visits to mine overseer sections across Impala to observe them interacting with their subordinates at first hand. During the study the researcher reported to a senior Impala management member who acted as a peer reviewer of the study, asking many insightful questions which guided the researcher in sourcing and interpreting field findings.

The reliability of the collected qualitative data was ensured in checking the transcripts for mistakes (Gibbs, 2007).

The researcher believes that Impala is representative of underground conventional hard rock mining in South Africa as it employs a conventional mining method and employs a management supervisory structure that is largely dictated by the Mines Health and Safety Act No. 29 1996 (MHSA). Therefore, any conclusions from this study could be generally applicable in similar operations.

#### **4.3.2.5 Limitations**

The limitations for the qualitative data were as follows:

- The researcher was known to some of the participants who consequently may have been reluctant to reveal sensitive information.
- The researcher has worked on Impala for twenty four years and hence is familiar with the mining process and associated problems. Every effort was made by the researcher to be unbiased and interpretations

in the qualitative findings were vetted by one of the interviewed mine overseers. The researcher was also guided by a senior Impala manager during the study.

#### **4.3.2.6 Ethical Considerations**

The following ethical issues relating to the study were addressed:

- The researcher got permission from Impala to conduct the interviews, focus group, observations, and to use Impala documents, and gave assurances to safeguard sensitive and confidential operational information.
- Participation in the qualitative study was on a voluntary basis and respondents were informed of this right before the process commenced.
- Confidentiality of information given was guaranteed so that respondents did not suffer any harm by supplying sensitive information concerning their supervisors. Respondents were given guarantees concerning the confidentiality of supplied information (Appendix 2) by the researcher who personally conducted the interviews, focus group, observations, and documents scrutiny.

#### **4.4 Conclusion**

The researcher argued that since transformational leadership is an established theory and that leadership is a complex phenomenon that is affected by context, that a mixed methods sequential explanatory case study research design was the most suitable option. Motivation was provided for using a self-administered survey questionnaire method for the quantitative phase, and focus groups, interviews, observations, and documents analysis for the qualitative phase. The constraints in obtaining reliable objectively measured injury rate and productivity data from companies outside Impala and the time that would be required to collect this data was given as motivation for confining the study to a single case. Motivation was also provided arguing that Impala is a representative case of underground conventional hard rock mining. Cluster sampling was used in phase one, to



get a representative random sample of the population of Impala mine overseers which was generalised using inferential statistics. Motivation was provided for the validity and reliability of the proposed survey instruments. The researcher believes that the study produced findings that meet the requirements of both internal validity and reliability. The phenomenon of leadership is universal, and it is believed that Impala is a representative case for underground conventional hard rock mining. It is argued that the results of this mixed methods case study may have inferences for other mining companies and other organisations operating in an uncertain environment.

The quantitative results from phase one are documented in chapter five and include; results on the pilot test, demographics, survey instruments validity and reliability, bivariate intercorrelations, descriptive statistics, and inferential statistics. Chapter six covers the qualitative results for phase two of the study and includes the results of the content analysis of the individual interviews, focus group, observations, and documents analysis. In chapter seven, the quantitative results from phase one of the study are connected to the qualitative findings from phase two, and an interpretation of the entire analysis is made and compared with the past literature.

## **CHAPTER FIVE**

### **QUANTITATIVE RESULTS**

#### **5.1 Introduction**

The quantitative results include; pilot test findings, demographics, survey instruments validity and reliability, bivariate intercorrelations, descriptive, and inferential statistics. The pilot test of the study instruments showed that the respondents did not have difficulty completing them. The survey instruments used in the study were adequate in terms of validity and reliability. The intercorrelations of the MLQ factors and the study variables intercorrelations are documented and interpreted. Descriptive and inferential statistics for the study variables are recorded and analysed.

#### **5.2 Pilot Test Findings**

Pilot testing of all the survey instruments used in the study was conducted by having fourteen mine overseers and twenty-five shift supervisors fill in the survey questionnaires. The results of the pilot-testing revealed that the instructions for completing the questionnaires were clear. There was not a problem with most respondents understanding the questions, and how to indicate the responses. It became clear to the researcher that it would be necessary to supervise the completion of the questionnaires during the study, as when respondents were not supervised during the pilot testing they tended not to complete the questionnaires diligently. Also, in a few cases the respondents needed help with understanding the questionnaire that was written in the English language which was not the first language for most of the respondents. Generally, respondents needed to be reassured by the researcher that the collected information would be kept confidential from their supervisors. The overall conclusion by the researcher was that there was no major problem with the proposed survey questionnaires or the proposed data collection procedure, and that the participants would be able to successfully complete the questionnaires. No data analysis was conducted during the pilot study as all the instruments used had been previously used for academic

research and were found to be acceptable in terms of validity and reliability.

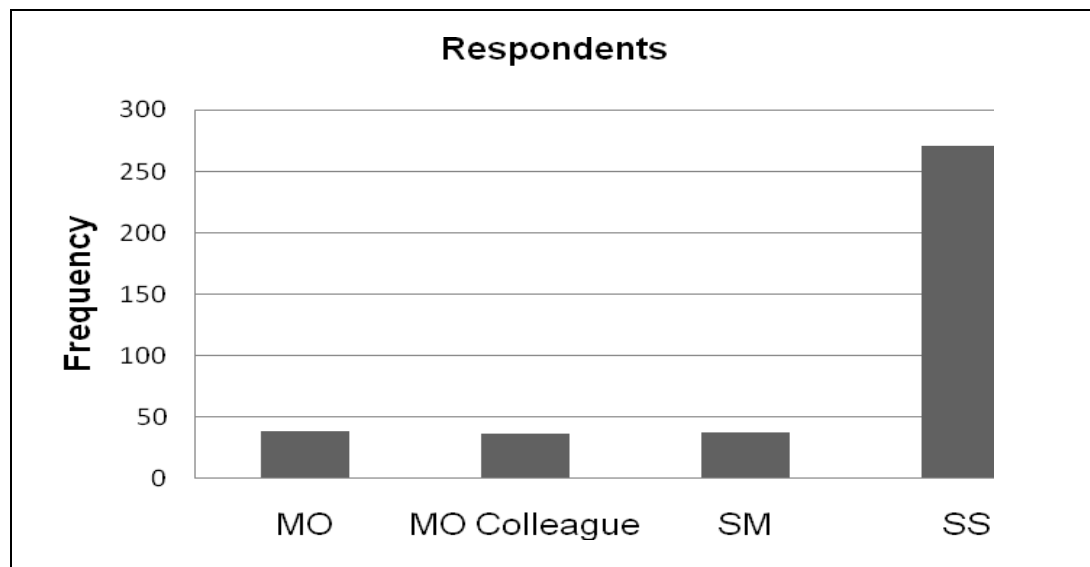
### 5.3 Quantitative Results

#### 5.3.1 Demographics

The respondents who completed questionnaires in this study are shown in Table 5.1 and Figure 5.1. All thirty-nine mine overseers included in the study were male.

**Table 5.1: Number of Respondents**

Number of Respondents				
Respondent	Frequency	Percent	Cumulative Frequency	Cumulative Percent
<i>Mine Overseer (MO)</i>	39	10.13	39	10.13
<i>MO Colleague</i>	37	9.61	76	19.74
<i>Section Manager (SM)</i>	38	9.87	114	29.61
<i>Shift Supervisor (SS)</i>	271	70.39	385	100.00

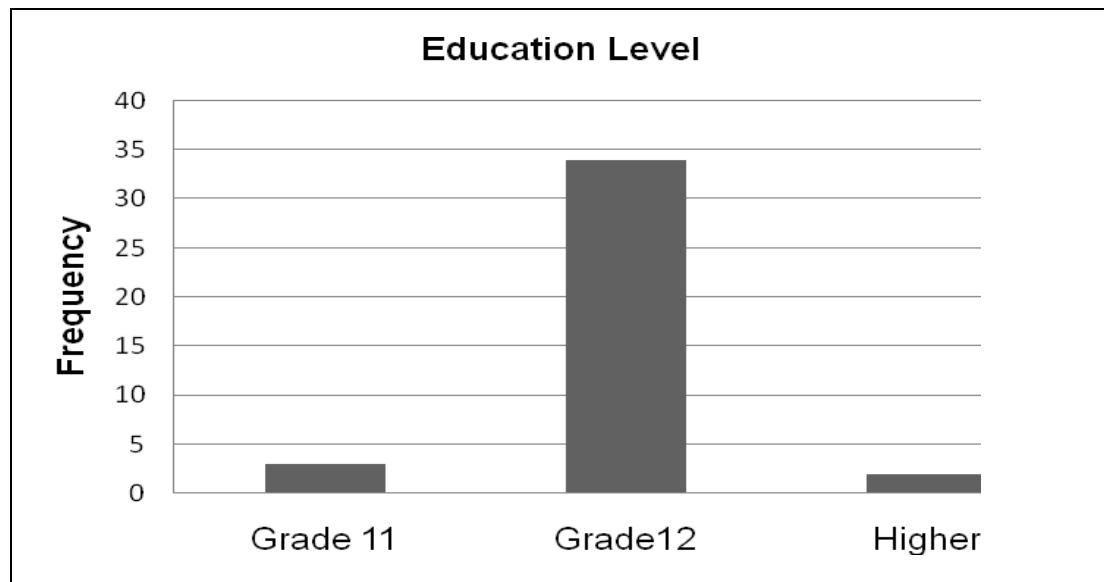


**Figure 5.1: Histogram of Respondents**

Eighty-seven percent of the mine overseers have completed a grade 12 education. Eight percent have completed grade 11 education, while only five percent of the mine overseers have a qualification higher than grade 12 as shown in Table 5.2 and Figure 5.2.

**Table 5.2: Education Level of Mine Overseers**

Qualification of Mine Overseer				
Qualification	Frequency	Percent	Cumulative Frequency	Cumulative Percent
<i>Grade 11</i>	3	7.69	3	7.69
<i>Grade 12</i>	34	87.18	37	94.87
<i>Higher than Grade 12</i>	2	5.13	39	100.00

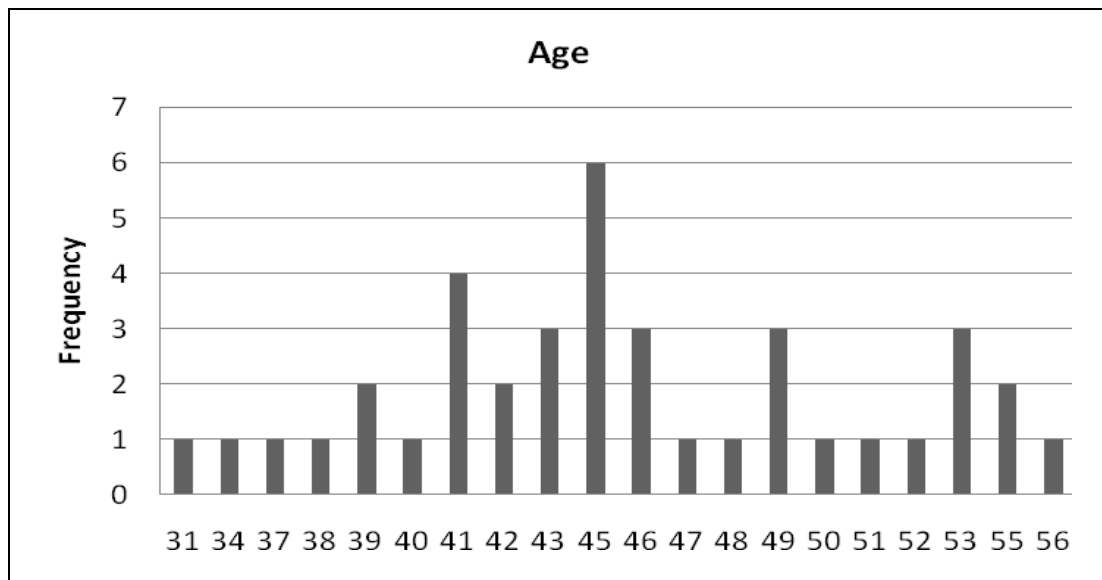


**Figure 5.2: Education Level of Mine Overseers**

The age of the mine overseers studied ranges from 31 to 56 years old as shown in Table 5.3 and Figure 5.3. Eighty percent of the mine overseers who participated in the study are between the ages of 31 and 50 years old.

**Table 5.3: Age of Mine Overseers**

Age of Mine Overseers				
Age (Years)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
31	1	2.56	1	2.56
34	1	2.56	2	5.13
37	1	2.56	3	7.69
38	1	2.56	4	10.26
39	2	5.13	6	15.38
40	1	2.56	7	17.95
41	4	10.26	11	28.21
42	2	5.13	13	33.33
43	3	7.69	16	41.03
45	6	15.38	22	56.41
46	3	7.69	25	64.10
47	1	2.56	26	66.67
48	1	2.56	27	69.23
49	3	7.69	30	76.92
50	1	2.56	31	79.49
51	1	2.56	32	82.05
52	1	2.56	33	84.62
53	3	7.69	36	92.31
55	2	5.13	38	97.44
56	1	2.56	39	100.00

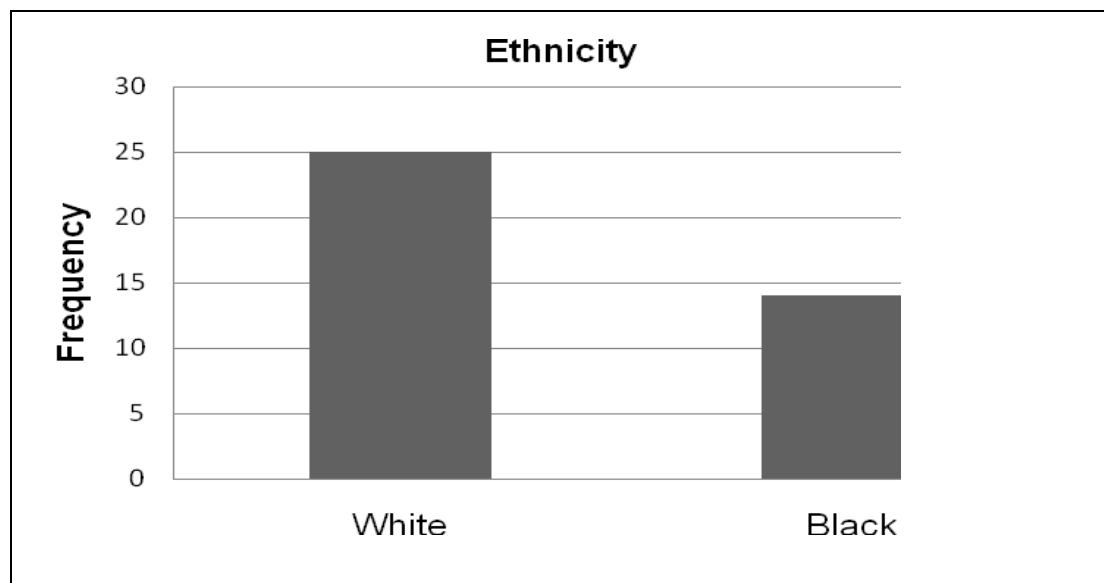


**Figure 5.3: Age of Mine Overseers**

Sixty-four percent of the mine overseers studied were white as shown in Table 5.4 and Figure 5.4.

**Table 5.4: Ethnicity of Mine Overseers**

Ethnicity of Mine Overseers				
Ethnicity	Frequency	Percent	Cumulative Frequency	Cumulative Percent
<i>White</i>	25	64.10	25	64.10
<i>Black</i>	14	35.90	39	100.00

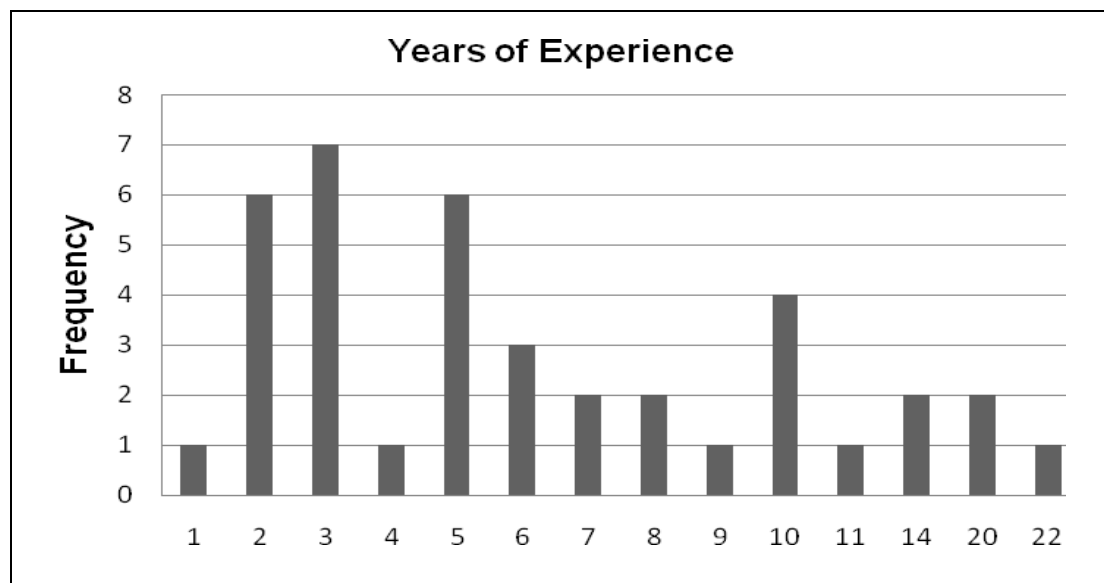


**Figure 5.4: Ethnicity of Mine Overseers**

Fifty-four percent of the mine overseers studied had five years experience or less as an appointed mine overseer as shown in Table 5.5 and Figure 5.5.

**Table 5.5: Years of Experience as Mine Overseer**

Years of Experience as Mine Overseer				
Years of Experience	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	1	2.56	1	2.56
2	6	15.38	7	17.95
3	7	17.95	14	35.90
4	1	2.56	15	38.46
5	6	15.38	21	53.85
6	3	7.69	24	61.54
7	2	5.13	26	66.67
8	2	5.13	28	71.79
9	1	2.56	29	74.36
10	4	10.26	33	84.62
11	1	2.56	34	87.18
14	2	5.13	36	92.31
20	2	5.13	38	97.44
22	1	2.56	39	100.00



**Figure 5.5: Years of Experience as Mine Overseer**

A summary of the demographics of the thirty-nine mine overseers included in this study are:

- They were all male.
- Eighty-seven percent had completed grade 12 education.
- Eighty percent were in the 31 – 50 years age group.

- Sixty-four percent were white.
- Fifty-four percent had five years or less experience as an appointed mine overseer.
- Thirty-nine from the population of fifty-two mine overseer clusters were randomly selected.

### **5.3.2 Aggregation of the MLQ Items**

The results of the Kruskal-Wallis test showed that the section managers, mine overseer colleagues, and shift supervisors ratings across the different items of the multifactor leadership questionnaire (MLQ) did not differ significantly from one another. The rating the mine overseers awarded themselves did differ significantly from the other three groups of respondents across the 45 items (36 leadership and 9 outcome items) of the MLQ. Based on this result it was decided to only use the ratings awarded by the mine overseer colleagues, shift supervisors, and section managers in subsequent analyses. Cronbach's alphas were calculated on the items included for each of the MLQ constructs to evaluate their internal consistency reliability. Since the Cronbach's alphas were at acceptable levels these MLQ constructs were calculated for every mine overseer included in the study (Table 5.11).

### **5.3.3 MLQ Validity – Factor Analysis**

Factor scores were calculated on the aggregated samples of mine overseer colleague, higher-level section manager, and lower-level shift supervisor ratings. It was detected that the sample data was not normally distributed using Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-Von Mises, and Anderson-Darling tests. Due to the violation of the assumption of normality, standard confirmatory factor analysis (CFA) could not be conducted. As distribution free methods require very large samples, an exploratory factor analysis (EFA) was conducted instead (Hair, *et al.*, 2006).

#### *Kaiser's Measure of Sampling Adequacy (MSA)*

Measure of sampling adequacy (MSA) quantifies the degree of intercorrelation among the observed variables entered into the EFA (Kaiser, 1974). The results shown in Table 5.6 yields an overall MSA = 0.91,



indicating that the 36 leadership items of the MLQ instrument can each be predicted by the other items.

**Table 5.6: Kaiser’s Measure of Sampling Adequacy**

<b>Kaiser’s Measure of Sampling Adequacy: Overall MSA = 0.91</b>	
<i>MLQ 1</i>	0.95
<i>MLQ 2</i>	0.93
<i>MLQ 3</i>	0.80
<i>MLQ 4</i>	0.88
<i>MLQ 5</i>	0.78
<i>MLQ 6</i>	0.85
<i>MLQ 7</i>	0.80
<i>MLQ 8</i>	0.88
<i>MLQ 9</i>	0.93
<i>MLQ 10</i>	0.94
<i>MLQ 11</i>	0.93
<i>MLQ 12</i>	0.90
<i>MLQ 13</i>	0.93
<i>MLQ 14</i>	0.92
<i>MLQ 15</i>	0.92
<i>MLQ 16</i>	0.95
<i>MLQ 17</i>	0.74
<i>MLQ 18</i>	0.95
<i>MLQ 19</i>	0.84
<i>MLQ 20</i>	0.82
<i>MLQ 21</i>	0.94
<i>MLQ 22</i>	0.94
<i>MLQ 23</i>	0.94
<i>MLQ 24</i>	0.86
<i>MLQ 25</i>	0.93
<i>MLQ 26</i>	0.96
<i>MLQ 27</i>	0.93
<i>MLQ 28</i>	0.81
<i>MLQ 29</i>	0.85
<i>MLQ 30</i>	0.93
<i>MLQ 31</i>	0.94
<i>MLQ 32</i>	0.93
<i>MLQ 33</i>	0.80
<i>MLQ 34</i>	0.93
<i>MLQ 35</i>	0.94
<i>MLQ 36</i>	0.93

### *Kaiser's Criterion*

Only factors having latent roots or eigenvalues greater than 1 from the principal components analysis were considered significant and retained (Table 5.7). The rationale is that any individual factor should account for the variance of at least a single variable if it is to be retained for interpretation (Hair, *et al.*, 2006). Only the first eight components had eigenvalues greater than 1, and were retained for rotation.

**Table 5.7: Eigenvalues of the Correlation Matrix**

<b>Eigenvalues of the Correlation Matrix: Total = 36 Average = 1</b>				
	<b>Eigenvalue</b>	<b>Difference</b>	<b>Proportion</b>	<b>Cumulative</b>
<b>1</b>	<b>10.21</b>	6.60	0.283	0.283
<b>2</b>	<b>3.61</b>	2.10	0.100	0.384
<b>3</b>	<b>1.51</b>	0.25	0.042	0.426
<b>4</b>	<b>1.26</b>	0.09	0.035	0.461
<b>5</b>	<b>1.17</b>	0.08	0.032	0.493
<b>6</b>	<b>1.09</b>	0.06	0.030	0.524
<b>7</b>	<b>1.03</b>	0.02	0.028	0.553
<b>8</b>	<b>1.01</b>	0.04	0.028	0.581
<b>9</b>	0.97	0.02	0.027	0.608
<b>10</b>	0.95	0.12	0.026	0.634
<b>11</b>	0.83	0.01	0.023	0.657
<b>12</b>	0.82	0.04	0.022	0.680
<b>13</b>	0.78	0.03	0.021	0.702
<b>14</b>	0.75	0.06	0.020	0.723
<b>15</b>	0.69	0.04	0.019	0.742
<b>16</b>	0.65	0.02	0.018	0.760
<b>17</b>	0.63	0.03	0.017	0.778
<b>18</b>	0.60	0.02	0.016	0.795
<b>19</b>	0.58	0.01	0.016	0.811
<b>20</b>	0.57	0.02	0.016	0.827
<b>21</b>	0.55	0.01	0.015	0.843
<b>22</b>	0.54	0.03	0.015	0.858
<b>23</b>	0.51	0.01	0.014	0.872
<b>24</b>	0.50	0.05	0.014	0.886
<b>25</b>	0.45	0.02	0.012	0.899
<b>26</b>	0.43	0.03	0.012	0.911
<b>27</b>	0.40	0.03	0.011	0.922
<b>28</b>	0.37	0.01	0.010	0.933
<b>29</b>	0.36	0.02	0.010	0.943
<b>30</b>	0.34	0.02	0.009	0.952
<b>31</b>	0.32	0.01	0.009	0.961
<b>32</b>	0.31	0.02	0.008	0.970
<b>33</b>	0.29	0.02	0.008	0.978
<b>34</b>	0.27	0.01	0.007	0.986
<b>35</b>	0.26	0.04	0.007	0.993
<b>36</b>	0.22		0.006	1.000

Table 5.7 shows that the cumulative percentage of the variance extracted by the eight retained factors is 58.1%. Therefore almost 60% of the variation in the original data set is retained by reducing the number of observed variables from 36 to 8 factors.

### *Communality*

Communality is the portion of the variance in a specific variable explained by the  $m = 8$  common factors (Table 5.8). The requirement for assessing the proposed factor structure is that all the communalities must be at least 0.5. Therefore at least 50% of the variance of a specific variable must still be explained by the remaining 8 common factors retained in the analysis (Hair, *et al.*, 2006). The results for the final communality estimates were adequate in terms of the above criteria.

**Table 5.8: Final Community Estimates**

<b>Final Community Estimates: Total = 20.92</b>	
<i>MLQ 1</i>	0.50
<i>MLQ 2</i>	0.59
<i>MLQ 3</i>	0.62
<i>MLQ 4</i>	0.56
<i>MLQ 5</i>	0.62
<i>MLQ 6</i>	0.60
<i>MLQ 7</i>	0.55
<i>MLQ 8</i>	0.54
<i>MLQ 9</i>	0.54
<i>MLQ 10</i>	0.52
<i>MLQ 11</i>	0.49
<i>MLQ 12</i>	0.63
<i>MLQ 13</i>	0.55
<i>MLQ 14</i>	0.64
<i>MLQ 15</i>	0.64
<i>MLQ 16</i>	0.54
<i>MLQ 17</i>	0.61
<i>MLQ 18</i>	0.49
<i>MLQ 19</i>	0.63
<i>MLQ 20</i>	0.61
<i>MLQ 21</i>	0.63
<i>MLQ 22</i>	0.50
<i>MLQ 23</i>	0.57
<i>MLQ 24</i>	0.65
<i>MLQ 25</i>	0.58
<i>MLQ 26</i>	0.56
<i>MLQ 27</i>	0.54
<i>MLQ 28</i>	0.58
<i>MLQ 29</i>	0.70
<i>MLQ 30</i>	0.56
<i>MLQ 31</i>	0.64
<i>MLQ 32</i>	0.68
<i>MLQ 33</i>	0.52
<i>MLQ 34</i>	0.45
<i>MLQ 35</i>	0.62
<i>MLQ 36</i>	0.66

*Factor Loadings*

The factor loadings for the MLQ questionnaire items were determined using varimax (orthogonal) rotation, indicating the correlation between the specific variable (item) with the factor. The correlations between a specific variable (item) and all retained factors were calculated. In interpreting the rotated factor pattern, a variable loaded onto the factor with which it had the highest correlation. Also, the factor loading needed to be 0.40 or greater for that factor, and less than 0.40 for the other factors (Table 5.9) (Hair, *et al.*, 2006).

**Table 5.9: Rotated Factor Pattern**

<b>Rotated Factor Pattern</b>								
<b>Item</b>	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>	<b>Factor 5</b>	<b>Factor 6</b>	<b>Factor 7</b>	<b>Factor 8</b>
<i>MLQ 32</i>	<b>0.76</b>	0.17	-0.18	-0.02	0.04	0.11	0.05	0.11
<i>MLQ 31</i>	<b>0.75</b>	0.14	-0.16	0.10	-0.07	0.02	0.08	0.00
<i>MLQ 21</i>	<b>0.72</b>	0.22	-0.20	-0.01	-0.00	0.07	0.00	-0.06
<i>MLQ 35</i>	<b>0.72</b>	0.08	-0.05	0.02	0.14	0.07	-0.24	-0.02
<i>MLQ 36</i>	<b>0.72</b>	0.20	0.03	-0.00	0.20	0.03	-0.23	-0.02
<i>MLQ 30</i>	<b>0.69</b>	0.09	0.05	0.07	0.15	0.11	-0.04	0.09
<i>MLQ 26</i>	<b>0.60</b>	0.22	-0.07	0.02	0.26	0.24	-0.00	-0.02
<i>MLQ 16</i>	<b>0.58</b>	0.15	-0.20	0.19	0.09	0.27	0.11	0.02
<i>MLQ 34</i>	<b>0.54</b>	0.22	-0.06	0.20	0.01	0.07	-0.23	-0.03
<i>MLQ 15</i>	<b>0.49</b>	0.29	-0.23	0.03	0.18	0.28	0.33	0.11
<i>MLQ 23</i>	<b>0.42</b>	0.36	0.00	0.37	0.06	0.21	-0.22	-0.15
<i>MLQ 18</i>	<b>0.41</b>	0.27	-0.19	0.35	0.17	-0.05	-0.08	0.22
<i>MLQ 10</i>	<b>0.40</b>	0.40	-0.00	0.14	-0.03	0.22	-0.33	-0.02
<i>MLQ 2</i>	0.38	<b>0.63</b>	-0.13	0.06	0.08	-0.02	-0.07	0.05
<i>MLQ 6</i>	0.02	<b>0.59</b>	0.02	0.39	-0.04	0.13	0.09	0.23
<i>MLQ 9</i>	0.28	<b>0.58</b>	-0.11	-0.00	0.16	0.21	-0.08	0.16
<i>MLQ 8</i>	0.20	<b>0.57</b>	0.14	0.23	0.07	0.16	0.01	-0.23
<i>MLQ 1</i>	0.46	<b>0.50</b>	-0.04	0.05	-0.01	-0.05	0.09	0.09
<i>MLQ 11</i>	0.40	<b>0.50</b>	-0.11	0.03	0.24	0.01	-0.00	0.08
<i>MLQ 13</i>	0.27	<b>0.43</b>	-0.11	-0.08	0.22	0.39	-0.23	0.08
<i>MLQ 3</i>	-0.06	0.10	<b>0.71</b>	-0.01	-0.04	-0.03	-0.18	0.22
<i>MLQ 12</i>	-0.20	-0.23	<b>0.70</b>	0.08	0.01	0.06	-0.05	0.12
<i>MLQ 5</i>	-0.05	0.06	<b>0.70</b>	-0.04	-0.03	-0.24	0.23	-0.03
<i>MLQ 7</i>	-0.06	-0.13	<b>0.68</b>	0.07	-0.10	0.11	-0.11	-0.15
<i>MLQ 20</i>	-0.10	0.03	<b>0.57</b>	-0.00	0.06	-0.10	0.49	-0.09
<i>MLQ 33</i>	-0.15	-0.00	<b>0.57</b>	0.23	0.13	-0.01	0.12	0.27
<i>MLQ 28</i>	-0.16	-0.18	<b>0.48</b>	0.10	0.00	0.32	0.33	0.24
<i>MLQ 29</i>	0.13	0.16	0.16	<b>0.76</b>	0.13	0.01	0.12	-0.08
<i>MLQ 19</i>	0.05	0.05	0.16	<b>0.60</b>	0.21	0.11	-0.28	0.29
<i>MLQ 24</i>	0.12	0.05	-0.01	0.15	<b>0.77</b>	0.01	0.09	0.03
<i>MLQ 25</i>	0.31	0.34	-0.07	0.10	<b>0.46</b>	0.02	-0.35	-0.02
<i>MLQ 22</i>	0.24	0.30	0.01	0.17	<b>0.45</b>	0.19	-0.15	-0.23
<i>MLQ 4</i>	0.21	0.24	0.01	0.25	-0.20	<b>0.57</b>	-0.05	-0.10
<i>MLQ 27</i>	0.27	0.01	0.09	0.04	0.36	<b>0.53</b>	0.04	0.19
<i>MLQ 14</i>	0.39	0.35	-0.15	-0.14	0.22	<b>0.49</b>	-0.10	-0.04
<i>MLQ 17</i>	0.13	0.17	0.27	0.06	-0.02	0.04	-0.00	<b>0.69</b>

Based on the above criteria the 36 leadership items of the MLQ instrument loaded onto the 8 retained factors as follows:

Factor 1: (32, 31, 21, 35, 36, 30, 26, 16, 34, 15, 23, 18, 10) items.

Factor 2: (2, 6, 9, 8, 1, 11, 13) items.

Factor 3: (3, 12, 5, 7, 20, 33, 28) items.

Factor 4: (29, 19) items.

Factor 5: (24, 25, 22) items.

Factor 6: (4, 27, 14) items.

Factor 7: (-).

Factor 8: (17) item.

### *Interpretation of Factors*

The following criteria were used to interpret the rotated factor solution (O'Rourke, Hatcher and Stepanski, 2005: 457-458):

- Are there at least three variables (items) with significant loadings on each retained component?
- Do the variables that load on a given component share some conceptual meaning?
- Do the variables that load on different components seem to be measuring different constructs?
- Does the rotated factor pattern demonstrate "simple structure"?

*Factor 1: Transformational Leadership and Contingent Reward (Active)*

Consist of thirteen MLQ items. They represent the more active components of transformational and contingent reward leadership factors.

*Factor 2: Transformational Leadership and Contingent Reward (Passive)*

Consist of seven MLQ items, representing more passive components of transformational and contingent reward leadership factors.

*Factor 3: Passive-Avoidant*

Consist of seven MLQ items, representing passive-avoidant leadership factors.

*Factor 4: Two Items Loaded*

Consist of two items representing the individual consideration factor from transformational leadership.

*Factor 5: Management-By-Exception-Active*

Consist of three items. Two items represent the more passive aspects of management-by-exception-active factor while the third item represents a more passive aspect of idealised influence (attributed) factor.

*Factor 6: Management-By-Exception-Active*

Consist of three items. Two items represent the more active aspects of management-by-exception-active factor while the third item represents a more active aspect of idealised influence (behavioural) factor.

*Factor 7: No Item Loaded*

No MLQ items loaded.

*Factor 8: One Item Loaded*

One MLQ item representing management-by-exception-passive loaded.

*Nine Factors – MLQ*

The exploratory factor analysis (EFA) did not yield the nine factors of the MLQ as expected, however:

- *Eighteen* items on the MLQ for transformational leadership and all the contingent reward items loaded onto Factor 1 (more active) and Factor 2 (more passive).
- Factor 3 consisted of *seven* MLQ items covering laissez-faire and management-by-exception-passive factors (passive-avoidant).
- Factor 4 consisted of *two* MLQ items from individual consideration.
- Factor 5 consisted of *two* management-by-exception-active items (more passive) and *one* passive idealised influence (attributed) item.
- Factor 6 consisted of *two* management-by-exception-active items (more active) and *one* active idealised influence (behaviour) item.
- *No* MLQ items loaded on Factor 7.
- *One* MLQ item of management-by-exception-passive loaded onto Factor 8.

The grouping of the MLQ items into 8 factors was broadly supportive of dividing leadership into the more active and passive forms of transformational, transactional and passive-avoidant behaviours. Most of the active and passive items representing transformational leadership from the

MLQ loaded onto Factor 1 (active) and Factor 2 (passive). Contingent reward loaded with the transformational items as has been found in previous studies (Antonakis, *et al.*, 2003), which split between Factor 1 and Factor 2. The active contingent reward items loaded onto Factor 1 while the more passive items loaded onto Factor 2. Transactional leadership was mainly represented by management-by-exception-active (MBEA), which loaded onto Factor 5 (more active) and Factor 6 (more passive) forms of MBEA. Factor 5 and Factor 6 each had one MLQ item from idealised influence. However, these items also correlated with Factor 1 and Factor 2 which may indicate some respondents had difficulty understanding the meaning of the item. Management-by-exception-passive and laissez-faire factor items mainly loaded onto Factor 3, a single passive-avoidant factor. The factors with one (Factor 8) or two MLQ items (Factor 4) loadings could possibly be due to a few questions in the MLQ instrument being difficult to comprehend, as English was not the first language for the majority of the study participants.

Antonakis *et al.* (2003), state that an EFA is not the most effective method to test the construct validity of the MLQ instrument. They recommend instead the use of a confirmatory factor analysis (CFA), where a priori constraints on the factor structure can be applied. Antonakis *et al.* (2003: 266) further state that “lack of support for the nine-factor model cannot be necessarily construed as lack of support for the construct validity of the MLQ for those studies that have used EFA”. A CFA was not done in this study as the sample data was not normally distributed and the sample size was too small, which dictated that an EFA be done instead.

Based on the previous research done on the construct validity of the MLQ instrument, the nine factors of the MLQ instrument were retained and used to analyse the collected data in the study. This allowed the study results to be directly compared with the previous studies done using the MLQ instrument.

The following constructs were used for every respondent across the aggregated levels (mine overseer colleagues, section managers, and shift supervisors) of the MLQ. Also, group cohesiveness, and group safety climate



instrument items are shown below (Appendix 3).

*MLQ:*

*Idealised influence (Attributed) (II (A)):* mean (10, 18, 21, 25) items.

*Idealised influence (Behaviour) (II (B)):* mean (6, 14, 23, 34) items.

*Inspirational Motivation (IM):* mean (9, 13, 26, 36) items.

*Intellectual Stimulation (IS):* mean (2, 8, 30, 32) items.

*Individual Consideration (IC):* mean (15, 19, 29, 31) items.

*Contingent Reward (CR):* mean (1, 11, 16, 35) items.

*Management-by-exception-Active (MBEA):* mean (4, 22, 24, 27) items.

*Management-by-exception-Passive (MBEP):* mean (3, 12, 17, 20) items.

*Laissez-Faire (LF):* mean (5, 7, 28, 33) items.

*Extra Effort (EE):* mean (39, 42, 44) items.

*Effectiveness (EFF):* mean (37, 40, 43, 45) items.

*Satisfaction (SAT):* mean (38, 41) items.

*Passive-Avoidant (PA):* mean (3, 12, 17, 20, 5, 7, 28, 33) items.

*Transformational leadership (TF):* mean (II (A), II (B), IM, IS, IC) factors.

*Group Cohesiveness (C):* mean (1, 2, 3, 4, 5, 6) group cohesiveness questionnaire items.

*Group Safety climate (SC):* mean (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16) group safety climate questionnaire items.

#### **5.3.4 Intercorrelations of MLQ Factor Scores**

The Multifactor Leadership Questionnaire (MLQ) was used to measure the perceived leadership style and outcomes of leadership for the mine overseers. Table 5.10 shows intercorrelations among MLQ factor scores for a normative sample based on data collected in the United States of America (US) (Avolio and Bass, 2004). These intercorrelations based on a large sample of 27 285, are used to compare with the data collected at Impala.

Table 5.11 shows intercorrelations among MLQ factors scores for the sample of 346 Impala respondents, including mine overseers' colleagues, subordinates, and superiors.

#### Note

A correlation score of -1.00 means that there is a perfect negative association between the two variables while a correlation score of 1.00 means there is a perfect positive association between the two variables. A correlation score of 0.00 means that there is no relationship between the two variables. A single asterisk means the correlation is statistically significant at a 95% confidence level, while a double asterisk means the correlation is statistically significant at a 99% confidence level (Gravetter and Wallnau, 2000).

**Table 5.10: Intercorrelations among MLQ Factor Scores (US Sample)**

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EFF	SAT
II(A)	(.75)											
II(B)	.64**	(.70)										
IM	.68**	.68**	(.83)									
IS	.64**	.59**	.59**	(.75)								
IC	.71**	.60**	.60**	.68**	(.77)							
CR	.67**	.61**	.61**	.61**	.68**	(.69)						
MBEA	-.07**	.02**	.02**	-.01	-.12**	.01	(.75)					
MBEP	-.36**	-.27**	-.27**	-.33**	-.32**	-.32**	.10**	(.70)				
LF	-.49**	-.34**	-.34**	-.39**	-.42**	-.44**	.08**	.61**	(.71)			
EE	.71**	.57**	.57**	.62**	.68**	.63**	-.06**	-.33**	-.42**	(.83)		
EFF	<b>.73**</b>	<b>.56**</b>	<b>.56**</b>	<b>.63**</b>	<b>.67**</b>	<b>.67**</b>	<b>-.06**</b>	<b>-.43**</b>	<b>-.56**</b>	<b>.72**</b>	<b>(.82)</b>	
SAT	.75**	.54**	.54**	.62**	.70**	.64**	-.12**	-.40**	-.52**	.71**	<b>.79**</b>	(.79)
M	2.94	2.77	2.92	2.78	2.85	2.87	1.67	1.03	0.65	2.74	<b>3.07</b>	3.08
SD	0.76	0.72	0.76	0.71	0.78	0.70	0.88	0.75	0.67	0.86	<b>0.72</b>	0.83

Source: Avolio and Bass (2004)

Note

Numbers in parentheses are reliability scores

N = 27 285 \* p < .05 \*\* p < .01

**Table 5.11: Intercorrelations among MLQ Factor Scores (Impala Study)**

	II(A)	II(B)	IM	IS	IC	CR	MBEA	MBEP	LF	EE	EFF	SAT
II(A)	(.70)											
II(B)	.64**	(.62)										
IM	.66**	.68**	(.72)									
IS	.67**	.66**	.73**	(.70)								
IC	.57**	.61**	.49**	.60**	(.56)							
CR	.72**	.66**	.71**	.72**	.57**	(.72)						
MBEA	.48**	.53**	.50**	.46**	.50**	.46**	(.54)					
MBEP	-.12*	-.10	-.13*	-.10	.05	-.14**	.04	(.59)				
LF	-.24**	-.11*	-.21**	-.14**	.01	-.21**	-.02	.66**	(.67)			
EE	.63**	.62**	.67**	.67**	.54**	.68**	.47**	-.13*	-.19**	(.71)		
EFF	<b>.65**</b>	<b>.61**</b>	<b>.68**</b>	<b>.66**</b>	<b>.52**</b>	<b>.72**</b>	<b>.43**</b>	<b>-.22**</b>	<b>-.28**</b>	<b>.75**</b>	<b>(.80)</b>	
SAT	.65**	.59**	.63**	.64**	.49**	.69**	.35**	-.17**	-.26**	.67**	<b>.76**</b>	(.67)
M	2.76	2.76	2.93	2.71	2.55	2.97	2.61	1.40	1.12	2.83	<b>2.91</b>	2.93
SD	0.87	0.72	0.78	0.80	0.81	0.74	0.78	0.90	0.94	0.90	<b>0.83</b>	1.01

Note

Numbers in parentheses are reliability scores

N = 346 \* p < .05 \*\* p < .01

## Legend

### *Transformational Factors (TF):*

*II (A):* Idealised Influence (Attributed)

*II (B):* Idealised Influence (Behaviour)

*IM:* Inspirational Motivation

*IS:* Intellectual Stimulation

*IC:* Individual Consideration.

### *Transactional Factors (TA):*

*CR:* Contingent Reward

*MBEA:* Management-By-Exception-Active.

### *Passive-Avoidant Factors (PA):*

*MBEP:* Management-By-Exception-Passive

*LF:* Laissez-Faire.

### *Outcomes of Leadership:*

*EE:* Extra Effort

*EFF:* Effectiveness

*SAT:* Satisfaction.

### *Descriptive Parameters:*

*M:* Mean

*SD:* Standard Deviation.

A comparative analysis of the intercorrelations of the MLQ factor scores for the Impala study with the normative US sample (Table 5.10 and Table 5.11) suggests the following:

- The Cronbach's alphas reliability scores for most of the nine leadership factors and particularly IC, MBEA, and MBEP for the Impala sample are lower than the US normative sample values. This may indicate that some of the participants in the Impala sample may have had some difficulty with the English language in understanding the meaning of some of the questions. This may also explain why a few unexpected factors with one or two loaded items appeared in the exploratory factor analysis.

- Contingent Reward (CR) which is a transactional factor is significantly correlated with the five transformational factors (II (A), II (B), IM, IS, IC) for both sets of data and is perceived as being associated with effectiveness (EFF). This result is consistent with previous research (Avolio and Bass, 2004). Avolio and Bass (2004), suggest that contingent reward (CR) may represent a link between transactional and transformational leadership.
- Transformational leadership (II (A), II (B), IM, IS, IC) and contingent reward (CR) are strongly linked with the outcomes of extra effort (EE), effectiveness (EFF), and satisfaction (SAT) for both sets of data. This seems to suggest that transformational leadership and contingent reward are perceived by followers as positively influencing effectiveness.
- Inspirational motivation (IM) is more strongly correlated with effectiveness in the Impala study ( $r = +.68$ ,  $n = 346$ ,  $p < .01$ ) compared to the US normative sample ( $r = +.56$ ,  $n = 27\ 285$ ,  $p < .01$ ). This seems to indicate that in the context of underground mining at Impala that giving encouragement is perceived to be closely associated with effectiveness.
- Individual consideration (IC) is less associated with effectiveness in the Impala sample ( $r = +.52$ ,  $n = 346$ ,  $p < .01$ ) compared to the U.S. sample ( $r = +.67$ ,  $n = 27\ 285$ ,  $p < .01$ ). This seems to suggest that in the context of underground mining at Impala that subordinates perceive training and development by their leader to be less important. A possible explanation for this result is that this behaviour is experienced less at Impala underground mining.
- Management-by-exception-active (MBEA) is positively correlated with effectiveness (EFF) in the Impala sample ( $r = +.43$ ,  $n = 346$ ,  $p < .01$ ), while in the US normative sample this relationship is very small and negative ( $r = -.06$ ,  $n = 27\ 285$ ,  $p < .01$ ). Underground mining is a risky environment where safety is a major concern. In such a context management-by-exception-active may predict effectiveness as suggested in the literature (Antonakis, *et al.*, 2003).

- The relationship between passive-avoidant behaviour (MBEP, LF) and the outcome variables of effectiveness (EFF), extra effort (EE), and satisfaction (SAT) are all negative for both the Impala sample and the US normative sample. This is consistent with previous research (Avolio and Bass, 2004). However the magnitude of the relationship in the Impala sample is smaller than the normative US sample (Table 5.10 and Table 5.11). This seems to suggest that in the case of underground mining at Impala that passive-avoidant leadership behaviour has a negative effect on the measured leadership outcomes, but not to the same extent as in the US normative sample. This may be due to the nature of underground mining where supervision is difficult due to the nature of the work, or a perception amongst Impala supervisors that delegation is more prevalent.
- The MLQ measured outcome variables of effectiveness (EFF), extra effort (EE), and satisfaction (SAT) are all strongly intercorrelated in both samples, indicating that all three of these variables are closely linked.

The important conclusions regarding the case of Impala that can be drawn from these intercorrelations are:

- Contingent reward is perceived as an important factor associated with leader effectiveness.
- Transformational leadership and contingent reward are strongly correlated, and both are perceived to be associated with the outcomes of effectiveness, extra effort, and satisfaction.
- Inspirational motivation is perceived to be strongly associated with leader effectiveness in the underground mining environment at Impala.
- Individual consideration is linked with the perception of effectiveness at Impala but the relationship is weaker than the normative US sample.
- It appears that management-by-exception-active (MBEA) is associated with effectiveness in the context of Impala while it has a slightly negative relationship with effectiveness in the US sample. This

seems to support the theory that in a risky environment MBEA is perceived as effective behaviour (Antonakis, *et al.*, 2003).

- The perception of leader effectiveness is negatively linked to passive-avoidant behaviour at Impala but the relationship is weaker than the US sample.

The next section examines the bivariate intercorrelations between the full range of leadership factors and the mediating variables of group safety climate and group cohesiveness and also the objective measures of injury rate and productivity.

### 5.3.5 Intercorrelations of Study Variables

The descriptive data and intercorrelations for all variables in the Impala study are summarised in the Table 5.12. An aggregated score for TF, EFF, MBEA, CR, and PA was calculated for every mine overseer. A weighted mean was calculated for each of these constructs across the three levels of management previously mentioned namely section managers, shift supervisors, and mine overseer colleagues. The unit of analysis was a mine overseer and the final data set contained construct scores for each of the thirty-nine mine overseers evaluated in the study.

**Table 5.12: Intercorrelations for All Variables in Study**

	LTIFR	P	TF	C	SC	EFF	MBEA	CR	PA
<b>LTIFR</b>	(-)								
<b>P</b>	-.03	(-)							
<b>TF</b>	<b>-.11</b>	<b>-.26</b>	<b>(.91)</b>						
<b>C</b>	-.13	-.18	<b>.34*</b>	(.91)					
<b>SC</b>	-.23	-.32*	<b>.67**</b>	<b>.47**</b>	(.93)				
<b>EFF</b>	<b>-.17</b>	<b>-.35*</b>	<b>.88**</b>	<b>.51**</b>	<b>.70**</b>	<b>(.80)</b>			
<b>MBEA</b>	-.08	-.37*	<b>.62**</b>	-.02	<b>.41**</b>	<b>.47**</b>	(.54)		
<b>CR</b>	-.14	-.37*	<b>.89**</b>	<b>.51**</b>	<b>.67**</b>	<b>.90**</b>	<b>.54**</b>	(.72)	
<b>PA</b>	<b>.33*</b>	.09	<b>-.24</b>	<b>-.43**</b>	-.30	<b>-.38*</b>	.06	<b>-.41**</b>	(.78)
<b>M</b>	5.46	0.89	<b>2.73</b>	5.53	5.81	<b>2.89</b>	2.60	2.97	1.27
<b>SD</b>	3.49	0.15	<b>0.35</b>	0.69	0.51	<b>0.40</b>	0.31	0.39	0.31

#### Note

Numbers in parentheses are reliability scores. N = 39 \* p < .05 \*\* p < .01

## Legend

*LTIFR*: Lost Time Injury Frequency Rate

*P*: Productivity

*TF*: Transformational Leadership

*C*: Group Cohesiveness

*SC*: Group Safety Climate

*EFF*: Effectiveness

*MBEA*: Management-By-Exception-Active

*CR*: Contingent Reward

*PA*: Passive-Avoidant

*M*: Mean

*SD*: Standard Deviation.

The Cronbach's alpha measures of internal consistency for the instrument constructs in the study are acceptable (Gravetter and Wallnau, 2000) (Table 5.12). The only Cronbach's alpha that is slightly low is MBEA ( $\alpha = 0.54$ ). This slightly low value may be due to some of the participants not having English as their first language, which may have caused them to misinterpret some of the questions.

The following relationships are evident from an analysis of Table 5.12 which includes all the variables measured in the study:

- The relationship between transformational leadership (TF) and injury rate (LTIFR) ( $r = -.11$ ,  $n = 39$ ,  $p > .05$ ) was negative but did not reach significance. Many other confounding variables may have influenced injury rate including mining conditions, the experience of the subordinates, or the non-reporting of accidents which caused contamination of the criterion variable (De Hoogh *et al.*, 2004). This result could also indicate that injury rate was too narrow a measure of the leader's effectiveness (Peters, 1997), or the one year period of data collection was too short (Zohar, 2002).
- The relationship between transformational leadership (TF) and productivity (P) ( $r = -.26$ ,  $n = 39$ ,  $p > .05$ ) was not statistically



significant. Productivity may also have been influenced by confounding variables such as the set target, mining conditions, and the experience of the crews which caused contamination of the criterion variable (De Hoogh *et al.*, 2004). This result could also indicate that productivity was too narrow a measure of the leader's effectiveness (Peters, 1997).

- There was a strong positive significant correlation between transformational leadership (TF) and effectiveness (EFF) ( $r = +.88$ ,  $n = 39$ ,  $p < .01$ ). This result supports the theory that followers perceive transformational leaders to be effective (Avolio and Bass, 2004).
- CR strongly predicted EFF ( $r = +.90$ ,  $n = 39$ ,  $p < .01$ ). This supports previous research done in an army environment (Bass, *et al.*, 2003).
- TF had a significant positive correlation with group safety climate (SC) ( $r = +.67$ ,  $n = 39$ ,  $p < .01$ ). This result supports previous research done in a different context (Zohar, 2002).
- TF had a significant positive correlation with group cohesiveness (C) ( $r = +.34$ ,  $n = 39$ ,  $p < .05$ ). This result supports previous research conducted in a different context (Bass, *et al.*, 2003).
- MBEA significantly predicted EFF ( $r = +.47$ ,  $n = 39$ ,  $p < .01$ ). This result supports the view that corrective leadership is effective in a risky environment (Antonakis, *et al.*, 2003).

The important conclusions regarding underground mining at Impala drawn from these bivariate intercorrelations are summarised as follows:

- There was a non-significant link between transformational leadership and objectively measured injury rate.
- No link between transformational leadership and objectively measured productivity was found.
- Transformational leadership had a positive significant link with the perceptions of group safety climate, and group cohesiveness.
- Management-by-exception-active significantly predicted the perception of effectiveness.

- There was a strong link between transformational leadership and the perception of effectiveness.
- There was a strong correlation between contingent reward and the perception of effectiveness.

These findings suggest that transformational leadership and contingent reward were strongly related to the perception of leader effectiveness and were also related to group safety climate and group cohesiveness. Management-by-exception-active was also positively related to effectiveness. No relationship was found between transformational leadership and either of the objective measures of injury rate or productivity. Given the positive relationship between transformational leadership, group safety climate, group cohesiveness and effectiveness, it may be possible that the measures of injury rate and productivity used in this study were too narrow or were contaminated by confounding variables.

### ***5.3.6 Multiple Regression Analysis***

Multiple regression analysis is a statistical analysis technique used to establish the linear relationship between a single dependent variable and two or more independent (explanatory) variables and is used to test the proposed hypotheses (Cooper and Schindler, 2001).

#### ***Regression Outputs***

The regression outputs from the statistical analysis system (SAS version 9.2) statistical computer program include an analysis of variance (ANOVA), a model summary, and the parameter estimates as follows:

#### ***ANOVA***

The F-test shows the overall significance of the model (Cooper and Schindler, 2001). The following hypotheses were tested:

$H_0$ : The slope coefficients of the model are simultaneously equal to zero therefore the model is of no statistical significance.

$H_1$ : At least one of the slope coefficients of the model is not equal to zero therefore the model is of statistical significance.

#### *Model Summary*

The adjusted R-square value is used since this is a multiple regression model and explains what percentage of the variance in the dependent variable is explained by the explanatory variables (Cooper and Schindler, 2001).

#### *Parameter Estimates*

In this part of the output the individual slope coefficients were tested for significance (Cooper and Schindler, 2001). The hypotheses are:

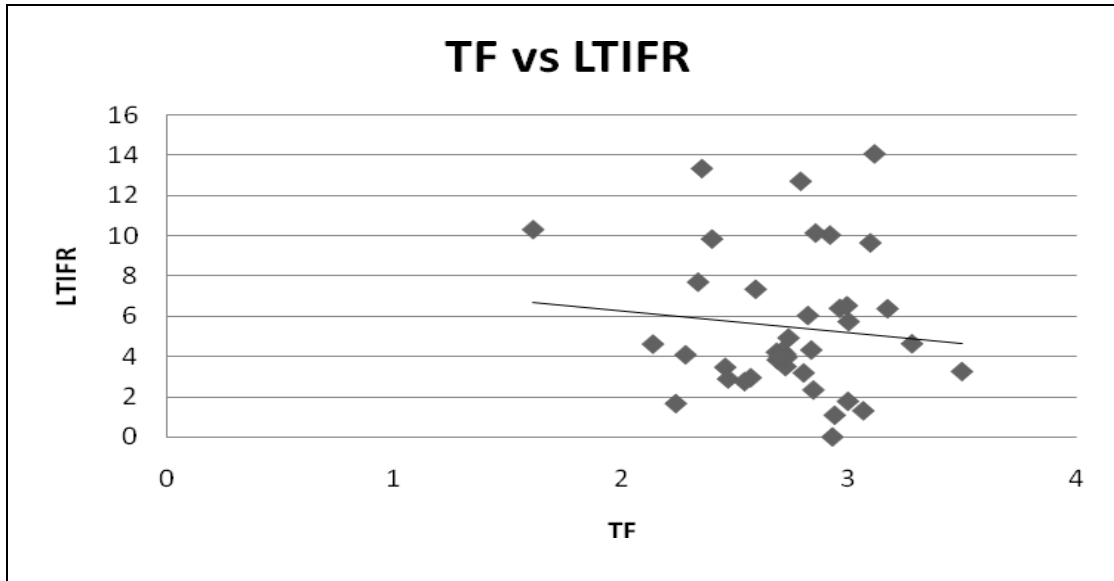
$H_0$ :  $\beta = 0$ : No linear relationship exists between the explanatory variable and the dependent variable.

$H_1$ :  $\beta \neq 0$ : A linear relationship exists between the explanatory variable and the dependent variable.

**5.3.6.1 Hypothesis 1:** Transformational leadership is positively related to both injury rate and productivity.

#### *Injury Rate*

Figure 5.6 shows a scatter plot of transformational leadership (TF) (independent variable) versus lost time injury frequency rate (LTIFR) for the aggregated data collected for the thirty-nine mine overseers. This does not indicate an obvious relationship between the variables as the points on the graph are spread out.



**Figure 5.6: Transformational Leadership (TF) vs Injury Rate (LTIFR)**

Table 5.13 below shows the regression outputs for injury rate (LTIFR) regressed on transformational leadership (TF).

**Table 5.13: Injury Rate (LTIFR)**

ANOVA						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
<i>Model</i>	1	5.558	5.558	0.45	<b>0.506</b>	
<i>Error</i>	37	456.489	12.338			
<i>Corrected Total</i>	38	462.047				

Model Summary			
<b>Root MSE</b>	3.512	<b>R-Square</b>	0.012
<b>Dependent Mean</b>	5.464	<b>Adjusted R-Square</b>	<b>-0.015</b>
<b>Coefficient Variation</b>	64.289		

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate
<i>Intercept</i>	1	<b>8.465</b>	4.507	1.88	0.068	0
<i>TF</i>	1	<b>-1.100</b>	1.639	-0.67	<b>0.506</b>	-0.110

### Note

*Independent variable:* Transformational leadership (TF)

*Dependent variable:* LTIFR

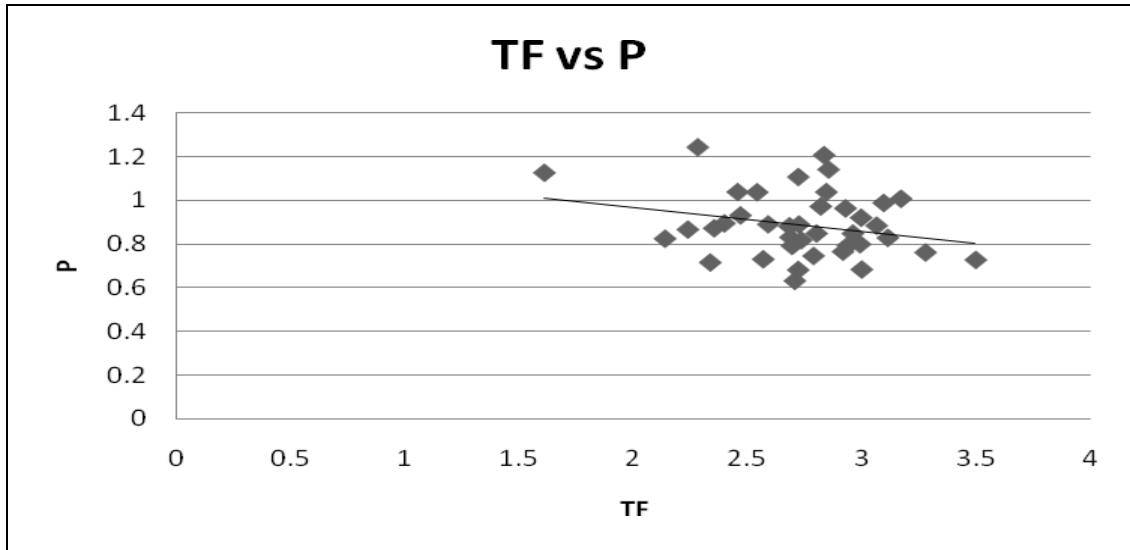
*Regression model:*  $LTIFR = 8.47 - 1.1TF$

There was a negative relationship between transformational leadership and the LTIFR but the F-test p-value ( $p = 0.51$ ) is greater than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was not statistically significant. The result of the regression analysis showed that the adjusted  $R^2$  value indicated that only 1.5% of the variation in the LTIFR was explained by the proposed model with TF as explanatory variable.

This was an unexpected result based on theory and previous studies done in different contexts. These studies found a negative relationship between transformational leadership and injuries but the LTIFR was not used as the objective measure (Barling *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006). However, previous research found that the relationship between transformational leadership and objective measures of a leader's effectiveness was lower in comparison to followers' perception of a leader's effectiveness (Lowe, *et al.*, 1996; Judge and Piccolo, 2004). Also, the LTIFR may have been contaminated by confounding variables (De Hoogh *et al.*, 2004) and/or was too narrow a measure of the leader's effectiveness (Peters, 1997). The relationship between transformational leadership and injury rate and the existence of confounding variables is explored further in the qualitative phase of the study.

### *Productivity*

Figure 5.7 shows a scatter plot of transformational leadership (TF) (explanatory variable) versus productivity (P) for the aggregated collected data. This graph does not indicate an obvious relationship between the variables as the points on the graph are spread out.



**Figure 5.7: Transformational Leadership (TF) vs Productivity (P)**

Table 5.14 below shows the outputs for productivity (P) regressed on transformational leadership (TF).

**Table 5.14: Productivity (P)**

ANOVA						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
<i>Model</i>	1	0.056	0.056	2.65	<b>0.112</b>	
<i>Error</i>	37	0.778	0.021			
<i>Corrected Total</i>	38	0.833				

Model Summary			
<b>Root MSE</b>	0.145	<b>R-Square</b>	0.067
<b>Dependent Mean</b>	0.889	<b>Adjusted R-Square</b>	<b>0.042</b>
<b>Coefficient Variation</b>	16.308		

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate
<i>Intercept</i>	1	<b>1.189</b>	0.186	6.39	< .0001	0
<i>TF</i>	1	<b>-0.110</b>	0.068	-1.63	<b>0.112</b>	-0.258

### Note

*Independent variable:* Transformational leadership (TF)

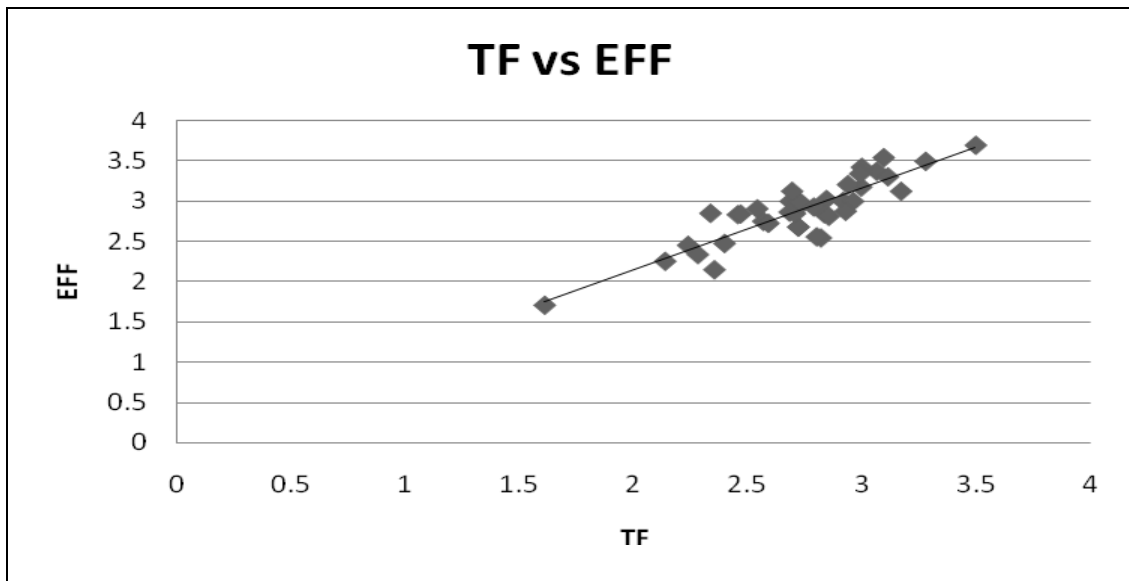
*Dependent variable:* Productivity (P)

*Regression model:*  $P = 1.19 - 0.11TF$

The F-test p-value ( $p = 0.11$ ) was greater than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was not statistically significant. The adjusted  $R^2$  value indicated that only 4.2% of the variation in P was explained by the proposed model with TF as explanatory variable. This result was unexpected based on theory and several empirical studies done in different contexts. These studies showed a positive link between transformational leadership and productivity (Yammarino, *et al.*, 1993; Thite, 1999; Masi and Cooke, 2000; Dvir, *et al.*, 2002; Bass, *et al.*, 2003; Pillai and Williams, 2003). However, previous research found that the relationship between transformational leadership and objective measures of a leader's effectiveness was lower in comparison to followers' perception of a leader's effectiveness (Lowe, *et al.*, 1996; Judge and Piccolo, 2004). The productivity measure (% production target met) used may have been too narrow a measure of the leader's effectiveness (Peters, 1997), or may have been contaminated by confounding variables (De Hoogh *et al.*, 2004). The relationship between transformational leadership and productivity and the existence of confounding variables is explored further in the qualitative phase of the study.

### *Effectiveness*

The perception of effectiveness (EFF) was measured by the MLQ instrument as an outcome of leadership and was examined as a proxy for the delivery of injury rate and productivity excellence. Figure 5.8 shows a scatter plot of transformational leadership (TF) (explanatory variable) versus effectiveness (EFF) for the aggregated data. This indicates that a linear relationship exists between the variables as the points on the graph are packed close together along a straight line.



**Figure 5.8: Transformational Leadership (TF) vs Effectiveness (EFF)**

Table 5.15 below shows the outputs for effectiveness (EFF) regressed on transformational leadership (TF).

**Table 5.15: Effectiveness (EFF)**

<b>ANOVA</b>						
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>	
<i>Model</i>	1	4.790	4.790	127.95	<b>&lt;.0001</b>	
<i>Error</i>	37	1.385	0.037			
<i>Corrected Total</i>	38	6.175				

<b>Model Summary</b>			
<b>Root MSE</b>	0.193	<b>R-Square</b>	0.776
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.770</b>
<b>Coefficient Variation</b>	6.696		

<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>
<i>Intercept</i>	1	<b>0.103</b>	0.248	0.42	0.680	0
<i>TF</i>	1	<b>1.021</b>	0.090	11.31	<b>&lt;.0001</b>	0.881



### Note

*Independent variable:* Transformational leadership (TF)

*Dependent variable:* Effectiveness (EFF)

*Regression model:*  $EFF = 0.10 + 1.02TF$

The F-test had a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The adjusted  $R^2$  value indicates that 77.0% of the variation in EFF was explained by the proposed model with TF as explanatory variable. Effectiveness (EFF) may be viewed as a proxy for leadership outcomes including injury rate and productivity. The existence of a strong relationship between transformational leadership (TF) and effectiveness (EFF) raises the question of whether the injury rate measure (LTIFR) and productivity measure (% production target met) were too narrow a measure of leadership effectiveness or were contaminated by confounding variables. These questions are examined in more detail in the qualitative part of this study.

### *FRLT predictors of EFF*

A stepwise regression was run to test for the best predictors of effectiveness (EFF) from the set of nine factors of the full range leadership theory (FRLT). These nine factors are II (A), II (B), IM, IS, IC, CR, MBEA, MBEP, and LF. The results of the stepwise regression showed that contingent reward (CR) and idealised influence (attributed) (II (A)) were the best two predictors of EFF in the context of underground mining at Impala. Table 5.16 below shows the outputs for effectiveness simultaneously regressed on contingent reward and idealised influence (attributed).

**Table 5.16: Effectiveness (EFF)**

ANOVA							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
<i>Model</i>	2	5.196	2.598	95.56	<.0001		
<i>Error</i>	36	0.979	0.027				
<i>Corrected Total</i>	38	6.175					

Model Summary			
<b>Root MSE</b>	0.165	<b>R-Square</b>	0.842
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.833</b>
<b>Coefficient Variation</b>	5.710		

Parameter Estimates							
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate	Variance Inflation
<i>Intercept</i>	1	<b>0.050</b>	0.207	0.24	<b>0.811</b>	0	0
<i>II(A)</i>	1	<b>0.321</b>	0.127	2.52	<b>0.016</b>	0.307	3.372
<i>CR</i>	1	<b>0.660</b>	0.125	5.29	<b>&lt;.0001</b>	0.644	3.372

Note

*Independent variables:* Idealised Influence (Attributed) (II (A)),  
Contingent Reward (CR)

*Dependent variable:* Effectiveness (EFF)

*Regression model:*  $EFF = 0.05 + 0.32 II (A) + 0.66CR$

The F-test has a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The results indicated that 83.3% of the variation in effectiveness (EFF) was explained by the proposed model with II (A) and CR as explanatory variables. The t-test p-values for the explanatory variables CR ( $p < .0001$ ) and II (A) ( $p < .016$ ) were both significant. This result showed that leader effectiveness is best predicted by two of the nine factors of the FRLT. Contingent reward had the strongest effect ( $\beta = 0.644$ ) on effectiveness followed by idealised influence (attributed) ( $\beta = 0.307$ ). As the five factors of transformational leadership are strongly correlated there is redundancy between them in their composite affect on the perception of effectiveness. Therefore contingent reward and transformational leadership are good predictors of effectiveness.

*Augmentation effect of TF on MBEA*

The augmentation effect of transformational leadership on corrective transactional leadership (management-by-exception-active) (Avolio and Bass, 2004) was investigated using effectiveness (EFF) as the dependent variable. Firstly, a regression model was run with effectiveness regressed on the explanatory variable of management-by-exception-active (representing corrective transactional leadership) (Table 5.17).

**Table 5.17: Effectiveness (EFF)**

<b>ANOVA</b>						
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>	
<i>Model</i>	1	1.360	1.360	10.45	<b>0.003</b>	
<i>Error</i>	37	4.814	0.130			
<i>Corrected Total</i>	38	6.175				

<b>Model Summary</b>			
<b>Root MSE</b>	0.361	<b>R-Square</b>	0.220
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.199</b>
<b>Coefficient Variation</b>	12.484		

<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>
<i>Intercept</i>	1	<b>1.288</b>	0.499	2.58	0.014	0
<i>MBEA</i>	1	<b>0.615</b>	0.190	3.23	<b>0.003</b>	0.469

Note

*Independent variables:* Management-by-exception-active (MBEA)

*Dependent variable:* Effectiveness (EFF)

*Regression model:*  $EFF = 1.29 + 0.62MBEA$

The F-test had a p-value ( $p = 0.003$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The result of regression analysis showed that 19.9% of the variation in effectiveness (EFF) was explained by the proposed model with MBEA as explanatory variable.

The model was rerun using management-by-exception-active (MBEA) and

transformational leadership (TF) as the explanatory variables (Table 5.18). This regression analysis was used to test for the augmentation effect of transformational leadership on transactional leadership.

**Table 5.18: Effectiveness (EFF)**

<b>ANOVA</b>							
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>		
<i>Model</i>	2	4.852	2.426	66.01	<b>&lt;.0001</b>		
<i>Error</i>	36	1.323	0.037				
<i>Corrected Total</i>	38	6.175					

<b>Model Summary</b>			
<b>Root MSE</b>	0.192	<b>R-Square</b>	0.786
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.774</b>
<b>Coefficient Variation</b>	6.634		

<b>Parameter Estimates</b>							
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>	<b>Variance Inflation</b>
<i>Intercept</i>	1	<b>0.289</b>	0.284	1.01	<b>0.317</b>	0	0
<i>MBEA</i>	1	<b>-0.168</b>	0.129	-1.30	<b>0.202</b>	-0.128	1.631
<i>TF</i>	1	<b>1.114</b>	0.114	9.75	<b>&lt;.0001</b>	0.960	1.631

Note

*Independent variables:* TF and MBEA

*Dependent variable:* Effectiveness (EFF)

*Regression model:*  $EFF = 0.29 - 0.17MBEA + 1.11TF$

The F-test had a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The results indicated that 77.4% of the variation in effectiveness (EFF) was explained by the proposed model with TF and MBEA as explanatory variables. TF ( $p < .0001$ ) accounts for the full variation in EFF as MBEA ( $p = 0.202$ ) was not significant in the model.

Bass (1985) suggested that transactional leadership was augmented by transformational leadership in relation to productivity. Transformational

leadership appears to be complementary to transactional leadership in relation to effectiveness (Yammarino, Spangler and Bass, 1993). This result provided evidence for the augmentation effect of transformational leadership complementing transactional leadership ( $\Delta R^2 = 57.5\%$ ) in relation to the perception of leader effectiveness as has been found in previous empirical research (Howell and Avolio, 1993).

**5.3.6.2 Hypothesis 2:** The relationship between transformational leadership and injury rate is partially mediated by group safety climate.

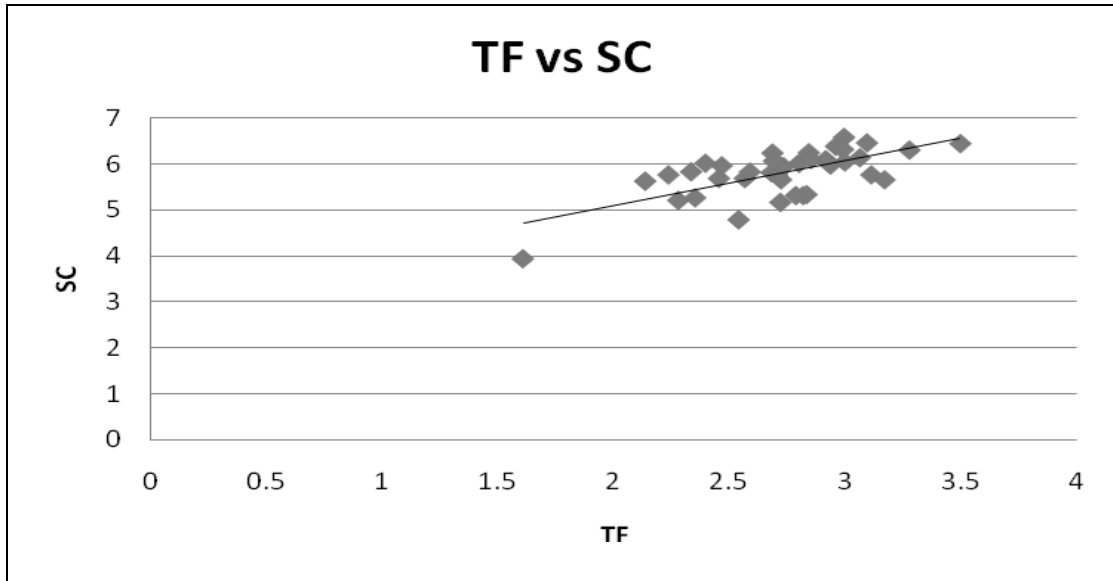
Partial mediation was investigated using a 3 step process (Baron and Kenny, 1986):

1. The independent variable is significantly related to the dependent variable and mediator variable.
2. The mediator variable is significantly related to the dependent variable.
3. When the independent variable and the mediator variable are considered simultaneously, the direct relationship between the independent and dependent variable decreases by a magnitude that is statistically significant.

#### Step 1

Transformational leadership (TF) was found not to be significantly related to injury rate (IR) (Adjusted  $R^2 = 1.5\%$ ;  $F(1, 37) = 0.45$ ,  $p = 0.51$ ).

Figure 5.9 shows a scatter plot of transformational leadership (explanatory variable) versus group safety climate (SC). This graph indicates a linear relationship between the variables as the points on the graph approximate a straight line.



**Figure 5.9: Transformational Leadership (TF) vs Group Safety Climate (SC)**

Table 5.19 below shows the outputs for the group safety climate (SC) regressed on transformational leadership (TF).

**Table 5.19: Group Safety Climate (SC)**

<b>ANOVA</b>						
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>	
<i>Model</i>	1	4.397	4.397	29.99	<b>&lt;.0001</b>	
<i>Error</i>	37	5.424	0.147			
<i>Corrected Total</i>	38	9.821				

<b>Model Summary</b>			
<b>Root MSE</b>	0.383	<b>R-Square</b>	0.448
<b>Dependent Mean</b>	5.815	<b>Adjusted R-Square</b>	<b>0.433</b>
<b>Coefficient Variation</b>	6.585		

<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>
<i>Intercept</i>	1	<b>3.145</b>	0.491	6.40	<.0001	0
<i>TF</i>	1	<b>0.979</b>	0.179	5.48	<b>&lt;.0001</b>	0.669

### Note

*Independent variable:* Transformational leadership (TF)

*Dependent variable:* Group safety climate (SC)

*Regression model:*  $SC = 3.15 + 0.98TF$

The ANOVA F-test has a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model is significant. The adjusted  $R^2$  value for the regression model indicates that 43.3% of the variation in group safety climate (SC) is explained by the proposed model with TF as explanatory variable. This result is consistent with previous empirical research and established theory supporting a positive link between transformational leadership and group safety climate (Barling, *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Groom, 2006; Kelloway, *et al.*, 2006; Mullen and Kelloway, 2009).

### Step 2

The relationship between group safety climate (SC) and injury rate (IR) was found to be not significant ( $r = -0.23$ ,  $n = 39$ ,  $p > .05$ )

### Step 3

Table 5.20 below shows the outputs for the injury rate (LTIFR) simultaneously regressed on transformational leadership (TF) and group safety climate (SC).

**Table 5.20: Injury Rate (LTIFR)**

ANOVA							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
<i>Model</i>	2	27.115	13.557	1.12	<b>0.337</b>		
<i>Error</i>	36	434.932	12.081				
<i>Corrected Total</i>	38	462.047					

Model Summary			
<b>Root MSE</b>	3.476	<b>R-Square</b>	0.059
<b>Dependent Mean</b>	5.464	<b>Adjusted R-Square</b>	<b>0.006</b>
<b>Coefficient Variation</b>	63.618		

Parameter Estimates							
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate	Variance Inflation
<i>Intercept</i>	1	<b>14.735</b>	6.475	2.28	0.029	0	0
<i>TF</i>	1	<b>0.851</b>	2.183	0.39	<b>0.700</b>	0.085	1.811
<i>SC</i>	1	<b>-1.994</b>	1.492	-1.34	<b>0.190</b>	-0.291	1.811

Note

*Independent variables:* Transformational leadership (TF),  
Group safety climate (SC)

*Dependent variable:* LTIFR

*Multiple regression model:*  $LTIFR = 14.74 + 0.85TF - 1.99SC$

The F-test p-value ( $p = 0.34$ ) was greater than the chosen level of significance ( $\alpha = 0.05$ ), therefore the null hypothesis was not rejected. The adjusted R-square value shows that less than 1% of the variation in LTIFR was explained by the proposed model with TF and SC as explanatory variables. The parameter estimates t-test p-values associated with the test procedure were greater than the chosen level of significance ( $\alpha = 0.05$ ), therefore the null hypothesis was not rejected. It was concluded that there was not enough statistical evidence to suggest that a linear relationship existed between the explanatory variables and the dependent variable. This result was unexpected based on previous empirical research done in different contexts (Barling, *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006). However this result seems to confirm the earlier finding that the LTIFR may have been



contaminated by confounding variables (De Hoogh *et al.*, 2004), and/or the LTIFR may have been too narrow a measure of leader effectiveness (Peters, 1997). This result is examined in more detail in the qualitative phase of the study.

The model was rerun with effectiveness (EFF) used as a proxy for injury rate. The same three step process was followed to test for partial mediation (Baron and Kenny, 1986).

### Step 1

Transformational leadership (TF) was significantly related to the dependent variable of effectiveness (EFF) (Adjusted  $R^2 = 77.0\%$ ;  $F(1, 37) = 127.95$ ,  $p < 0.0001$ ).

Transformational leadership (TF) was also significantly related to the mediating variable of group safety climate (Adjusted  $R^2 = 43.3\%$ ;  $F(1, 37) = 29.99$ ,  $p < 0.0001$ ).

### Step 2

The relationship between group safety climate (SC) and effectiveness (EFF) was significant ( $r = +0.70$ ,  $n = 39$ ,  $p < 0.01$ ).

### Step 3

Table 5.21 below shows the outputs for effectiveness (EFF) simultaneously regressed on transformational leadership (TF) and group safety climate (SC).

**Table 5.21: Effectiveness (EFF)**

ANOVA							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
<i>Model</i>	2	4.932	2.466	71.41	<.0001		
<i>Error</i>	36	1.243	0.035				
<i>Corrected Total</i>	38	6.175					

Model Summary			
<b>Root MSE</b>	0.186	<b>R-Square</b>	0.799
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.788</b>
<b>Coefficient Variation</b>	6.431		

Parameter Estimates							
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate	Variance Inflation
<i>Intercept</i>	1	<b>-0.406</b>	0.346	-1.17	0.249	0	0
<i>TF</i>	1	<b>0.863</b>	0.117	7.40	<.0001	0.744	1.811
<i>SC</i>	1	<b>0.162</b>	0.080	2.03	<b>0.050</b>	0.204	1.811

Note

*Independent variables:* Transformational leadership (TF),  
Group safety climate (SC)

*Dependent variable:* Effectiveness (EFF)

*Multiple regression model:*  $EFF = -0.41 + 0.86TF + 0.16SC$

The F-test had a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The result of the multiple regression analysis indicated that 78.8% of the variation in effectiveness (EFF) was explained by the proposed model with TF and SC as explanatory variables. The t-test p-values for both the explanatory variables (TF, SC) were also statistically significant. Descriptive statistics indicated that the relationship between transformational leadership (TF) and effectiveness (EFF) was partially mediated by group safety climate as the standardised beta coefficient for TF ( $\beta = 0.74$ ) when group safety climate and transformational leadership were inputted into the model together, was smaller than the standardised beta coefficient for TF ( $\beta = 0.88$ ) when transformational leadership was inputted into the model alone (Baron and Kenny, 1986). This result was

confirmed by the Sobel test for statistical significance as the mediation effect of group safety climate in the model was  $p = 0.058$ , indicating that partial mediation was present (Preacher and Hayes, 2004).

This result showed that group safety climate partially mediated the relationship between transformational leadership and effectiveness (EFF). This result provided further evidence to suggest that the absence of a relationship between both transformational leadership and group safety climate, and the organisational objective measure of injury rate (LTIFR) may have been due to:

- The LTIFR was too narrow a measure of leader effectiveness.
- The LTIFR was contaminated by confounding variables.

These results are further explored in the qualitative second phase of the study.

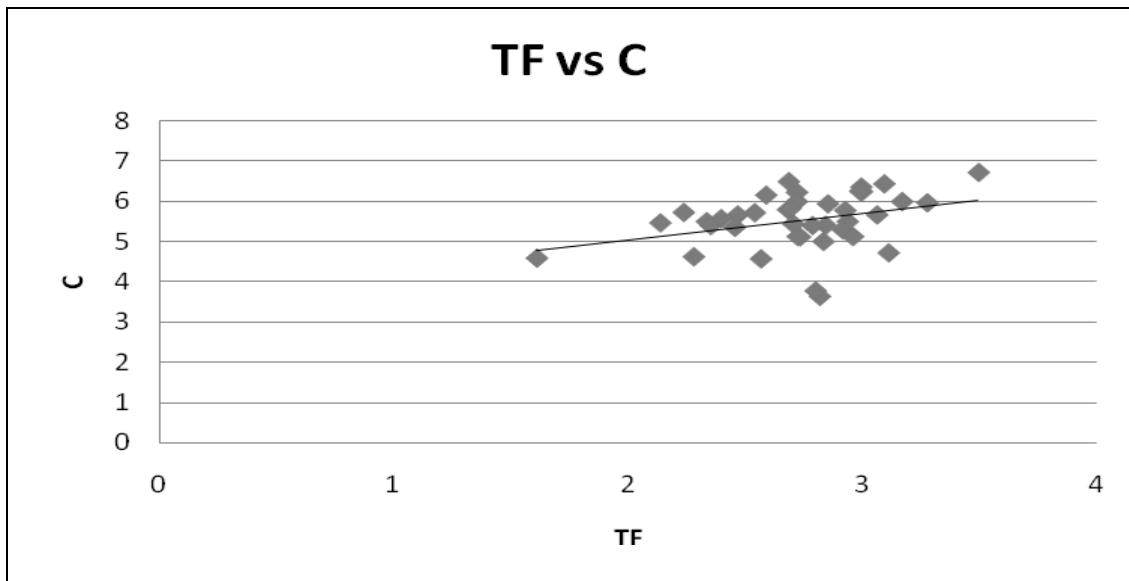
**5.3.6.3 Hypothesis 3:** The relationship between transformational leadership and productivity is partially mediated by group cohesiveness.

Partial mediation was investigated using the three step process described by Baron and Kenny (1986) as discussed earlier.

#### Step 1

Transformational leadership (TF) was found not to be significantly related to productivity (P) (adjusted  $R^2 = 4.2\%$ ;  $F(1, 37) = 2.65$ ,  $p = 0.11$ ).

Figure 5.10 shows a scatter plot of transformational leadership (TF) (explanatory variable) versus group cohesiveness (C) for the aggregated data collected. This indicated a linear relationship between the variables as the points on the graph approximate a straight line. However the points on the graph are spread out around the line indicating that the relationship between the variables was moderately strong.



**Figure 5.10: Transformational Leadership (TF) vs Group Cohesiveness (C)**

Table 5.22 below shows the outputs for group cohesiveness (C) regressed on transformational leadership (TF).

**Table 5.22: Group Cohesiveness (C)**

ANOVA					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
<i>Model</i>	1	2.025	2.025	4.69	<b>0.037</b>
<i>Error</i>	37	15.986	0.432		
<i>Corrected Total</i>	38	18.011			

Model Summary			
<b>Root MSE</b>	0.657	<b>R-Square</b>	0.112
<b>Dependent Mean</b>	5.529	<b>Adjusted R-Square</b>	<b>0.088</b>
<b>Coefficient Variation</b>	11.889		

Parameter Estimates						
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate
<i>Intercept</i>	1	<b>3.717</b>	0.843	4.41	<.0001	0
<i>TF</i>	1	<b>0.664</b>	0.307	2.16	<b>0.037</b>	0.335

Note

*Independent variable:* Transformational leadership (TF)

*Dependent variable:* Group cohesiveness (C)

Regression model:  $C = 3.72 + 0.66TF$

The F-test had a p-value ( $p = 0.034$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The adjusted  $R^2$  value indicated that 8.8% of the variation in group cohesiveness (C) was explained by the proposed model with TF as explanatory variable. This result supports previous empirical research where transformational leadership was found to be significantly related to group cohesiveness (Pillai and Williams, 2003; Bass, *et al.*, 2003).

### Step 2

The relationship between group cohesiveness (C) and productivity (P) was found not to be significant ( $r = -0.18$ ,  $n = 39$ ,  $p > .05$ ).

### Step 3

Table 5.23 below shows the outputs for productivity (P) simultaneously regressed on the explanatory variables of transformational leadership (TF) and group cohesiveness (C).

**Table 5.23: Productivity (P)**

ANOVA							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
Model	2	0.063	0.032	1.48	<b>0.242</b>		
Error	36	0.770	0.021				
Corrected Total	38	0.833					

Model Summary			
Root MSE	0.146	R-Square	0.076
Dependent Mean	0.889	Adjusted R-Square	<b>0.025</b>
Coefficient Variation	16.453		

Parameter Estimates							
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate	Variance Inflation
Intercept	1	<b>1.270</b>	0.232	5.48	<.0001	0	0
TF	1	<b>-0.096</b>	0.072	-1.32	<b>0.195</b>	-0.224	1.127
C	1	<b>-0.022</b>	0.037	-0.59	<b>0.556</b>	-0.101	1.127

### Note

*Independent variables:* Transformational leadership (TF),  
Group cohesiveness (C)

*Dependent variable:* Productivity (P)

*Multiple regression model:*  $P = 1.27 - 0.10TF - 0.02C$

The F-test had a p-value ( $p = 0.24$ ) greater than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was not significant. The model indicated that only 2.5% of the variation in productivity (P) was explained by the proposed model with TF and C as explanatory variables. The t-test p-values for both the explanatory variables (TF, C) were not statistically significant. These results indicate that group cohesiveness did not mediate the relationship between transformational leadership and productivity (Baron and Kenny, 1986). This was an unexpected result compared to established theory and previous empirical research (Pillai and Williams, 2003; Bass, *et al.*, 2003). These results are further explored in the qualitative phase of the study.

The model was rerun with effectiveness (EFF) used as a proxy for productivity. The same three step process was followed to test for partial mediation (Baron and Kenny, 1986).

### Step 1

Transformational leadership (TF) was significantly related to the dependent variable of effectiveness (EFF) (adjusted  $R^2 = 77.0\%$ ;  $F(1, 37) = 127.95$ ,  $p < 0.0001$ ). Transformational leadership (TF) was also significantly related to the mediating variable of group cohesiveness (adjusted  $R^2 = 8.8\%$ ;  $F(1, 37) = 4.69$ ,  $p < 0.05$ ).

### Step 2

The relationship between group cohesiveness (C) and effectiveness (EFF) is significant ( $r = +0.51$ ,  $n = 39$ ,  $p < 0.01$ ).

### Step 3

Effectiveness (EFF) was again inputted into the regression model as a proxy for

the dependent variable of productivity to determine if group cohesiveness partially mediated the relationship between transformational leadership and effectiveness (EFF) (Table 5.24).

**Table 5.24: Effectiveness (EFF)**

<b>ANOVA</b>							
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>		
<i>Model</i>	2	5.099	2.549	85.28	<b>&lt;.0001</b>		
<i>Error</i>	36	1.076	0.030				
<i>Corrected Total</i>	38	6.175					

<b>Model Summary</b>			
<b>Root MSE</b>	0.173	<b>R-Square</b>	0.826
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.816</b>
<b>Coefficient Variation</b>	5.984		

<b>Parameter Estimates</b>							
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>	<b>Variance Inflation</b>
<i>Intercept</i>	1	<b>-0.414</b>	0.274	-1.51	0.140	0	0
<i>TF</i>	1	<b>0.929</b>	0.086	10.85	<b>&lt;.0001</b>	0.801	1.127
<i>C</i>	1	<b>0.139</b>	0.043	3.21	<b>0.003</b>	0.237	1.127

Note

*Independent variables:* Transformational leadership (TF),  
Group cohesiveness (C)

*Dependent variable:* Effectiveness (EFF)

*Multiple regression model:*  $EFF = -0.41 + 0.93TF + 0.14C$

The F-test had a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The result of the multiple regression analysis indicated that 81.6% of the variation in effectiveness (EFF) was explained by the proposed model with TF and C as explanatory variables. The t-test p-values for both the explanatory variables (TF, C) were also statistically significant. Descriptive statistics indicated that the relationship between transformational leadership (TF) and effectiveness (EFF) was partially mediated by group cohesiveness as the standardised parameter

estimate for TF ( $\beta = 0.80$ ) when cohesiveness and transformational leadership were both inputted into the model, was smaller than the standardised parameter estimate for TF ( $\beta = 0.88$ ) when transformational leadership was inputted into the model alone (Baron and Kenny, 1986). This result was confirmed by the Sobel test for statistical significance as the mediation effect of group cohesiveness in the model was  $p = 0.072$ , indicating that partial mediation was present (Preacher and Hayes, 2004). This result further indicated that the objective measure of productivity (% production target met):

- May have been too narrow a measure of leader effectiveness.
- The relationship between transformational leadership and productivity may have been contaminated by confounding variables.

These results are further explored in the qualitative second phase of the study.

Group cohesiveness (C) was inputted into the model as the dependent variable to determine if group safety climate partially mediated the relationship between transformational leadership and the perception of group cohesiveness (C) as suggested by Krause (2005) (Table 5.25).

**Table 5.25: Group Cohesiveness (C)**

ANOVA							
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F		
<i>Model</i>	2	3.923	1.962	5.01	<b>0.012</b>		
<i>Error</i>	36	14.087	0.391				
<i>Corrected Total</i>	38	18.011					

Model Summary			
<b>Root MSE</b>	0.626	<b>R-Square</b>	0.218
<b>Dependent Mean</b>	5.529	<b>Adjusted R-Square</b>	<b>0.174</b>
<b>Coefficient Variation</b>	11.314		

Parameter Estimates							
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Standardised Estimate	Variance Inflation
<i>Intercept</i>	1	<b>1.856</b>	1.165	1.59	0.120	0	0
<i>TF</i>	1	<b>0.085</b>	0.393	0.22	<b>0.830</b>	0.043	1.811
<i>SC</i>	1	<b>0.592</b>	0.269	2.20	<b>0.034</b>	0.437	1.811



### Note

*Independent variables:* Transformational leadership (TF),  
Group safety climate (SC)

*Dependent variable:* Group Cohesiveness (C)

*Multiple regression model:*  $C = 1.86 + 0.09TF + 0.59SC$

The F-test had a p-value ( $p = 0.012$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The result of the multiple regression analysis indicated that 17.4% of the variation in group cohesiveness (C) was explained by the proposed model with TF and SC as explanatory variables. The t-test p-value for the explanatory variable TF was not significant while the t-test p-value for the explanatory variable SC was statistically significant. Descriptive statistics indicates that the relationship between transformational leadership (TF) and group cohesiveness (C) was mediated by group safety climate as the standardised beta parameter estimate for TF ( $\beta = 0.04$ ) when group safety climate and transformational leadership are both inputted into the model, is smaller than the standardised beta parameter estimate for TF ( $\beta = 0.34$ ) when transformational leadership was inputted into the model alone (Baron and Kenny, 1986). This result was confirmed by the Sobel test for statistical significance as the mediation effect of group safety climate in the model was  $p = 0.04$ , indicating that mediation was present (Preacher and Hayes, 2004).

The model was rerun with TF, C, and SC as explanatory variables (Table 5.26).

**Table 5.26: Effectiveness (EFF)**

<b>ANOVA</b>							
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>		
<i>Model</i>	3	5.138	1.713	57.79	<.0001		
<i>Error</i>	35	1.037	0.030				
<i>Corrected Total</i>	38	6.175					

<b>Model Summary</b>			
<b>Root MSE</b>	0.172	<b>R-Square</b>	0.832
<b>Dependent Mean</b>	2.890	<b>Adjusted R-Square</b>	<b>0.818</b>
<b>Coefficient Variation</b>	5.958		

<b>Parameter Estimates</b>							
<b>Variable</b>	<b>DF</b>	<b>Parameter Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Pr &gt;  t </b>	<b>Standardised Estimate</b>	<b>Variance Inflation</b>
<i>Intercept</i>	1	<b>-0.630</b>	0.332	-1.90	0.066	0	0
<i>TF</i>	1	<b>0.853</b>	0.108	7.88	<b>&lt;.0001</b>	0.735	1.813
<i>C</i>	1	<b>0.121</b>	0.046	2.64	<b>0.012</b>	0.206	1.279
<i>SC</i>	1	<b>0.090</b>	0.079	1.15	<b>0.259</b>	0.114	2.055

Note

*Independent variables:* Transformational leadership (TF),

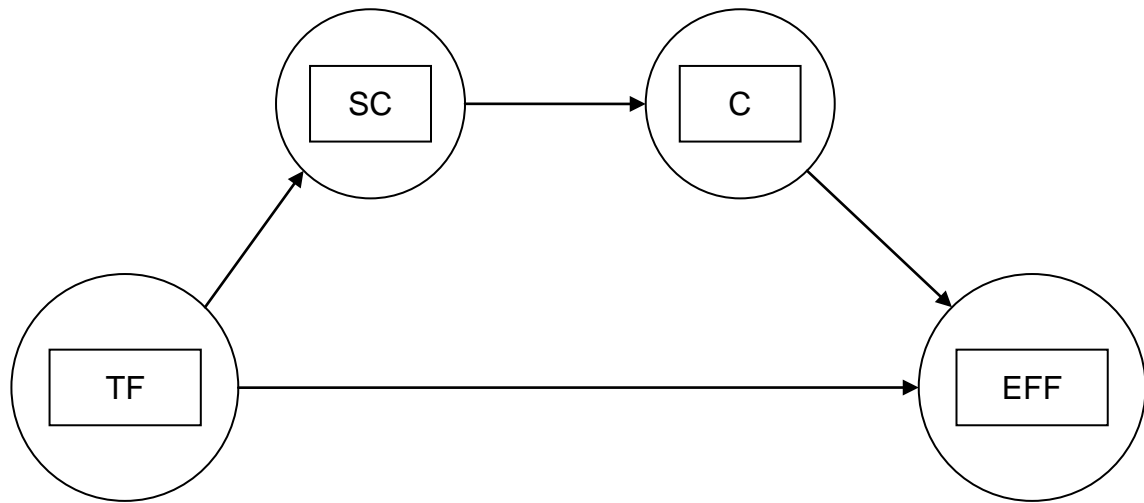
Group cohesiveness (C), Group safety climate (SC)

*Dependent variable:* Effectiveness (EFF)

*Multiple regression model:*  $EFF = -0.63 + 0.85TF + 0.12C + 0.09SC$

The F-test had a p-value ( $p < .0001$ ) less than the chosen level of significance ( $\alpha = 0.05$ ) and hence the overall model was significant. The result of the multiple regression analysis indicates that 81.8% of the variation in effectiveness (EFF) was explained by the proposed model with TF, C, and SC as explanatory variables. The t-test p-values for the explanatory variables (TF, C) were statistically significant, while the t-test p-value for SC was not statistically significant. This indicates that transformational leadership and group cohesiveness were significantly related to effectiveness while the previous model (Table 5.25) indicates that group safety climate mediated the relationship between transformational leadership and group cohesiveness. This result suggests that the followers of transformational leaders directly perceive them to

be effective. Also, they achieve high group safety climate which in turn predicts group cohesiveness, and indirectly the perception of leader effectiveness as shown in Figure 5.11.



**Figure 5.11: Leadership Model**

Legend

TF: Transformational Leadership

SC: Group Safety Climate

C: Group Cohesiveness

EFF: Effectiveness

**5.4 Conclusion**

The following are the overall conclusions that are drawn from the quantitative results:

- The relationship between transformational leadership and the objectively measured injury rate (LTIFR) was negative but not significant. There was a significant positive relationship between transformational leadership and effectiveness (EFF). As the perception of leader effectiveness can be viewed as a proxy for injury rate this suggests that the objective injury rate measure (LTIFR) may have been too narrow a measure of leader effectiveness and/or may have been contaminated by confounding variables.

- There was a positive significant relationship between transformational leadership and group safety climate.
- Group safety climate was not found to mediate the relationship between transformational leadership and injury rate, but it did partially mediate the relationship between transformational leadership and the perception of leader effectiveness.
- No link was found between transformational leadership and the objectively measured productivity (P). As transformational leadership was positively linked to the perception of effectiveness there is also reason to suggest that the objective measure of productivity (% production target met) may have been too narrow an indicator of a leader's effectiveness and/or may have been contaminated by confounding variables.
- There was a positive significant relationship between transformational leadership and group cohesiveness.
- Group cohesiveness was not found to mediate the relationship between transformational leadership and productivity, but it did partially mediate the relationship between transformational leadership and the perception of leader effectiveness.
- Contingent reward and idealised influence (attributed) are the two best predictors of the perception of leader effectiveness in the context of Impala, amongst the nine leadership factors of the multifactor leadership questionnaire (MLQ).
- Management-by-exception-active was augmented by transformational leadership in positively linking with the perception of leader effectiveness.
- Group safety climate mediated the relationship between transformational leadership and group cohesiveness. This result suggests that

supervisors that use a transformational leadership style improve group safety climate resulting in improved group cohesiveness, which in turn is link to the perception of leader effectiveness.

These results suggest that transformational leadership is positively related to the perception of leader effectiveness and that this relationship is partially mediated by both group safety climate and group cohesiveness. There was not a significant relationship between transformational leadership and either injury rate (LTIFR) or productivity (% production target met) found, suggesting that these measures may have been too narrow and may have been contaminated by confounding variables. The measures of injury rate (LTIFR) and productivity (% production target met) are widely used in the mining industry but may be outcomes that are too narrow and contaminated by confounding variables to use as a reliable measure of a leader's effectiveness.

The above quantitative results were further explored in greater depth by qualitative methods detailed in the next section. The views of mine overseers were obtained via a focus group and individual interviews, and also several mine overseers were observed underground to gauge their interaction with the crews. Documents from the safety department recording the mining conditions in the underground sections visited were also scrutinised as leading indicators of safety and productivity excellence. The objective of the qualitative phase of this sequential explanatory design was to further explain and interpret the following aspects of the quantitative results in the context of Impala:

- The relationship between supervisor's leadership style and the delivery of both injury rate and productivity.
- The relationship between group safety climate and injury rate.
- The relationship between group cohesiveness and productivity.
- The perceived trade-off between the delivery of safety and productivity.
- The effect of management's priorities on both safety and productivity excellence.
- The existence of confounding variables that may contaminate the relationship between transformational leadership and both injuries and

productivity.

The qualitative findings on the above questions are discussed in chapter six.

## CHAPTER SIX

### QUALITATIVE FINDINGS

#### 6.1 Introduction

The qualitative findings regarding the focus group, individual interviews, observations, and documents analysis are discussed in this section. The results from the quantitative first phase were further explored in the qualitative second phase. Content analysis was used to code the collected qualitative data into themes to better explain the quantitative findings. The identified themes and subthemes were recorded and discussed, supported by several quotations from the respondents.

#### 6.2 Findings

Qualitative data was collected by conducting:

- A focus group with six mine overseers. The focus group proceedings was recorded and transcribed.
- Three individual interviews were conducted with mine overseers. The interviews were recorded and subsequently transcribed.
- Underground visits were conducted to nine mine overseers sections to interact with the mine overseers, shift supervisors, and crews. Also, the mining conditions and behaviour of supervisors were observed. During the underground visits field notes were recorded.
- Various documents supplied by the safety department were scrutinised which recorded the mining conditions in the nine underground sections visited. The recorded mining conditions served as leading indicators of safety and productivity excellence.

The qualitative findings are recorded below supported by quotations. A total of 119 statements were identified and coded based on the mine overseer's responses to six open ended questions:

- What is the relationship between leadership and the delivery of both injury rate and productivity?

- What is the relationship between group safety climate and injury rate?
- What is the relationship between group cohesiveness and productivity?
- Is the delivery of both safety and productivity related?
- What is the effect of management's priorities on the delivery of both safety and productivity?
- What other variables affect the delivery of both safety and productivity?

There was a high level of consensus between the mine overseers interviewed regarding the topics discussed.

The main themes and sub-themes were established to better explain the results from the quantitative phase of the study.

### ***6.2.1 Passive-Avoidant Leadership***

Passive-avoidant (PA) (main theme) behaviour is composed of two factors, management-by-exception-passive and laissez-faire.

#### *Passive-Avoidant (PA)*

The interviews revealed that passive-avoidant behaviour by the leader is a style of leadership that has a negative impact on mining at Impala:

- The mine overseers supported the view that passive-avoidant behaviour had a negative effect on the delivery of safety and productivity. One respondent in supporting the view that supervisors need to interact with the workforce and conduct over-inspections to ensure safety and productivity stated:

If I have not been there for a while and things go wrong, then I am also guilty because I should have over-inspected.

### ***6.2.2 Transactional Leadership***

Transactional leadership (TA) (main theme) is composed of two factors, management-by-exception-active (MBEA) and contingent reward (CR).



*Management-By-Exception-Active (MBEA): (subtheme)*

It was expressed that the maintenance of discipline is an important component of supervision in the underground environment as there are many risks, and failure to comply with the standards and procedures may lead to an injury occurring and poor productivity:

- It was stated that discipline is the foundation on which the delivery of safety and productivity excellence is based. A respondent highlighted that the workforce need discipline to keep them focused on the safety and productivity goals:

If people see discipline they are aware that they are getting direction.

Another respondent stated that discipline is vital to ensure that workers comply with the standards and procedures:

The most important thing to address is the behaviour problem.

- It was also explained that discipline and respect for authority in the underground operations at Impala have declined in recent years which is having an adverse effect on the delivery of safety and productivity.

One respondent stated:

Discipline and respect have declined.

A second respondent expressed the view that the workforce on Impala was not too concerned about disciplinary action being taken for violation of the rules as supervisors seldom used the disciplinary procedure:

There is no fear of disciplinary consequences underground.

- The mine overseers highlighted the importance of getting buy-in from the workforce by interacting and communicating with them and explaining the need to comply with the rules as opposed to just telling them what to do. A mine overseer stressed that supervisors need to interact with the workers and convince them of the right thing to do

rather than merely issuing instructions or pursuing propaganda campaigns:

You need to explain the rules by interaction with the guys on the job, rather than putting up posters and telling them. They need to buy-in to the concept.

### *Contingent Reward (CR); (subtheme)*

The interviews suggested that the bonus system and rewarding performance had an important impact on the delivery of safety and productivity by the underground production crews:

- The bonus scheme has a positive influence on the high performing crews in terms of safety and productivity delivery, while the poor performing crews were not motivated by the bonus as they regularly have not achieved bonus. One respondent stated:

Safety and production go hand in hand. The top producing teams know that if they don't have lost time injuries they get their bonus. The bonus is the motivator. The low producing crews get no bonus and their safety is not good.

Another respondent reinforced this view:

The bonus scheme punishes and rewards crews in their pockets.

- The mine overseers also suggested that many of the crews do not know how the bonus scheme works and consequently do not know what safety and productivity targets they must achieve in order to earn a good bonus. Therefore, the motivating effect of the bonus was lost. One mine overseer stated:

The guys don't know how the bonus scheme works.

### **6.2.3 Transformational Leadership**

Transformational leadership (TF) (main theme) is composed of five sub-themes namely, idealised influence (attributed), idealised influence (behaviours), inspirational motivation, intellectual stimulation, and individual consideration.

*Idealised Influence (Attributed)( II (A)): (subtheme)*

It was apparent that the behaviour modeled by the leader had a major influence on subordinate's behaviour:

- The mine overseers expressed the view that a leader must model the kind of behaviour they expect from their subordinates to set a good example for them to follow to deliver safety and productivity excellence. It was pointed out that a supervisor must lead by example and exercise discipline to get respect from the workforce:

A good quality leader is consistent with everybody and leads by example. If you want to enforce something you need to do it yourself. You have to show zero tolerance with everyone, and then you get respect.

Another respondent supported this view by stating:

You must practice what you preach.

A third respondent suggested that the most successful supervisors were natural charismatic leaders who did not rely on bureaucratic systems and also had the necessary knowledge and experience:

The most successful individual is a guy that is a natural good leader and uses minimal management to get success, having knowledge and experience, minimising paperwork by great leadership style.

*Idealised Influence (Behaviour)( II (B)): (subtheme)*

It is necessary for the leaders to demonstrate and explain their values to their subordinates so that they can better understand them:

- It is very important to handle subordinates with respect in order to get their support and commitment to the mission. A mine overseer expressed the view that supervisors need to be aware of the importance of dealing with the feelings and emotions of the workers and to handle them kindly:

We have to realise that every person working for us is a human being with feelings, and we have got to learn more and more to treat that person the way you expect them to treat you.

- It was indicated that communication is as much about your body language as it is about what you say and the resultant positive or negative environment created by the leader cascades down through the entire section quickly. One respondent stated the supervisors' attitude had an effect on the whole atmosphere in that section:

Your body language says a lot to your people, if you come to work with an attitude, it becomes contagious.

- There was also support for the theory of situational leadership where the leader takes the context into account when selecting the appropriate leadership behaviour to adapt for a given situation. It was stated that:

Leadership is the art of knowing when to be autocratic and when to be democratic.

- It was highlighted that a successful mine overseer is fair and consistent, gaining the respect of the workforce by handling them with respect. A respondent stated:

Earn respect by showing respect.

A second respondent highlighted the need to be fair and consistent with the workforce to get their support:

Always be fair and consistent.

#### *Inspirational Motivation (IM): (subtheme)*

The mine overseers felt that giving encouragement to their workers in tackling the difficult task of underground mining had a positive influence on their attitude and the effort that they made to be successful in delivering safety and productivity:

- It was stated that it was important to establish communication with the crews and motivate them by giving encouragement to produce safely in the uncertain and harsh conditions of underground mining. One mine overseer indicated that supervisors need to spend quality time underground interacting with the workforce to build a good relationship

with them based on understanding, rather than using their positional authority:

Making time for the people, making them feel important. Interaction with the people right at the rock face so they know you understand them and they understand you, you will get everything from them. If you are against them or the type of leader that just give instructions, it will not work.

A second respondent felt that people relationships were vital in terms of supervisor success in delivering safety and productivity excellence:

My take is that it is all about the people. It has nothing to do with the job. If you know your people well, then you know their strengths and weaknesses, which button to push and where to assist. The job is actually a pushover because if you can master the people they will do their best for you.

It was stated that the workforce responded to a leader's influence and delivered his/her requirements:

A leader is able to influence people to do for him what he wants them to do.

- It was suggested that by interacting with the crews, leaders could establish a relationship based on trust and respect, which is the basis for building a good working relationship and achieving results. A respondent highlighted that getting buy-in from the workers through interaction was critical in terms of a supervisor's success at work:

I think in the mining industry at the moment, most of your work goes around people so that you can be the best in mining but if people don't buy-in to it, you are not going to be successful. The interaction between the people and the leader is very important.

Another respondent supported this point of view and stated:

You need to build up rapport with your workers, and once you have that, you are 90% home, gaining mutual trust and respect.

A third respondent felt that visible felt leadership by supervisors was essential to establish good communication with the workforce:

I believe in visible felt leadership. You need to spend time with the crews, and then the communication lines are more open.

*Intellectual Stimulation (IS): (subtheme)*

The mine overseers' felt that it was important to explain to the workers what was required so that they understand why something must be done in a certain way to be safe and productive:

- It was suggested that workers need to know the reason why a particular process is required rather than taking the supervisor's word for it. It was stated that it was important to explain your decisions to the workers as opposed to issuing instructions:

Workers need to know the why and not just follow the order blindly.

- The view was expressed that it is very important to give good explanations when giving instructions and check for understanding so that the workers understand the reasoning. One respondent stated that supervisors should check for understanding when giving instructions to confirm that the worker understands what he/she needs to do:

Don't just give instructions, check that the guy understands what he needs to do, you can then correct him.

It was suggested that a supervisor needs to have good knowledge of the work and must communicate that knowledge to the workforce to be successful:

If you know what is wrong, show the people and suggest a way to fix it.

- It was also stated that best practices and standards are not cast in concrete and that there should always be a quest to find a better way. A respondent stated that supervisors needed to challenge the status quo and suggest better ways of doing the work:

We tend to do something because it worked for twenty years, I don't say shortcuts are right but sometimes there is a better and shorter way.

*Individual Consideration (IC): (subtheme)*

The interviews supported the view that taking interest in a subordinate's personal development is important for the follower's growth. Furthermore, successful followers contribute to the leader's success:

- The importance of training and development was highlighted as being an important consideration in terms of workers delivering safety and productivity. They need to be competent in both the technical and managerial aspects of the job before they can achieve superior results. A mine overseer stated that:

Training and coaching are essential.

Another respondent suggested that the training and development of subordinates leads to their success and also contributes to the supervisor's success:

Work on the peoples' needs so that they become successful, and then you will also become successful.

- It was pointed out that it is very important for leaders to interact with their subordinates to determine their training and development needs, especially new recruits who have not yet learned the work culture, methods, and mining processes of Impala. One respondent stated that supervisors should analyse their subordinates training needs so that an individual development plan can be drawn up:

You need to know your peoples' strengths and weaknesses in order to train and develop them to become efficient.

A second respondent suggested that the supervisor must spend time with the subordinate to identify his/her training needs:

Quality time spent with each individual result in identifying areas that need attention.

A third respondent highlighted that training requirements were not generic but individual based:

Different personalities have different needs so you need to treat each one as an

individual.

- An opinion was expressed that many of the presently appointed shift supervisors and mine overseers were not adequately trained and experienced to competently carry out their duties. Hence, they were unable to guide their subordinates in the technical and managerial aspects of the job with a consequent detrimental effect on safety and productivity excellence. One respondent commented:

Talking about our present supervisors, did they have the necessary training and exposure?

Another respondent stated that supervisors needed the necessary experience to guide their subordinates to success:

If you have enough experience you know the right buttons to press to get it done.

#### **6.2.4 Group Safety Climate**

Group safety climate (SC) was identified as an important aspect in the delivery of safety and productivity, as employees with a work culture that considers safety to be a priority are more likely to consider the safety aspects of the work and avoid injury:

- Safety was suggested to be a state of mind or a belief that is achieved by continuously reinforcing the safety first message which leads to improved safety climate. One mine overseer believed that the safety first message needs to be reinforced daily so that it became a habit for the worker:

Safety is a state of mind. You have to actively reinforce the safety message every day until it becomes a state of mind.

Another respondent suggested that it is essential for supervisors and workers to believe that it is possible to work safely:

Safety has to be inherent, a state of mind.

While a third respondent suggested that the delivery of safety excellence is based on a policy of safety first:



If something is unsafe, then it needs to get attention. Safety must come first.

- A culture change needs to occur amongst the underground employees to improve their attitude to achieve safety excellence. One respondent stated that a safety first culture among the workforce is essential for safety excellence:

We need to get our people's culture right so that they commit themselves to safety.

### **6.2.5 Group Cohesiveness**

It was suggested that group cohesiveness (C) is an important component to be taken into consideration in the process of teams delivering safety and productivity excellence:

- It was stated that the stability of the production crews was a very important consideration in the delivery of safety and productivity with the best crews having been together for a considerable amount of time. One respondent was convinced that the longer a team worked together the more cohesive and successful they became:

The longer the team works together the better they become.

A second respondent stated that in his experience that the most productive teams have been working together for a long time:

You can go look at the teams that are performing, they are the old teams. They have been together for more than a year.

- When a crew had been working together for a considerable amount of time group cohesiveness increased leading to better understanding of each other's roles and they also got to know their supervisor's requirements. It was highlighted that group cohesiveness was essential for the delivery of safety and productivity excellence:

It is important to have the group thinking and moving in the same direction, as it makes or breaks you as a leader.

Another respondent suggested that when a group had been together

for a long time that the group members knew what the supervisor required, reducing the need for close supervision:

You come to the stage that you don't even have to talk to the people, as the guys know what you are looking for.

- A term that was often repeated to describe stable cohesive crews was the concept of operating as a “family”. These crews clearly understood each other, supported each other, operated with high levels of trust, and resolved work issues by discussion rather than using the formal discipline procedure. It was stated that the established stable teams operated like a family:

The stable teams work like a family.

### **6.2.6 Safety and Productivity**

The mine overseers were convinced that there was a close relationship between safety and productivity, with the best teams delivering both. They suggested that a safety first approach lead to the delivery of both safety and productivity excellence:

- There was strong support for the view that safety and productivity were closely related. It was felt that some short term productivity could be achieved without safety but in the long term the most productive crews were also the safest. One respondent stated that the delivery of safety and productivity by a mining crew were correlated:

A good production team is a safe team.

A second respondent suggested that high producing mining crews are focused, and consequently are successful in delivering both safety and productivity:

Your producing teams are far less prone to injuries. They are focused.

- The view was expressed that it is necessary to find a balance between safety and productivity, as when too much emphasis is put on productivity then safety tends to suffer. Concentrating too much on

productivity without attending to the safety aspects of the job led to injuries:

Production and safety go hand in hand, and all you need to do is find a balance. If you put more emphasis on production and safety takes a back seat, then you are heading for trouble.

A second respondent stated that it was important to first address safety issues and only then drive the crews to produce:

The safety conditions need to be fixed then the workers can be driven to produce.

It was stated that when production pressure was increased in a particular section that more injuries occurred:

Production pressure led to a decrease in safety performance.

- The skills level of the supervisors is an important component in the delivery of safety, as their knowledge of the mining processes, standards, and best practices is essential to ensure that the workers are working safely. One respondent highlighted the importance of supervisors having the necessary knowledge and experience to successfully lead their section:

You can't tell a guy safety first but you don't know how to do it yourself. If you have the knowledge then you can do it safely.

- The mine overseers suggested that technical skills alone were not enough to achieve safety and productivity excellence, claiming that leadership skills and systems management were also required. One respondent stated that leadership skills and systems management by a supervisor were essential to be successful in underground mining:

You can be the most technical minded person, but if you can't carry over the message and you can't manage the systems that are in place, then you won't be successful.

### **6.2.7 Section Manager's Priorities**

The focus group and individual interviews provided evidence that the priority the section manager gives to safety does influence the mine overseers'

focus. Ultimately it influences the behaviour of the workforce, as the manager's priorities cascade from one management level to the next:

- The mine overseers stated that they reacted to their manager's priorities and made every effort to please him/her. The more experienced individuals stated that they may filter the message but would still follow the priority set by the manager to avoid conflict. One respondent stated that to be successful as a mine overseer required attending to the section manager's priorities:

To be a successful mine overseer you have to know how to manage your manager, his priority is your priority.

A second respondent claimed that by observing the section manager's priorities one adapted to his/her standards:

If I go underground with the manager and the support is substandard and he does not comment, then I ask myself how important the safety rules are to him.

It was further stated that one quickly identified the priorities of a new manager:

When you get a new manager you feel what he wants, is he a safety guy or a production guy.

- It was also suggested that the priority set by the manager soon cascades down to the workforce and has an influence on their behaviour:

The manager's priorities filter through quickly to the workforce. You focus on what the manager focuses on. It has a domino effect.

### **6.2.8 Extraneous Variables that affect Safety and Productivity**

It was also suggested that many factors other than leadership style had an impact on safety and productivity excellence. The additional factors identified included the following:

- Lack of mining flexibility (areas to mine) leads to low productivity.
- Poor rock mining conditions.
- The level of experience of the mining crews.

- The length of time the team has been together.
- Strained relations with the unions on some shafts create a poor industrial relations climate.
- Poor physical working environment creating adverse conditions for safety and productivity delivery.
- Challenges with women-in-mining implementation.
- Presence of sick employees in the workforce who are not capable of hard physical work and are often absent.
- Some lack of understanding between the members of the culturally diverse workforce, leading to miscommunications.

One mine overseer suggested that sometimes a lack of performance by a supervisor is more attributable to the circumstances than to poor leadership on the supervisor's behalf:

If a guy fails then you think he is a poor leader but maybe the circumstances are too adverse to conquer. The pressure causes the need for scapegoats.

Another respondent highlighted that successful mining required people, material, and ore reserves:

To mine you need people, materials and ground. If one of these three is missing, it becomes a problem.

The need for good planning was highlighted as important for successful mining:

Successful planning needs to be done and the plan must be followed through.

The existence of several unmeasured confounding variables may explain why no relationship between transformational leadership and the delivery of both injury rate and productivity was found in the quantitative phase of the study.

### 6.3 Conclusion

A summary of the qualitative findings are as follows:

- Passive-avoidant (PA) behaviour of the leader has a negative effect on subordinates' delivery of safety and productivity. This finding suggests that a mining supervisor needs to be actively involved in daily operations.
- The full range of leadership is required for the delivery of safety and productivity excellence. This indicates firstly that mining needs to take place in a disciplined environment (MBEA) as it is a risky operation where injuries can occur if the standards and procedures are not followed. Contingent reward (CR) appears to be a highly effective motivator in the underground mining environment. The qualitative data gathered generally supported the argument that transformational factors (II (A), II (B), IM, IS, IC) are important for the delivery of safety and productivity. Visible felt leadership (II (A), II (B)); enthusiasm and encouragement (IM); explaining the reasons for doing things and challenging the status quo (IS); and training and coaching individuals (IC) all appear to inspire workers to deliver safety and productivity excellence.
- The cohesiveness in a crew is an important element for good productivity and this cohesiveness is associated with maintaining crew stability. The longer the crew stays together the more they work as a "family" supporting each other to achieve excellent productivity, and better understanding their supervisor's priorities.
- Group safety climate is positively linked to injuries as the beliefs the workforce hold about safety appear to have a major influence on their behaviour. Crews with high group safety climate prioritise safety over productivity and ultimately deliver both.

- Delivering safety and productivity appears to be closely linked, but it requires the leader to balance the safety and productivity aspects of the work by using both transactional and transformational leadership styles. The mine overseers generally supported the view that a safety first policy laid the foundation for success in simultaneously delivering safety and productivity excellence.
- There is a positive link between the manager's priorities and the follower's priorities. It appears that the mine overseers try to satisfy the manager's priorities and that these priorities cascade down the hierarchical management chain to the workers on the rock face.
- Many extraneous variables besides leadership affect the delivery of safety and productivity excellence. These confounding variables may have contaminated the effect of transformational leadership as a predictor of injury rate and productivity in the quantitative phase of the study.

The qualitative findings support supervisors using the full range of leadership at Impala to be effective in the delivery of safety and productivity. Also, group safety climate influences safety and group cohesiveness is related to productivity. Management's priorities influence the workforce's priorities.

The quantitative results from phase one of the study are connected to the second phase qualitative findings in chapter seven, to give an overall interpretation of all the data collected in the study.

## CHAPTER SEVEN

### INTERPRETATION OF DATA

#### 7.1 Introduction

The quantitative results from the first phase of the sequential explanatory design are detailed in chapter five. The qualitative findings from the second phase of the mixed method design are documented in chapter six. In this chapter an interpretation of the results from the quantitative and qualitative phases of the study are combined to answer the research question concerning the impact of transformational leadership on the delivery of safety and productivity excellence at Impala. An interpretation of the quantitative and qualitative data collected for each hypothesis posed is discussed. The connected triangulated results are related to the literature.

#### 7.2 Research Hypotheses

**7.2.1 Hypothesis 1:** Transformational leadership is positively related to both injury rate and productivity.

Hypothesis 1 was partly supported by the mixed methods evidence for the existence of a relationship between transformational leadership and both injury rate and productivity.

##### *Injury Rate*

The regression analysis showed that there was not a significant relationship between transformational leadership and injury rate (adjusted  $R^2 = 1.5\%$ ;  $F(1, 37) = 0.45$ ,  $p = 0.51$ ). This was an unexpected result as previous empirical research in different contexts established a negative link between transformational leadership and injuries (Barling, *et al.*, 2002; Zohar, 2002; Zacharatos, *et al.*, 2005; Kelloway, *et al.*, 2006). The regression model was rerun testing the relationship between transformational leadership and the perception of effectiveness (EFF) as measured by the MLQ instrument. A



strong positive relationship was shown to exist (adjusted  $R^2 = 77\%$ ;  $F(1, 37) = 127.95$ ,  $p < 0.0001$ ). The perception of leader effectiveness may be viewed as a proxy for the delivery of safety and productivity excellence.

The quantitative results were further explored by means of qualitative methods involving interviews, focus group, observation, and scrutinising documents. The respondents in the qualitative phase of the study, perceived a relationship between transformational leadership and the delivery of safety. The qualitative findings were in support of the quantitative result when transformational leadership was linked to effectiveness. This suggests that the objective measure of injury rate (LTIFR) may have been too narrow a measure of leader effectiveness (Peters, 1997) and/or was contaminated by confounding variables (De Hoogh *et al.*, 2004). Respondents in the qualitative part of the study indicated that many factors other than leadership style affect injury rate. The identified confounding variables included health of the workforce, mining ground condition, length of time the team had been together, not reporting accidents, and the relationship with the unions.

Although the quantitative results did not find transformational leadership to be related to injury rate in this study, a positive relationship between transformational leadership and effectiveness was found. The qualitative findings also suggested that transformational leadership was linked to injury rate. These results suggest that transformational leadership is related to injury rate but the circumstances in a mine overseer's section may nullify the effect of transformational leadership on injuries. These conclusions support the claims made by others that supervisors should develop caring relationships with their followers to deliver safety excellence (Schutte, 1998; Hofmann and Morgeson, 1999; Carrillo, 2002; Krause and Weekley, 2005; Hermanus, 2007; Loubser, 2009).

### *Productivity*

The results of the regression analysis showed that there was not a significant relationship between transformational leadership and productivity (adjusted  $R^2 = 4.2\%$ ;  $F(1, 37) = 2.65$ ,  $p = 0.11$ ). This was an unexpected

result as previous empirical research established a positive link between transformational leadership and productivity in different contexts (Yammarino, *et al.*, 1993; Thite, 1999; Masi and Cooke, 2000; Dvir, *et al.*, 2002; Bass, *et al.*, 2003; Pillai and Williams, 2003). The regression model testing the relationship between transformational leadership and the perception of effectiveness (EFF) showed that a strong positive relationship existed (adjusted  $R^2 = 77.0\%$ ;  $F(1, 37) = 127.95$ ,  $p < 0.0001$ ). In support of previous empirical research (Howell and Avolio, 1993), transformational leadership was shown to augment transactional leadership in the relationship with perceived leader effectiveness (EFF) ( $\Delta R^2 = 57.5\%$ ).

The quantitative results were further explored by means of qualitative methods involving interviews, focus group, observation, and scrutinising documents. The respondents in the qualitative phase of the study perceived a relationship between transformational leadership and the delivery of productivity. The qualitative findings were in support of the quantitative result when transformational leadership was linked to the perception of effectiveness. This suggests that the objective measure of productivity (% production target met) may have been too narrow a measure of leader effectiveness (Peters, 1997) and/or was contaminated by confounding variables (De Hoogh *et al.*, 2004). Referring to the qualitative findings from the study, evidence from the respondents indicated that many factors other than leadership style affected productivity. The identified confounding variables included; mining flexibility, crew experience, health state of the workforce, production target set, mining ground conditions, and the relationship with the unions.

Although the quantitative results did not find transformational leadership to be related to productivity in this study, a positive relationship between transformational leadership and the perception of leader effectiveness was found. The qualitative findings also suggested that transformational leadership was positively related to productivity. These results suggest that transformational leadership is related to productivity but confounding factors in a mine overseer's section may neutralise the effect of the leader's

transformational leadership style on productivity. The findings of this study support the work of others done in different contexts that suggest effective supervisors employ transformational leadership to deliver productivity (Bass *et al.*, 2003; Ryan, 2006).

### *Safety and Productivity*

The overall conclusion of this study from the results of the combined quantitative and qualitative findings suggests that supervisors need to employ the full range of leadership to deliver safety and productivity excellence. These findings support the view that delivering safety and productivity excellence are related (Peters, 1989; O'Dea and Flin, 2003) and that both transactional (productivity focused) and transformational (people focused) leadership skills are required for success (Krause, 2005).

**7.2.2 Hypothesis 2:** The relationship between transformational leadership and injury rate is partially mediated by group safety climate.

Hypothesis 2 was partly supported by the mixed methods evidence that the relationship between transformational leadership and injury rate is partially mediated by group safety climate.

There was a significant positive relationship between transformational leadership and group safety climate. Multiple regression analysis showed that group safety climate did not partially mediate the relationship between transformational leadership and injury rate. However, multiple regression analysis showed that group safety climate did partially mediate the relationship between transformational leadership and the perception of leader effectiveness.

The qualitative findings indicated that there was a perception among Impala's mine overseers that group safety climate and transformational leadership did have a positive impact on reducing injuries.

The overall mixed methods results provide partial support for hypothesis two as follows:

- The quantitative results indicated no relationship between transformational leadership and injury rate. This result could have been affected by injury rate being too narrow a measure of leader effectiveness and/or contamination by confounding variables as suggested by the qualitative findings.
- There was a positive relationship between transformational leadership and group safety climate.
- Group safety climate partially mediated the relationship between transformational leadership and effectiveness.
- The qualitative findings suggested a perception among Impala's mine overseers that transformational leadership and group safety climate are both negatively related to injuries.

Although the quantitative results did not find that group safety climate partially mediated the relationship between transformational leadership and injury rate in this study, group safety climate did mediate the relationship between transformational leadership and the perception of leader effectiveness. The qualitative findings also suggested that group safety climate is negatively related to injuries. These results suggest that group safety climate does partially mediate the relationship between transformational leadership and injury rate but the circumstances in a mine overseer's section may nullify the effect of the leader's transformational leadership style and group safety climate on injuries. These conclusions support the work of other researchers working in various contexts that group safety climate partially mediates the relationship between transformational leadership and injury rate (Loughlin and Kelloway, 2002; Kelloway *et al.*, 2006).

**7.2.3 Hypothesis 3:** The relationship between transformational leadership and productivity is partially mediated by group cohesiveness.

Hypothesis 3 was partly supported by the mixed methods evidence that the relationship between transformational leadership and productivity is partially mediated by group cohesiveness.

There was a significant positive relationship between transformational leadership and group cohesiveness. Multiple regression analysis showed that group cohesiveness did not partially mediate the relationship between transformational leadership and productivity. However, multiple regression analysis showed that group cohesiveness did partially mediate the relationship between transformational leadership and the perception of leader effectiveness.

The qualitative data gathered in phase two of the study suggests that there was a perception among Impala's mine overseers that group cohesiveness and transformational leadership were both positively linked to the delivery of productivity.

The overall mixed methods results provide partial support for hypothesis three as follows:

- The quantitative results indicated no relationship between transformational leadership and productivity. This result could have been affected by productivity been too narrow a measure of leader effectiveness and/or contamination by confounding variables as suggested by the qualitative findings.
- There was a positive relationship between transformational leadership and group cohesiveness.
- Group cohesiveness partially mediated the relationship between transformational leadership and effectiveness.
- The qualitative findings suggest a perception among Impala's mine overseers that both transformational leadership and group cohesiveness positively affect productivity.

Although the quantitative results did not find that group cohesiveness partially mediated the relationship between transformational leadership and productivity in this study, group cohesiveness did mediate the relationship between transformational leadership and the perception of leader effectiveness. The qualitative findings also suggested that group cohesiveness was positively related to productivity. These results suggest that group cohesiveness does partially mediate the relationship between transformational leadership and productivity but confounding factors in a mine overseer's section may neutralise the effect of the leader's transformational leadership style and group cohesiveness on productivity. These conclusions support research findings from different contexts that group cohesiveness partially mediates the relationship between transformational leadership and productivity (Pillai and Williams, 2003; Bass *et al.*, 2003).

### **7.3 Conclusion**

The combined quantitative and qualitative findings give mixed support for the impact of transformational leadership on the delivery of safety and productivity excellence. The quantitative results did not show a link between transformational leadership and objective measures of safety and productivity. However, transformational leadership was positively linked to group safety climate, group cohesiveness and the perception of leader effectiveness. The qualitative findings also supported the view that transformational leadership was linked to safety and productivity excellence. The qualitative finding also suggested that many factors affect safety and productivity besides transformational leadership. The overall conclusion from the evidence presented suggests that transformational leadership has a positive effect on the simultaneous delivery of safety and productivity at Impala.

The final conclusions and recommendations for implementation arising from this study are proffered in chapter eight. An evaluation of the study, its contribution to the body of knowledge, and suggestions for future research are also discussed.

## CHAPTER EIGHT

### CONCLUSIONS AND RECOMMENDATIONS

#### 8.1 Introduction

This chapter begins with a summary of the main conclusions from the quantitative first phase and the connected qualitative second phase of the study. This is followed with the overall study conclusions. An evaluation of the study is then discussed in the light of the limitations that were highlighted in chapter one and chapter four. A summary of the study's contribution to the body of knowledge is proffered. Recommendations for the practical application of the findings are discussed. Finally, suggestions are made for future research arising from this work.

#### 8.2 Conclusions

##### *8.2.1 Summary of Findings*

The results of the regression analysis showed that there was not a significant relationship between transformational leadership and the objective measures of either injury rate or productivity. These unexpected results may be explained due to injury rate and productivity being too narrow measures of leadership effectiveness and/or contamination by unmeasured confounding variables as suggested in the qualitative findings.

When the perceived outcome of leader effectiveness measured by the MLQ instrument was used as the dependent variable in the regression model it was found to be significantly related to transformational leadership. Both group safety climate and group cohesiveness partially mediated the relationship between transformational leadership and effectiveness. These findings suggest that transformational leadership has a strong direct link with effectiveness. Also, transformational leadership was indirectly linked to effectiveness through the effects of group safety climate and group cohesiveness. Furthermore, group safety climate mediated the

relationship between transformational leadership and group cohesiveness. Transformational leadership and group cohesiveness were in turn both significantly related to the perception of leader effectiveness. This result indicates that the followers of transformational leaders prioritise safety and consequently by pursuing this common goal become a more cohesive team, ultimately delivering better productivity. Evidence was also produced showing that transformational leadership augmented transactional leadership in relation to the perception of leader effectiveness.

The results obtained in the quantitative first phase of the study were further explored using qualitative methods to better explain and interpret their meaning. The qualitative findings suggest that the perception of the respondents was that both transactional and transformational leadership were associated with the delivery of both safety and productivity. This was in broad agreement with the quantitative results when the measured perception of effectiveness was used as the dependent variable in the model. The qualitative findings also indicated that group safety climate was negatively related to injuries and group cohesiveness was positively linked to productivity. The respondents suggested that safety and productivity could be achieved simultaneously when supervisors employed both transactional and transformational leadership, balancing the trade-off between the task and people aspects of work. It was also suggested that management's priorities has a major effect on the workforce behaviour concerning safety and productivity.

### **8.2.2 Study Conclusions**

The overall results of this mixed methods research done on Impala led to the following conclusions:

#### ***Quantitative Results (Phase 1):***

##### ***Injury Rate:***

- Transformational leadership was positively related to the perception of group safety climate.



- A significant relationship between transformational leadership and objectively measured injury rate was not found. This unexpected result could be due to the existence of unmeasured confounding variables affecting injury rate.

*Productivity:*

- Transformational leadership was positively linked to the perception of group cohesiveness.
- The relationship between transformational leadership and objectively measured productivity was found to be not significant. This unexpected result could be due to the existence of unmeasured confounding variables affecting productivity.

*Effectiveness:*

- There was a strong positive link between transformational leadership and perceived effectiveness.
- Contingent reward (CR) and idealised influence (II (A)) were the two best predictors of perceived effectiveness from the nine leadership factors measured by the multifactor leadership questionnaire (MLQ).
- Group safety climate and group cohesiveness partially mediated the relationship between transformational leadership and effectiveness.
- Group safety climate mediated the relationship between transformational leadership and group cohesiveness. Group cohesiveness and transformational leadership were related to the perception of effectiveness. This result suggests that transformational leaders influence followers to prioritise safety who in turn become more cohesive as a result of having a common goal. Consequently, better team cohesiveness leads to improved productivity.

*General:*

- Transformational leadership was negatively linked to the perception of passive-avoidant behaviour. This indicates that leaders who are not

actively involved in operations have a negative impact on the workforce.

- There was a positive link between management-by-exception-active and effectiveness. This result indicates that maintaining discipline in a risky mining environment is important.
- The positive significant link between management-by-exception-active and effectiveness was augmented by transformational leadership. This suggests that leaders in mining need to employ both transactional and transformational leadership to be successful.

Although transformational leadership was not found to be related to the objective measures of injury rate and productivity, transformational leadership was found to be directly and indirectly related to the perception of effectiveness. Transformational leadership augmented transactional leadership in relation to effectiveness.

#### ***Qualitative Findings (Phase 2):***

- There was a perception amongst the respondents that passive-avoidant behaviour by leaders had a negative effect on subordinates' effectiveness.
- It was suggested that the full range of leadership was required for the delivery of safety and productivity. Transactional leadership ensured mining took place in a disciplined environment with employees motivated by reward for meeting targets. While transformational leadership was employed to inspire the workforce.
- Group safety climate positively affected injuries. The beliefs the workforce hold about safety appears to have a major influence on their safety behaviour and ultimately injuries.
- The cohesiveness in a crew was an important element for good productivity and this group cohesiveness was associated with maintaining crew stability and developing "family" values.
- Delivering safety and productivity appeared to be closely linked. It requires the leader to balance the safety and productivity aspects of

the work by using both transactional and transformational leadership styles.

- It was suggested that the managers' priorities cascaded down to the followers.

The qualitative results indicated a perception that both transactional and transformational leadership have a positive effect on safety and productivity delivery. The qualitative results also indicated that group cohesiveness supports productivity delivery while group safety climate supports delivery on safety. The qualitative results further indicated that the manager's priority influences the mine overseer's behaviour and cascades down the organisation management chain. Finally, passive-avoidant behaviour by supervisors had a negative effect on both safety and productivity.

The overall conclusion was that although the quantitative results did not find a relationship between transformational leadership and, injury rate and productivity, a positive relationship between transformational leadership and the perception of effectiveness existed. The qualitative results suggest that many confounding variables affect the delivery of safety and productivity such as, the quality of followers, mining conditions, the production targets set, the non reporting of accidents, and the environment in which mining was performed. The qualitative findings further suggest that the full range of leadership styles are required to achieve safety and productivity. Passive-avoidant leadership has a negative effect on the workforce. The transactional leadership styles of corrective (management-by-exception-active) and constructive (contingent reward) leadership are required to maintain discipline and to motivate the workforce. Furthermore, underground mining at Impala involves people operating in a hazardous and culturally diverse environment. Consequently, the successful supervisor also needs to employ a transformational leadership style to engage the hearts and minds of the workforce, giving meaning to their work and a feeling of group membership. This inspires them to deliver both safety and productivity excellence. Supervisors are also influenced by their manager's priorities, which tends to cascade down the organisation hierarchy.

### **8.2.3 Evaluation of the Study**

The following steps were taken to minimise the effects of the study limitations (highlighted in chapters one and four) on the findings:

#### *External Validity*

The researcher believes that Impala is representative of underground hard rock conventional mining as the mining methods and management structures are broadly similar across South Africa. However, it is recommended that a study with a larger sample collected across several mines be conducted to validate the findings of this study.

#### *Supervisory Leadership*

The focus of this study was to determine the effect of supervisory leadership style on the simultaneous delivery of both safety and productivity. The organisational leadership effect was only investigated in the qualitative phase of the study.

#### *Transformational Leadership*

Restricting this study to transformational leadership allowed the results to be compared with the previous empirical work done using transformational leadership.

#### *Confounding Variables*

It became clear during the qualitative phase of the study that many confounding variables contaminated the effect of transformational leadership by supervisors on the objective measures of injury rate and productivity. The presence of these contaminating variables coupled with the fact that injury rate and productivity are narrow measures of leadership effectiveness, may explain why the expected relationship between transformational leadership and both injury rate and productivity were not found in the quantitative results. It would not have been easy to measure the confounding variables and would have taken an excessive amount of time. The measurement of the relationship between transformational leadership and the perception of effectiveness was used as a proxy for the objective outcome measures.

Furthermore, the qualitative phase two of the study allowed for the relationship between transformational leadership and both injury rate and productivity to be explored in depth.

#### *One Year's Injury Rate Data*

The collection of injury rate statistics for a one year period prior to the study is believed by the researcher to have been the best option. Over longer periods of time mine overseers move to different sections, and mining conditions may change affecting their injury rate.

#### *Mono-Source Bias*

The shift supervisor respondents completed three questionnaires, which may have introduced mono-source bias into the study findings. However, objective measures were used to measure the outcomes of injury rate (LTIFR) and productivity (% production target met). This study used a sequential explanatory mixed method research design. Consequently, the results from the quantitative first phase were examined using qualitative methods to better explain and understand them. Therefore, it was possible to triangulate the findings, reducing the effect of mono-source bias on the interpretation of the results.

#### *English Literacy of Respondents*

The researcher supervised the respondents while they completed the survey questionnaires and was satisfied that most completed them diligently. The researcher and an assistant were available to answer questions while the respondents completed the questionnaires and most of them did not have difficulty. However, a small number of the respondents took a relatively long period of time to complete the questionnaires, indicating perhaps that they struggled with the English language.

#### *Confidentiality*

The researcher gave a written letter guaranteeing confidentiality to all the respondents that completed the survey questionnaires (Appendix 2). The respondents name also did not appear on the questionnaire and the

completed questionnaires were deposited into a box. The researcher is satisfied that any concerns that the respondents may have had about confidentiality were addressed.

#### *The Researcher and Impala*

The researcher has worked on Impala for twenty-four years and has good knowledge of the mining processes. The researcher was known to some of the respondents. However, the researcher believes that his knowledge of Impala and acquaintance with some of the respondents did not materially impact the study findings. During the study the researcher reported to a senior manager who guided him and vetted his work. The data collected from the qualitative phase of the study was scrutinised by one of the interviewed mine overseer's who was satisfied that the content accurately reflected the interviews.

Overall, the researcher believes that the findings of this study are both valid and reliable and support any conclusions that have been drawn.

#### **8.2.4 Contribution to Body of Knowledge**

This study contributes to the body of knowledge in the following areas:

- Found evidence for the existence of a relationship between transformational leadership and the delivery of safety and productivity excellence in the context of Impala.

Although no link between transformational leadership and the objective organisational measures of injury rate and productivity was found using quantitative methods, transformational leadership was found to be related to the perception of effectiveness. The absence of a relationship between transformational leadership and both injury rate and productivity in this study, may have been caused by the chosen objective measures being too narrow and/or contamination by confounding variables. The qualitative findings suggested the existence of confounding variables.

The qualitative findings support the existence of a relationship between transformational leadership and the delivery of safety and productivity. Passive-avoidant (PA) behaviour of the leader has a negative effect on subordinates' delivery of safety and productivity. There was support for the full range of leadership theory indicating firstly that mining needs to take place in a disciplined environment (MBEA) as it is a risky operation where injuries can occur if the standards and procedures are not followed. Contingent reward (CR) on delivering targets appears to be a highly effective motivator in the underground mining environment. The qualitative data gathered generally supported the argument that transformational factors (II (A), II (B), IM, IS, IC) are important for the delivery of safety and productivity. Visible felt leadership (II (A), II (B)); enthusiasm and encouragement (IM); explaining the reasons for doing things and challenging the status quo (IS); and training and coaching individuals (IC) all appear to give meaning to work and a feeling of team membership, inspiring workers to deliver safety and productivity excellence.

Delivering safety and productivity appears to be closely linked, but it requires the leader to balance the safety and productivity aspects of the work by using both transactional and transformational leadership styles. The respondents generally supported the view that a safety first policy laid the foundation for success in simultaneously delivering safety and productivity excellence.

There was a positive link between the manager's priorities and the follower's priorities. It appears that the mine overseers try to satisfy the manager's priorities and that these priorities cascade down the hierarchical management chain to the workers on the rock face.

The existence of many factors that influence safety and productivity besides leadership suggests that the situation in which a leader operates must be carefully considered when drawing conclusions

about the leader's ability to deliver safety and productivity.

- Further evidence was provided to support previous research done in different environments, that transformational leadership is positively linked to group safety climate in the context of underground mining at Impala. Group safety climate was negatively linked to injuries as the beliefs the workforce hold about safety appear to have a major influence on their behaviour. Crews with high group safety climate prioritise safety over productivity, become a cohesive group and consequently deliver both.
- Evidence was provided to support previous research done in different contexts that transformational leadership was positively linked to group cohesiveness in the context of Impala. The cohesiveness in a crew is an important element for good productivity and this cohesiveness is associated with maintaining crew stability. The longer the crew stay together the more they work as a "family" supporting each other to achieve excellent productivity, and better understanding their supervisor's priorities.
- This study found evidence that group safety climate mediated the relationship between transformational leadership and group cohesiveness, which are both in turn related to the perception of effectiveness. This finding may better explain the mechanism how transformational leaders are able to manage the trade-off required to deliver both safety and productivity, by prioritising safety and consequently becoming a cohesive productive group (Krause, 2005).
- Confirmed that management-by-exception-active (MBEA) was positively related to effectiveness in the risky environment of underground mining at Impala, as predicted by theory (Antonakis, *et al.*, 2003).



- The Multifactor Leadership Questionnaire (MLQ) factor of contingent reward (CR) was found to be highly correlated with the transformational factors of the MLQ as was the case for several previous studies done in different contexts (Avolio and Bass, 2004). Also, in the context of Impala CR was found to be the best predictor of the perception of leader effectiveness amongst the nine leadership factors measured by the MLQ.
- Confirmed the augmentation effect of transformational leadership on transactional leadership relating to the perception of leader effectiveness in the context of Impala. This result provides further evidence that transformational leadership augments transactional leadership (Howell and Avolio, 1993).
- Most previous leadership studies have only used quantitative methods and measured followers' perceptions of leader effectiveness (Lowe, *et al.*, 1996; Berson, 1999). This study used a sequential explanatory mixed methods design where the results from the quantitative first phase of the study were further explored in the qualitative second phase in the leadership context of Impala, which helped better interpret the results. This study also used objective measures of injury rate (LTIFR) and productivity (% production target met).
- The Exploratory Factor Analysis (EFA) of the MLQ did not yield the expected nine factors, but did yield a factor structure that broadly supported passive-avoidant, transactional, and transformational leadership. The EFA also found that contingent reward loaded with the transformational factors as has been found previously in a different context (Bycio, Hackett and Allen, 1995).

### **8.3 Recommendations**

The following issues arising from this study may have practical implications for Impala and similar mining companies:

- Passive-avoidant behaviour by a leader in this context should be avoided as it is associated with a negative perception of supervisor effectiveness by followers. The supervisor needs to be actively involved in daily operations.
- Train supervisors to employ the full range of leadership skills (transactional and transformational) to deliver safety and productivity excellence, as the study provided further evidence that transformational leadership augments transactional leadership in terms of the perception of leader effectiveness. Transformational leadership directly predicts the perception of effectiveness and indirectly predicts effectiveness through the mediating effect of group safety climate and group cohesiveness.
- It is important for the effective leader to maintain discipline using management-by-exception-active (MBEA) in the context of a risky environment such as Impala.
- Contingent reward and idealised influence (attributed) (visible leadership) had the highest correlation with the perception of leader effectiveness in the context of the study. This suggests that effective supervisors should reward and model desired behaviour in this environment.
- It appears that manager's priorities cascade down through the supervisors to the workforce, therefore management priorities have a major influence on the workforce behaviour.

In the context of Impala or similar operations, this study suggests that the effective supervisor should employ the full range of leadership to deliver safety and productivity excellence. This behaviour ranges from management-by-exception-active to maintain discipline, through contingent reward to motivate the delivery of goals, and the transformational style to give work

meaning and a feeling of team membership, inspiring the diverse workforce in the difficult and risky conditions. Management needs to prioritise safety uniting supervisors and workers in a common goal, creating a more cohesive organisation that is ultimately more productive.

#### **8.4 Suggestions for Future Research**

The following suggestions are made in terms of conducting future research, resulting from the findings of this study:

- Conduct a larger sample study across several companies to confirm the external validity of the findings.
- Design a study that controls for the effect of the many confounding variables that contaminate the relationship between transformational leadership and the delivery of the objective measures of injury rate and productivity.
- Confirm the validity of the MLQ instrument in the context of underground mining in South Africa by doing a confirmatory factor analysis (CFA) on a larger sample.
- Empirically test the moderating effect of organisational safety priority by management on the relationship between supervisors' transformational leadership style and group safety climate, in the context of underground hard rock mining.

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## Appendix 1

For use by Patrick OToole only. Received from Mind Garden, Inc. on October 26, 2010

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To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material;

Instrument: ***Multifactor Leadership Questionnaire***

Authors: ***Bruce Avolio and Bernard Bass***

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for his/her thesis research.

Five sample items from this instrument may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any other published material.

Sincerely,

Robert Most

Mind Garden, Inc.  
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## Appendix 2

### Leadership Model Development

The purpose of this survey is to test a leadership model that examines the relationship between leadership style and, safety and productivity. Findings of this research could be used to inform future training and development programmes.

**Your responses in the questionnaires are strictly confidential and will be coded and inputted anonymously into a statistical program to test the proposed leadership model.**

Please complete the questionnaire diligently, as the quality of the research will critically depend on your answers.

Thanking you

Yours in Health and Safety

PFM O'Toole

## **Appendix 3**

### **Questionnaires**

# Multifactor Leadership Questionnaire

## Leader Form

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Shaft: \_\_\_\_\_

Age: \_\_\_\_\_

Highest educational qualification: \_\_\_\_\_

Ethnicity: \_\_\_\_\_

Number of years experience as an appointed Mine Overseer: \_\_\_\_\_

---

This questionnaire is to describe your leadership style as you perceive it. Please answer all items on this answer sheet. If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits you. The word "others" may mean your peers, clients, direct reports, supervisors and / or all of these individuals.



Use the following rating scale. Circle your choice in the rating column.

Not at all 0	Once in a while 1	Sometimes 2	Fairly often 3	Frequently, if not always 4	Rating
1.	I provide others with assistance in exchange for their efforts .....				0 1 2 3 4
2.	I re-examine critical assumptions to question whether they are appropriate.....				0 1 2 3 4
3.	I fail to interfere until problems become serious .....				0 1 2 3 4
4.	I focus attention on irregularities, mistakes, exceptions and deviations from standards .....				0 1 2 3 4
5.	I avoid getting involved when important issues arise.....				0 1 2 3 4
6.	I talk about my most important values and beliefs.....				0 1 2 3 4
7.	I am absent when needed.....				0 1 2 3 4
8.	I seek differing perspectives when solving problems.....				0 1 2 3 4
9.	I talk optimistically about the future.....				0 1 2 3 4
10.	I instill pride in others for being associated with me.....				0 1 2 3 4
11.	I discuss in specific terms who is responsible for achieving performance targets.....				0 1 2 3 4
12.	I wait for things to go wrong before taking action.....				0 1 2 3 4
13.	I talk enthusiastically about what needs to be accomplished.....				0 1 2 3 4
14.	I specify the importance of having a strong sense of purpose.....				0 1 2 3 4
15.	I spend time teaching and coaching.....				0 1 2 3 4
					Continued →

	Not at all 0	Once in a while 1	Sometimes 2	Fairly often 3	Frequently, if not always 4	Rating
16.	I make clear what one can expect to receive when performance goals are achieved .....					0 1 2 3 4
17.	I show that I am a firm believer in "If it ain't broke, don't fix it" .....					0 1 2 3 4
18.	I go beyond self-interest for the good of the group .....					0 1 2 3 4
19.	I treat others as individuals rather than just as a member of a group .....					0 1 2 3 4
20.	I demonstrate that problems must become chronic before I take action .....					0 1 2 3 4
21.	I act in ways that build others' respect for me .....					0 1 2 3 4
22.	I concentrate my full attention on dealing with mistakes, complaints and failures .....					0 1 2 3 4
23.	I consider the moral and ethical consequences of decisions .....					0 1 2 3 4
24.	I keep track of all mistakes .....					0 1 2 3 4
25.	I display a sense of power and confidence.....					0 1 2 3 4
26.	I articulate a compelling vision of the future .....					0 1 2 3 4
27.	I direct my attention toward failures to meet standards.....					0 1 2 3 4
28.	I avoid making decisions .....					0 1 2 3 4
29.	I consider an individual as having different needs, abilities and aspirations from others .....					0 1 2 3 4
30.	I get others to look at problems from different angles .....					0 1 2 3 4
31.	I help others to develop their strengths.....					0 1 2 3 4
32.	I suggest new ways of looking at how to complete assignments.....					0 1 2 3 4
33.	I delay responding to urgent questions .....					0 1 2 3 4
34.	I emphasise the importance of having a collective sense of mission .....					0 1 2 3 4
35.	I express satisfaction when others meet expectations.....					0 1 2 3 4
36.	I express confidence that goals will be achieved .....					0 1 2 3 4
37.	I am effective in meeting others' job-related needs .....					0 1 2 3 4
38.	I use methods of leadership that are satisfying.....					0 1 2 3 4
39.	I get others to do more than they expected to do.....					0 1 2 3 4
40.	I am effective in representing others to higher authority .....					0 1 2 3 4
41.	I work with others in a satisfactory way .....					0 1 2 3 4
42.	I heighten others' desire to succeed.....					0 1 2 3 4
43.	I am effective in meeting organisational requirements.....					0 1 2 3 4
44.	I increase others' willingness to try harder .....					0 1 2 3 4
45.	I lead a group that is effective.....					0 1 2 3 4

# Multifactor Leadership Questionnaire Rater Form

Name of Mine Overseer: \_\_\_\_\_

Shaft: \_\_\_\_\_

Date: \_\_\_\_\_

---

This questionnaire is used to describe the leadership style of the above mentioned individual as you perceive it. Answer all items on this answer sheet. If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank. Please answer this questionnaire anonymously.

**Important** (necessary for processing): Which best describes you?

- \_\_\_\_\_ I am a higher organisational level than the person I am rating.
- \_\_\_\_\_ The person I am rating is at my organisational level.
- \_\_\_\_\_ I am at a lower organisational level than the person I am rating.
- \_\_\_\_\_ Other than the above.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits the person you are describing.

Use the following rating scale. Circle your choice in the rating column.

Not at all 0	Once in a while 1	Sometimes 2	Fairly often 3	Frequently, if not always 4	Rating
The Person I Am Rating .....					
1.	Provides me with assistance in exchange for my efforts .....				0 1 2 3 4
2.	Re-examines critical assumptions to question whether they are appropriate.....				0 1 2 3 4
3.	Fails to interfere until problems become serious .....				0 1 2 3 4
4.	Focuses attention on irregularities, mistakes, exceptions and deviations from standards .....				0 1 2 3 4
5.	Avoids getting involved when important issues arise .....				0 1 2 3 4
6.	Talks about his / hers most important values and beliefs .....				0 1 2 3 4
7.	Is absent when needed .....				0 1 2 3 4
8.	Seeks differing perspectives when solving problems .....				0 1 2 3 4
9.	Talks optimistically about the future.....				0 1 2 3 4
10.	Instills pride in me for being associated with him / her.....				0 1 2 3 4
11.	Discusses in specific terms who is responsible for achieving performance targets .....				0 1 2 3 4
12.	Waits for things to go wrong before taking action .....				0 1 2 3 4
13.	Talks enthusiastically about what needs to be accomplished .....				0 1 2 3 4
14.	Specifies the importance of having a strong sense of purpose .....				0 1 2 3 4
15.	Spends time teaching and coaching .....				0 1 2 3 4
					Continued →

Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always	Rating
0	1	2	3	4	
16.	Makes clear what one can expect to receive when performance goals are achieved .....				0 1 2 3 4
17.	Shows that he/she is a firm believer in "If it ain't broke, don't fix it" .....				0 1 2 3 4
18.	Goes beyond self-interest for the good of the group .....				0 1 2 3 4
19.	Treats me as an individual rather than just as a member of a group .....				0 1 2 3 4
20.	Demonstrates that problems must become chronic before taking action .....				0 1 2 3 4
21.	Acts in ways that builds my respect .....				0 1 2 3 4
22.	Concentrates his/her full attention on dealing with mistakes, complaints and failures .....				0 1 2 3 4
23.	Considers the moral and ethical consequences of decisions .....				0 1 2 3 4
24.	Keeps track of all mistakes .....				0 1 2 3 4
25.	Displays a sense of power and confidence.....				0 1 2 3 4
26.	Articulates a compelling vision of the future .....				0 1 2 3 4
27.	Directs my attention toward failures to meet standards.....				0 1 2 3 4
28.	Avoids making decisions .....				0 1 2 3 4
29.	Considers me as having different needs, abilities and aspirations from others .....				0 1 2 3 4
30.	Gets me to look at problems from many different angles .....				0 1 2 3 4
31.	Helps me to develop my strengths.....				0 1 2 3 4
32.	Suggests new ways of looking at how to complete assignments.....				0 1 2 3 4
33.	Delays responding to urgent questions .....				0 1 2 3 4
34.	Emphasises the importance of having a collective sense of mission .....				0 1 2 3 4
35.	Expresses satisfaction when I meet expectations.....				0 1 2 3 4
36.	Expresses confidence that goals will be achieved .....				0 1 2 3 4
37.	Is effective in meeting my job-related needs .....				0 1 2 3 4
38.	Uses methods of leadership that are satisfying.....				0 1 2 3 4
39.	Gets me to do more than I expected to do.....				0 1 2 3 4
40.	Is effective in representing me to higher authority .....				0 1 2 3 4
41.	Works with me in a satisfactory way .....				0 1 2 3 4
42.	Heightens my desire to succeed.....				0 1 2 3 4
43.	Is effective in meeting organisational requirements.....				0 1 2 3 4
44.	Increases my willingness to try harder .....				0 1 2 3 4
45.	Leads a group that is effective.....				0 1 2 3 4

## Group Safety Climate Questionnaire

**Mine Overseer Name:** \_\_\_\_\_

Use the scale below to rate the extent to which you agree or disagree with each statement.

Circle your choice in the rating column.

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral or Don't Know	Somewhat Agree	Agree	Strongly Agree	Rating
	1	2	3	4	5	6	7	
	My direct supervisor...							
1.	Makes sure we receive all the equipment needed to do the job safely.....							1 2 3 4 5 6 7
2.	Frequently checks to see if we are all obeying the safety rules.....							1 2 3 4 5 6 7
3.	Discusses how to improve safety with us.....							1 2 3 4 5 6 7
4.	Uses explanations (not just compliance) to get us to act safely.....							1 2 3 4 5 6 7
5.	Emphasises safety procedures when we are working under pressure.....							1 2 3 4 5 6 7
6.	Frequently tells us about hazards in our work.....							1 2 3 4 5 6 7
7.	Refuses to ignore safety rules when work falls behind schedule.....							1 2 3 4 5 6 7
8.	Is strict about working safely when we are tired or stressed.....							1 2 3 4 5 6 7
9.	Reminds workers who need reminders to work safely.....							1 2 3 4 5 6 7
10.	Makes sure we follow <i>all</i> the safety rules (not just the most important ones).....							1 2 3 4 5 6 7
11.	Insists that we obey safety rules when fixing equipment or machines.....							1 2 3 4 5 6 7
12.	Says a "good word" to workers who pay special attention to safety.....							1 2 3 4 5 6 7
13.	Is strict about safety at the end of the shift, when we want to go home.....							1 2 3 4 5 6 7
14.	Spends time helping us to see problems <i>before</i> they arise.....							1 2 3 4 5 6 7
15.	Frequently talks about safety issues throughout the work week.....							1 2 3 4 5 6 7
16.	Insists we wear our protective equipment even if it is uncomfortable.....							1 2 3 4 5 6 7

## Group Cohesiveness Questionnaire

**Mine Overseer Name:** \_\_\_\_\_

Below are six statements concerning your perception of cohesiveness in your section.

Use the scale below to rate the extent to which you agree or disagree with each statement.

Circle your choice in the rating column.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral or Don't Know	Somewhat Agree	Agree	Strongly Agree	Rating
1	2	3	4	5	6	7	
1.	There is a great deal of trust among the members of our section.....						1 2 3 4 5 6 7
2.	The members of our section work together as a team.....						1 2 3 4 5 6 7
3.	The members of our section are co-operative with each other.....						1 2 3 4 5 6 7
4.	Our section members know that they can depend on each other.....						1 2 3 4 5 6 7
5.	The members of our section stand up for each other.....						1 2 3 4 5 6 7
6.	The members of our section regard each other as friends.....						1 2 3 4 5 6 7