



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

**A MODEL FOR MANAGING THE BARRIERS OF INTRODUCING WOMEN INTO A
MINING INDUSTRY**

by

ANDREA HEINE

Submitted in partial fulfilment of the requirements for the degree

**MAGISTER COMMERCII
(HUMAN RESOURCES MANAGEMENT)**

in the

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

at the

UNIVERSITY OF PRETORIA

PRETORIA

OCTOBER 2008



INDEX

Declaration	i
Abstract	ii
Acknowledgements	v
Glossary	vi

Chapter 1

The introduction and background of introducing women into a Mining Industry

1. Introduction.....	1
2. Purpose of the study.....	1
3. Background to the Mining Industry.....	2
4. Legislative framework.....	3

Chapter 2

Barriers that exist when introducing women in a Mining Industry

1. Introduction.....	11
2. Competent qualified female employees.....	11
3. Physical differences between males and females.....	14
2.3.1. Material handling.....	14



2.3.2. Pregnancy.....	17
2.3.3. VO ₂ Max aerobic capacity.....	22
4. The Mining Environment for Women.....	22
2.4.1. Physical strain.....	22
2.4.2. Shifts and fatigue.....	29
2.4.3. Design of mining machines and ergonomics.....	31
5. Infrastructure.....	35
2.5.1. Ablution facilities and change rooms.....	36
2.5.2. Housing facilities.....	36
2.5.3. Work-life balance.....	37
2.5.4. Childcare facilities.....	37
2.5.5. Personal safety and security.....	38
6. Personal Protective Equipment (PPE).....	39
7. High turnover of women.....	40
8. Cultural differences.....	40
9. Cost implications.....	41

Chapter 3

Implementation Model of employing women in a Mining Industry

1. Introduction.....	42
2. Phase One: Single snapshot at any given time.....	44



3. Phase Two: Repetitive process over a period of time.....51

Chapter 4

Research Methodology

1. Introduction.....55

2. Research approach.....57

3. Research design.....57

4. Data gathering.....58

5. Population and sample.....59

6. Measuring instrument.....60

7. Validity of the study.....62

4.7.1. Content evaluation panel.....62

4.7.2. Content Validity Index.....63

4.7.3. Implications for internal validity of the study.....65

4.7.4. Implications for external validity of the study.....65

8. Data Analysis.....65



Chapter 5

Results and Recommendations

1.	Panel of Experts and biographical data.....	66
2.	Evaluation of the Model by the Panel of Experts.....	69
1.	Determining the Content Validity Ratio for each facet of the Model.....	70
2.	Determining the Content Validity Index for the aspects of the model and the final model.....	73
3.	The Model for Managing the Barriers of Introducing Women into a Mining Industry.....	73
4.	Research conclusion.....	77
 Addenda:		
	List of Figures.....	80
	List of Tables.....	81
	List of Diagrams.....	82
	Survey Questionnaire: Female.....	83
	Survey Questionnaire: Male.....	90
	Evaluative Questionnaire: Panel of Experts.....	95



DECLARATION

I, Andrea Heine, hereby declare that this Master's Dissertation titled:

“A Model for Managing the Barriers of Introducing Women into a Mining Industry”

is my own work and that acknowledgement has been given to all sources of reference.

A handwritten signature in black ink that reads "Heine".

Andrea Heine

September 2008

ABSTRACT

Since its inception, the Mining Industry was reserved for males. Females were allowed to perform the so-called “soft jobs”, but only started working underground in 1996. As a result the Mining Charter was introduced and one of its objectives was to force employment of women in the core function of the Mining Industry. The target of 10% women in mining is only a starting point for organisations to comply with each and every individual’s constitutional right. It is clear from the legislation that changes in the Mining Industry should take place and therefore the Mining Charter was introduced to have clear targets with set time frames for meeting these targets. There are several challenges or barriers that organisations are faced with once they introduce women into a Mining Industry. These barriers typically include: competent, qualified females, physical differences between males and females, the mining environment, standards of Personal Protective Equipment, high turnover of women, specifically professional and middle management women, cultural differences and lastly the cost implications for organisations.

Mining Houses are profit-orientated organisations and reserve the right to review the cost implications of employing women in mining and to consider the advantages and disadvantages of doing so. Ultimately it affects the bottom line of the organisation and whether the cost implication is direct or indirect, it is crucial for organisations to manage the changes of introducing women into a Mining Industry.

In general the Mining Environment is known to be a harsh environment not only because of the physical strain that is required to complete the tasks under noisy, cold or warm conditions, but also the necessity of employees working shifts and the risks related to working shifts. Other conditions associated with the Mining Environment are, fatigue, design of mining machines and ergonomics. It is clear that physical strain is present in the Mining Industry, although technology has been incorporated to improve olden days mining techniques compared to the mechanised mining techniques of today. The problems that shift workers experience relate to both the phase-displacement of their work-sleep periods and adverse negative working conditions that may be combined with

shift work. Work-related fatigue may arise in situations requiring concentration for extended periods during work hours, performing strenuous physical work, working in temperature extremes, working in noisy environments or being exposed to vibration.

The mining workplace is a very dynamic work environment. Although machine design and ergonomics in the Mining Industry affects women as well as men, a smaller built person will be more likely to experience problems in enduring these conditions. Infrastructure forms part of the barriers that exist when women are introduced in the Mining Industry as well as ablution facilities and change rooms, housing facilities, work-life balance and personal safety and security.

Mines are reluctant to train and place women in artisan and engineering positions, due to the physical nature of this work as well as the female employees' unwillingness to establish themselves in these careers. Due to cultural differences and different thinking patterns, little or limited support from the male employees will be given to female employees when needed. This implies that not only should the infrastructure be changed due to the introduction of women into the Mining Industry but also change in team structures, interpersonal relationships and the sense of acceptability by fellow male employees and supervisory level.

The purpose of this study was to develop a model which an organisation can use to overcome and manage the barriers that were identified when women are introduced in core positions of the Mining Industry. As the problem statement is threefold, the model considers the three primary parties involved in the process of introducing women into the Mining Industry, namely the Organisation, Men and Women. In the model it is illustrated that these three parties function interdependently of each other. The primary concern of each of the parties is: The Organisation – cost implication; Men – paradigm shift; and Women – several barriers identified. The suggested solutions and focus areas for each of the parties are considered and/or implemented. The communication channels between these parties are a vast contributor to the success of this model. This is only the groundwork phase, phase one, of the process.

Phase Two of this model is that this snapshot of the threefold system, at any given time, should be monitored and re-evaluated in order for this change intervention to progress.

After monitoring and re-evaluation took place a decision can be made with regards to continuing with the system or adapting the system. The role of the Human Resources department in this process will mainly be limited to that of a facilitating and advisory role. To achieve the targets set by the Mining Charter and legislation it is vital for Mining Houses to overcome and manage these barriers that exist when introducing women in the Mining Industry. Therefore applying and implementing the basic principles set out in the model of managing the barriers of introducing women in the Mining Industry is a practical way to ensure that Mining Houses deal effectively with these changes brought forward by legislation.

ACKNOWLEDGEMENTS

I would like to thank the following people and institutions for their contribution and support in the completion of this study. My Friend who had played a significant part in the completion of my studies and my family for their love and support. I would also like to thank my professor, Hein Brand, for his valued support and guidance throughout the completion of my dissertation. My gratitude is also extended to Delmas Coal (Pty) Ltd for affording me the opportunity and assisting me to gather information needed for this study. Lastly, I would like to say a special thanks to the Panel of Experts that found the time to evaluate the Model.

Thank you.



GLOSSARY

CVR	Content Validity Ration
dB	Decibels
HAVS	Hand Arm Vibration Syndrome
HDSA	Historically Disadvantaged South Africans
HPD	Hearing Protective Devices
ILO	International Labour Organisation
IPCA	Injury Prevention Control Australia
MCVI	Mean Content Validity Index
MHSA	Mine Health and Safety Act
MQA	Mining Qualification Authority
MSD	Musculoskeletal disorders
NHL	Noise-induced Hearing Loss
NIOSH	National Institute of Occupational Safety and Health
PPE	Personal Protective Equipment
SIMRAC	Safety in Mines Research Advisory Committee
W	Watt
WBV	Whole-Body Vibration

CHAPTER 1

THE INTRODUCTION AND BACKGROUND OF INTRODUCING WOMEN IN A MINING INDUSTRY

1.1 Introduction

Since its interception, the Mining Industry was reserved for males. The mining environment was seen from men's perspective as essentially male dominated due to the reasons of women being the weaker specie and not having the mental and physical capabilities to cope in the core functions of the mine. Women were allowed to perform the so-called "soft jobs", but only started working underground in 1996. As a result the Mining Charter was introduced and one of its objectives is to force employment of women in the core functions of the Mining Industry.

1.2 Purpose of the study

The purpose of this study is to develop a model which an organisation can use to overcome and manage the barriers that are identified when women are introduced in core positions of the Mining Industry. This industry used to be a male-dominated environment. The study will be looking at the different barriers that exist from women's, men's as well as the organisation's perspective.

The rationale for executing this research project is not only to assist the organisation that has to comply with the guidelines set out by the Mining Charter, but also to provide a basis from which these barriers can be overcome. This will ensure that fair and conducive workplaces are established regardless of the changes that organisations are faced with. Furthermore women can enter into this industry with minimised effects of turmoil and maximised efforts of improved infrastructure and systems. Thirdly, managing these changes that are set out by the Mining Charter involves the voice of men working in the Mining Industry that needs to shift the paradigm of "women have no voice" to equal rights for both men and women.

Mining Houses are profit-orientated organisations and reserve the right to review the

cost implications of employing women in mining and to consider the advantages and disadvantages of doing so. Ultimately it affects the bottom line of the organisation and whether the cost implication is direct or indirect, it is crucial for organisations to manage these changes of introducing women into a Mining Industry. From this viewpoint it is clear that the need for organisations to manage these barriers is powerful in the sense that we are increasingly driven towards a diversified universe, whether it is by law, through changing times, different cultures, economical needs or survival. The success of the organisation is duly influenced by change. How an organisation and its most valuable asset, its human resources, accept and manage these changes will determine the success or failure of these profit-seeking organisations.

The necessity of the problem statement is therefore threefold, namely legislation prescribes it; the value women add and equality of rights, as well as human rights issues.

1.3 Background to the Mining Industry

Mining was a male dominated industry and hostile to women's participation in work. Women were considered unfit for the hard labour of working in the mines. Most of the jobs occupied by women were the typical administrative or menial lower rank activities like that of cleaning ladies, sweepers and attendants in the offices.

Faith Letlala, representative of the National Union of Mineworkers, is of the opinion that historical dimensions of Black women's oppression and exploitation consist firstly of class (F. Letlala, June 2007). Women were exploited as a class in the developing sectors around the mines and in rural areas, and exploitation took place as part of the broad working class. Secondly, based on race, Black women were discriminated against as Black people by White people, as a definitive character of South African society. More racial exploitations manifested in the Apartheid policies of discrimination, job reservations and inferior jobs. Statistics indicated a classic example of the latter to be true. In one of the biggest Mining Houses their employment equity statistics show that top management consisted of 12 White males, 1 African male and 1 African female. The supervisory level consisted of 116 White males, 4 African males, 12 White females

and 1 African female. This most definitely is not a true reflection of the intention of enforcing Affirmative Action and the Employment Equity Act (Act No. 55 of 1998).

Gender is seen as the third area of exploitation. Women were oppressed by their families and communities on the basis of their being female. In particular, African societies encouraged male chauvinism and gender discrimination. The capitalist outlook of the industrial revolution reinforced male chauvinism and gender discrimination. Women were marginalised in the Mining Industry because they did not have the required strength. It was dangerous to work underground; women are more prone to fear and also lacked the intelligence. This was the legacy that did the rounds in previous years of mining, which women struggle to outlive today. The consequences of the legacy were the birth of racial and gender disparities in South Africa and the mining sector. These disparities typically include White male dominated upper level jobs, racist White influence in the Mining Industry and general male chauvinism perpetrated by both Black and White males against women. Women are seen as sex slaves, who should only cook and “make babies” and not as potential colleagues. Generally the equity spread of mines consisted predominantly of Africans working as underground workers and the surface positions were predominantly occupied by White males with a few exceptions.

1.4 Legislative framework

There are certain legal implications in order to make provision for females in the Mining Industry. Firstly one should look at what was stipulated by the Constitution. If we take a look at the following section of the Constitution it clearly states the following: “9(4) reads that no person may unfairly discriminate directly or indirectly against anyone on one or more grounds, including race, gender, sex, pregnancy, marital status, ethnic and social origin, colour, sexual orientation, age, disability, religion, conscience, belief, culture, language and birth”. Section 22 reads that every citizen has the right to choose their trade, occupation or profession freely. The practice of a trade, occupation or profession may be regulated by law. Section 23 (1) of the constitution states that everyone has the right to fair labour practices.” From this it is evident that the need for change in organisations is due. The target of 10% women in mining is only a starting point for

organisations to comply with each and every individual's constitutional right.

Secondly, the Employment Equity Act (Act No. 55 of 1998) promotes equal opportunities for all Historically Disadvantaged South Africans (HDSA's), for example Africans, Coloureds and Indians and that no discrimination takes place during any actions between possible employees, current employees and the employer. Companies shall publish their employment equity plans and achievements and subscribe to ensuring higher levels on inclusiveness and advancement of women. That includes the targets of aspiring to a baseline of 10 % of women participation in the Mining Industry. Section 6 of the Employment Equity Act (Act No. 55 of 1998) prohibits unfair discrimination as follows: "no person may unfairly discriminate, directly or indirectly, against an employee, in any employment policy or practice, on one or more grounds including race, gender, sex, pregnancy, marital status, family responsibility, ethnic or social origin, colour, sexual orientation, age, disability, religion, HIV status, conscience, belief, political opinion, culture, language and birth." Section 6 (2) of the Employment Equity Act provides a defence claim of unfair discrimination, namely the distinction, exclusion or preference of any person on the basis of an inherent requirement of the job.

Thirdly, the Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997), section 25 provides that a pregnant employee is entitled to at least four (4) months' consecutive maternity leave. Section 26(1) reads that no employer may require or permit a pregnant employee or an employee who is nursing her child to perform work that is hazardous to her health or the health of her child. The Act furthermore in Section 26(2) states that during an employee's pregnancy, and for the period of six months after the birth of her child, her employer must offer her suitable, alternative employment on terms and conditions that are no less favourable than her ordinary terms and conditions of employment, if:

- (a) the employee is required to perform night work, as defined in section 17(1) or her work poses a danger to her health or safety or that of her child; and
- (b) it is practicable for the employer to do so.

To facilitate the abovementioned the Code of Good Practice is issued in terms of the Basic Conditions of Employment Act.

Lastly for the legislation framework, the Mine Health and Safety Act, 1996 (Act No.29 of 1996), determines measures to minimise occupational risks and encourages employees to stand up for the right not to work in dangerous areas. There are full-time health and safety representatives appointed in every mining house to evaluate the compliance of the mining house to the minimum requirements laid down by the Mine Health and Safety Act and to represent employees at joint health and safety meetings. According to the Mine Health and Safety Act, and the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) the employer is also required to provide and maintain a work environment that is safe and without risk to the health of employees. This is broad enough to include risks to the reproductive health of employees. Risk assessments need to be done. The risk of exposure needs to be assessed through risk assessment of all specific jobs, to determine what is potentially hazardous to the health of a pregnant worker or a worker nursing a child. Such work could be detrimental to the health of both the pregnant worker and her unborn child.

These Acts mentioned above set the stage for integration of women into previously male dominated industries. It is clear from the legislation that changes in the Mining Industry should take place and therefore the Mining Charter was introduced to have clear targets with set time frames for meeting these targets.

The Mining Qualification Authority's (MQA's) vision is to have sufficient and appropriate knowledge and skills in order to support the productivity, occupational health and safety and transformation of the Mining and Minerals Sector. The MQA is responsible for facilitating skills development in the Mining and Minerals Sector in terms of the Skills Development Act, 1998 (Act No. 97 of 1998). In addition, the MQA, in the execution of its mandate, supports the Proposed Broad-Based Socio-Economic Empowerment Charter (Mining Charter) in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) and the Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

The priorities outlined in the Mining Charter include, amongst others, human resource development, redressing the imbalances brought about by the previous dispensation, increasing the participation of women in the mining sector and empowering previously disadvantaged communities. The MQA is in the process of ensuring that targets across

the sector are met, developing more grants to support specific transformation initiatives, and implementing a number of cooperation agreements with several roleplayers.

One of the Mining Charter's objectives is employment equity with regards to women. Mining companies agreed to establish plans for the target of 10% women participation in the Mining Industry within five years. The basis from which these targets were derived can be seen in Table 1 below:

Table 1: Profile of Historically Disadvantaged South Africans (HDSA's) Represented at Technical Reference Groups								
	African		Coloured		Indian		White	
	Male	Female	Male	Female	Male	Female	Male	Female
Sub total	43	12	8	2	5	3	240	26
Total	339							
% Participation	12.68	3.54	2.36	0.59	1.47	0.88	70.80	7.67

Source: (Proposed Broad-Based Socio Economic Empowerment Charter for the South African Mining Industry, 18 June 2002)

Women are often found in support functions such as: human resources, public relations, finance, legal and audit departments in Mining Houses but lack in the technical departments that keep mining in business. Technical areas include geology, metallurgy, mining and engineering which are seen as the core functions of business in the Mining Industry and the 10% target should be met in the core functions of mining and not in the non-technical disciplines within Mining Houses. Women are already fairly well represented within those non-technical disciplines (C Reichardt, 20-22 June 2007, Conference of Women in Mining, School of Mining Engineering, University of Witwatersrand).

Further objectives with regards to the Mining Charter are to:

- Promote equitable access to the nation's mineral resources to all the people of South Africa;
- Substantially and meaningfully expand opportunities for HDSA's, including women,

to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources;

- Utilise the existing skills base for the empowerment of HDSA's;
- Expand the skills base of HDSA's in order to serve the community;
- Promote employment and advance the social and economic welfare of mining communities and the major labour sending areas; and
- Promote beneficiation of South Africa's mineral commodities.

(Proposed Broad-Based Socio Economic Empowerment Charter for the South African Mining Industry, 18 June 2002)

The Mining Charter therefore provides a framework for progressing into a more equalised workforce, and therefore exact targets and deadlines were set by the Department of Minerals and Energy with the input of the Department of Labour and representatives of the Mining Industry. The Mining Charter is therefore a guideline for implementing what is set out in the legislation previously mentioned.

ML Tupy (2 December 2002, Well-Intended South African Mining Charter is Recipe for Disaster, Project on Global Economic Liberty, Cato Institute) has a different view with regards to the implementation of the Mining Charter. In her view the South African government recently adopted a charter aimed at altering the racial composition of the Mining Industry. The stated goal is to "empower the previously disadvantaged groups" through racial quotas in both employment and the ownership of mining companies' stock.

According to Tupy the Mining Charter is destined for disaster; she furthermore mentioned why she thought the Mining Charter was not a positive change for the Mining Industry. She is of the opinion that racial quotas established by the government will likely result in economic harm to the country, and to Black South Africans. In hiring, the quotas will place the racial classification of each applicant at the centre of the selection process, instead of the worker's ability to do the job. In other words, one of the mining company's most important business decisions, the hiring of workers, will be dependent upon non-business related criteria.

The recruiting requirements will likely have their most severe effects at managerial level.

South Africa has an undersupply of qualified management personnel, a fact the Mining Charter acknowledges. For that reason, mining companies have been urged to produce qualified staff from within their own ranks. The managerial training of mineworkers, who in many cases do not have any formal schooling, will come at a significant price. The same holds for the other goals of the Mining Charter, including improvements in company housing and nutrition, and increases in home ownership amongst employees.

The mining companies have agreed to raise \$10 billion over the next five years for the purchase and transfer of company stock to non-whites. This will drive down the profit margins in the industry and the mining companies will be forced to cut their costs by hiring fewer employees than they normally would, or by letting some of their employees go. As a result, unemployment will increase. That outcome is the direct opposite of what South Africa currently needs and what the government aspires to do (Tupy ML, December 2002).

South Africa's top mining executives publicly expressed support for the Mining Charter, but in private they are said to be gravely concerned about the cost associated with it. That is a dismal sign, for it means that the businesses will now likely resort to political manoeuvring to escape Mining Charter requirements. In other words, the companies will believe it to be more beneficial to spend their limited money and energy to try to get around the Mining Charter and any legislation that may arise from it. (Tupy ML, December 2002).

Current statistics indicate that women make up fifty two percent of the adult population in South Africa and forty one percent of the working South African population, but only 16,8% of all executive managers and 11,5% of all directors in the country. Taking into consideration that there will always be more people in the overall workforce than in corporate leadership positions, the relative position of women in executive management and board positions does not correspond meaningfully to the proportion that women form of South Africa's overall working population (Tupy ML, December 2002).

The implementation of the Mining Charter, however, did have an effect on the latter; the number of women in corporate leadership has increased since 2004 to 2005 as indicated in Table 2 below:



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 2: The percentage of women in corporate leadership for 2004 – 2005			
2004		2005	
All executive management	14,7%	All executive management	19,8%
All directors	7,1%	All directors	10,7%

Source: (Peter Leon Mining Law Committee, International Bar Association, Webber Wentzel Bowens.)

Therefore there has been an increase of 5,1% of women in all executive management positions and a 3,6% increase of women in all directors' positions.

However, from 2005 to 2006 there was a slight drop of 3% in all executive management positions and only a marginal increase of 0,8% in all directors positions as indicated in Table 3 below:

Table 3: The percentage of women in corporate leadership for 2005 – 2006			
2005		2006	
All executive management	19,8%	All executive management	16,8%
All directors	10,7%	All directors	11,5%

Source: (Peter Leon Mining Law Committee, International Bar Association, Webber Wentzel Bowens.)

The total number of women, however, did increase from 1102 to 1323 women executive managers. (Peter Leon Mining Law Committee, International Bar Association, Webber Wentzel Bowens.)

With these changes set forward by legislation and the Mining Charter, Coaltech 2020 has discovered challenges with regards to the introduction of women into a Mining Industry. These challenges will be discussed briefly in the next chapter. In the research done by Coaltech 2020 researchers, certain challenges facing women in production areas were identified, such as:

- Long unpaid leave periods for pregnant employees who could not find alternative employment or other duties on the surface during pregnancy and/or lactation periods.

- Physiological issues, which include the problems of machinery designs that make it difficult for women to adapt to working with them.
- Psycho-social (cultural) issues, which include the lack of adequate support structures for female employees doing underground or production work.
- The lack of physical infrastructure for women employees such as change rooms, ablution facilities, etcetera.
- Providing Personal Protective Equipment (PPE) that does not meet the needs of female employees and sometimes compromises their privacy.
- The lack of strict implementation of sexual harassment policies by management.
- The lack of management's buy-in with regards to issues affecting women at the workplace.
- Racial discrimination with regards to utilisation of facilities such as change rooms and ablution facilities.
- High labour turnover amongst professional or middle management women.

CHAPTER 2

BARRIERS THAT EXIST WHEN INTRODUCING WOMEN INTO A MINING INDUSTRY

1 Introduction

It was previously mentioned that several challenges or barriers exist when organisations introduce women into a Mining Industry. From the study done by Coaltech 2020, as well as Survey Questionnaires that were distributed amongst male and female Delmas Coal (Pty) Ltd employees, the following barriers were determined to be dominant at this stage:

1. Competent qualified females
2. Physical differences between males and females
3. The mining environment
4. Infrastructure
5. Standards of Personal Protective Equipment (PPE)
6. High turnover of women, specifically professional and middle management women
7. Cultural differences
8. Cost implication for organisations

A closer look will now be taken at each of the eight barriers identified in previous research initiatives.

2 Competent qualified females

Mining Engineering enrolment statistics from the University of Witwatersrand indicate that there is a huge transformation in students, which indicates that the trend is positive (C Reichardt, June 2007). But we are always aiming to reduce the scarcity of skills and gender, and getting female students into the system is only the start. The real problem exists in retaining female students.

Table 4 below indicates the enrolment statistics for females and males from the year 2000 until 2007.

Table 4: Enrolment statistics from the University of Witwatersrand		
Year	% females	% males
2000	7.1	92.9
2001	10.8	89.2
2002	11.4	88.6
2003	12.7	87.3
2004	30.7	79.3
2005	22.0	78.0
2006	23.5	76.5
2007	26.3	73.7

Source: (Cathy Reichardt of The School of Mining Engineering at the University of Witwatersrand)

The real opportunity to increase women’s representation is therefore to recruit and develop women into management positions and technical disciplines. According to Cathy Reichardt of the School of Mining Engineering at the University of Witwatersrand, experience that women need is paramount to succeed in the Mining Industry. Reichardt refers to experience in technical competence, the ability to solve problems, assertiveness, adaptability and to be fond of the company of men. According to Zanele Nzimande no women mining engineers have been appointed as General Managers to date. But trends are showing a steady increase in female mining engineers at tertiary level. Statistics indicate that 20% of first-year students that enrolled for Mining Engineering in 2008, are females (C Reichardt, June 2007).

From Reichardt’s experience (C Reichardt, June 2007) many students drop out because, firstly, Mining Engineering is not what they thought it would be. Secondly, their inability to develop the “problem-solving” approach required for Applied Science and lastly, disappointment of what they experience personally during vacation work, including sexual harassment, racial abuse and no direction, training or mentoring received during their experiential period in the industry itself.

Considering the abovementioned factors, let us take a look at the graduation percentages from the year 2000 until 2006 in Table 5 below:

Year	% female	% male
2000	12.9	87.1
2001	4.5	95.5
2002	5.0	95.0
2003	9.1	90.9
2004	19.2	80.8
2005	21.2	78.8
2006	5.6	94.4

Source: (Cathy Reichardt of the School of Mining Engineering at the University of Witwatersrand)

Although some of the females graduate as engineers, they still do not remain in the industry. Experts in the training industry believe that after graduating they still have a misconception of what the Mining Industry is all about. Firstly, their inability to cope with the physical or social challenges of the operational environment, sexual harassment and the new graduate's perception of slower career progression and lower salaries compared to other industries, contribute to females not remaining in the Mining Industry (C Reichardt, June 2007).

Secondly, these scarce commodities of engineers are 'poached' by other more attractive sectors. Thirdly, family considerations such as the decision of when to start a family and the competing demands of their partner's jobs contribute to qualified female engineers leaving the Mining Industry. There exists a lot of social pressure when you are a woman entering a male dominated environment. Therefore finding suitable candidates for the hostile underground environment is yet another barrier Mines are faced with. To a lesser extent lack of tools to ascertain inherent potential and possible career advancement avenues and ineffective monitoring systems to review training and progress can also be seen as barriers within the Mining Industry (C Reichardt, June 2007).

Affirmative Action and Employment Equity initiatives are perceived as a threat by the current workforce. This is particularly challenging for White males to relate to Black

females, who are not only unfamiliar with their race but also their gender. The same accounts for male staff from all races. They feel that women are being given unfair advantage; this can enhance the underlying paradigm that already exists in this male dominated environment (C Reichardt, June 2007).

3 Physical differences between males and females

Men and women are physically different. That would seem to be self-evident. Men and women are different in aptitude, skills and behaviour. But the big protest is with regards to several physical factors, biological factors and most of all the fact that women can fall pregnant, which on its own, has a lot of specific risk factors for the mother and her unborn child. $\dot{V}O_2\text{Max}$ – Aerobic Capacity provides a quantitative measure of a person's capacity for aerobic work. The aerobic capacity of a person is an important determinant, which indicates a person's capability to sustain long and intense physical work (S Seiler, 2005). Each of these physical differences between males and females will now be discussed in further detail.

2.3.1 Material handling

Manual material handling refers to the lifting, lowering, pushing, pulling, holding and dragging of loads without the help of mechanical devices or tools. These activities often require static and dynamic efforts that place great strain on the human musculoskeletal system. The question often arises, "What can a person be reasonably expected to handle?" and there is not any straight answer to that. The reason for this being the great diversity of people, different strengths and physical conditions, size and shape of objects to handle.

Manual material handling, right-hand grip strength for a female is 36-64 % lower than that of a male's strength. In the earlier years of mining, one of the common tasks of a miner was to undercut a coal face in preparation for blasting. This task was performed with the miner lying on his side, using a pick to cut the coal and a shovel to support the body. The miners could spend between three to six hours in this position. A study by Lawrence (1955) suggests that the seam height of the mine has a marked influence on

the incidence of lower back disorders. Today's miner is not required to do this type of physical work due to mining becoming predominantly mechanised. Modern mining technology allows the mining of coal by means of continuous mining, to allow higher production rates as compared to the traditional blasting techniques. For this reason blasting techniques are utilised mainly for the production of coal where conditions and dolerite/stone intrusions will not allow for modern mining techniques. Today the miner's common tasks consist of the following:

- Inspection and management of all physical conditions that pose a risk to the health and safety of the workers
- Ensuring compliance to all legal requirements pertaining to mining
- Ventilation
- Management and control of the production team underground

As can be seen from the above-mentioned aspects, there was a radical transformation from mining in the earlier years and mining with modern techniques, which, as it is practised now is less physical and more management orientated. Today the actual physical tasks that are occasionally performed require the barring of unsafe roofs, sides, cable handling and operation of machines. Although the other core functions of Mining still involve a lot of physical work, such as Engineers and Artisans.

The International Labour Organisation (ILO) has provided guidelines, which are generally accepted as the norm for lifting tasks, as indicated in Table 6 below:

Age (in years)	Males	Females
18-20	23kg	14kg
20-35	25kg	15kg
35-50	21kg	13kg
50+	16kg	10kg

Source: [R Guild, RI Ehrlich, JR Johnston, MH Ross, 2001, A Handbook on Occupational Health Practice in the South African Mining Industry, The Safety in Mines Research Advisory Committee (SIMRAC)].

The question here is whether or not women have the ability to physically cope with the demands of the specific task in the core business of mining. The findings according to Coaltech 2020, indicate that males and females have biologically different physiques. This has a significant influence on how females execute certain tasks as required per job category. In the Coaltech 2020 study, research compared males with females and it was determined that females have a lower manual handling capacity. The implication of this finding is that the majority of female employees or applicants are incapable of lifting and pulling items of a certain weight.

Another study was conducted by Injury Prevention Control Australia (IPCA), School of Human Movement Studies, Queensland University of Technology, Brisbane, Australia. This study was done in order to compare the muscular strength of average adult males and average adult females (Westcott, 1991). IPCA collected data on more than 900 men and women, in one of the largest comparative studies of the sexes. Each of the study participants performed 10 leg extensions with the heaviest weight load possible. This strength assessment for the front thigh muscles (quadriceps) was conducted on a specific leg extension machine equipped with a special computer to ensure proper exercise technique with respect to movement speed as well as full movement range.

The results revealed that the male subjects were about 50 percent stronger than the female subjects. According to the researchers if they divide the weight, what men and women lifted, by their body weight, to adjust for weight differences, the average male completed 10 leg extensions with 62 percent of his body weight and the average female completed 10 leg extensions with 55 percent of her body weight. IPCA researchers were still not satisfied with the comparison's accuracy. The researchers wanted to examine pound-for-pound muscle strength between men and women, therefore it is necessary to divide the weight lifted by the subject's lean (muscle) weight to obtain an accurate comparison between males and females. After this calculation it was determined that the average male and the average female could both perform 10 leg extensions with about 75 percent of their lean weight. Follow-up studies by IPCA have demonstrated that women respond to strength exercise in the same way as men (Westcott, 1991). Females are therefore not the weaker specie as per the social generalisation paradigm of the Mining Industry, but females are simply the smaller specie, but on a muscle-for-muscle basis, women are just as strong as men.



From the two different studies by Coaltech 2020 and IPCA, it is clear that although females typically have less muscle than males, the muscle similarly adapts to progressive resistance exercise. Therefore Dr. Cas Badenhorst (June 2007, Conference of Women in Mining) was true in his quote below:

“A woman can do any job that she is qualified to do, subjected to her fulfilling the physical and functional requirements set for that specific job.”

-Dr. Cas Badenhorst-

2.3.2 Pregnancy

Another physical difference between male and female employees is the fact that female employees can become pregnant. There are three primary concerns with female employees falling pregnant in the mining environment, namely:

- The long-term reproductive health hazard
- Leave periods due to pregnancy
- Breast-feeding periods while women are on light duty. A further concern is that some organisations do not provide for light-duty work.

An employee is entitled to at least four consecutive months’ maternity leave any time from four weeks before the expected date of birth and may not return to work for at least six weeks after the birth of her child. Furthermore the Basic Conditions of Employment Act also places obligations on the employer in respect of the health and safety of pregnant employees. An employer may not demand or allow a pregnant employee or an employee that is breast-feeding her child to perform work that is hazardous to her health or the health of her child. During the period of pregnancy, and for six months afterwards, an employer must offer any employee engaged in night work or whose work may pose a danger to her health or safety or that of her child, suitable alternative employment with at least the same terms and conditions of employment, unless it is not practicable to do so (R Guild *et al.* 2001).

It is important to consider the physical hazards that women are faced with when becoming pregnant. Table 7 provides an outlay of the hazards, complications and solutions regarding pregnant women in the workplace.

Table 7: Physical hazards for pregnant women

Hazard	Possible complication/risks	Possible solution and withdrawal time
Vibration and mechanical shock	Risk of pre-term labour.	<ul style="list-style-type: none"> Independent wheel suspension systems on equipment.
Extreme cold	Hypertension risk to fetus, risk of pre-term labour.	<ul style="list-style-type: none"> Thermal clothing.
Extreme heat (Heat is limited to only a few operations in the coal industry)	Hypertension risk to fetus, risk of pre-term labour.	<ul style="list-style-type: none"> Only limited exposure to heat then rotate if work permits it Should be avoided
Noise	After child has been born complication can possibly be experienced by the child.	<ul style="list-style-type: none"> Employer should comply with regulation 7 of the Occupational Health and Safety Act.
Physical strain (such as lifting heavy objects)	Risk of impaired fetal growth and higher risk of carpal tunnel syndrome.	<ul style="list-style-type: none"> Should be avoided At 20 weeks
Prolonged sitting and standing	Venous, spinal, foot problems, risk of pre-term labour, cervical insufficiency, pre-term labour.	<ul style="list-style-type: none"> Workstation should be adjustable to allow necessary changes in posture Frequent rest periods Task rotation if organisation permits it At 24 weeks
Stooping and bending below knee level	Ergonomics, vascular, falling, balance, cervical insufficiency.	<ul style="list-style-type: none"> At 20 weeks

Source: (Dr. Dipalesa Mokobolo, June 2007, Charter update, Conference of Women in Mining)

Table 7: Physical hazards for pregnant women (Continued)

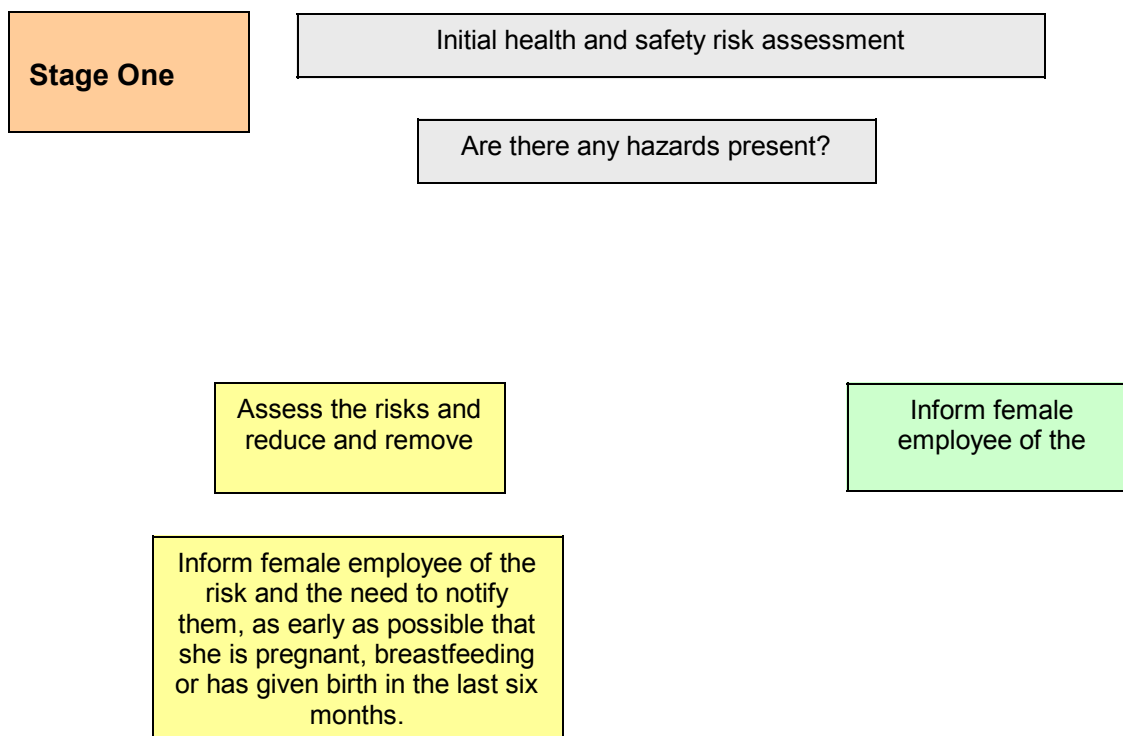
Hazard	Possible complication/risks	Possible solution and withdrawal time
Climbing ladders	Balance and ergonomics, the possibility of falling is very high and this can lead to pre-term labour.	<ul style="list-style-type: none"> • At 20-24 weeks
Dust exposure	Poor lung functioning and breathing can have an indirect effect on the health of the fetus.	<ul style="list-style-type: none"> • Wear Personal Protective Equipment • Prevent exposure prior to falling pregnant • Employer should comply with the minimum regulations as set out in the Occupational Health and Safety Act.
Bacteria and viruses	Risk of impaired fetal growth. Risk of abortion.	<ul style="list-style-type: none"> • Universal hygiene measures • High standards of personal hygiene • The use of Personal Protective Equipment in high-risk areas

Source: (Dr. Dipalesa Mokobolo, June 2007, Charter update, Conference of Women in Mining)

Reproductive rights are human rights and therefore Mining Houses should be careful not to be at fault with drafting pregnancy policies that undercut women’s human rights to recreation which lead to de-civilisation by capitalism of the African family unit. Recent statistics have shown that the size of the typical African family unit has declined and will continue to do so as more women enter the mining environment and having to sign these types of policies (Faith Letlala, June 2007).

Anglo Platinum, as indicated in the diagram, uses the following Risk Assessment Flow to ensure that pregnant and/or breastfeeding employees are not exposed to significant risk. (Dr. Cas Badenhorst, June 2007).

Diagram 1: Risk Assessment Flow of Pregnant Employees



Stage Two

After the employee has provided written notification that she is pregnant, has given birth in the last six months or that she is breastfeeding.

Carry out a risk assessment specific to the employee, her work environment and her job, based on the initial assessment and any medical advice her doctor has provided.

Has a risk been identified?

Can the risk be removed?

Remove the Risk.

Action 1: Can her working conditions/hours

Adjust the condition.

Action 2: can she be given suitable alternative work?

Give suitable alternative work on same terms and

Action 3: suspend her from work for as long as necessary to protect her health and safety, and that of her child

2.3.3 $V_{O_2}Max$ – Aerobic Capacity

The final physical difference that will be discussed is $V_{O_2}Max$ – Aerobic Capacity. A study by Moss (1934) showed that before mines were mechanised, the average daily energy consumption for a miner working in the coal mines was approximately 4 500 kilocalories per day. Rest periods were not of sufficient length to bring the oxygen consumption back down to a normal resting level. Modern coal mining is characterised by short bursts of high energy-consumption tasks, interspersed with periods of rest or lower energy-consumption tasks. This aerobic capacity between males and females differs. Female's aerobic capacity is lower and therefore females will tend to get tired earlier in the shift, which could have an effect on her performance in comparison with that of male employees (S Seiler, 2005).

4 The Mining Environment for Women

The Mining Industry needs to comply with the Mine Health and Safety Act (MHSA No.29 of 1996) which promotes safe and healthy working conditions for all. The health and safety of an employee cannot be compromised by appointing an employee in a job or requiring the employee to conduct tasks for which the employee is not medically fit or does not have the physical or functional capabilities or to complete the tasks without endangering the health and safety of the employee and his/her co-workers.

In general the Mining Environment is known to be a harsh environment not only because of the physical strain that is required to complete the tasks under noisy, cold or warm conditions, but also the necessity of employees working shifts and the risks related to working shifts. Other conditions associated with the Mining Environment are, fatigue, design of mining machines and ergonomics. Each of these conditions known to the Mining Environment will be discussed in further detail.

2.4.1 Physical strain

Noise–sound is a form of energy carried by waves through an elastic medium. The energy is eventually converted into heat through internal friction of the medium or when

the sound is absorbed by some obstruction. When one is underground at blasting time, one first hears the sharp cracks of shots going off as the sounds travel through the rock, and several seconds later one hears the long drawn-out boom of the waves travelling more slowly by air and being distorted by reflections from the rock sidewalls. This is important to know because the frequency of the sound waves determines the pitch of the sound by setting up a vibration of the same frequency in a person's eardrum, from which a message regarding the type of sound is sent to the brain. Noise has been aptly described as unwanted sound and therefore long exposure to high levels of noise causes some degree of hearing loss. To guard against this, certain health standards are laid down which determine that equivalent noise exposure may not exceed 85 dB (Decibels) for 40 hours a week in an eight-hour day. There are two main sources of noise from machines, namely vibrating surfaces and air disturbances (WL Le Roux, February 1990). Noise has been increasingly recognised as a significant health hazard for workers and a serious financial threat to many industries.

The next condition that contributes to the strenuous conditions underground is heat, which is more applicable to the gold mining industry. Physiological effects of heat – the human body has very intricate and very effective heat-regulating mechanisms which strive to keep the body temperature constant at about 37°C. To achieve this body temperature, equilibrium requires a constant exchange of heat between the body and the environment. As the muscles perform, they produce heat as a by-product. While the normal metabolic rate of a resting person is approximately 70 Watts (W), a person doing very hard work can produce up to 450 Watt (W) of waste heat continuously for several hours.

On the first day of work in heat, unacclimatised men readily show signs of distress and discomfort, develop increased body core temperatures and heart rates, complain of headaches and giddiness and suffer from other symptoms of incipient heat exhaustion. Repeated exposure to work in heat causes a gradual adjustment in the body system which leads to an improved human heat tolerance. In order to manage the potentially deleterious consequences of heat stress, workers destined to work under so-called heat stress conditions in mines are exposed to a heat-tolerance test to establish their inherent or natural level of heat tolerance. Heat tolerance does not only consider heat but also strenuous physical work, high environmental heat loads and dehydration which

will contribute to heat illnesses (WL Le Roux, February 1990).

Responses to heat stress are extremely varied and the underlying mechanisms are often not fully understood. At lower levels of heat stress, the main signs are behavioural changes, including aggression, depression and numerous psychological problems. Early laboratory studies on women indicated that they were relatively intolerant to work in heat. However, it is now recognised that nearly all gender differences can be explained in terms of body size and acquired levels of physical fitness and heat acclimatisation. There are only minor differences in heat dissipation mechanisms which are higher maximum sweat rates in males which may enhance tolerance for extremely hot, dry environments. Whereas females are better able to suppress excess sweating and therefore conserve bodily fluid in hot, humid environments. When allowance is made for individual physique and fitness, men and women are essentially alike in their responses to heat stress and their ability to acclimatise to work under hot conditions. Therefore selection of workers for “hot jobs” should be based on physical capacity and not on gender. Heat stress is particularly present in the gold mines.

Traditionally, fitness for duty has been described as “the detection of medical problems that may compromise personal, co-worker, and/or public safety” (Kales *et al.* 1998). This view of work ability focuses solely on the identification of pre-existing medical conditions and the resultant risk of injury. Mining and some other hazardous industries have responded to legislation and increased awareness of risks by also testing employees for drug and alcohol intoxication, and in some instances, excessive fatigue. Thus, if a worker is found not to have either medical problems or impairments related to drugs, alcohol or fatigue, he or she is considered ‘fit for work’ – implicitly extending the concept of fitness for work beyond the absence of illness or injury. However, a broader view of this concept should consider the interaction between a worker’s capacities and the demands of the job, and how much they do, or do not, match. It should also take a long-term view of how a worker’s health and fitness status may change over a career, the capacity for and limits to physical adaptation, and cumulative effects of work demands. This more comprehensive concept of fitness for work is consistent with the goals of career-long health surveillance, and would allow interventions to preserve health and maintain work capacity to be implemented in a timely way, and tailored to the individual’s needs (Tony Parker *et al.* 2004).

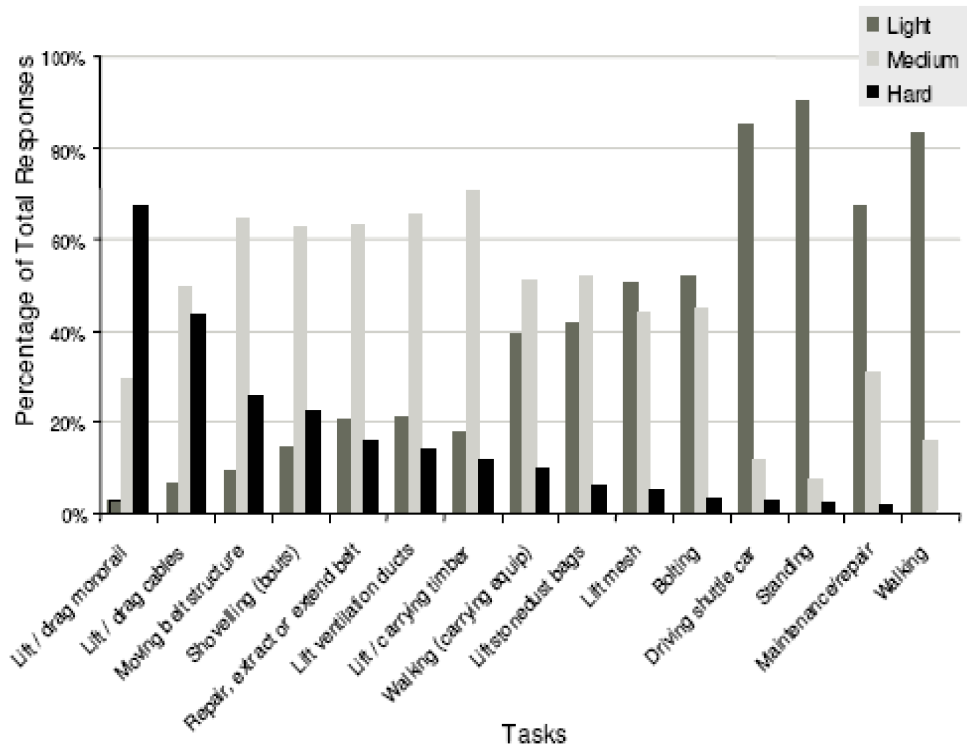
A specific challenge in defining fitness for work in mining is that the actual physical fitness requirements of many work tasks have been under-emphasised in recent years. This reflects conflicting philosophies as well as major structural change. Historically, it has always been accepted that underground mining work imposes heavy physical demands on miners, and that not all are suited to this work. Mechanisation in general, and open-cut methods specifically, have reduced many physical demands, but in an inconsistent way. Some manual tasks have disappeared completely, but mechanisation itself has created new physical demands, especially in maintenance, moving and set-up of equipment. This will support the statement earlier made that although changes from traditional mining and blasting techniques were made, mechanised mining also has physical strain. Although we have heard previously that law prescribes these changes of gender visibility in the core functions of mining and after a range of job re-design efforts, many of the work tasks undertaken by miners still require significant manual handling, exertion of high forces, often with non-optimal postures, and frequently in poor environments. Furthermore, the work is often of an irregular nature. There is a real danger that in trying to comply with the goals of equal employment opportunity, and the ergonomics credo that work should always be modified to fit the human, the effects of those “irreducible” physically demanding work-tasks on miners will not be properly appreciated. Because of population-level health and fitness changes, the expectation that all members of the general workforce could perform all mining work-tasks, and that they could do so with no risk of injury, may be increasingly unrealistic (Tony Parker *et al.* 2004).

Injury Prevention Control Australia (IPCA) data confirms that many tasks remain physically demanding, at least in underground coal mining. A group of miners rated the frequency, intensity, and duration of a range of work-tasks involved in the development, production and extraction processes. These tasks frequently involved manual handling associated with repetitive lifting, shovelling, operating heavy machinery, and handling awkward objects such as cabling and ventilation materials.

Figure 1 shows the perceived job demands of various underground tasks. The data demonstrates that the frequency and intensity of the tasks performed by the workers in different positions are quite varied. This emphasises the need for a level of functional

fitness consistent with the demands of the position (Tony Parker *et al.* 2004).

Figure1: Perceived job demands of various underground tasks



Source: (Tony Parker and Charles Worringham, 2004, School of Human Movement Studies, Queensland University of Technology, Brisbane, Australia)

Therefore, some intermittent but extremely demanding tasks were performed, which could provoke an intense physiological response for a brief period of time, putting the body under extreme stress. However, the infrequent nature of these extreme tasks may

not be sufficient to elicit a *training* response and thus may not cause a physiological adaptation to the task. IPCA's research has shown heart rates attaining values close to maximum in several common underground tasks, with clear individual variation. All these observations emphasise the need for health promotion approaches that are individual rather than generic.

Therefore the assumption that people who are required to lift heavy loads in the workplace are physically well conditioned is not well founded. A study by Ruzic *et al.* (2003) found that workers exposed to high physical loads did not necessarily have improvement in functional abilities, in fact they were only found to have a stronger handgrip. The disparity between actual fitness and the perception of fitness levels suggests that miners may be unaware that they lack the necessary functional capacity to safely perform a particular work-task without risk of injury.

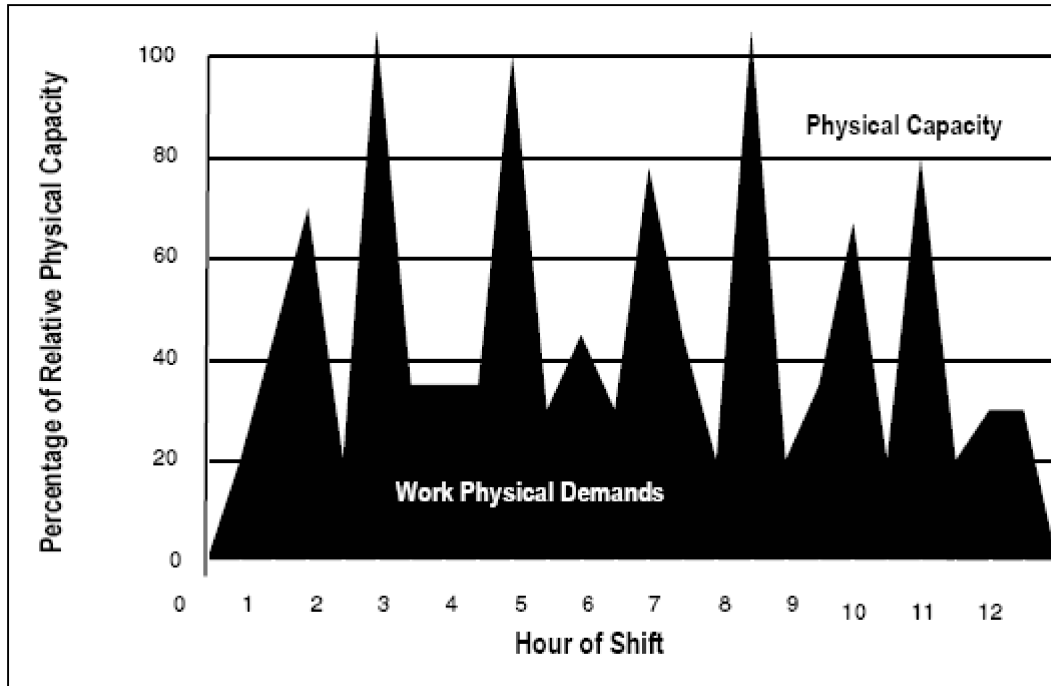
The workers' roles at a mining environment are extremely varied and job specific. However, many positions still involve a significant amount of physical work with tasks involving strength, mobility and muscular endurance. Because work intensity is generally intermittent, this raises concern with respect to musculoskeletal injury since many may be unprepared for high-intensity loading which may exceed their physical capacity.

An example of the effect of cumulative load was demonstrated in a study of 355 radiographic records of workers exposed to long periods of heavy physical exertion or whole-body vibration (Brinkmann, 2000). The results for miners indicated significant decreases in the lumbar disc height. It was suggested that this may be due to loss of disc tissue and/or endplate fracture of adjoining vertebrae as a function of high loads and repetitive handling. The effectiveness of ergonomic redesign was demonstrated by the finding that miners with improved damped seat design had no changes to vertebrae in contrast with those with unsprung seats.

Some vertebral bodies and discs showed an increase in height which suggests the possibility of a 'training effect' or positive adaptation to the loads to which they were exposed. This emphasises the difficulty in defining loading thresholds for positive or

negative effects and individual tolerances to load. The difficulty in preventing this type of injury reflects the limited information available on the relationship between the various tasks and overuse injury (overload), the effects of cumulative loading on tissue damage, individual tolerances to these loads, and the lack of reliable and valid measures of cumulative load. Other confounding effects such as age, work environment and work organisation increase the complexity of the problem. In addition to ergonomic interventions where these are possible, appropriate physical conditioning of the structures directly affected by the demands of the work would help to soothe these injuries, therefore reducing unnecessary pain and suffering on behalf of the miner and lost productivity time and compensation for the mine.

Figure 2: Hypothetical model of work physical demands over a shift and the percentage of relative physical capacity



Source: (Tony Parker and Charles Worringham, 2004, School of Human Movement Studies, Queensland University of Technology, Brisbane, Australia)

Physical strength and stamina are necessary to prevent acute and overuse musculoskeletal injury (Parker, 2002). The inclusion of strength, aerobic fitness and flexibility is essential in any fitness programme for workers with physically demanding jobs, to reduce the incidence rate of, and recovery from, musculoskeletal injuries such as sprains and strains (Shepherd, 1999).

However, it is not only those jobs requiring specific physical fitness that need to ensure a level of fitness. Primarily sitting tasks such as truck or dozer driver, require appropriate fitness to counteract the adverse health effects of these largely sedentary

occupations which include exposure to vibration. These injuries generally appear after a longer period of time. When employees in these positions have to perform physical tasks infrequently, they are at increased risk of overloading the musculoskeletal structures involved in manual handling and force exertion. A starting point for devising tailored fitness programmes is to develop a detailed knowledge of physical requirements by work category, and to pay special attention to high loading conditions even when these are not frequent.

A couple of health determinants must be considered and planned for when recruiting female employees, including physical and social determinants.

The following physical determinants of health should be considered:

- Women's specific physiologies of life stages such as childhood, menstruation, pregnancy, lactation, etcetera.
- Physical characteristics such as percentage body fat, ability to absorb and retain nutrients, height, etcetera.

The following social determinants of health should be considered:

- Stress
- Housing
- Lack of social and economic power for most women

(E Solomons and Dr A Banyini, Mining Environment for Women, The Health and Safety perspective). These determinants will impact negatively on the performance and endurance ability of physical tasks during working hours or shift work.

It is clear that physical strain is present in the Mining Industry, although technology has been incorporated to improve olden days' mining techniques to the mechanised mining techniques of today. What is also important, studies have shown that it is not always about males and females and their capacity, but the determinant factor is individual capabilities and the fitness of the employee to fulfil his or her work obligations.

2.4.2 Shifts and fatigue

The term "shift" is defined as the hours of the day that a worker is required to be at the

workplace (R Guild, *et al.* 2001). Many workers have rotating hours, with the time of day of the work changing in a scheduled way. The problems that shift workers experience relate to both the phase-displacement of their work-sleep periods and adverse negative working conditions that may be combined with shift work. The Mining Environment, as explained earlier, is an enhancer for fatigue and because women, determined to be the weaker specie, will be prone to experiencing fatigue earlier in the shift than men. In the long run, sleep deprivation can cause persistent and severe disturbances of sleep itself, chronic fatigue and psychoneurotic syndromes, such as chronic anxiety and depression, which often require treatment with hypnotic or psychotropic drugs (Costa, 2001). Sleep disturbances, chronic fatigue and oscillatory fluctuations of vigilance and performance can also be important contributing factors to “human error” and the accidents that result. Work-related fatigue may arise in situations requiring concentration for extended periods during work hours, performing strenuous physical work, working in temperature extremes, working in noisy environments or being exposed to vibration. Fatigue is a functional state which in one direction grades into sleep, and in the opposite direction grades into a relaxed, restful condition.

Cardiovascular health is also negatively affected by shiftwork (Holmes, 2001), a fact that may be in part explained by poorer patterns of nutrition and greater rates of smoking in shiftworkers relative to their daytime counterparts (Knutsson, 2000). Survey data on the cardiovascular health of the Australian mining workforce indicated higher levels of hypertension and obesity than found in the general population (Bofinger & Ham, 2002). This appeared to be part of a pattern of regional differences in which the general population of coal mining regions also had higher overall levels of hypertension and obesity than the national average.

2.4.3 Design of mining machines and ergonomics

Mining is one of the most physically demanding occupations. It is also one of the most dangerous in terms of exposure to ergonomic hazards. Musculoskeletal disorders (MSD's) resulting from repetitive manual work have long been identified as a significant and costly problem for the mining industry. Strain and sprain injuries account for 24.0% and 25.2% respectively, of all reported injuries for underground coal mining (S. Gallagher, 1999).

They account for 19.4% and 20.4% respectively, of all injuries for underground metal or nonmetal mining. In 2003, the Mine Safety and Health Administration (MSHA) reported that 44% of all illnesses involved joints, tendons, or muscles (S. Gallagher, 1999). Using a new process integration and interventions development approach in mining, National Institute of Occupational Safety and Health (NIOSH) contributed to 34% overall reduction in lost workdays due to repetitive type injuries during 1998-2004. This approach focuses on incorporating the ergonomics process in existing safety and health programmes of the Mining Industries and empowering the workers to proactively develop injury prevention solutions to their tasks (T Parker *et al.* 2004).

Although the need for intervention and prevention is great, the underground mining environment poses unique barriers to implementing many standard ergonomic "fixes". The mining workplace is a very dynamic work environment. This dynamic nature requires that workers be made aware of risk factors and take early actions to reduce their injury risk. However, Mining Houses rarely spend the resources to educate workers about ergonomic interventions despite recent evidence that ergonomic considerations can have a significant impact in reducing the risk of both musculoskeletal disorders (MSD's) and traumatic injuries (T Parker *et al.* 2004).

Recent major accomplishments pertain to - (1) whole-body vibration; and (2) development of ergonomic processes through partnerships with mines (S. Seiler 2005). Previous studies have shown that operators of heavy mobile equipment are afflicted by musculoskeletal injuries of the arms, shoulders, neck, and lower back. From this review, it is shown that whole-body vibration (WBV) and the postural requirements of work (both static and awkward postures) are important risk factors that contribute to musculoskeletal disorders (MSD's) among equipment operators (S. Seiler 2005). Despite this, very little research has been done to systematically characterize the exposure to these ergonomic hazards. Quantifying vibration and postural requirements in practical settings is needed for a better understanding of the exposure levels present in different equipment while performing various tasks. Furthermore, it is important to evaluate postural instability caused by exposure to whole-body vibration (WBV) and evaluate the availability of proper egress for preventing falls among operators of mobile equipment. As such, our research evaluates exposure to whole-body vibration (WBV),

awkward posture, postural stability, and improper egress from equipment among operators of mobile equipment (S. Seiler 2005). Whole-body vibration (WBV) will be discussed in further detail, later in this chapter.

The physical requirements of any job are not easily measured in the workplace. Lab experiments provide opportunities to study musculoskeletal disorders (MSD's) risk factors in a controlled environment. The results add to the science and knowledge base of ergonomics (T Parker *et al.* 2004). Recently, a National Institute of Occupational Safety and Health (NIOSH) researcher conducted studies that defined the physiological demand of performing lifting tasks while the back is in flexion. This study showed that the angle of flexion has a significant effect on resultant low-back pain and injury. Considering the restricted postures used by miners while doing their jobs, the impact of this study is far reaching. This research directly relates to the importance of the design of physical tasks performed in mining and has contributed to a preliminary assessment tool designed to determine the prevalence of low-back pain as it relates to typical mining tasks (T Parker *et al.* 2004).

The importance of simulating mining tasks and equipment, determine physical effort, and test possible interventions for better job and equipment design is to assist the Mining Industry to improve on machine design (T Parker *et al.* 2004). This will contribute to improving the Mining Environment with all its strain and ergonomic challenges. In view of the current predominantly older workforce, the mining industry is in a unique position to make use of their experience and knowledge to help design better mining methods, tools, equipment, and processes for a new generation of miners. Although machine design and ergonomics in the Mining Industry affect women as well as men, a smaller built person will be more likely to experience problems in enduring these conditions (T Parker *et al.* 2004).

Another component of ergonomics is the restricted spaces in coal mines which present huge challenges for developing appropriately designed operator compartments and workstations. The interaction of the confined space of the mine and the massive equipment required to mine the coal often results in operator compartments being cramped and poorly designed. Underground mobile equipment may not have sufficient vertical space to provide systems for shock absorption, leading to whole-body vibration

exposure (S. Seiler 2005).

The extent of exposure to vibration can lead to physical injury but the severity of the injury depends on the duration of exposure as well as the type of vibration released by the tool or machine.

The consequences of exposure to vibration are not only injury but injury leads to poor job performance, reduced efficiency, poorer quality of life and eventually disability. Vibration exposure can be categorised into two main areas, namely:

1. Whole body vibration (WBV)
2. Vibration affecting the upper limbs or hand arm vibration syndrome (HAVS)

In the mining industry whole-body vibration (WBV) is usually associated with operators of transport equipment such as trucks and locomotives (R Guild, *et al.* 2001). The most common self-reported symptom associated with WBV exposure is lower-back pain. Less well documented is sciatic pain, gastrointestinal tract disturbances and dizziness. In female workers, disturbances of the urogenital tract have been reported, with menstrual disorders and spontaneous abortion being the most common. The clinical findings associated with WBV are degenerative changes in the spine and intervertebral disc disorders. Individual characteristics such as gender, age, strength and health status may also have a bearing on susceptibility to back pain along with anthropometric factors such as the height, weight and length of limbs of the driver or operator (R Guild, *et al.* 2001). The body being much the same as a machine can tolerate certain levels of vibrational energy but eventually starts to deteriorate and fail as long-term damage is done and natural processes and systems of the body are disrupted. Muscle fatigue also occurs as the muscles try to react to the vibrational energy to maintain balance and protect and support the spinal column, but these are often too slow as the muscular and nervous system cannot react fast enough to the shocks and loads being applied to the body. Other health effects that have been associated with whole-body vibration are haemorrhoids, hypertension, kidney disorders and even impotence and other adverse reproductive effects in both men and women (R Guild, *et al.* 2001). This is especially present where operating or driving machinery is present.

Sources of exposure to whole-body vibration (WBV) are usually associated with the driving or operation of transportation equipment (R Guild, *et al.* 2001). Vibration can be due to the machinery itself or the road surfaces. In the Mining Industry equipment that has been categorised in terms of risk according to the levels of vibration are indicated in Table 8 below:

Table 8: Mining equipment categorised in terms of risk according to vibration levels	
Equipment	Risk
Articulated dump trucks	High
Bulldozers	High
Front-end loaders	High
Hydraulic shovels	High
Tractor tippers	High
Underground locomotives	Moderate
Load haul dumpers	Moderate
Shuttle cars	Low
Draglines	Low

[R Guild, RI Ehrlich, JR Johnston, MH Ross, 2001, A Handbook on Occupational Health Practice in the South African Mining Industry, The Safety in Mines Research Advisory Committee (SIMRAC)].

It is important to use the abovementioned table only as a guideline since machinery may cause different vibrations under different conditions, e.g. if the machine is not properly maintained, the engine may vibrate excessively. Worn suspension and conditions of the road will also influence the vibration transmitted to the driver of the vehicle, therefore all vehicles are potential sources of whole-body vibration (WBV) (R Guild, *et al.* 2001).

Ergonomics, if literally translated means “the laws of work”. Ergonomics describes the interaction between the operator and the job demands, and is concerned with aiming to reduce unnecessary stress in the workplace (R Guild, *et al.* 2001). Furthermore ergonomics seeks to design equipment, tools, workstations and tasks that are compatible with human capabilities and limitations with the purpose of providing work conditions that assure safety, health, well-being and efficiency. The characteristics of the workspace and the environment will affect the task performance of the human.

Factors like size and layout will have an effect on the body position, body posture and reach distances of the expected user population, and consequently on comfort and efficiency (R Guild, *et al.* 2001).

Challenges for women in the mining environment include:

- The discriminatory view of males, that women are mentally and physically weak.
- Sexual and verbal harassment.
- Unavailability of physical facilities such as ablution facilities etcetera.
- When women become pregnant while working in a hazardous environment.

“If you go for playoffs for rugby you cannot expect to play soccer, therefore if women enter into a male-dominated environment they should stand their ground with the necessary support structures that are in place.”

-A Heine-

Biologically there is a vast difference in the compilation of women versus men as well as individuals. The responsibility of the Mining Industry is to create a safe working environment and this is being challenged with the introduction of the weaker specie, women, and their special needs.

2.5 Infrastructure

Infrastructure forms part of the barriers that exist when women are introduced in the Mining Industry. The most common infrastructure barriers have been identified as the following:

1. Ablution facilities and change rooms
2. Housing facilities
3. Work-life balance
4. Childcare facilities
5. Personal safety and security

When we look at the detail of the abovementioned infrastructure barriers, we can determine the impact of each of these barriers and prioritise the rectification thereof.



Ablution facilities and change rooms

The unavailability of physical facilities underground is largely due to the fact that the Mining Industry was dominated by males and therefore the need for these facilities did not exist, but now increasingly more women are entering into the core functions of the Mining Industry. Mining Houses need to look at changing their old ways to accommodate the needs of women. This goes hand in hand with the poor conditions of the facilities that are available which do not cater for the added needs of women, especially during their menstrual cycle. This leads to female employees staying at home during this period, as was detected by the trend of long records of absenteeism each month. The mines should ensure that the ablution facilities at least have lockable doors with sanitary bins that can be serviced and maintained and that these facilities created for women be dedicated to the female employees.

The change room facilities are currently designed to be suitable for the use of men and the criteria for dedicated “female friendly” change room facilities should at least include screened-off showers by means of walls or shower curtains. Therefore private cubicles should be created for female change rooms, whether underground or on the surface.

Housing facilities

There are two options with regards to housing facilities, namely hostel accommodation which the mine provides to its employees versus living-out allowances that are paid to employees. This allowance will typically be paid out to employees of a mine when the mine does not provide mine accommodation. Looking at hostel accommodation, children are not allowed because it poses numerous problems such as secondary health issues, safety and child care facilities and if these special facilities are offered to females it should also be offered to males. Therefore, one would believe that the option of paying living-out allowances to all employees is more favourable.

Work-life balance

Gone are the days when employees were content to arrive at the office every morning, sit in their assigned office space and work away until it was time to go home. Our employees are more demanding, more questioning, do not accept authority blindly, but most importantly, they demand to be seen as whole human beings.

Work-life balance becomes increasingly important to control with today's "fast moving" career and evolving business arena. People become goal and target driven at any cost, be it at the expense of your role as wife, husband, mother, father, home keeper, home protector, etcetera. The Mining Industry is booming and people experience a lot of pressure to comply with the demands of the markets. If one cannot manage the balance between your work and your family life, you often find yourself in a situation where workload and pressure interfere with your physical and mental health. This in turn can have a negative impact on the workplace should the employer not look at assisting employees to balance their work and their personal life.

The negative effects may consist of high absenteeism with regards to stress-related symptoms, time away from work to attend to family responsibilities, etcetera. If we go back to the demands of the Mining Industry a typical underground shift is between eight to twelve hours of hard physical work. This results in low energy levels and lack of strength to attend to dependants and housework at home. Another challenge is that single parents or guardians who need to support their children often have to seek alternative means to get the children to and from school and school activities, etc. especially when working long hours and working night or dayshifts. If working night shift someone must take care of the children. These are current and valid challenges employees are often faced with.

Childcare facilities

Women enter the Mining Industry mostly as a means of survival and for the money. It is common amongst African cultures that if parents have passed away the eldest daughter will fulfil the duties of the mother and have to provide for the children and

housework. Some of these female employees suffer from working excessively long hours and still having to attend to the children and do some housework when they get home. This often leads to health conditions such as stress, chronic fatigue, premature ageing and psychological problems.

Personal safety and security

There are several areas that have been identified as higher safety and security risks for female employees. These areas usually include the cages, underground, change rooms, dark places, individual security searches and medical treatment. Sexual harassment also forms part of this barrier.

- Females' safety in the cages is often compromised due to the number of people in the cage as well as the lighting. The overcrowding and darkness in cages could result in unwanted physical contact and physical injury. Horseplay between males places females in a situation where they are unable to single out the perpetrator.
- Females' safety underground. The conditions underground are usually of such nature that there is a risk for female employees to be separated from the rest of the work team and this will isolate her to be vulnerable to sexual harassment.
- Security of female employees at change rooms can also be compromised if access of unwanted parties to the change rooms is allowed and the gender of the cleaners is not considered.
- Individual security searches should be gender specific to ensure that the security and safety of female employees is not compromised. Applying the mine's sexual harassment policy to security personnel can also be seen as a preventative measure initiated by the employer.
- During the treatment of illnesses, injuries and emergency medical treatment it is important that it is a priority to save lives and there is no difference between male and female employees. Caution should be taken when removing clothing, in the case of heat stroke, burns, etcetera and touch when applying pressure to bleeding. The correct procedure would be to ask for consent from the respondent should she be able to respond. A sexual harassment policy should be in place to educate employees. What should also be addressed in the sexual harassment policy are the consequences of unfair or ungrounded sexual harassment accusations.

One of the most concerning issues when focusing on women entering a male dominated environment is sexual harassment, which prevails more frequently when females enter traditional male fields of work (Dr. C Badehorst, June 2007). There are four forms of sexual harassment, namely: physical conduct or contact, verbal acts such as insults or jokes, non-verbal forms of sexual harassment such as pictures and objects and lastly sexual favouritism which includes hostile working environments. Therefore it is of utmost importance that the sexual harassment policy should be in place and should contain the code of good practice that recognises the right for dignity and equality, defining sexual harassment emphasising “no” means “no”, what constitutes sexual harassment, zero tolerance approach and lastly the right as well as the procedure for lodging a grievance.

2.6 Personal Protective Equipment (PPE)

Personal Protective Equipment includes:

- Ear protection
- Safety glasses
- Respirator
- Hard hat
- Cap lamp
- Battery
- Mining belt
- Overalls
- Gloves
- Safety boots
- Self-rescue pack

Personal Protective Equipment is currently designed for the use of males only and does not have specific requirements for female employees. Mines currently make use of the general male-based Personal Protective Equipment that is available and generally constitutes the following issues:

- The sizes of equipment are normally too big. Although this seems to be insignificant, incorrectly sized Personal Protective Equipment poses a number of risks in itself, such as clothing getting caught in equipment.
- Overalls that employees wear often compromise the privacy of female employees and are not practical to put on and remove during the shift.
- Correctly sized safety boots are usually not to be found at the stores.

2.7 High turnover of women

Mines are reluctant to train and place women in artisan and engineering positions, due to the physical nature of this work as well as the female employees' unwillingness to establish themselves in these careers. In the research done by Coaltech 2020, mines reported that they were unable to retain the women that opted for these newly created opportunities, mainly because once exposed to the mining environment, specifically underground, they opt for less physical demanding positions. Furthermore, after Mining Houses had invested high amounts of training costs in these female employees, the latter move to other non-mining industries. This is mainly because of the strenuous environment of the mines.

2.8 Cultural differences

A holistic approach to biological, socio-political, cultural and various belief systems that shape human development, thinking and behaviour are examined to determine factors influencing gender balance and gender relations and how these dynamics influence socialisation of males and females. The deviation of filling core occupations by gender preferences causes a reaction of reluctance, which can be expected because change is an intimidating phenomenon. Despite the ability of women to perform most of the tasks assigned to them, there will come times when they will need assistance from their supervisors or fellow male employees. Due to cultural differences and different thinking patterns little or limited support from the male employees will be given to female employees when needed. This implies that not only should the infrastructure be changed due to the introduction of women into the Mining Industry but also change in

team structures, interpersonal relationships and the sense of acceptability by fellow male employees and supervisory level.

From the Coaltech 2020 study the following thoughts and responses of the male employees, with regards to the integration of women into the Mining Industry, included:

- Shock and disbelief, how will women be able to make it if the environment as tough for them as men.
- Could not reconcile with the thought of women working alongside men in physically strenuous conditions.
- Almost certain female employees were not going to survive their first month on the job.
- No place for women who are comparatively seen as fragile.
- Younger men are of the opinion that this is an unfair employee practice seeing that “equal work for equal pay” is the norm and therefore leniency or favouritism exists with regards to the introduction of female employees which construes unfair employee practice.

2.9 Cost Implication

It is clear that the abovementioned challenges and barriers all have a financial implication, largely with regards to the organisation having either to change the environment, infrastructure, paradigms of male employees and supervisors in order to successfully integrate women in the Mining Industry.

“The human race is a two winged bird, one wing is female and the other is male. Unless both wings are equally developed the human race will not be able to fly.”

- B. Boutros Ghali -

CHAPTER 3

IMPLEMENTATION MODEL FOR EMPLOYING WOMEN IN MINING

3.1 Introduction

A literature study was done and informal interviews were conducted with employees from Delmas Coal (Pty) Ltd. From this the barriers to introducing women in the Mining Industry were identified. Two survey questionnaires were developed (refer to Addenda) and circulated amongst employees. The purpose of these questionnaires was to verify existing barriers that were previously identified and to determine if there were any other or new barriers that exist when introducing women in the mining industry. From this whole process a Model was developed to assist organisations when introducing women into the Mining Industry.

A Questionnaire will be developed to accompany the Model to the Panel of Experts where each item in the Model will be validated. When the feedback comes back from the Panel of Experts the Model will be adapted to the final Model that can be used by organisations to effectively introduce women in the Mining Industry.

The essence of the problem statement is therefore threefold, namely legislation prescribes it; the value women add and equality of rights; and human rights issues. As the problem statement is threefold, the model considers the three primary parties involved in the process of introducing women into the Mining Industry. This is the first phase of the model, namely “single snapshot at any given time”. These primary parties are:

1. The Organisation
2. Men
3. Women

In the model it is illustrated that these three parties function interdependently of each other. The primary concern for each of the parties mentioned above is: The Organisation – the cost implication; Men – paradigm shift; and Women – barriers that

exist in the Mining Industry. The suggested solutions and focus areas for each of the parties are considered. The communication channels between these parties contribute vastly to the success of this model. This is only the first or groundwork phase of the process.

Phase Two of this model is the “repetitive process over a period of time”. Meaning Phase One in the model, at any given time, should be monitored and re-evaluated in order for this change intervention to progress. After monitoring and re-evaluation took place, a decision can be made with regards to continuing with the system or adapting the system to the changes in the economy, legislation and technological macro-environment. This process should be repeated on a continuous basis depending on the needs of the specific organisation.

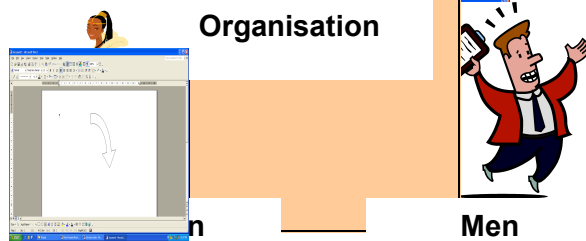
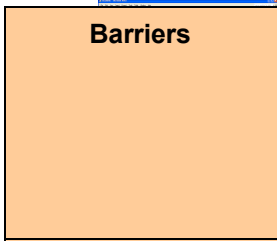
The role of the Human Resources department in this process will be stipulated and will mainly be limited to that of a facilitating and advisory role.



Diagram 2: A Model for Managing the Barriers of Introducing Women into a Mining Industry

Phase One: Single snapshot at any given time

- Set groundwork for organisational culture
- Strategy
- Involvement and commitment
- Budget, for example pregnancy



- Awareness of environment
- Training & induction
- Your choice
- Competency
- Confidence, transform thoughts about self
- Own responsibility
- Value self
- Networking

- Training
- Change Management
- Mentoring and Coaching Skills Development
- Interpersonal Skills
- Leadership
- Emotional

3.2 Phase One: Single snapshot at any given time

The first party involved in the process of introducing women into the Mining Industry that we are going to look at in greater detail, is the organisation. Looking at the organisation the primary concerns with regards to implementing women into the Mining Industry, initially included setting the groundwork for organisational culture. This typically involves creating and implementing the necessary standard operating procedures, codes of practice as well as policies that are potentially needed to ensure the smooth transition from a male dominated environment to a more diverse environment. To foresee possible difficulties and problems will assist in setting an environment conducive to the changes that come with introducing women in the Mining Industry. Taking into consideration all the areas that are affected by the changes, it is crucial to align the organisation's strategy with the targets set by the Mining Charter as well as the business and departmental strategic and operational goals.

Policies such as the maternity leave policy, sexual harassment policy, training policy, Personal Protective Equipment standards, operating moving machinery, ergonomic design standards, all Human Resource policies pertaining to job description, physical requirements, etcetera should be drawn up and implemented. Infrastructure and machine design should be addressed and considered to be conducive to the needs of women. Budgets should be drawn up in such a way that it allows for leave reliefs, waste removal, training and miscellaneous costs that may be incurred.

Once the groundwork has been done and set to be favourable for the changes of introducing women into the Mining Industry, then the strategy can be aligned with the operational and departmental goals to reach 10% women representation in the core functions of mining. The involvement and commitment from top to bottom should be visible and adequate in order to successfully transform the organisation to a diverse organisation, which proclaims a culture where women can also proceed with their career goals. Looking at the abovementioned factors that the organisation needs to consider, when introducing women into the Mining Industry it is clear that there is a large cost implication to be considered by the organisation. In order to minimise the cost implications, organisations are often faced with challenges such as correct budgeting,

planning and determining potential changes from which cost emanates.

Keeping in mind that the organisation has certain responsibilities that need to be met, let us stand still for a moment and explore the implication of this statement.

According to the Mine Health and Safety Act, 1993 (MHSA No. 85 of 1993) and Codes of Practice, the employer has several duties with regards to occupational health and safety in the South African Mining Industry. These duties include:

- Operating the mine in a healthy and safe manner
- Implementing a health and safety management system based on risk assessment principles
- Supplying and maintaining the necessary health and safety equipment and facilities at the cost of the mine
- Appointing persons to manage the mine according to set standards
- Establishing a health and safety policy
- Preparing and implementing Codes of Practice as required by the Chief Inspector of Mines
- Providing all employees with information, instructions, training and supervision to enable them to work safely and without risk to health

Every mine must have a system of medical surveillance for employees exposed to health hazards (T Parker *et al.* 2004). The system of medical surveillance must be designed so as to - provide relevant information to the employer for the purpose of controlling the health risk; and for:

- Preventing;
- Detecting; and
- Treating occupational diseases.

Initial medical examinations that are conducted when starting work at the mine should also serve the purpose of ensuring that the female employee meets the set minimum standards of fitness laid down for the specific position that the employee will fulfil. For the period that the employee is employed at the mine, the yearly periodic medical examinations should serve as a monitoring tool (R Guild, *et al.* 2001).

As the Mine Health and Safety Act imposes certain duties on the employer, the Act also requires employees to take reasonable care to protect their own health and safety as well as that of their fellow employees (MHSA No. 85 of 1993). This involves employees participating in health and safety by means of health and safety representatives, full-time health and safety representatives, health and safety committees, training and information sharing.

The employer's legal responsibility with regards to noise includes (R Guild, *et al.* 2001):

- Risk assessment
- Noise control engineering
- Noise monitoring
- Medical surveillance
- Hearing and Safety training for noise-exposed employees to reduce the risk of Noise-induced Hearing Loss (NHL)
- Provision of appropriate Hearing Protective Devices (HPD's) to noise-exposed persons
- Compilation of a Code of Practice for controlling noise and managing the risk of Noise-induced Hearing Loss (NHL)

The employee's legal responsibility and obligation to noise hazard include (R Guild, *et al.* 2001):

- The proper use and care of Hearing Protective Devices (HPD's)
- Reporting problems that may preclude or limit the use of Hearing Protective Devices (HPD's)
- Reporting noise sources, communication problems or perceived lack of protection

All of the above groundwork should be done in co-operation and consultation with the other two parties, namely the men and the women employees. Without their buy-in and ownership this exercise will be futile. Getting them involved from the start will save time, and time is money.

Not only should we look at the organisation, we should also look at each of the other

parties' needs and expectations during this change intervention. Therefore we will now look into more detail at these interdependent parties.

The second party's involvement in the change process of introducing women into the Mining Industry that we will look at, is that of men. The primary aspect that needs to change when looking at male employees, is their paradigm of females being the weaker specie and not capable of functioning in the mining environment. The mining environment was seen from the men's perspective as essentially male dominated due to the reasons of women being the weaker specie and not having the mental and physical capabilities to cope in the core functions of the mine. Women were allowed to work in the so-called "soft jobs", and started working underground in 1996. The Model suggests typical ways to address the change from the old paradigm to the new suggested way of thinking, encouraged by the introduction of the Mining Charter and the Employment Equity Act.

Training in Diversity, Change Management, Mentoring and Coaching Skills, Interpersonal Skills, Leadership and Emotional Intelligence is essential to shift the paradigm of male employees. Shifting a person's paradigm is a process of emotional and personal growth and will need an intervention on its own to constitute this type of change in a person's thinking. The unknown creates fear, fear for not knowing how to handle these changes, how this will affect my position, my culture differs from what is expected from me at work, etcetera. Information is power and by transferring knowledge by means of training, coaching and facilitating will assist with the process of shifting paradigms. It is evident that people will be more prone to defensive strategies due to lack of knowledge. Therefore if organisations equip male employees, supervisors and managers with the necessary knowledge which they might be confronted with, it will ensure establishing a better working relationship and working more effectively as a team within the organisation. Again these training interventions have a cost implication to the organisation and should be pre-determined and planned for.

The third party's involvement in the change process of introducing women into the Mining Industry, is women. The critical and primary concern, which derives from the introduction of women into the Mining Industry, is the barriers that were raised and

confirmed in the Questionnaires that the sample group of employees completed. The following barriers were identified:

1. Physical differences between males and females: Men and women are different in aptitude, skills and behaviour, but then so is every individual. The big protest is with regards to several physical factors, biological factors and most of all the fact that women can fall pregnant, which has a lot of specific risk factors for the mother and her unborn child.
2. The Mining environment for women: the following key issues come to mind when referring to the mining environment, namely physical strain, fatigue, shift work, not an environment where women's basic needs are considered. The Mining environment further includes the discriminatory male view that women are mentally and physically weak, sexual and verbal harassment, the unavailability of physical facilities such as ablution facilities, and when women become pregnant while working in a hazardous environment they need to be removed from this endangering area.
3. Infrastructure refers to the following key issues that the organisations and women are faced with:
 - Ablution facilities and change rooms
 - Housing facilities
 - Childcare facilities
 - Machine designCurrent structures only cater for the male employees' basic needs and do not cater at all for the different needs women have with regards to the above-mentioned.
4. Work-life balance becomes increasingly vital to control with today's "fast moving" career and evolving business arena. People become goal- and target-driven at any cost, sometimes at the expense of their role as wife, husband, mother, father, home keeper, home protector, etcetera. The Mining Industry is booming and people experience a lot of pressure to comply with the demands of the markets. If one cannot manage the balance between your work and your personal life, you often find yourself in a situation where workload and pressure interfere with your physical and mental health. This in turn can have a negative impact on the workplace should the employer not look at assisting employees to balance their work and their personal life.

5. Personal Protective Equipment is currently designed for the use of male employees only and does not have specific requirements for female employees. Mines currently make use of the general Personal Protective Equipment that is available and this male-based Personal Protective Equipment generally constitutes the following issues: the sizes of equipment are normally too big, although this seems to be insignificant, the incorrectly sized Personal Protective Equipment poses a number of risks in itself. Overalls that employees wear often compromise the privacy of female employees and are not practical to put on and remove during the shift.
6. Personal safety and security: there are several areas that have been identified as higher safety and security risks for female employees. These areas usually include the cages, underground, change rooms, individual security searches and during medical treatment. Sexual harassment also forms part of this barrier.

Suggested interventions to overcome these barriers all start with recruitment of female employees. Job profiling done by the organisation plays an important role in recruiting the suitable candidates for the vacancies that exist. Part of effective job profiling is the physical demands of the specific job. Once the female applicant has been successfully measured against fulfilling the physical demands of the job, awareness of the mining environment is essential. This is to ensure that the candidates are fully aware of the mining environment and what it involves to work underground. Awareness of the mining environment is created through induction employees receive. The reason for creating awareness of the mining environment is ensuring the female recruits are of the opinion that “it is my own choice to work in the mines and I know what is expected of me”.

Training should be incorporated in the early stages of employment with the focus on areas such as technical competencies, confidence, transforming the thoughts about their self-worth and responsibility. The organisation should go a step further in assisting females to adapt to this environment by creating an environment where women can do some social or work-related networking. This is the platform where what was learned is reinforced and practised. Focusing on survival techniques for female employees, making it in a male dominated environment, is typically where life skills can be picked up.

It was earlier mentioned that the three interdependent parties, each with their primary

concerns which are intertwined, with the co-operation of each to successfully function as a whole, need to have a fine understanding of communication. Communication in this threefold interdependent system includes the following:

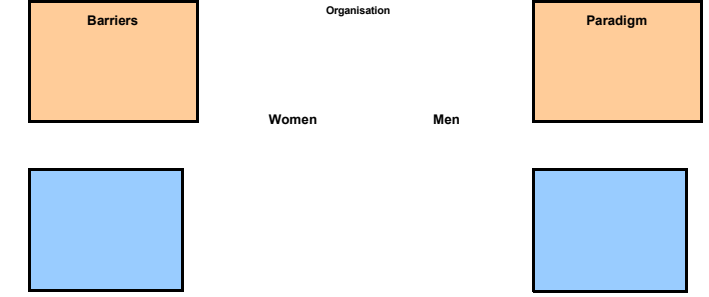
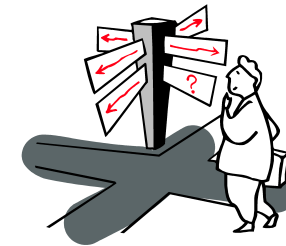
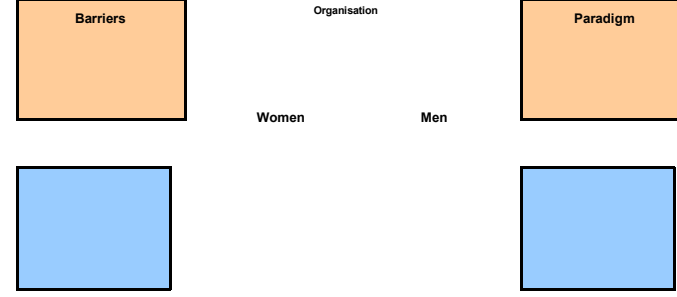
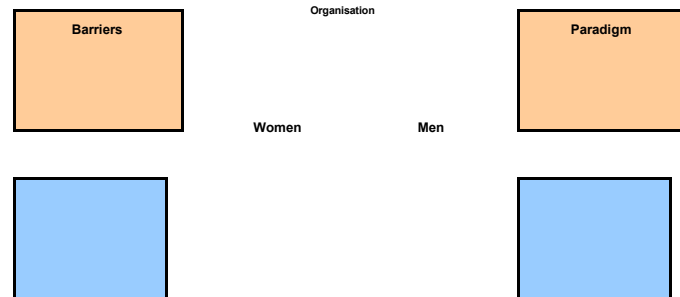
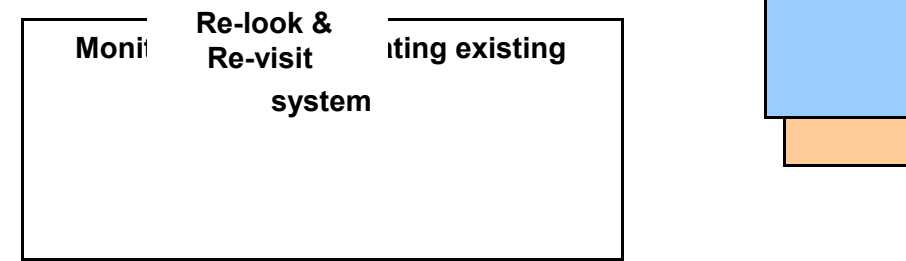
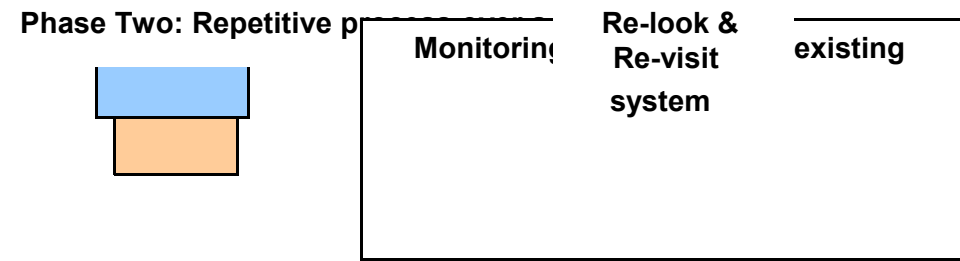
1. Dialogue, which has the goal of going beyond one person's understanding. The goal is not to win, but for the team to reach a deep, common understanding.
2. Two-way communication involves communication taking place from the sender to the receiver. The receiver provides feedback to the sender and the sender is receptive of the feedback.
3. Downward communication is information that flows from higher to lower levels in the organisation's hierarchy. This typically involves policies, coaching, etcetera. Upward communication is where the information flows from lower levels to higher levels in order for management to gain more insight, and to obtain an accurate picture of what is going on. Horizontal communication is information shared amongst people at the same level. Typically it is either formal or informal such as the "grapevine" and networking (TS Bateman *et al.* 1999).

3.3 Phase Two: Repetitive process over a period of time

In the second phase of the model, communication will typically be feedback, but is not limited to only feedback but dialogue and two-way communication can also exist. Primarily feedback with regards to the monitoring and evaluation of the systems and their interdependence is communicated to all the stakeholders and parties involved.

Feedback is given once a snapshot of the threefold system has been revisited and evaluated to determine whether or not the systems, procedures, policies, training, change interventions, etcetera, that have been implemented are yielding the desired results.

A closer look will now be taken at Phase Two of this Model of Introducing Women into the Mining Industry. On the following page is an illustration of the second phase.



Role of HR

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

Role of HR

5. Position
6. Marginality
7. Emotional Demands
8. Use of knowledge and experience

Role of HR

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

Human Resources will take on the role of Organisation Development Practitioner throughout this process in which they will provide a service to top managers, functional departmental heads and staff groups. These Organisation Development Practitioners will ultimately consist of foundation competencies, which are orientated toward description of an existing system, as well as core competencies, which are aimed at how systems change over time (Cummings &

First Evaluation

Worley 1999).

Second Evaluation

Cummings and Worley believe the role of Human Resources as Organisation Development Practitioner involves the following:

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

Time Line of Repetit

The role of the Organisation Development Practitioner is often positioned in the Human Resources department. The organisation can also contract an external consultant to fulfil this Organisation Development Practitioner role. However, the advantage of having an internal party such as Human Resources to fulfil this role is simply because they save time to identify the organisation's culture, informal practices, and sources of power. They have access to a variety of information, including rumours, company reports, and direct observations (Cummings & Worley 1999).

Marginality is required of the Organisation Development Practitioner and he or she is the one who successfully straddles the boundary between two or more groups with differing goals, value systems and behaviour patterns. Being objective and flexible will create the perception that you are on both parties' sides, which will enable you to reach a solution or common ground more effectively (Cummings & Worley 1999).

Thirdly, emotional demands are high for an Organisation Development Practitioner and understanding emotional intelligence can aid the Organisation Development Practitioner in conducting successful change efforts. This can be done by recognising and expressing emotions appropriately and using emotions in thoughts and decisions. Furthermore, to regulate emotions in oneself and in others, will minimise and control

having an emotionally charged change intervention. The implication of an emotionally charged intervention is usually associated with emotionally disruptive behaviour rather than behaviour that is channelled towards positive inputs and progress (Cummings & Worley 1999).

Lastly, the use of knowledge and experience plays an important role in facilitating this process and taking on the advisory role at certain stages of the change intervention.

To summarise, the model for introducing women in the Mining Industry consists of two phases, namely:

1. Phase One: Single snapshot at any given time
2. Phase Two: Repetitive process over a period of time

Phase One, is a single snapshot taken of the organisation at any given time, focusing on the three parties involved in this intervention and their individual and interdependent interventions at that given time. In this phase, establishing whether the groundwork for the change intervention is in place, is important. This will form the basis for the second evaluation that will take place after a certain period of time has lapsed. Therefore once Phase One is complete, the organisation is ready for Phase Two of the model.

Phase Two of the model involves monitoring the single snapshot of the previous phase and re-evaluating the current system that is in place. Progress should be measured with regards to the end goals in mind. Should the systems, interventions, changes and training be effective or ineffective, Phase One should be re-looked and re-visited. This process should be repeated over a period of time where a single snapshot of the system should be taken, evaluated and the progress measured. The “adapted” groundwork, if necessary, should form the basis for the third evaluation of the system. This will ensure that the system is adapted if deemed necessary and progress will be tracked until targets are reached over a repetitive time line. Therefore you will not re-invent the wheel every time but rather build on the groundwork that was previously done.

CHAPTER 4

RESEARCH METHODOLOGY

4. Introduction

As explained in Chapter One, the purpose of this study is to develop a model which an organisation can use to overcome and manage the barriers that have identified when women are introduced in the Mining Industry, which is known to be a male-dominated environment. With specific reference to the different barriers that exist from the women's, men's as well as an organisational perspective.

The type of study would be explorative due to the fact that the introduction of women in the Mining Industry is relatively new. No extensive research has been done on this current challenge that organisations within the Mining Industry are faced with.

If one looks at history, the importance of this study is evident. Since the first democratic election that was held in 1994, a new government was introduced which resulted in changes of government policies and legislation. This led to a number of changes that impacted on the different industries. The Mining Industry was impacted to a large extent with the introduction of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) and the Mining Charter.

Emphasis was placed on a non-discriminatory working environment, where no discrimination will be tolerated with regards to gender, race, sex, pregnancy, marital status, family responsibility, ethnic or social origin, colour, sexual orientation, age, disability, religion, HIV status, conscience, belief, political opinion, culture, language and birth.

This change in legislation and government policies has brought specific challenges to the Mining Industry. For the Mining Industry to comply with these legislative requirements, certain issues need to be addressed and as stated in the Employment Equity Act and the Mining Charter, the necessity of appointing women in the Mining Industry becomes a challenge that needs to be addressed. 10% of the total workforce

should be women, which emphasises the importance of making this transition successfully, since the Mining Industry is a male dominated environment. Although this legislation was already in effect since 2002, no significant progress has been made to reach the target of 10%. Therefore it must be accepted that there are specific challenges that prevent organisations from achieving these targets.

Research is limited on this topic, which leaves no prescribed method or guideline to address this current dilemma that organisations are facing.

Addressing the challenges organisations, women and men are faced with, will ensure a smoother transition of the changes that legislation and government policies have brought about. This will also lead to more job opportunities and economic wealth. Living standards and community development will also be affected and improved by these changes on the basis of more skills-driven people. All of this is what the nature and results of the study will contribute to the community.

The contribution that this research project will have to the researcher's field of study, is to develop a model that the organisation and management can use with regards to this organisational development process. This needs to be done:

- To adhere to the guidelines laid down by the Mining Charter.
- To ensure that fairness and conducive workplaces are established and that community upliftment and skills development are initiated.
- To facilitate diversity in the workplace and train people where the need arises.

This study intends to answer the following specific research questions:

1. How can the organisation make the transition from a male dominated environment only, to a gender-diversified environment more manageable?
2. How can the barriers that come with introducing women in mining be overcome or minimised for women to add value in the positions they are appointed in?
3. How can the psychological transition from the traditional male paradigm be

facilitated to incorporate equalities of rights in a male dominated environment?

This study will attempt to answer some of these questions. In order to do this a suitable research method must be used to obtain the desired answers. This Chapter will cover the choice of research approach, the design, the procedures through which the data was collected and how the data was analysed.

4.2 The research approach

For this study, a literature review was conducted via studying material, in this case various articles and case studies. These materials contain information about the barriers that are under scrutiny in this study. The Survey Questionnaire was based on the literature review to serve as verification of the existing barriers and to determine if those barriers were the same at different Mining Houses. From this a Model to overcome and manage the barriers was developed (refer to Chapter 3). Although a mixed-methods approach has been used, the focus was on a qualitative research methodology approach (De Vos, 1998). The reason for using the qualitative approach is because of the limited research that has been done on this topic. Theory will be gathered and verified during the data collection process.

4.3 The Research Design

The research will be used as applied research, which means that the specific concern about introducing women in the Mining Industry will be examined, with the intention of developing and testing a suitable model as a possible tool for overcoming these challenges that not only the organisations are faced with, but also all female and male employees.

The purpose of the Survey Questionnaire was to verify the attitudes of a collection of people that will be gathered and observed at one time, therefore the time dimension of this research will be seen as cross sectional. The Questionnaire is based on people's experiences as well as the already identified barriers.

The research will be conducted by looking at males and females currently employed within the Mining Industry with specific reference to the Coal Mining Industry. The population on which the study was conducted typically had the following characteristics:

- More experienced males, typically 15 years plus experience.
- The younger generation males and females between the ages of 18 – 30 years with limited working experience ranging between 0-5 years.

The survey questionnaires, to be used in this study, will be distributed amongst the different Mining Houses in various geographical locations within the boundaries of South Africa. This will be done over a period of two months, after which analysis and consolidation of the questionnaires will be done. The aim is to verify existing barriers and to identify possible new barriers that may exist.

4. Data Gathering

The data-gathering technique that will primarily be used is historical – comparative research, which will examine aspects of social life in a past historical era across different cultures. Theory will be combined with the data that is collected and a mix of evidence including existing statistics, documents, observations and interviews are used (Neuman, 2003).

Two survey questionnaires were developed, one to verify and gather the perceptions, feelings and experiences of females in a male dominated environment. The second survey questionnaire was specifically designed to determine the underlying issues that men experience and feel, surrounding the implementation of what legislation prescribes and the principles laid down by the Mining Charter. The reasons for developing two survey questionnaires were to reinforce barriers that were already identified from literature, and to determine whether there were any additional barriers that exist when introducing women in the Mining Industry. The information gathered from the survey questionnaires aided with developing the model that will assist organisations to overcome and manage the barriers when introducing women in the Mining Industry.

The questionnaire was specifically chosen for data gathering because it had the following advantages (Neuman, 2003):

- This is the most cost- and time-effective manner of gathering data and can be conducted by a single researcher.
- This type of data-gathering technique can cover a wide geographical area.
- Furthermore the questionnaire can cover a larger size of the population to ensure that all types of people are ultimately represented in the study.
- The respondents can complete the questionnaire when it is convenient for them.
- A questionnaire eliminates the bias factor in an interview.

4.5 Population and Sample

For the purpose of this study, two different sample groups were used:

- For the verification part to verify existing barriers and to determine if there were any new barriers that could be identified, the sample group used were employees in the Mining Industry; and
- For the development of a model to manage and overcome the barriers of introducing women in the Mining Industry, the sample group that will be used is the Panel of Experts.

According to what Flick believed “for qualitative researchers, it is their relevance to the research topic rather than their representativeness, which determines the way in which people to be studied are selected”, non-random samples were used (Neuman, 2003). Although non-random samples were used, the samples came primarily from the Mining Industry with specific reference to the Coal Mining Industry. The sample size that was used was not determined beforehand.

Quota sampling was the method of determining the sample for the first part of this study. The two relevant categories that were identified were divided according to gender (male and female). This would ensure that both perspectives were considered when answering the research questions.

For the second part of this study, 10 experts will be identified, therefore the Panel of Experts will be chosen non-randomly. The criteria used to select the Panel of Experts included the following:

- Must be employed in the mining environment
- Job level should be at least D-level on the Patterson grading system
- At least 5 years' experience in a management position
- Must be actively involved in Mine Level Committees that look at complying with and implementing certain targets as laid down by the Mining Charter and the conversion of Mining Rights
- Must be a Member of South Africa Coal Managers' Association Committee or any other registered professional organisation within the Mining Industry.

The Panel of Experts will be evaluating the model to determine its relevance and validity. The following are the aspects that will be considered during the evaluation:

- The validity of the integrated model.
- Content validity of the integrated model.
 - The content evaluating panel.
 - The content validity index.
- Evaluation questionnaire
- Elaborating the information (Warnich, 2001).

4.6 Measuring Instrument

The specifically compiled questionnaires are used to measure the research questions mentioned earlier in the proposal. Furthermore the questionnaire is designed in such a way that it will confirm the already existing barriers that were identified for introducing women in the Mining Industry. The questionnaires were designed in such a manner that it is easy and quick for the respondents to answer and for the researcher it is cost effective, easy to compare and anonymity is ensured.

The time it takes to complete the questionnaires was kept brief, between 25 - 30 minutes for the Female Questionnaire and 10 – 15 minutes for the Male Questionnaire. A lengthy questionnaire discourages the respondent and he or she would not give a true picture of current experiences. Where illiterate people are required to answer the questionnaire, an interpreter will be present to assist with overcoming the language and literacy barriers. The questionnaires will only be available in English.

See Addenda for examples of the two Survey Questionnaires that were distributed to the respondents for completion.

The Female questionnaire consists of 22 questions, which comprises the following type of questions:

- Seven Multi-response questions
- Six Yes or No questions
- Four open-ended questions
- Three Agree or Disagree questions
- One multiple-choice question
- One True or False question

The Male Questionnaire consists of 10 questions, which comprise the following type of questions:

- Four Multi-response questions
- One Yes or No question
- One Open-ended question
- Three Agree or Disagree questions
- One Multiple-choice question

The questionnaires are used to measure the research questions mentioned earlier in the proposal. Furthermore, the questionnaires are compiled in such a way that one will also confirm the already existing barriers that were identified for introducing women in the Mining Industry.

The questions in the Female Questionnaire are based on previously identified barriers that exist when women are introduced in the Mining Industry, as well as people's experiences from working in the industry for a long time.

4 Validity of the study

Lawshe (1975) developed a technique where content validity can be quantified by means that are acceptable in general. This technique consists of a Panel of Experts, which he calls a content evaluation panel in a specific study field that can evaluate the items used in the model that was developed for this study. The panel for this study consists of ten people that are experts in the Mining Industry and are concerned with the development of the organisation according to changes laid down by legislation.

.1. The content evaluation panel

Every individual on the panel will receive items relating to the model that he/she needs to validate individually. The evaluations of the individual panel members are then combined to determine the specific value of these evaluations. Two important assumptions have to be made:

1. Every item that is labelled as "necessary" or "very applicable" consists of a specific level of content validity.
2. If more than 50% of the panel values an item as "necessary" or "very applicable", the greater its content validity will be (Warnich, 2001).

Lawshe (1975) also compiled a formula for determining the content validity ratio (CVR):

$$\text{CVR} = \frac{\text{Ne} - (N/2)}{(N/2)}$$

Ne is the total number of members that have chosen the option “necessary” or “very applicable” and N is the total number of members on the panel. The CVR is the direct linear conversion of the percentage that had chosen the option “necessary” or “very applicable” but it is useful in this form if you look at its characteristics. If less than 50% of the panel chooses “necessary” or “very applicable”, the CVR is negative.

If 50% of the panel chooses “necessary” or “very applicable” and the other 50% does not, then the CVR will be negative. In the case where everyone chooses “necessary” or “very applicable”, the CVR will be calculated at 1.00. This is adapted to 0.99 to make manipulation easier. If the number of members that choose “necessary” or “very applicable” are more than 50% of the panel but not all of them, then the CVR is between 0 and 0.99.

.2. Content validity index

To determine the content validity of the integrated model it is necessary to:

- Determine the items that will have significant CVR values.
- Calculate the mean content validity index (MCVI) for the model as a whole.

A minimum CVR of 0.99 is required. This requirement is determined by the number of members on the panel (see Table 9). Only the items that comply with the requirement will be included in the final format. When these items are identified the MCVI will be calculated (the mean of the CVR values of the items that are left out).

Table 9: Minimum Values of CVR	
Number of members on the panel	Minimum CVR-values*
5	0.99
6	0.99
7	0.99
8	0.75
9	0.78
10	0.62
11	0.59
12	0.56
13	0.54
14	0.51
15	0.49
20	0.42
25	0.37
30	0.33
35	0.31
40	0.29

- * Every item that is labelled as “necessary” or “very applicable” consists of a specific level of content validity.
 - If more than 50% of the panel values an item as “necessary” or “very applicable” the greater its content validity will be (Warnich, 2001).

3 Implications for internal validity of the study

High internal validity is expected, because the questionnaires are structured in such a way that employees will answer the questions based on their experiences and the questions are based on already identified barriers that exist when appointing women in the mining environment.

Honesty of the respondents always influences the validity of the study. The only way in which this can be eliminated is to inform the facilitator that he or she should instruct the learners to answer all questions honestly. The fact that the completion of the questionnaires is voluntary should be emphasised by the facilitator. This is to ensure that the respondents’ attitudes are positive towards the questionnaire because they chose to participate in the survey. To ensure that respondents know that they are busy completing an assessment, it should be stipulated to them that there are no right or wrong answers and that this is

only a means to obtain information from a variety of people.

4 Implications for external validity of the study

If the sample effectively represents the view of males and females in the Coal Mining Industry of South Africa's population, the findings and the results from the study can be verified against the already existing barriers. Proposed solutions can be generalised, applicable to the research questions measured in this specific study and the population as a whole and incorporated in the proposed model.

7 Data Analysis

The purpose of this study is to develop an integrated model that can be followed to manage and overcome the barriers of introducing women in the Mining Industry. Data analysis for qualitative studies is less standardised but more diverse. Qualitative researchers develop explanations or generalisations that are close to concrete data and contexts but are more than simple descriptions. A lower level and less abstract theory, which are grounded in concrete details, is used (Neuman, 2003). In general data analysis means a search in patterns for data. Once a pattern has been identified, it is interpreted in terms of a social theory in which it occurs (Neuman, 2003).

Content analysis will be used to analyse the data gathered from the completed questionnaires. Content analysis is a research tool used to determine the presence of certain words or concepts within texts or sets of texts (Neuman, 2003). Researchers quantify and analyse the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of which these consist. Texts can be defined broadly as books, book chapters, essays, interviews, discussions, newspaper headlines and articles, historical documents, speeches, conversations, advertising, theatre, informal conversation, or really any occurrence of communicative language (Neuman, 2003).

These methods will determine which information will be kept and which information will be left out of the model.

CHAPTER 5

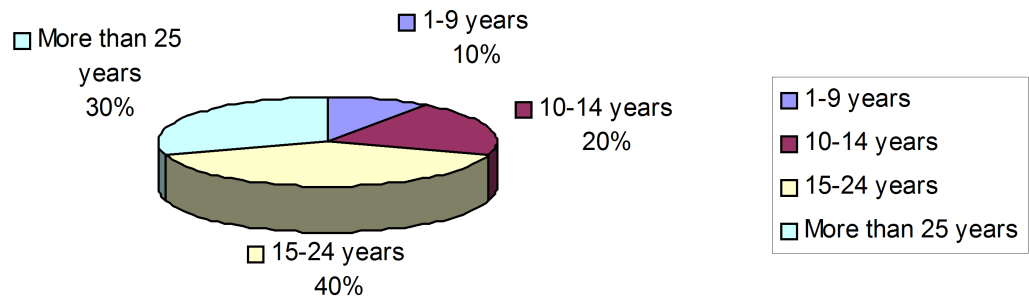
RESULTS AND RECOMMENDATIONS

Panel of Experts and Biographical Data

The Panel of Experts were selected based on their expertise in the Mining Industry. They have obtained their expertise through a combination of work experience, formal education and networking with official mining associations in the Mining Industry. The Panel of Experts' years of experience in the Mining Industry are illustrated in Figure 3 below:

Figure 3: Panel of Experts' years of experience in the Mining Industry

Panel of experts' years of experience in the Mining Industry



From Figure 3 it can be determined that 90% of the Panel of Experts have more than 10 years of experience in the Mining Industry. Only 10% of the panel have less than 10 years of experience in the Mining Industry.

Not only can one look at the Panel of Experts' number of years in the Mining Industry, but it also goes hand in hand with their knowledge and formal education on which their experience is based. The education levels of the Panel of Experts are illustrated in Figure 4 below:

Figure 4: Panel of Experts Highest Qualifications

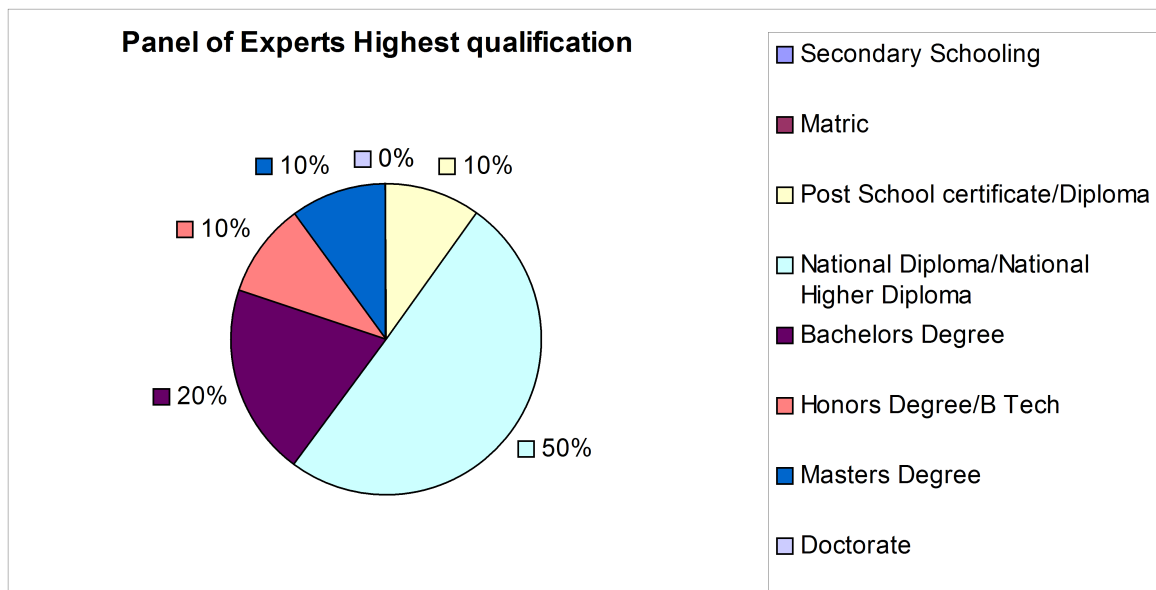


Figure 4 illustrates that Matric, Secondary Schooling and Doctorate were all 0%. Furthermore 10% respectively have Masters or Honours degrees and Post-school certificates/diplomas. 20% of the Panel of Experts has a Bachelors Degrees and lastly, 50% of the Panel of Experts have a National Diploma or National Higher Diploma.

Although Figure 4 illustrates the Panel of Expert's highest qualifications, it is important

for you to refer to the frequency and percentages for each of the different qualification groups. This is indicated in Table 10 on the following page.

Table 10: Frequency table in terms of the highest qualification obtained by each panel member that participated in this research study

Highest Qualification Family Group	Frequency	Percentage
Secondary Schooling	0	0.00%
Matric	0	0.00%
Post-School certificate/Diploma	1	10%
National Diploma/National Higher Diploma	5	50%
Bachelors Degree	2	20%
Honours Degree/B Tech	1	10%
Masters Degree	1	10%
Doctorate	0	0.00%
Total	10	100%

When the Panel of Experts were selected one of the criteria was that the Panel of Experts should affiliate with a mining association. Table 11 indicates the exposition of the Panel of Experts' affiliation with these mining associations and the years that each member has been involved in the specific mining association.

Table 11: Frequency table in terms of years networking with Official Mining Associations

Official Mining Association	Frequency	Years involved
South African Coal Managers Association (SACMA)	4	6
		4
		1
		8
South African Coal Human Resources Association (SACHRA)	3	4
		6
		1
South African Coal Environmental Practitioner Association (SACEPA)	2	7
		7
South African Coal Engineering Association (SACEA)	1	8
Total	10	Average of 5.2 years

In conclusion, it is clear from the analysis of the above data that the Panel of Experts that participated in this study have the necessary expertise in terms of work experience supported by formal education and networking with Official Mining Associations.

Therefore one can assume that the selected panel members have sufficient expertise in the Mining Industry to enable them to evaluate the elements contained in the model for introducing women into a Mining Industry.

Evaluation of the model by the Panel of Experts

In section 5.1 above, the appropriateness of the Panel of Experts was established for evaluating the Model for Managing the Barriers of Introducing Women into a Mining Industry, utilising Lawshe's method to quantify the content validity of each item contained in the proposed model.

The Panel of Experts consisted of 10 experts whom were each provided with an evaluative questionnaire listing all the possible items contained in the proposed Model for Managing the Barriers of Introducing Women into a Mining Industry. With the evaluative questionnaire the Panel of Experts received an explanation letter, which consisted of an introduction, explaining the purpose of developing the model, a brief background stating where the model emanated from and lastly a description of the model. Guidelines were given to the Panel of Experts on how to complete the evaluative questionnaire. The Panel of Experts then completed the evaluative questionnaire by rating each item contained in the model, where after they returned the completed evaluative questionnaires.

Determining the Content Validity Ratio for each facet of the model

Lawshe's formula was used to calculate the CVR value for each item contained in the proposed model, in an attempt to validate the model. In tables 13-17 below, the responses of the Panel of Experts are summarised and the CVR values for each item noted.

Table 12: The content validity ratio for the items concerning the organisation				
No.	Criteria			CVR Value
	Not applicable	Useful, but not necessary	Necessary	
Component 1: THE ORGANISATION				
1.1		1	9	0.80
1.2	1		9	0.80
1.3		3	7	0.40
1.4.1			10	1.00
1.4.2			10	1.00
1.4.3			10	1.00
1.4.4		1	9	0.80
1.4.5		2	8	0.60
1.4.6		2	8	0.60
1.5		3	7	0.40
1.6		2	8	0.60
1.7	2	6	2	0
1.8	1	1	8	0.60
1.9		1	9	0.80
1.10		2	8	0.60

Table 13: The content validity ratio for the items concerning male employees				
No.	Criteria			CVR Value
	Not applicable	Useful, but not necessary	Necessary	
Component 2: THE MEN				
2.1			10	1.00
2.2		1	9	0.80
2.3		2	8	0.60
2.4		2	8	0.60
2.5.1		4	6	0.20
2.5.2		2	8	0.60
2.5.3		2	8	0.60
2.5.4		4	6	0.20
2.5.5		6	4	-0.20
2.6		2	8	0.60
2.7		2	8	0.60

Table 14: The content validity ratio for the items concerning female employees				
No.	Criteria			CVR Value
	Not applicable	Useful, but not necessary	Necessary	
Component 3: THE WOMEN				
3.1			10	1.00
3.2.1		2	8	0.60
3.2.2	1	1	8	0.60
3.2.3			10	1.00
3.2.4		4	6	0.20
3.2.5		2	8	0.60
3.2.6		2	8	0.60
3.3		2	8	0.60
3.4		2	8	0.60
3.5		2	8	0.60
3.6.1		1	9	0.80
3.6.2		4	6	0.20
3.6.3	1	3	6	0.20
3.7	2	3	5	0

Table 15: The content validity ratio for the items concerning communication				
No.	Criteria			CVR Value
	Not applicable	Useful, but not necessary	Necessary	
Component 4: COMMUNICATION				
4.1		2	8	0.60
4.2.1		1	9	0.80
4.2.2		1	9	0.80
4.2.3		2	8	0.60
4.3		4	6	0.20
4.4			10	1.00

Table 16: The content validity ratio for the items concerning Human Resources				
No.	Criteria			CVR Value
	Not applicable	Useful, but not necessary	Necessary	
Component 5: HUMAN RESOURCES				
5.1			10	1.00
5.2			10	1.00
5.3		2	8	0.60
5.4			10	1.00
5.5		2	8	0.60
5.6			10	1.00

The items in the model with a CVR value greater than 0.49 will be included in the final Model for Managing the Barriers of Introducing Women into the Mining Industry. From the tables above, one can determine that in component one, the organisation, there are three items that are useful but not necessary, namely items 1.3, 1.5 and 1.7. The second component, male employees, has three items that are useful but not necessary, namely 2.5.1, 2.5.4 and 2.5.5. Component three, the Women, again has four items that are useful but not necessary, namely 3.2.4, 3.6.2, 3.6.3 and 3.7. Component four, Communication, has only one item that is useful but not necessary, namely 4.3. Lastly component five, Human Resources, all the items are deemed necessary.

Determining the Content Validity Index for the aspects of the model and

the final model

Determining the content validity index for all the aspects of the proposed Model for Managing the Barriers of Introducing Women into the Mining Industry implies the calculation of the mean score (MCVI). Therefore the mean score of the CVR values of the items included in the final model will be determined.

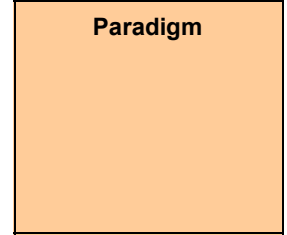
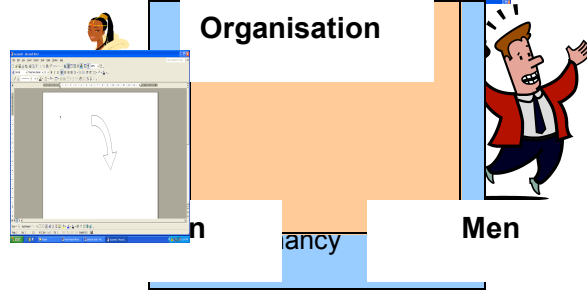
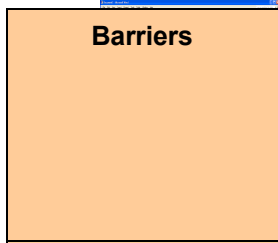
Table 17: The content validity index for the items of the Model for Managing the Barriers of Introducing Women into the Mining Industry	
Items of the model	Content validity index per item
The Organisation	0.77
Male employees	0.69
Female employees	0.70
Communication	0.76
Human Resources	0.87
The overall content validity index	0.76

The Model for managing the barriers of introducing women in the Mining Industry

The model for managing the barriers of introducing women in the Mining Industry was adopted based on the feedback from the Panel of Experts as indicated on the following page.

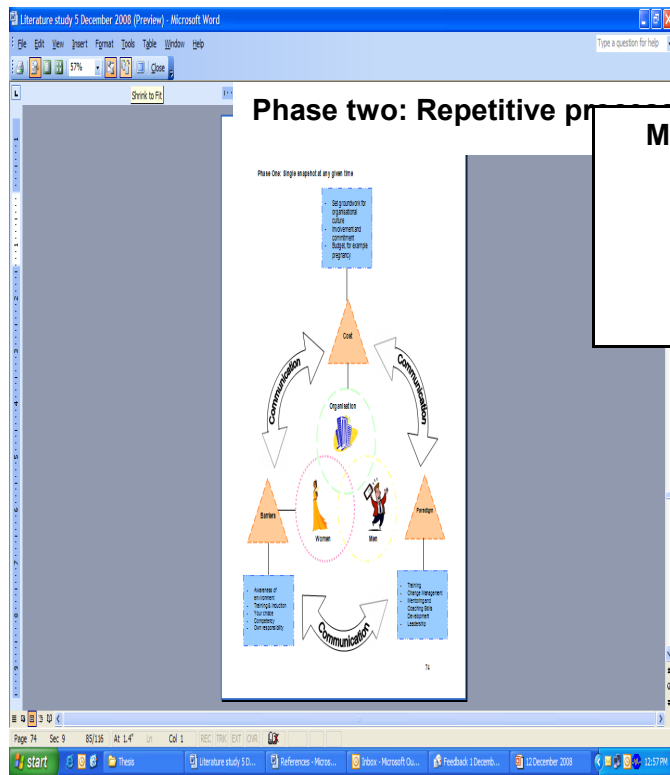


Phase One: Single snapshot at any given time

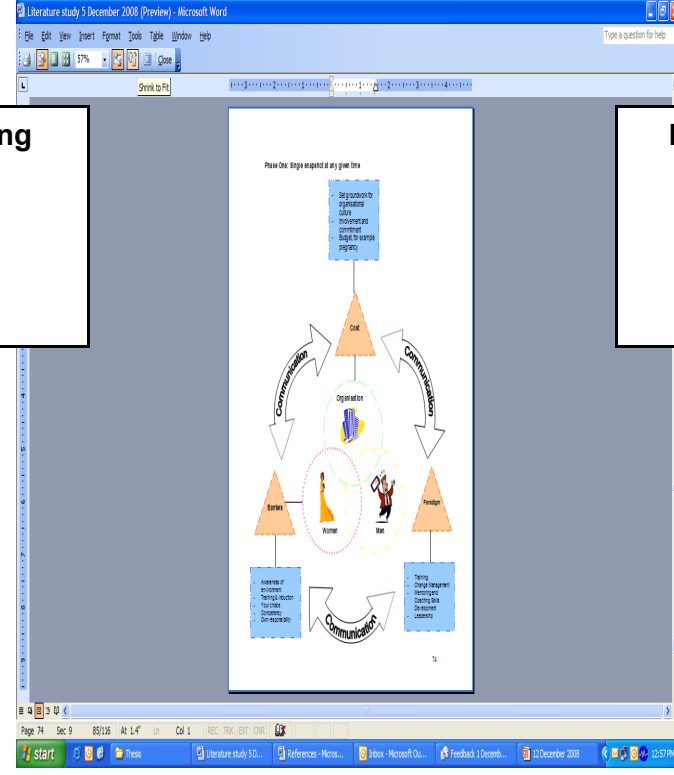


- Awareness of environment
- Training & induction
- Your choice
- Competency
- Own responsibility

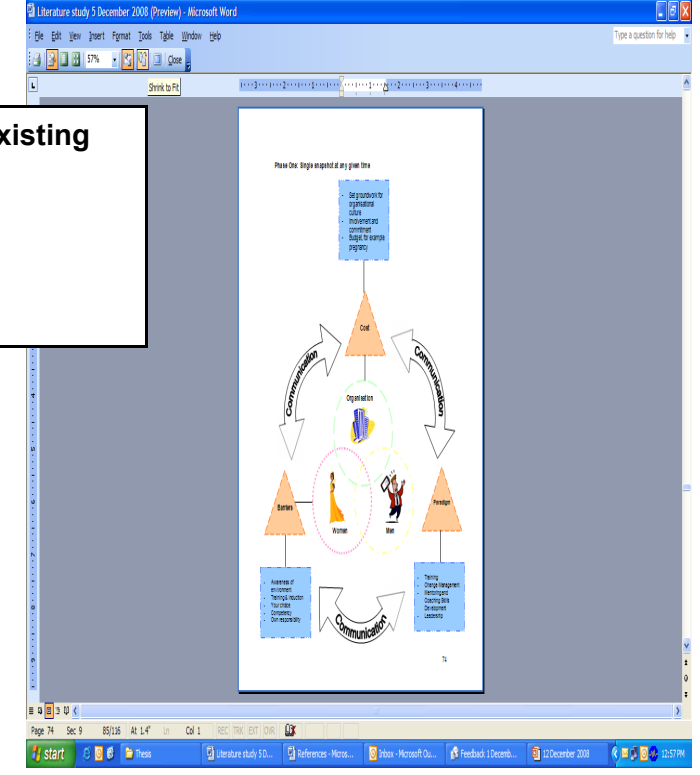
- Training
- Change Management
- Mentoring and Coaching Skills Development
- Leadership



Monitoring
Re-look & Re-visit system
existing



Monitoring
Re-look & Re-visit system
existing



Role of HR

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

Role of HR

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

Role of HR

1. Position
2. Marginality
3. Emotional Demands
4. Use of knowledge and experience

First evaluation

Second evaluation

Third evaluation

Time Line of Repetitive Process

Important comments from the Panel of Experts that had an influence on the integration of the model are noted below:

- There is a distinct difference in the way supervisors and managers need to manage the integration of women into the Mining Industry, when compared to the rest of the workforce. This needs to be taken into account, especially when considering the type of training and any intervention where the culture of the organisation needs to be changed.
- Both parties, male and female employees, strongly indicated during their mine specific focus groups that they want fair and equal opportunities and not to be handled with kid gloves as they would like to be fully fledged and competent participants in the process. Change and diversity interventions will only be as successful as the content of perceived equality.
- Throughout the process it should never be forgotten that women need to take ownership of these changes that are introduced in these male dominated workplaces.
- Management will play the most important role in making this intervention successful and it is essential to drive it down to the lowest levels.
- Recruitment can be costly if not done correctly from the beginning and if the wrong candidates are appointed.

An organisation that plans to implement this model to manage the barriers of introducing women into the Mining Industry should be guided by the matters stated below:

- Setting the groundwork is dependable on the company's needs and strategy and you will need to have your end goal in mind. Therefore you need to set the ground work that will suite your organisation's specific needs.
- Phase One considers the three interdependent parties primarily involved in any organisation. The only difference between the application of the model in the different organisations is the level of growth that the three parties operate at and this will influence the intervention that you need to put in place to reach the set targets initiated by legislation and the Mining Charter.
- Recruitment is an essential step and should be adapted to ensure that the physical

needs of each individual vacancy are identified and considered, even tested during recruitment and selection of employees. This is due to the physical environment of the Mining Industry that can only change to a certain extent.

- The groundwork for change interventions in principle is predicted to be fairly similar from organisation to organisation. This is where the application of the second phase of the model is important. The organisation needs to evaluate what worked for them and what needs to be adapted to suite their specific needs.
- When an organisation implements this model, this evaluation is important to track the progress of meeting the desired outcomes.
- The model to manage the barriers of introducing women into the Mining Industry should be guided by a clearly defined communication system or policy.

Research conclusion

The purpose of this study was to develop a model, which an organisation can use to overcome and manage the barriers that were identified when women are introduced in core positions of the Mining Industry. To attain this, qualitative research methodology was utilised.

A literature review was conducted via studying material and Survey Questionnaires were developed to verify the existing barriers. Two Survey Questionnaires were developed, one to verify and gather the perceptions, feelings and experiences of female employees in a male dominated environment. The second survey questionnaire was specifically designed to determine the underlying issues that male employees experience and feel, surrounding the implementation of what legislation prescribe and the principles laid down by the Mining Charter. Once the initial phase was completed the theory was classified according to relevance and importance. From this a Model to overcome and manage the barriers was developed.

The last step of this research project was to verify the research conclusions, therefore to determine the validity and feasibility of the model developed for organisations to manage and overcome the barriers when introducing women into the Mining Industry. The aim of evaluating the validity of the model was to determine whether this Model for

Managing the Barriers of Introducing Women into a Mining Industry, developed in this study, could be applied by Mining Houses. Therefore using this model as a tool or guideline in order to buffer and manage the effects of introducing females into a male dominated and harsh environment.

To determine the content validity of the model, Lawshe's method was applied. A Panel of Experts, which is seen as a content evaluation panel, in the field of Mining, was selected to evaluate the items used in the model that was developed for this study.

Two important assumptions that required consideration in the development of the Model for Managing the Barriers of Introducing Women into a Mining Industry, included:

1. Every item that was labelled by the Panel of Experts as "necessary", by more than 50% of the Panel of Experts had some degree of content validity.
2. If more than 50% of the panel values the item as "necessary", the greater the item's content validity.

The formula as developed in Lawshe's (1975) study, calculates the content validity ratio, known as CVR. The calculation was applied to determine the CVR values for each of the items contained in the model. Only the items scored with a CVR value of 0.49 and greater were included in the final Model for Managing the Barriers of Introducing Women into the Mining Industry.

The last step in validating the model was to calculate the Content Validity Index for each of the items included in the final Model for Managing the Barriers of Introducing Women into a Mining Industry. The content validity index for the final model was calculated to be 0.79. This emphasises the content validity of the final model and the items of the final model which will all exceed the minimum value of 0.49 as prescribed by Lawshe's (1975) methodology.

The Model for Managing the Barriers of Introducing Women into the Mining Industry has three interdependent components that are affected by this change intervention. These three components, namely: the organisation, male employees and female employees have their own as well as interdependent barriers to overcome when women are

introduced in this male dominated and physical demanding environment of the Mining Industry. The primary concern of each of the three components individually are cost implications for the company, the set paradigm of male employees and lastly the several barriers that women are faced with when entering the mining environment.

The model for managing the barriers focuses on the individual components and their needs to manage the changes brought about by introducing women into the Mining Industry. Not only should the model and the implementation thereof be aligned with the strategy and procedure of the company, but involving and attending to the individual needs of each component in the model. This will set the groundwork, phase one, to make this model work. A communication policy which governs this model, and the Human Resource facilitator plays an essential role in implementing the model, as indicated by the Panel of Experts. Lastly, an important factor is Phase Two of the model, which is the evaluation of the single snapshot after a period of time. This should happen on a continuous basis to ensure that the desired outcomes are achieved and to ensure that this model is tailor-made for the specific needs of each individual Mining House.



Addenda:

List of Figures

- Figure 1: Perceived job demands of various underground tasks
- Figure 2: Hypothetical model of work physical demands over a shift, and the percentage of relative physical capacity.
- Figure 3: Panel of Experts' years of experience in the Mining Industry
- Figure 4: Panel of Experts' Highest Qualifications

List of Tables

- Table 1: Profile of Historically Disadvantaged South Africans (HDSA's) Represented at Technical Reference Groups
- Table 2: The percentage of women in corporate leadership for 2004 – 2005
- Table 3: The percentage of women in corporate leadership for 2005 – 2006
- Table 4: Enrolment statistics from the University of Witwatersrand
- Table 5: Graduation percentages from the University of Witwatersrand
- Table 6: Guideline to lifting capacities for different age and gender groups
- Table 7: Physical hazards for pregnant women
- Table 8: Mining equipment categorised in terms of risk according to vibration levels
- Table 9: Minimum values of CVR
- Table 10: Frequency table in terms of the highest qualification obtained by each panel member that participated in this research study
- Table 11: Frequency table in terms of years networking with Official Mining Associations
- Table 12: The content validity ratio for the items concerning the organisation
- Table 13: The content validity ratio for the items concerning the male employees
- Table 14: The content validity ratio for the items concerning the female employees
- Table 15: The content validity ratio for the items concerning the communication
- Table 16: The content validity ratio for the items concerning Human Resources
- Table 17: The content validity index for the items of the Model for Managing the Barriers of Introducing Women into the Mining Industry

List of Diagrams

Diagram 1: Risk Assessment Flow of Pregnant Employees

Diagram 2: A Model for Managing the Barriers of Introducing Women into a Mining Industry

Survey Questionnaire: Female

Letter of informed consent to Female employees in the Mining Industry.

To Whom It May Concern:

This letter contains information of the survey research done by Andrea Heine, Masters Student from the University of Pretoria. The need for the study came from the employers' obligation to obey the Mining Charters' principles, which is to have 10 % representation of women in the Mining Industry. Therefore legislation prescribes it, the value women add and equality of rights.

The purpose of this study is to develop a model which an organisation can use to overcome and manage the barriers that are identified when women are introduced into the Mining Industry. This industry used to be a male dominated environment. The research will be looking at the different barriers that exist from the women's, men's as well as the organisations' perspective.

The rationale for executing this research project is not only assisting the organisation that has to comply with the guidelines laid down by the Mining Charter, but also providing a basis from which these barriers that exist, can be overcome. This will ensure that fairness prevails and conducive workplaces are established regardless of the changes that organisations are faced with. Furthermore women can enter into this industry with minimised effects of turmoil and maximised efforts of improved infrastructure and systems. Thirdly managing these changes that are laid down by the Mining Charter involves the voice of men working in the Mining Industry that needs to shift the paradigm of "women have no voice" to equal rights for both men and women.

Therefore the researcher seeks your appreciated cooperation in this regard.

Yours sincerely
Andrea Heine
Researcher



Female Questionnaire

Age

Nationality

Marital Status

Single

Married

Divorced

Widowed

Gender

Male

Female

Currently employed

Yes

No

Job title

Years in service

**Industry currently
working in**

Qualification /s

By completing this questionnaire I give permission for the researcher to use the data disclosed in this questionnaire, not only for this research proposal but any further research that might arise as a result of the findings of the original research.

I agree to the abovementioned permission statement.

Yes

No



1. What was the reason for you to apply for a position in the mining environment?

- Need for an income
- Lack of other job opportunities
- My family is currently working in mining
- I was given a bursary or learnership
- Other

If other, please specify.

2. Have you previously worked in a male dominated / mining environment?

- Yes
- No

If yes, please specify the industry where you worked?

3. How do you feel working in a male dominated workplace? (Mark the ones that best describe your feelings.)

- Scared
- Couldn't be bothered
- Enjoy
- Safe
- Unsafe

4. If you marked Scared and Unsafe, what are the reasons for you to feel scared and unsafe? (Explain your feelings; what makes you feel unsafe)



5. What do you experience as being disadvantages of working in a male dominated environment?

6. Do you work shifts?

Yes

No

7. If yes, in question 6, how do you feel about working shifts?

8. Do you have any children?

Yes

No

9. Do the hours that you work interfere with raising your children?

Yes

No

If yes, please specify.

10. How do your family, friends and husband feel about you working in a male dominated environment?
(Mark the ones that best describe your relatives' feelings.)

Supportive

Do not care

Worried

Angered

11. If you marked Worried or Angered, what are the reasons why they feel angered or worried about you working in a male dominated environment?

12. Do you find it difficult to operate the machinery or equipment?

Yes

No

13. If yes, what are the main reasons why you find it difficult to operate the machinery or equipment?

Ergonomics (design of the machinery or equipment)

Lack of proper training

Physical abilities required

Other

If Other, please specify.

14. My physical strength limits me to embark on carrying heavy cables, drums, tools, etc.

Agree

Disagree



15. When you were issued with your Personal Protective Equipment (PPE) what were the main problems that you encountered?

Overalls:

- Right size overalls
- Overalls covering all body parts
- The overall is not practical. For example, when using the change room facilities

Rescue packs & lamps:

- Comfort
- Weight

Other: Please specify any other problems encountered when you were using the PPE.

16. Are you aware of sexual harassment incidences that occur in your working environment?

- Yes
- No

17. Why do you think sexual harassment occurs? (More than one option can be marked.)

- The working environment is conducive to sexual harassment
- Working in shifts
- Cultural differences
- Other (please specify in the space below)
-



18. Change rooms at work do not accommodate the needs of women.
- True
- False
19. Are the change rooms situated far or near from the place of work?
- Far
- Near
20. My work performance is influenced during my menstrual cycle.
- Agree
- Disagree
21. My work performance is influenced during the initial stages of pregnancy.
- Agree
- Disagree
22. What is your perception of promotion opportunities for women in mining?
- No opportunities exist
- Discrimination occurs on the grounds of gender
- It is evident that I can get a promotion based on the fact that I am a woman

Survey Questionnaire: Male

Letter of informed consent to Male employees in the Mining Industry.

To Whom It May Concern:

This letter contains information of the survey research done by Andrea Heine, Masters Student from the University of Pretoria. The need for the study came from the employers' obligation to obey the Mining Charters' principles, which is to have 10 % representation of women in the Mining Industry. Therefore legislation prescribes it, the value women add and equality of rights.

The purpose of this study is to develop a model which an organisation can use to overcome and manage the barriers that are identified when women are introduced into the Mining Industry. This industry used to be a male dominated environment. The research will be looking at the different barriers that exist from the women's, men's as well as the organisations' perspective.

The rationale for executing this research project is not only assisting the organisation that has to comply with the guidelines laid down by the Mining Charter, but also to provide a basis from which these barriers, that exist, can be overcome. This will ensure that fairness and conducive workplaces is established regardless of the changes that organisations are faced with. Furthermore women can enter into this industry with minimised effects of turmoil and maximised efforts of improved infrastructure and systems. Thirdly managing these changes that are set out by the Mining Charter involves the voice of men working in the Mining Industry that needs to shift the paradigm of "women have no voice" to equal rights for both men and women.

Therefore the researcher seeks your appreciated cooperation in this regard.

Yours sincerely
Andrea Heine
Researcher



Male Questionnaire

Age

Nationality

Marital Status

Single

Married

Divorced

Widowed

Gender

Male

Female

Currently employed

Yes

No

Job title

Years in service

**Industry currently
working in**

Qualification /s

By completing this questionnaire I give permission for the researcher to use the data disclosed in this questionnaire, not only for this research proposal but any further research that might arise as a result of the findings of the original research.

I agree to the abovementioned permission statement.

Yes

No



1. Have any women been introduced into your place of work?

Yes

No

2. The introduction of women into male dominated environments leaves me with a feeling of...

Anger

Fear

Neutral

Excited

3. Explain your feeling in Question 2. Why do you feel that way?

4. When my organisation appoints women in my department I often feel intimidated.

Agree

Strongly agree

Disagree

Strongly disagree

5. You often find that men have to accommodate women not being physically strong enough to fulfil certain tasks.

Agree

Strongly agree

Disagree

Strongly disagree



6. The problems that men experience when women are introduced into their places of work are:
- Work related
 - Social related
 - Both
 - Experience no problems
7. Work-related problems typically include:
- Physical strength
 - Knowledge about line of work
 - It worked in “olden” days, so why change?
 - Not applicable
8. Social-related problems typically include:
- Women are home-keepers
 - Perceptions and impressions of the community when continually working closely with female colleagues
 - Cultural differences
 - Not applicable
9. Women are only recruited not because they can do the work, but because organisations need to comply with the Employment Equity Act and the principles of the Mining Charter.
- Agree
 - Strongly agree
 - Disagree
 - Strongly disagree



10. Women are not accepted in the mining environment because of:

My cultural beliefs

My upbringing

My perception of their capabilities

Opportunities are taken away from me

Evaluative Questionnaire: Panel of Experts

The purpose of the Questionnaire is to evaluate the content validity of every component of the model.

It is required of you:

- To go through the brief summary received with the Questionnaire in order to have a broad knowledge about the topic that will enable you to do the evaluation.
- To evaluate each component on the evaluation form according to the given scale.
- To evaluate the practical application of the model.

The Questionnaire consists of Section A (Personal Information) and a Section B (Evaluation of the Components of the Model).

SECTION A: PERSONAL INFORMATION

To be able to describe the skills and qualifications of the evaluating panel, the following information is required:

1. Name and Surname (Not compulsory)

--

2. Address (Not compulsory)

3. Contact Numbers (Not compulsory)

Office:	
Cell Phone:	
Fax:	



4. Occupation (Position at work)

--

5. Highest Qualification

--

6. Years of experience in the Mining Industry

Number of years	Mark the relevant period with an X
Less than 1 year	
1 year and more, but less than 2 years	
2 years and more, but less than 5 years	
5 years and more, but less than 10 years	
10 years and more, but less than 15 years	
15 years and more, but less than 25 years	
More than 25 years	

SECTION B: EVALUATION OF THE COMPONENTS OF THE MODEL

The integrated model consists of different elements that need to be evaluated. After the brief summary, you must evaluate each component separately by making a cross in the applicable block, i.e., whether you think the action in the model is necessary, useful, but not necessary, or not applicable.

PHASE ONE

COMPONENT 1: THE ORGANISATION

- 1.1 The organisation is seen as one of the three primary parties involved in the intervention.

Not applicable	Useful, but not necessary	Necessary

- 1.2 The initial step includes setting the groundwork for organisational culture.

Not applicable	Useful, but not necessary	Necessary

- 1.3 The ground work for creating/changing the organisational culture starts with the implementation of Standard Operating Procedures, Codes of Practice, policies, job profiles, etc.

Not applicable	Useful, but not necessary	Necessary

- 1.4 The following policies are essential when setting up the process:

1. Maternity Leave Policy

Not applicable	Useful, but not necessary	Necessary

2. Sexual Harassment Policy

Not applicable	Useful, but not necessary	Necessary

3. Training Policy

Not applicable	Useful, but not necessary	Necessary

4. PPE Standards Policy



Not applicable	Useful, but not necessary	Necessary

5. Operating Moving Machinery Policy

Not applicable	Useful, but not necessary	Necessary

6. Ergonomic Design Policy

Not applicable	Useful, but not necessary	Necessary

- 1.5 The organisation needs to take into consideration all the areas affected by the changes and align it with the organisation's strategy and goals.

Not applicable	Useful, but not necessary	Necessary

- 1.6 Current infrastructure needs to change to address women's needs as well.

Not applicable	Useful, but not necessary	Necessary

- 1.7 Machine design should be re-engineered because it poses a risk to women's health in particular.

Not applicable	Useful, but not necessary	Necessary

- 1.8 In order to minimise the cost implications, organisations are often faced with challenges such as correct budgeting, planning and determining potential changes from which cost emanates.

Not applicable	Useful, but not necessary	Necessary

- 1.9 The involvement and commitment from top to bottom should be visible and adequate in order to successfully transform the organisation to a diverse organisation.

Not applicable	Useful, but not necessary	Necessary

- 1.10 Consultation during the intervention with the male and female employees is important. Without their buy-in, this intervention will be futile.

Not applicable	Useful, but not necessary	Necessary

COMPONENT 2: THE MEN

- 2.1 The male employees are seen as one of the three primary parties involved in the intervention.

Not applicable	Useful, but not necessary	Necessary

- 2.2 The primary concern that needs to change when looking at male employees is their paradigm.

Not applicable	Useful, but not necessary	Necessary

- 2.3 The mining environment was seen from the men's perspective as essentially male dominated due to the reasons of women being the weaker specie and not having the mental and physical capabilities to cope in the core functions of the mine.

Not applicable	Useful, but not necessary	Necessary

- 2.4 It is necessary to change the paradigm of men in the Mining Industry.

Not applicable	Useful, but not necessary	Necessary

2.5 To assist with changing men’s paradigms, the following training is important:

1. Diversity Training

Not applicable	Useful, but not necessary	Necessary

2. Change Management Training

Not applicable	Useful, but not necessary	Necessary

3. Mentoring and Coaching Skills Training

Not applicable	Useful, but not necessary	Necessary

4. Interpersonal Skills Training

Not applicable	Useful, but not necessary	Necessary

5. Emotional Intelligence Training

Not applicable	Useful, but not necessary	Necessary

2.6 It is evident that people will be more prone to defensive strategies due to lack of knowledge and therefore if we can equip male employees, supervisors and managers with the necessary knowledge that they might be confronted with it will ensure establishing a better working relationship and working more effectively as a team within the organisation.

Not applicable	Useful, but not necessary	Necessary

2.7 The organisation needs to work on the male employee’s paradigm to ensure that they assist with accommodating female employees within the Mining Industry.

Not applicable	Useful, but not necessary	Necessary

COMPONENT 3: THE WOMEN

3.1 The female employees are seen as one of the three primary parties involved in the intervention.

Not applicable	Useful, but not necessary	Necessary

3.2 The following applicable barriers were identified:

1. Physical differences between males and females

Not applicable	Useful, but not necessary	Necessary

2. The Mining Environment for women

Not applicable	Useful, but not necessary	Necessary

3. Infrastructure referring to the following key issues such as: ablution facilities and change rooms, housing facilities, childcare facilities and machine design.

Not applicable	Useful, but not necessary	Necessary

4. Work-life balance

Not applicable	Useful, but not necessary	Necessary

5. Personal Protective Equipment

Not applicable	Useful, but not necessary	Necessary

6. Personal safety and security

Not applicable	Useful, but not necessary	Necessary

3.3 Suggested interventions to overcome these barriers all start with recruitment of female employees.

Not applicable	Useful, but not necessary	Necessary

3.4 Job profiling for a specific vacancy will set the tone for what the physical determinants are and whether or not the female applicant will be successful or not.

Not applicable	Useful, but not necessary	Necessary



--	--	--

- 3.5 Induction and creating awareness of what is expected and what the mining environment is all about, will enhance the probability of female employees remaining in the specific job.

Not applicable	Useful, but not necessary	Necessary

- 3.6 Training should be incorporated in the early stages of employment, namely:

1. Enhancement of technical competencies

Not applicable	Useful, but not necessary	Necessary

2. Confidence building and self-worth training

Not applicable	Useful, but not necessary	Necessary

3. Networking and life skills training

Not applicable	Useful, but not necessary	Necessary

- 3.7 Opportunities should be created by the organisation to encourage and give time to do social and work-related networking, to assist females with coping in the male- dominated environment.

Not applicable	Useful, but not necessary	Necessary

COMPONENT 4: COMMUNICATION

- 4.1 These interdependent parties of the change intervention need to have a fine understanding of communication for the intervention to be successful.

Not applicable	Useful, but not necessary	Necessary

- 4.2 Communication in the first phase of this intervention includes the following:

1. Dialogue which has the goal of going beyond one person's understanding, the goal is not to win, but for the team to reach a common understanding

Not applicable	Useful, but not necessary	Necessary

2. Two-way communication that involves communication taking place from the sender and the receiver providing feedback and the sender being receptive to the feedback

Not applicable	Useful, but not necessary	Necessary

3. Downward, upward and horizontal communication

Not applicable	Useful, but not necessary	Necessary

PHASE TWO

COMPONENT 4: COMMUNICATION (continued)

- 4.3 In the second phase of the model, communication will typically be feedback but not limited to only feedback.

Not applicable	Useful, but not necessary	Necessary

- 4.4 Feedback is given once a snapshot of the threefold system has been revisited and evaluated to determine whether or not the systems, procedures, policies, training, and change interventions implemented are obtaining the desired results.

Not applicable	Useful, but not necessary	Necessary

COMPONENT 5: HUMAN RESOURCES

- 5.1 Human Resources will take on the role of Organisation Development Practitioner throughout this process in which they will provide a service to top managers, functional departmental heads and staff groups.

Not applicable	Useful, but not necessary	Necessary

- 5.2 Human Resources has a critical role to play within this change intervention.

Not applicable	Useful, but not necessary	Necessary

- 5.3 The role of the Organisation Development Practitioner is often positioned in the Human Resources department, meaning we allocate the duties to an internal consultant.

Not applicable	Useful, but not necessary	Necessary

- 5.4 Secondly, marginality is required of the Organisation Development Practitioner and he or she needs to be objective and flexible to ensure that common ground is reached more effectively.

Not applicable	Useful, but not necessary	Necessary

- 5.5 Thirdly, emotional demands are high for Organisation Development Practitioners and to regulate emotions in oneself and in others will minimise and control having an emotionally charged change intervention that is usually associated with emotionally disruptive behaviour.

Not applicable	Useful, but not necessary	Necessary



5.6 Lastly, the use of knowledge and experience plays an important role in facilitating this process and taking on the advisory role at certain stages of the change intervention.

Not applicable	Useful, but not necessary	Necessary

Any other comments:

THANK YOU VERY MUCH FOR COMPLETING THE QUESTIONNAIRE