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The underrepresentation of technical women in executive and board of directors' roles in the ten largest listed mining companies in South Africa

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UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

THE UNDERREPRESENTATION OF TECHNICAL WOMEN IN EXECUTIVE AND BOARD OF DIRECTORS' ROLES IN THE TEN LARGEST LISTED MINING COMPANIES IN SOUTH AFRICA

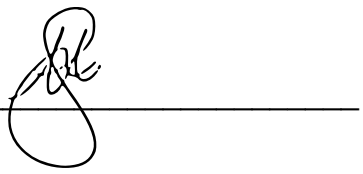
Noluthando Zulu

A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, 2022

DECLARATION

I declare that this report is my own, unaided work. I have read the University Policy on Plagiarism and hereby confirm that no plagiarism exists in this report. I also confirm that there is no copying nor is there any copyright infringement. I willingly submit to any investigation in this regard by the School of Mining Engineering and I undertake to abide by the decision of any such investigation.



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ABSTRACT

As with many technical industries, mining is dominated by men. It is well established that the industry has struggled with the attraction and retention of female talent. While women have made significant inroads in the industry, technical women (defined here as women who come from a geology, engineering, metallurgical, etc background) are underrepresented in the most senior decision-making roles of major mining companies. The purpose of the study was to explore this phenomenon, examining the executive committee and board composition of the 10 largest mining companies listed on the Johannesburg Stock Exchange and interviewing 30 technical women who have worked for, or currently work for, these organisations.

The results demonstrate that technical women seldom advance from operations to the boardroom and, typically, play a support function while men make core mining and technical decisions. The study also finds that many technical women move into non-technical roles for a number of reasons. Further, while attraction of women to the industry continues to rise, the studied companies are struggling to retain technical female talent.

The study further highlights the significance of government intervention concerning the inclusion and advancement of women in mining. It also emphasises the need for continued policy development and concludes with recommendations on how mining companies can drive both the inclusion of women in mining as well as their corporate advancement.

DEDICATION

For Minnie

ACKNOWLEDGMENTS

- My grandmother, Minnie Mseleku for whom I wrote this thesis. You were my first example that a woman can be whoever she wants to be. You are the love of my life.
- My mother, Nompumelelo Zulu who has been my biggest cheerleader and the wind beneath wings. I love you more than words could say.
- All my family members who took all my teary calls and encouraged me to the finish line. Zotha Zulu, Mpumelelo Zulu, Sibongile Ngidi, Thandanani Ngidi and Nompilo Ngidi, thank you for everything.
- My supervisor Prof. Tania Marshall who has been an example of what excellence is. Thank you for being the best supervisor anyone could ask for, lifting me up when I was down, the words of encouragement, believing in me when I had given up on myself. This is for you.
- Every participant in the study who took their time to fill out the questionnaire and offer their painful and beautiful stories of their lived experience on South African mining operations.
- Every person who has played a hand in the advancement of my career as a woman in the mining industry. Every person who has given me an opportunity, mentored me, been a sponsor and mentioned my names in rooms while I was not there, thank you.
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LIST OF ABBREVIATIONS AND ACRONYMS

AMCU	Association of Mineworkers and Construction Union
CA (SA)	Chartered Accountant South Africa
CEO	Chief Executive Officer
CFA	Chartered Financial Analyst
CFO	Chief Financial Officer
DMRE	Department of Minerals Resources and Energy
ESG	Environmental, Social and Corporate Governance
GDP	Gross domestic product
HR	Human Resources
ILO	International Labour Organization
JSE	Johannesburg Stock Exchange
MBA	Master of Business Administration
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002)
NUM	National Union of Mineworkers
PPE	Personal Protective Equipment
PWC	PriceWaterhouseCoopers
STEM	Science, technology, engineering, and mathematics
UK	United Kingdom
WiMSA	Women in Mining South Africa

1 INTRODUCTION

1.1 Overview of Study

In South Africa mining continues to play a critical role in the economy, contributing to the Gross Domestic Product (GDP) and being a large employer in the country. Globally the mining industry is known to be dominated by men. There has been extensive research on the underrepresentation of women in technical and male dominated industries such as mining.

To address some of the inequalities of the mining industry under the apartheid regime, the new democratic government of South Africa through the Department of Mineral Resources and Energy (DMRE) introduced policies such as the Mining Charter in 2004, amended in 2010 and 2018. The intention of the Mining Charter was to introduce specific measurable targets to effect transformation in the mining industry. One of the key targets was for employment equity - setting targets for historically disadvantaged groups such as women.

While policy has played a role in the introduction of women to the industry, this study aimed to understand how women were represented in decision-making and core mining roles. Listed companies report the percentage of women represented at the most senior levels of management that is, the female representation at executive management and board of directors' level. This study, through a sample of the 10 largest mining companies listed

on the Johannesburg Stock Exchange (JSE) in South Africa, seeks to understand the role women hold in these committees.

Studies conducted by institutions such as PricewaterhouseCoopers (2014) show that there is a limited number of women in executive management and board roles in mining companies when compared to other industries such as financial services and consumer services. It is apparent that there are sufficiently qualified female candidates, but they do not seem to make it all the way to the boardroom. Research on the representation of women by Moalusi & Jones (2019) and Moraka (2015) show results in increased frustration for young technical mining females, who do not see a clear career pathway to the top positions. If the reasons for this lack of senior technical women (that is women in core technical mining functions such as mining, engineering, metallurgical and geology, etc.) can be understood and mitigated, more younger women may be re-invigorated in their endeavours to pursue senior and executive roles. This research report aims to highlight the underrepresentation of technical women in key decision-making roles in the most senior levels of management of mining organisations.

1.2 Research Objectives

This research project investigates issues surrounding the notion that technical women are underrepresented in executive roles and board seats in the top 10 JSE listed mining companies. The objectives of this study were to explore and understand the following:

- Verify the underrepresentation of technical women by analysing the composition of executive and board roles of the top 10 largest mining companies in South Africa.
- Identify the major factors that have led to this underrepresentation.
- Highlight issues currently faced by technical women in these organisations.
- Identify specific actions South African mining companies can take to address the identified issues.

1.3 Problem Statement

There are few technical women in executives and board members roles of listed mining companies. What are some of the issues that both mining companies and technical women face in populating these senior roles?

1.4 Research Question

The research project sought to address the following questions:

- Are technical women underrepresented in executive and board roles of the top 10 largest mining companies?
- What are the reasons for technical women in core mining functions not rising to the highest levels of management, executive and board of director roles, in mining companies?
- What can mining companies do to increase the representation of technical women in executive and board roles?

1.5 Research Limitations

The limitations identified in the study were as follows:

- The study used a sample of the 10 largest listed mining companies. These are large establishments with some having a multi-jurisdiction footprint. This study did not interview technical women who worked in medium and small mining companies or women working for exploration companies.
- The companies are listed, or public companies, thus the views of women in small and unlisted companies were not expressed.
- While the study was limited regionally (the women interviewed were only in South Africa), the mining companies within the study had a global reach with operations not only in Africa, but South America and Australia. The perspective of women in other regions where these companies operate was not taken into consideration for comparative purposes.
- The demographics of the interviewees were largely concentrated in the 25–35-year-old age group, geologists by profession having had worked for one of the companies in the study for a period of 1 to 5 years. This concentration is due to the authors network as she falls into that demographic. The results may have differed if there was a greater representation of the 46-55 cohort as they would have entered the industry before policies such as the Mining Charter were in place and were probably the first group of technical women on mining operations.

- Only women who had reached junior and middle management were interviewed. The perspective and experiences of the few women who had made it to senior management of mining organisations were not reflected in this study.
- The study did not interview board members who have a hand in selecting executive directors of a mining organisation to provide insight on the skills and experience required for these roles that technical women may not have.

2 LITERATURE REVIEW

2.1 Mining in South Africa

South Africa is a well-known mining jurisdiction where mining began in 1867 when diamonds were first discovered (Africa Mining IQ, 2022). Since then, the discovery of other commodities such as gold, coal, platinum and many more ensured that mining became an integral part of the South African economy. Mining in South Africa created employment, attracting foreign direct investment, and enriching the governments purse through taxes and royalties. In 1980 the mining industry was the second biggest contributor to the South African GDP, contributing 21% (Statistics South Africa, 2016). Like any developing economy, the South African economy has transitioned where primary activities, such as mining's contribution, have declined and financial services are now the leading contributor to GDP in South Africa. In 2020 while mining gross domestic product continued to decline, the industry still contributed R27.2 billion in taxes and R361.6 billion to GDP in South Africa (Minerals Council South Africa, 2021). However, while the mining industry unlocked value from South Africa's mineral deposits and created enrichment for many people, for a long time, women were excluded from directly benefitting from the mining industry.

2.1.1 The landscape of women in mining in South Africa

In 2020, the South African mining industry employed 451 427 people, of which 15% were women (Minerals Council South Africa, 2021). While the overall number of people employed by the industry has declined as mining

is in structural decline in South Africa and modernisation increases, female representation however has increased. Between the decade of 2010 and 2020, the number of women in the mining industry increased by 58% from 39 874 to 63 095 (Minerals Council South Africa, 2021). Table 2.1 shows the representation of women within the various commodities extracted in South Africa. While there has been an increase in the number of women employed by the industry, the numbers are not reflective of South African demographics of women making up 51% of the population and 46% of economically active labour force (TheGlobalEconomy.com, 2022).

Table 2.1. Women employment in mining within the different commodities in South Africa.

COMMODITY	**NUMBER OF WOMEN EMPLOYEES**	**PERCENTAGE OF WOMEN EMPLOYEES (%)**
Platinum Group Metals	21 103	13
Coal	13 828	15
Gold	12 281	13
Chrome	3 156	17
Iron ore	3 342	16
Diamond	2 001	15
Manganese	1 887	15
Industrial Minerals	1 675	14
Non-ferrous metals	2 862	16
Other minerals	966	18

Source: Minerals Council South Africa (2021)

Table 2.2, shows women are represented across all levels of management in mining in South Africa. However, the table also shows that women make up only 19% of skilled and technical employees and 25% of top management.

Table 2.2. A spread of women in mining across various job categories in South Africa.

Job Category	**Women representation (%)**
Top management	25
Senior management	17
Professionally qualified employees	24
Skilled and technical employees	19

Source: Minerals Council South Africa (2021)

2.1.2 Legislation in South Africa regarding women in mining

Prior to South Africa becoming a democratic country in 1994, the mining industry was governed by the Minerals Act 50 (Republic of South Africa, 1991), the successor to the Mines and Works Act 12 of 1911 (Union of South Africa, 1914) and its subsequent amendments (Republic of South Africa, 1956) which had prohibited women from working underground since, *inter alia*, only men were deemed physically able to deal with underground work.

The current key policies in South Africa that support gender equality that are most relevant to the mining industry are the Mineral and Petroleum Resources Development Act (MPRDA) 28 of 2002 and the Broad-Based Socio-Economic Empowerment Charter for the South African Mining Industry (Republic of South Africa, 2010). Both policy documents prohibit the exclusion of women and require companies to set specific targets to increase the number of women in their employment, making specific provisions for the inclusion of women in core mining activities.

The MPRDA states that the objectives of the Act are to *"substantially and meaningfully expand opportunities for historically advantaged persons, including women, to enter the mineral and petroleum industries and benefit from the exploitation of the nation's mineral and petroleum resources."* The Mining Charter was developed by the South African government to encourage mining companies to comply with their employment equity targets and ensure that historically disadvantaged South Africans are trained and developed. The latest Mining Charter released in 2018 gives the updated targets as shown in Table 2.3.

Table 2.3. Mining Charter III employment equity targets.

EMPLOYMENT EQUITY TARGETS		
Element	*Measure*	*Weighting*
Board		
Africans, Coloureds, Indians	50%	2%
Black Females	20%	2%
Executives/top management		
Africans, Coloureds, Indians	50%	2%
Black Females	15%	2%
Senior management		
Africans, Coloureds, Indians	50%	2%
Black Females	15%	2%
Middle management		
Africans, Coloureds, Indians	60%	2%
Black Females	20%	2%
Junior management		
Africans, Coloureds, Indians	70%	1%
Black Females	25%	1%
Core and critical skills		
Africans, Coloureds, Indians	60%	1%
Disabilities		
Africans, Coloureds, Indians, Whites	2%	1%

Source: Department of Mineral Resources and Energy (2018)

The King IV Report on Corporate Governance™ (King IV) for South Africa published in 2016 (Institute of Directors of Southern Africa, 2016) emphasized the need for board of directors to comprise of an appropriate balance of knowledge, skill, experience, diversity, and independence, for it to discharge its governance role and responsibilities. The diversity required would include academic qualifications, technical expertise, industry experience, nationality, age, and gender (PricewaterhouseCoopers, 2014).

King IV propose that each company set and publish race and gender targets for board membership. *"These measures aim to promote gender equality in economic decision making, and to take full advantage of the talent pool of candidates for a more equal gender representation on company boards"* (Deloitte & Touche, 2017, p.4). Post the publication of the King III report, the South African government responded by amending the Companies Act in 2009, making it mandatory for companies to disclose how board diversity is considered and the percentage of female employees in the workforce and senior management (PricewaterhouseCoopers, 2014).

2.2 The Representation of Women in Executive and Board Roles

Mining is well known as a "male dominated industry" due to policies keeping women out the industry and the perception that mine work was only for men. Male dominance in the industry is seen at operational level but also in the most senior positions of companies. Listed companies, typically, have two layers of senior management, namely an executive management team and a board of non-executive directors.

2.2.1 Executive directors

Research by Kuykendall & Darden (2020) in Figure 2.1, shows that, across 262 global mining companies, women are underrepresented at the uppermost levels of management. This research demonstrated that women only make up 14.9% of executive ranks. Africa and the Middle East regions had the highest representation of women in executive management.

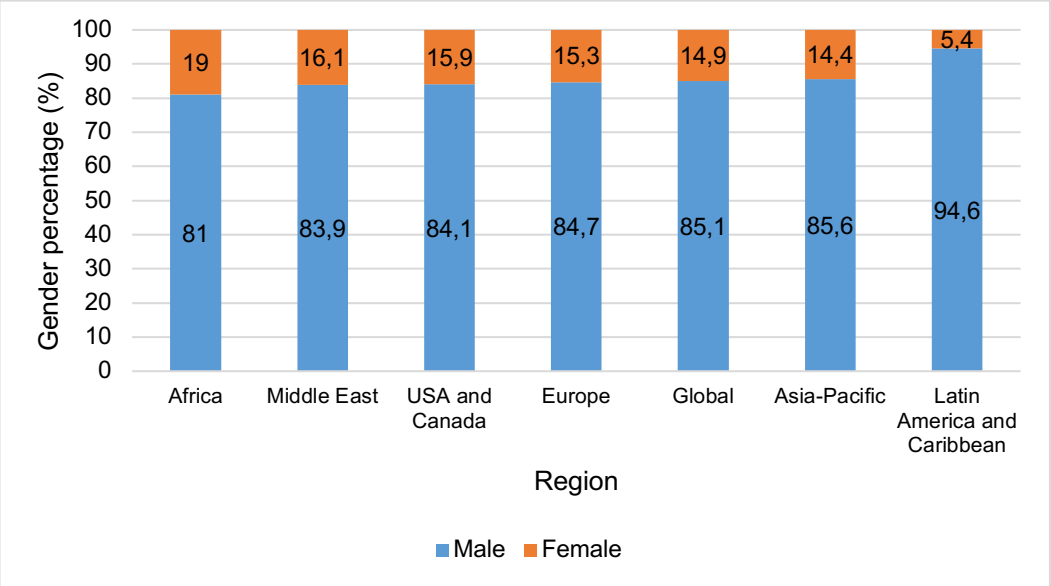


Figure 2.1. Gender representation in mining company executive ranks. Source: Kuykendall & Darden (2020)

In 2022, the current top 40 listed companies on the JSE have four female Chief Executive Officers and five Chief Financial Officers as seen in Table 2.4 and determined from their current Integrated Annual Reports. Fourteen of the top 40 companies are mining companies, of which only five have a female executive director. Only one company has a female Chief Executive Officer.

Table 2.4. Female representation of the Top 40 listed companies on the Johannesburg Stock Exchange.

COMPANY NAME	MINING	FEMALE CEO	FEMALE CFO	TECHNICAL FEMALE
Prosus N.V.				
Naspers Ltd -N-				
Anheuser-Busch InBev SA NV				
British American Tob plc				
BHP Group Plc	X			
Glencore plc	X			
Anglo American plc	X			
Compagnie Fin Richemont				
Anglo American Plat Ltd	X	X		X
Firstrand Ltd				
Vodacom Group Ltd				
Standard Bank Group Ltd				
Sibanye Stillwater Ltd	X			
Kumba Iron Ore Ltd	X			
Impala Platinum Hlgs Ltd	X		X	
Mondi plc				
Capitec Bank Hldgs Ltd				
South32 Limited	X			
MTN Group Ltd				
Sanlam Limited				

Anglogold Ashanti Ltd	X		X	
Sasol Limited	X			
Northam Platinum Ltd	X		X	
Gold Fields Ltd	X			
Absa Group Limited				
Discovery Ltd				
BID Corporation Ltd				
Shoprite Holdings Ltd				
African Rainbow Min Ltd	X		X	
Nedbank Group Ltd				
Aspen Pharmacare Hldgs Ltd				
Old Mutual Limited				
Exxaro Resources Ltd	X			
Clicks Group Ltd				
Bidvest Ltd				
MultiChoice Group Ltd				
NEPI Rockcastle Plc				
Remgro Ltd				
Reinet Investments S.C.A				
Quilter Plc				
Total	**13**	**1**	**4**	**1**

Source: Johannesburg Stock Exchange (2021)

Light grey highlights – mining companies

Dark grey highlight – the single mining company with a female CEO

2.2.2 Board of directors

The Kuykendall & Darden (2020) study illustrates in Figure 2.2 and Figure 2.3 notes that only 18.1% of the industry's board positions and 13.2% of the industries executive level management, referred to as C-suite, roles are held by women. The study further notes that Africa has the highest number of women working in executive roles and occupying board seats in the mining industry while Latin America and the Caribbean have the lowest. PricewaterhouseCoopers (2014, p.2) showed that "mining companies on the Johannesburg Stock Exchange in South Africa had the best level of female board representation" and the highest number of female senior executives compared to countries such as the United States of America, Canada, Australia, and the United Kingdom.

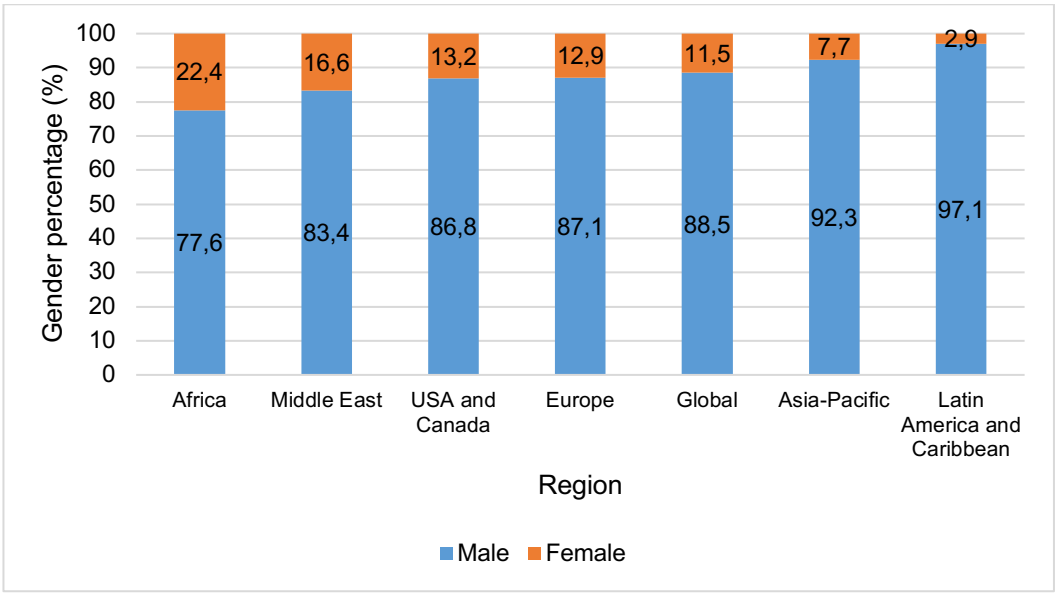


Figure 2.2. Gender representation in mining company C-suites. Source: Kuykendall & Darden (2020)

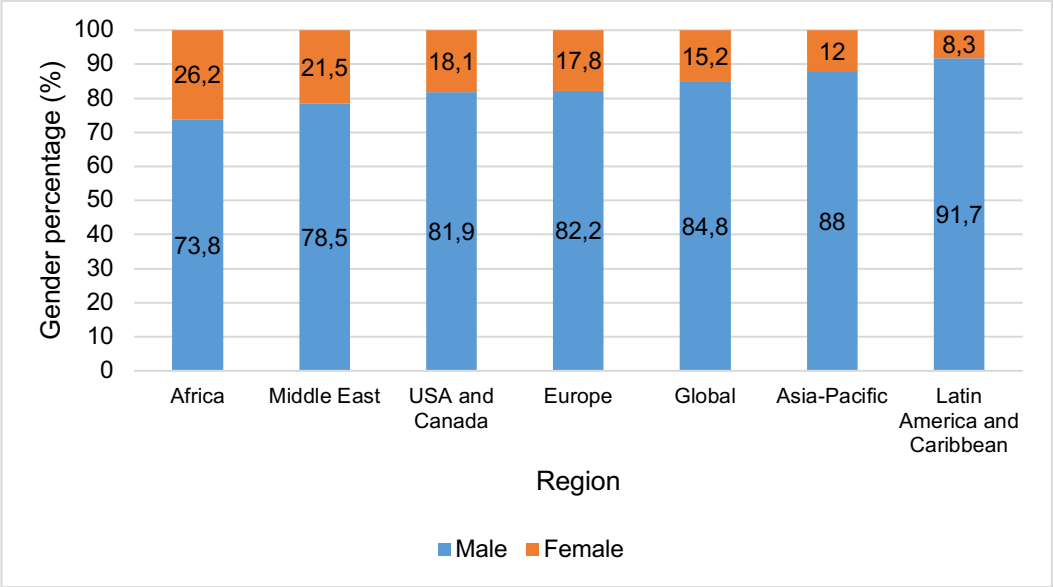


Figure 2.3. Gender representation on mining company boards. Source: Kuykendall & Darden, (2020)

Executive directors play an active role in the management of a business while non-executive directors play more of an advisory role. PricewaterhouseCoopers (2015, p.12) state that female directors are less likely to serve as executive directors than male directors. Figure 2.4 illustrates that *"94% of all board roles held by women are non-executive director roles within the top 100 companies,"* showing that very few women are actively running the activities of mining companies.

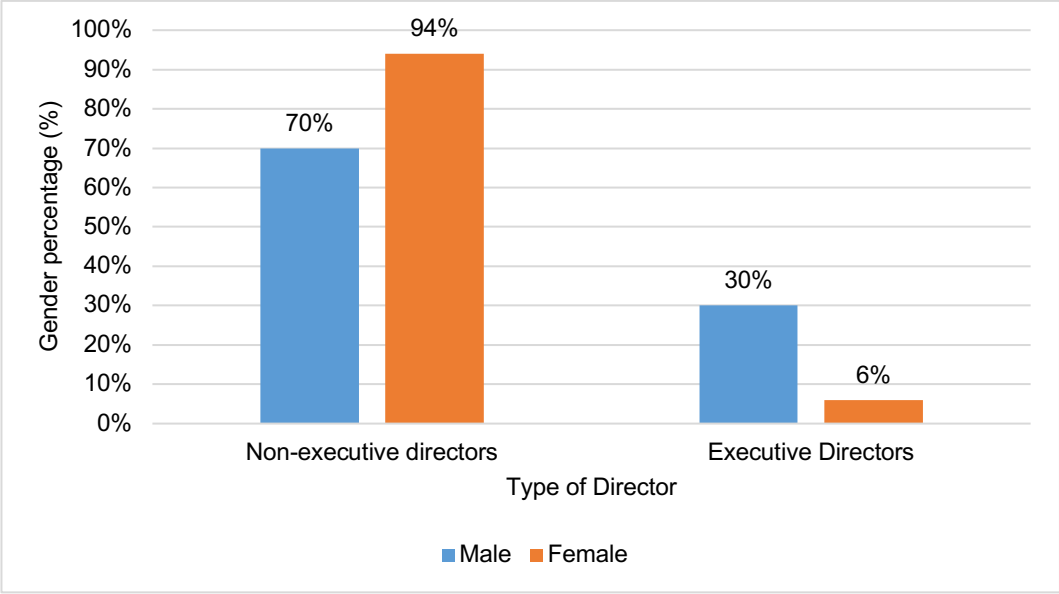


Figure 2.4. Percentage women/men directors in 2014. Source: PricewaterhouseCoopers *(2015, p.12)*

The low representation of women in board roles is not only observed in mining companies. However, of all the industries studied by PricewaterhouseCoopers (2015), the mining industry has the lowest representation of women on boards over the preceding three years, as illustrated in Figure 2.5.

The PricewaterhouseCoopers (2015) study showed that because of South Africa being the only mining jurisdiction that has active legislation concerning diversity in the workplace and in management, the country has the highest female representation at board level as illustrated in Table 2.5. While South Africa fares well on a global scale, the JSE 100 indicates that the mining industry lags other industries with respect to the number of women on boards. In 2014 the percentage of women on the boards of the

JSE top 100 index company was 18.6% and 16.8% for the top 100 listed mining companies in this same period.

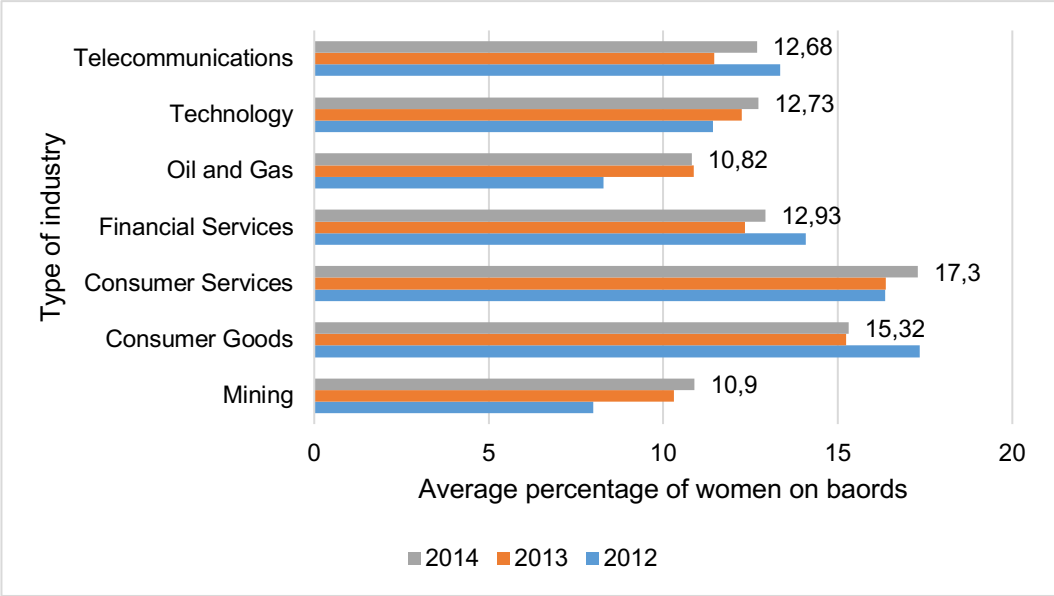


Figure 2.5. Average percentage of women on boards by industry over three years. Source: PricewaterhouseCoopers (2015)

Table 2.5. Board seats filled by women by jurisdiction.

COUNTRY	**EXCHANGE**	**% OF WOMEN ON BOARDS OF TOP 100 MINING COMPANIES**
South Africa	JSE	21.05
Australia	ASX	11.97
USA	NYSE	7.34
Hong Kong	SEHK	6.02
Canada	TSX/TSXC	5.24
United Kingdom	LSE/AIM	4.27

Source: *PricewaterhouseCoopers (2014)*

The above research indicates that, while there is still a significant underrepresentation of women in executive and board roles, South Africa appears to be leading the charge in the minerals industry, possibly because of regulatory requirements. However, the education and training of the women in the executive and/or on boards of minerals companies shows a distinct lack of technical skills – this in an industry that is technical by nature.

2.3 Lack of Technical Women in Executive and Board Roles.

The mining value chain is complex with stages from mineral exploration to ore extraction (underground or surface mining) and ore processing to obtain the intended metal or mineral. Technical roles primarily require an individual to work in exploration, minerals processing, metallurgy or in underground or surface mining. As illustrated in Figure 2.6 technical roles involve working with the orebody in roles such as geologist, mining engineers and metallurgists, etc.

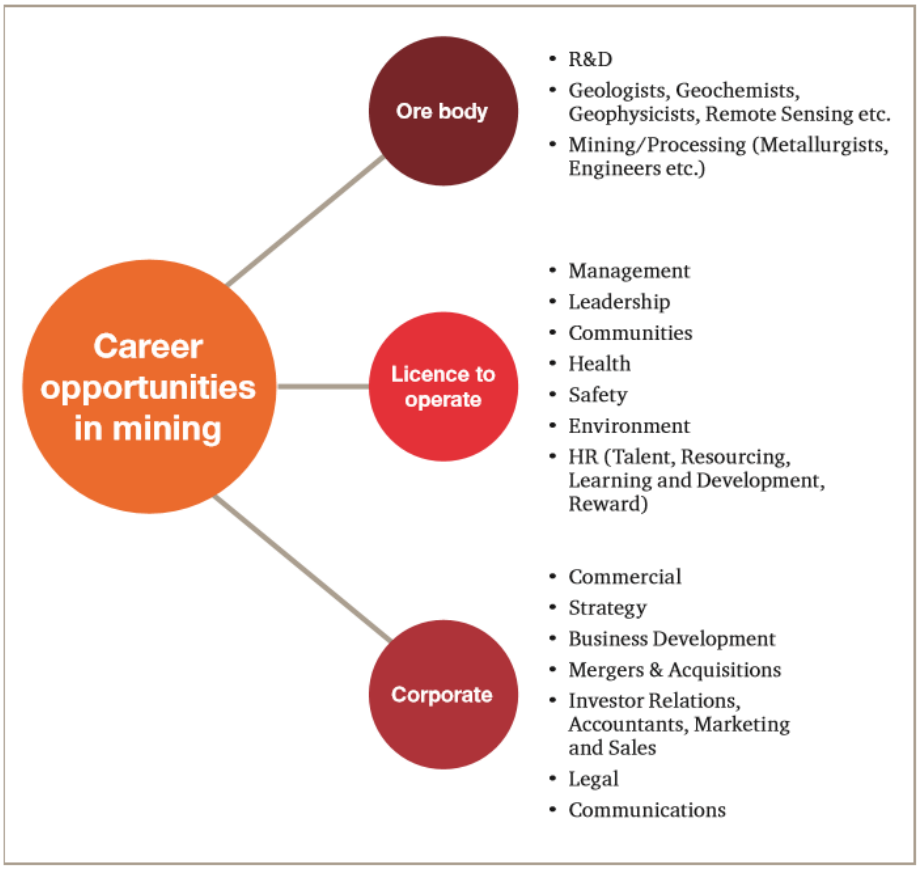


Figure 2.6. Careers in the mining industry. Source: PricewaterhouseCoopers (2014, p.23)

As a consequence of laws such as the South African Minerals Act of 1991 prohibiting women from working underground, technical roles had primarily been reserved for men while women were primarily employed in corporate, administrative and advisory roles (Botha, 2017; Botha & Conje, 2015a; Botha & Cronje, 2015b; Zungu, 2013). With the new democratic government coming into power in South Africa, women were permitted to work underground from 1996 onwards, allowing for women to fully participate and take advantages of all the opportunities in mining

Botha & Cronje's (2014) research on opportunities for women employed in core mining activities highlighted that, women experienced difficulties in advancing to senior roles in the mining industry, namely, senior management and executive roles. Kuykendall & Darden (2020) and Moraka (2015) stated that many women who held executive roles in mining companies were not technical, but were derived from other professions such as accounting, law, and finance. Kuykendall & Darden (2020) also showed that this phenomenon is most prevalent among midsize and large companies while junior mining companies have more technical women such as geologists and mining engineers represented on their boards. PricewaterhouseCoopers (2014) showed that in general, smaller mining companies have a greater representation of women where 11.7% of executive management roles were held by women were held by women compared with only 10.6% in the top 100 companies.

PricewaterhouseCoopers conducted research in 2014 and 2015 comparing the representation of women at executive management and board level of the top 100 and top 500 mining companies globally. They noted that, while many strides have been taken in South Africa for the inclusion of women in mining, technical women are still underrepresented in executive and board roles in large, listed companies. Table 2.6 shows that female executives in listed mining companies, typically, come from industries such as finance, health, telecommunications, or construction, and serve in non-technical

roles such as executive of Human Resources, Corporate Affairs, Social Development, Investor and Stakeholder Relations.

Table 2.6. Roles held by women in executive management positions in the top 100 mining companies in 2014.

ROLE	NUMBER OF WOMEN
Human Resources	22
Finance	19
Investor Relations	17
Secretary	14
Other	14
Legal	8
Operations	7
CEO	1

Source: PricewaterhouseCoopers (2015, p.13)

When looking at educational qualifications of directors of the top 100 mining companies, Table 2.7 illustrates that only six female directors hold an engineering degree compared to 21 male directors. The PricewaterhouseCoopers (2015) study also shows that more women hold a bachelor's qualification in Law, Finance, and the Arts in comparison to their male peers. In terms of professional experience as illustrated by Figure 2.7, 20% of male directors have professional mining experience while only 12% of female directors have the same experience. A similar trend can be seen

in the oil and gas industry as well – both historically male dominated fields of practice.

Table 2.7. Educational background of board members of the top 100 listed mining companies.

UNDERGRADUATE DEGREES		**FEMALE (N)**	**MALE (N)**
	BEng	6	22
	BSc Geo	5	9
	Law	18	13
	BCom/Fin/Eco	35	27
	BA	16	17
POSTGRADUATE DEGREES	Other	23	10
	MBA	21	19
	MA	25	13
	MEng	1	5
	MSc	7	7
	PhD	15	12

Source: PricewaterhouseCoopers (2015, p18)

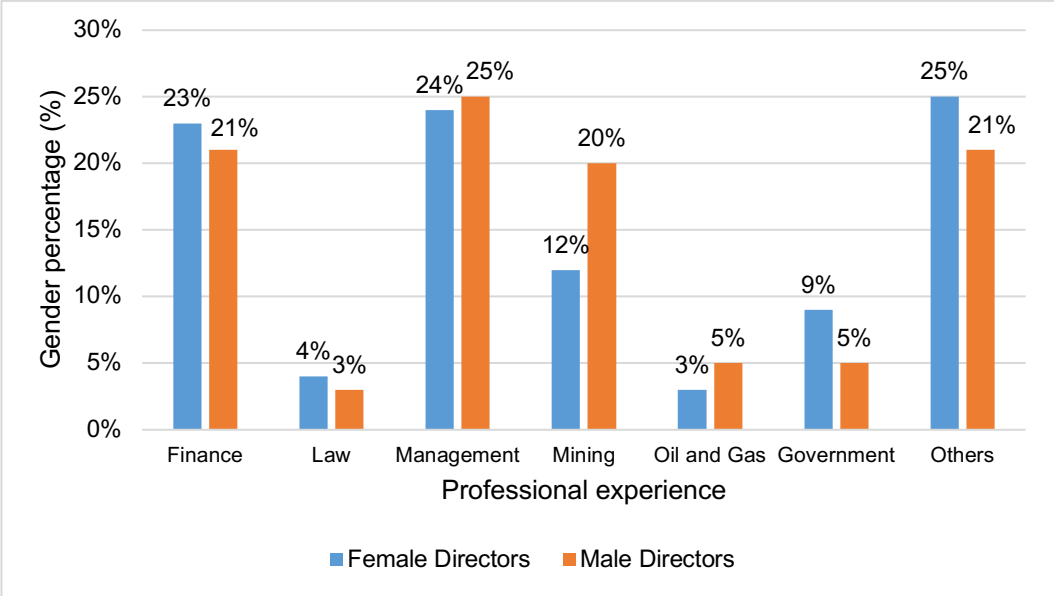


Figure 2.7. Professional experience of female and male directors on mining company boards in 2014. Source: PricewaterhouseCoopers (2015)

2.4 Why Women are Underrepresented in Executive and Board Roles

According to PricewaterhouseCoopers (2014) and S4 Development Services (2019), technical industries, namely, oil and gas, mining and construction are male dominated at executive level. These studies further note that such technical industries face challenges both in the attraction and the retention of technically skilled women.

With respect to attraction of technically skilled women, the PricewaterhouseCoopers (2014, p.20) study noted that *"at university, few women choose degrees that would naturally take them into a career in the mining industry and very few school-age girls identify mining or industrial careers as their preference."* The implication of this statement is that technical industries are male dominated primarily because, historically,

young women were not encouraged to enrol *in "mathematics and science, which feed into these industries"* PricewaterhouseCoopers (2014, p.6). However, in recent history there has been an increase in women studying and taking up careers in Science, Technology, Engineering and Mathematics (STEM). According to Society of Women Engineers (2022) in the year 2019, 34% of STEM workers are female with a rise of female workers with a bachelor's degree rising from 42% in 2010 to 44%. This has largely been to young women being exposed to careers in STEM and bursaries offered in these fields (Campbell, 2007).

Regarding retention of technically skilled women, the PricewaterhouseCoopers (2015) study found that on average, 30% of graduate recruitment for mining companies was female, however this number had fallen to 10% when these same female graduates had reached mid-level management. The career trajectories of women in the technical occupations are encumbered by several factors, resulting in less women remaining in industry and rising up the ranks (Walsh, 2012; Woolnough & Redshaw, 2016). Research by Moalusi & Jones (2019, p.5) identified three main themes from women's perspectives on why their career advancement was encumbered, namely:

- *"male domination that has marginalised women and compelled them to emulate masculinity has legitimised existing gender barriers.*

- *the long, awkward, and unpredictable hours of work have deepened women's time constraints because they must combine the home or family caretaker role with work; and*
- *the essence of being a woman in a mining organisation."*

Lahiri-Dutt (2015) added that mining operations are often in remote locations far away from the city with few recreational activities and amenities young people enjoy. She, further, mentions that the mining industry's conventional nature of operating fails to attract graduates, especially female graduates as they seek careers in digital and innovative industries.

Consequently, with only a small talent pool of STEM female graduates, mining companies often must compete, both in the recruitment process and in retention, as better opportunities may present themselves from a competing mining company. Campbell (2007, p.1) stated that *"it is not only competing mining companies that poach the technical female mining graduates, but companies in different sectors of the economy such as Finance, which have less physical, more comfortable jobs, with higher salaries, higher social status and more family-friendly."*

Based on the research above, some of the more significant issues that influence the ability of companies to attract or retain women in technical positions are discussed below. These include: the fact that the industry was designed for men; the workplace culture; safety, motherhood, and awkward working hours; and the lack of mentorship and visibility of female leaders.

2.4.1 Industry was designed for men

As women were excluded from participating in core mining activities, the mining industry had largely been designed and developed for men. This is notable as some mining operations did not even have facilities such as female change houses, underground toilets for women or personal protective equipment (PPE) that accommodates women's bodies (Buthelezi, 2013). In addition, machinery and equipment such as rock drills were designed for male sizes and strength

2.4.2 Workplace culture

Pimpa & Moore (2018, p.77) states that, *"Culture is critical in shaping gender roles in any context. It determines how society values the opinions and work of women and men, and it creates not only barriers but also opportunities related to the realisation of women's rights."* Due to implicit and explicit bias, according to Kuykendall & Darden (2020), culture remains a large contributing factor for young female graduates choosing to leave the mining industry mid-career, a fact highlighted further by Benya (2016, p.vi) who noted that *"the entrance of women in South African mines in 2004 and their allocation into occupations that were previously exclusively reserved for men is a significant challenge and a disruption to masculine subjectivities and the occupational culture."*

This occupational culture manifests itself in stereotypical gender roles as noted by Bobbit-Zeher (2011) and Mathur-Helm (2006), as well as by Cha (2013) in (Martin & Barnard, 2013, p.9) who noted, *"Covert discriminatory*

behaviour manifests in stereotypical male-gender roles and expectations that permeate the workplace. It also manifests in male colleagues' resistance to accommodate and support female employees. Stereotypes and male resistance emanate from cultural and societal norms because of patriarchal structures in family units, where women play submissive roles to men." These stereotypical gender roles and patriarchal norms often spill over into the workplace with men challenging and undermining female managers who may be more senior than them.

Workplace culture that is experienced by women in mining operations is also experienced by women in boardrooms. Brandt, 2013 and Scherer 1997 in (Moraka, 2015) research found that boards with a male majority can create an inhospitable environment to female board members, where women may be undermined or viewed as token appointments. A further complicating factor is that women in senior positions can also create in inhospitable environment for other women, adopting what Hawarden, 2010 in (Moraka, 2015) calls "Queen Bee" behaviour. This behaviour is exhibited when women do not want to see the advancement or development of other women as they want to be the only woman in that male dominated space.

Workplace culture being difficult for women to thrive goes beyond male colleagues' behaviour but is perpetuated by systems that allow for this behaviour and still uphold wide gender pay gaps. According to Martin & Barnard (2013) issues such as salary inequalities further intrench discrimination against women in male dominated industries.

2.4.3 Safety

Mining has generally been perceived as too dangerous an environment for women to work where injuries and fatalities occur from mining or machine related accidents. Apart from the obvious hazards in an operating environment, women also potentially face other safety issues on mining operations – namely sexual harassment and assault. According to Pons and Deale (2010) in Botha (2016, p.2), sexual harassment is regarded as *'unwanted conduct of a sexual nature' and may include 'unwelcome physical, verbal or non-verbal conduct'*. According to Botha (2016) women working in male dominated industries such as mining are most vulnerable to sexual harassment due to the high male-to-female ratio.

Botha (2016), further, mentions that women in technical roles are more likely to face sexual abuse and/or harassment as they work in close proximity to men in dark and isolated working areas underground. In underground operations, employees are transported from the surface to underground working areas in tightly packed mine cages which according to (Botha, 2016) increases the risk of sexual harassment. Botha (2016, p.4) further described that sexual harassment incidents varied from *"whistling, name calling, use of vulgar or derogatory language; display of body parts; physical contact, ranging from touching to sexual assault and rape; to the exchange of sexual favours for a promotion."*

According to Lahiri-Dutt (2015), as cited in Williams et al. (2012), while sexual harassment or assault is generally reported by women, there is

inadequate legal redress against the alleged perpetrators. This lack of legal redress can result in women having to work with, and face, their alleged perpetrators daily, which may lead to women preferring to leave their respective operation or the mining industry.

The results of such gender discrimination and/or sexual assault are multiple. Botha (2016) highlights psychological and physical affects as well as economic consequences. Further, according to Anderson and Taylor (2006) in Botha (2016) victims of sexual violence in the workplace may lose their ambition and self-confidence and develop a negative attitude towards their work and workplace.

2.4.4 Motherhood and awkward working hours

According to McFaden & Rawson Swan (2012), females in mid-career stage experience more challenges than male peers in efforts to advance their careers to senior roles because of the demands of caretaker roles such as childbearing that primarily fall on women. In society certain traditional gender roles and stereotypes still exist, where women are the primary caregiver in the household.

Moalusi & Jones (2019) described the long working hours, the shift systems and standby systems as being unpredictable and unfavourable for the work-life balance for women who are also wives and mothers. Pimpa & Moore (2018) mention that retaining women once they become mothers can be challenging as motherhood requires flexible work arrangements, that mining

operations often to not have. Moalusi & Jones (2019, p.11) also stated that *"entry into motherhood had ramifications not only on the career advancement of women in core mining positions, but also for their continued employment".* Moalusi & Jones (2019) further found that some women even declined opportunities for promotions that could potentially require working longer hours and may impact negatively impact on their work-life balance.

Pimpa & Moore (2018) mention that mining operations are often in remote locations and thus there is often low access to quality childcare. As women are often seen to give priority to their family responsibilities, men are often seen as being more committed to their jobs and can thus take on senior roles with greater responsibility than their female peers (Acker, 1990; Banihani, et al., 2013). However, while not all women aspire to be married and have children, according to the PricewaterhouseCoopers (2015) study, senior male managers generally assume through an unconscious bias, that women do not want to work long hours or work in remote locations as this may interfere with their family obligations. This same study also states that because of such bias, women in middle management roles may also be denied advancement into senior roles with more responsibilities as it is assumed that they are at an age where they are focused on raising their young families.

2.4.5 Lack of mentorship and visibility of female leaders

Du Plessis and Barkhuizen (2012) in (Martin & Barnard, 2013) found that insufficient training and mentorship of women played a critical role as a

barrier for women in the engineering field. Mentorship, according to Haggard *et al*., 2011 in (Montgomery, 2017), is a key factor that can contribute to career development and success. However, due to the male dominated nature of the industry, mentors for young women are often likely to be men. Botha (2016) noted that such male colleagues often refuse to provide the required mentorship, guidance, and support to new female colleagues. In addition, Hakim (2004) in (Botha D. , 2016) indicated that some women also faced sexual harassment incidents from older male mentors, potentially making mentorship not the positive experience that it should be.

Even in the face of all the issues mentioned above, young women may be encouraged to persevere in their mining career if they see examples of older technical women who have risen from mining operations to executive management positions. The 2015 PricewaterhouseCoopers study mentions that the paucity of such role models as one of the reasons why women believe that they may not advance up the corporate ladder. PricewaterhouseCoopers (2014) shows that women who are often selected to serve on the board of mining companies have had careers in financial, human resources or sustainability industries among others. This highlights the need for technical women in mining to be mentored in a way so as to broaden their career experiences in preparation for board roles.

2.5 Benefits for Women Inclusion in Executive and Board Roles

The survey by PricewaterhouseCoopers (2015), p.20 stated that participants believe that *"the most important attributes that women bring to business, are a robust work ethic, strong teamwork, strong communication skills, resilience and empathy."* Figure 2.8 shows the key findings by PricewaterhouseCoopers (2015, p.20) of the *"perceived benefits of women in the mining industry."*

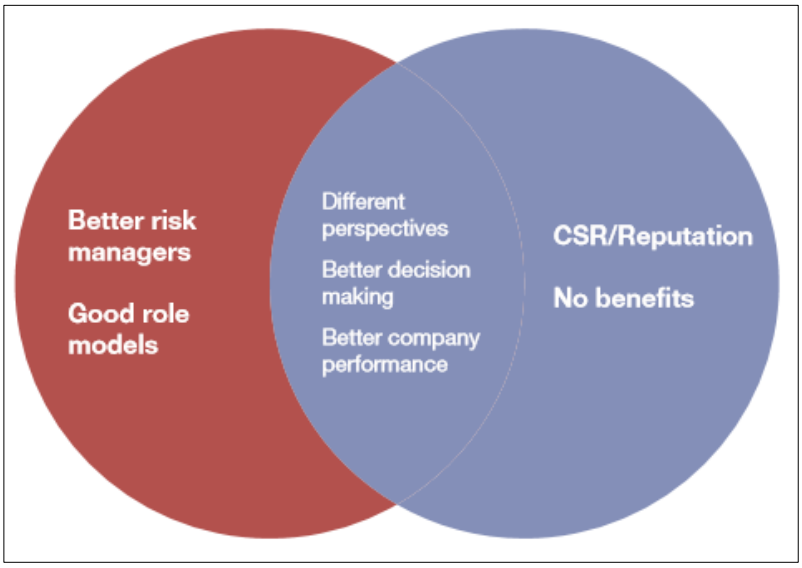


Figure 2.8. Perceived key benefits of women on boards. Source: PricewaterhouseCoopers (2015, p.20)

PricewaterhouseCoopers (2015, p.25) stated that Fortune 500 companies with gender diverse boards were *"better at identifying and capitalising on innovative opportunities"* to help these businesses to stay ahead. The study further found that the inclusion of women in senior management also motivates and inspires women in junior and middle management to work towards senior positions. Other advantages of gender diverse boards

include better corporate governance, better financial performance, and better risk management (PricewaterhouseCoopers, 2015).

2.5.1 Better corporate governance

PricewaterhouseCoopers (2015) defines corporate governance as the ability to balance the interests and creating value for all the stakeholders of an organisation. In this study, PricewaterhouseCoopers (2015, p.25) looked (*inter alia*) at a variety of Canadian companies and noted *"that boards with three or more women performed better in terms of governance than companies with all male boards."* They noted that female board members had a more collaborative style that resulted in an increase listening and tolerance thus better boardroom dynamics. Additionally, PricewaterhouseCoopers (2015, p.26) stated that *"having a critical mass of women directors is good for corporate governance in at least three ways; the content of boardroom discussion is more likely to include the perspectives of multiple stakeholders, difficult issues and problems are considerably less likely to be ignored or brushed aside, the boardroom dynamics is more open and collaborative."*

Companies that have diverse board leadership in terms of culture, race, education, and gender have been known to outperform those that do not. The 2014 Bloomberg Environmental, Social and Corporate Governance (ESG) review in PricewaterhouseCoopers (2015, p.27) shows that, *"boards with one female director within the top 100 listed companies performed better than all male boards by 22% on the ESG disclosure score, boards*

with two or more women performed 96% better than all male boards." PricewaterhouseCoopers (2015, p.26) referred to "*a 2012 study by Massachusetts Institute of Technology, Carnegie Mellon University and Union College on the collective intelligence of groups determined that the three major factors influencing the collective intelligence of the group were an increase in the average social sensitivity of group members, the group's ability to take turns contributing; and the proportion of females in the group."*

PricewaterhouseCoopers (2015, p.28) research further provides evidence that "*a link really does exist between women directors and corporate sustainability and that gender diversity is expected to impact on 'good' governance, thereby minimising effects of subversion or misappropriation of shareholder funds that can be detrimental to their returns. Because of their relational abilities, women on boards are more likely able to engage with multiple stakeholders and respond to their needs, resulting in an avenue for demonstrating social responsiveness."*

Women are deemed as more risk aware compared to men and thus the inclusion of female directors on boards improves risk management. PricewaterhouseCoopers (2015, p.27) showed *"that having at least one female director on the board reduced"* the likelihood of bankruptcy by 20% and *"having two or three female directors lowered the likelihood of bankruptcy even further."*

2.5.2 Financial performance

McKinsey & Company (2018) conducted a global study titled, “Why diversity matters” of more than 1 000 companies in 15 countries and found that there is a positive correlation between greater levels of diversity and higher likelihood of financial outperformance across all geographies at the executive level. According to Carter *et al.,* (2003) in (Moraka, 2015), women react faster to problem solving, thus improving communication, which results in a better financial performance.

Several studies demonstrate that mining companies with women on their Boards outperform those that don’t. For example, McKinsey & Company (2018) that showed that companies in the top quartile of gender diversity in their executive teams were 25% more likely to experience above average profitability than companies in the fourth quartile and 28% more likely to outperform for gender diverse boards.

A 2019 Credit Suisse study, looking at 30 000 executives in 3 000 companies globally, demonstrated that companies where women comprise of 20% or more in management improved share price performance when compared to companies where women comprised 15% or less in management; that companies where women occupied 10% or more of board seats had a better share price performance than companies where women occupied less than 10%; and that companies which comprised of 20% or more women in management roles generates 2% higher EBITDA margins than companies that had 15% or less women in management roles.

Furthermore, several studies by PricewaterhouseCoopers (2014, p.2) all demonstrate that mining companies with women on the board have higher profit margins (Figure 2.9), higher return on invested capital, *"higher return on equity, lower gearing, higher price/book value and better than average growth."*

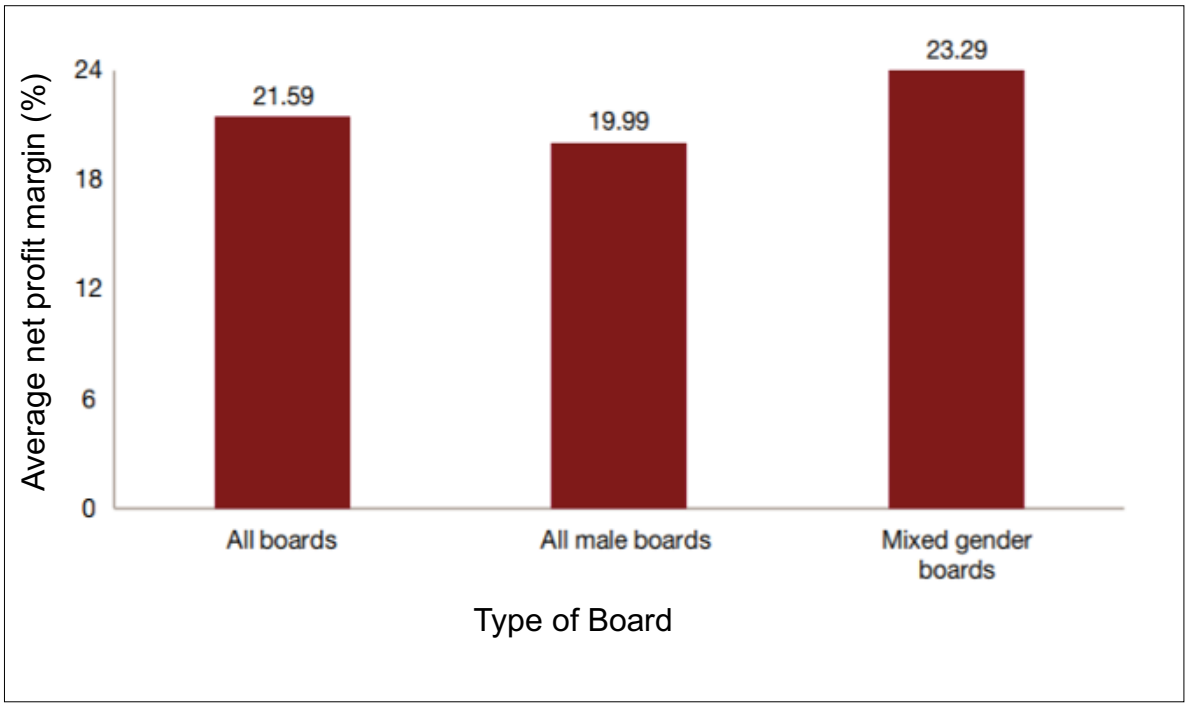


Figure 2.9. Average net profit margin for top 100 mining companies for all boards, all male boards and mixed gender boards. Source: PricewaterhouseCoopers (2014, p.9)

3 RESEARCH METHODOLOGY

3.1 Research Design

There are primarily two types of research design, namely quantitative and qualitative design. In view of the aim and objectives of the study, the research project combined qualitative and quantitative methods to analyse the current statistics of female representation at executive and board level and using questionnaires to document the reasons for the underrepresentation of technical women in mining companies.

According to Myers, (1997, p.241) *"qualitative research uses qualifying words and descriptions to record aspects about the world through qualitative data such as interviews, documents and participation observation, to understand and explain social phenomena."* The use of qualitative research assisted in the understanding of study participants in technical mining roles. According to Mertler (2016, p.108) *"Quantitative research relies on the collection and analysis of numerical data to describe, explain, predict or control variables and phenomena of interest."*

3.2 Research Population and Sample

3.2.1 Companies

The research was limited to the top 10 largest, by market capitalization, mining companies listed on the Johannesburg Exchange in South Africa. The ten companies, named Company's A to J (Table 3.1), account for a market value of over four trillion rand. Two companies have a primary listing

on the London Stock Exchange in the United Kingdom and two have a primary listing on the Australian Securities Exchange in Australia however all four have a secondary listing on the Johannesburg Stock Exchange due to the company's origins in South Africa and or having mining operations in South Africa. The commodities extracted by these companies include bulk commodities such as thermal and metallurgical coal and iron ore, base metals such as nickel, copper and zinc and precious metals such as gold and platinum group metals. The companies sampled in this study, mine almost all the commodities extracted in South Africa and are the largest employers in the industry. The operations owned by these mining companies include both underground and surface operations.

Mining companies of different sizes, that is; junior miners, medium sized and large listed organisations will have different issues relating to women. To include all the listed companies would be beyond the scope of an MSc research paper. Selecting the largest companies in terms of size does introduce a bias. However these companies are large employer of many mining professionals and while the results of this research report are specifically applicable to large listed companies, many of the principles highlighted may be applicable in a variety of mining companies.

Table 3.1. The top 10 largest listed mining companies on the Johannesburg Stock Exchange.

COMPANY	MARKET CAPITALISATION (RAND TRILLION)	COMMODITY TYPE	PRIMARY LISTING JURISDICTION
Company A	1,017,279,380,543	Diverse	Australia
Company B	905,948,886,099	Diverse	United Kingdom
Company C	822,737,179,546	Diverse	United Kingdom
Company D	506,946,876,445	Platinum Group Metals	South Africa
Company E	212,728,676,022	Platinum Group Metals and Gold	South Africa
Company F	207,423,367,256	Iron Ore	South Africa
Company G	203,160,262,211	Platinum Group Metals	South Africa
Company H	146,100,017,911	Diverse	Australia
Company I	124,935,386,582	Gold	South Africa
Company J	116,347,266,015	Platinum Group Metals	South Africa

Source: Johannesburg Stock Exchange (2021)

All general information related to women in the listed mining companies was obtained from public information. Information that has not been made public such an internal policy regarding succession planning and upskilling female employees was not available.

3.2.2 Interviewees

The research sample for this study comprised of 30 technical women who have or currently working in a technical role for any of the top 10 largest listed mining companies on the Johannesburg Stock exchange in South Africa. A total of 50 questionnaires were sent to individuals who had expressed an interest in participating in the study. Only 30 fully completed questionnaires were received which may have introduced a bias to the study. The participants were from various mining operations of the 10 companies across various categories of employment and mining disciplines. The study interviewed women from across the value chain of mining operations including geologists, mining engineers, engineers, and metallurgists.

The number of women interviewed were a small sample and not necessarily representative of all technical women in mining. The experience of women in the top10 JSE-listed companies may be very different from successful women in Junior companies or in large, listed companies elsewhere in the world – this issue has not been explored in any detail in this study.

The participants in this study had to meet the following criteria:

- Female
- Must have a technical qualification (from a tertiary institution)
- Operational/technical experience at one of the top 10 largest listed mining companies.

The study interviewed 30 technical women who currently work for or have worked for Company's A to J. The demographics of the research participants are detailed in Table 3.2.

Table 3.2. Demographics of interviewees.

Age Group:	
25-35	18
36-45	8
46-55	4
Qualification:	
Mining Engineer	6
Geologist	12
Engineer (Mechanical/Electrical)	3
Metallurgist/Chemical Engineer	7
Process Engineer	2
Other	0
Period in a top 10 listed company	
1-5 years	11
6-10 years	9
11-15 years	9
16-20 years	1

3.3 Data Collection

Data has been collected using both qualitative and quantitative methods. Quantitative data was collected from the information extracted from company websites, integrated annual reports and any other publicly available supplementary information. Qualitative data was obtained through

defined questionnaires which were used to interview 30 women who currently work for or have worked for one of the top 10 listed mining companies in a technical capacity.

3.3.1 Company data

Company data was collected by downloading publicly available company reports, namely, annual reports and sustainability reports. These reports detail executive committee and board committee composition. The reports supply the information of both executive and non-executive directors such as their names, age, gender, and qualifications. The information obtained from company reports can be viewed in Appendix A.

3.3.2 Interviews

Semi-structured interviews in the form of a questionnaire were conducted with 30 participants (Appendix B). The questionnaire consisted of predetermined 24 questions, some multiple choice with an opportunity to expand upon and comprehensively explain their view and opinions on certain issues. The questionnaire was submitted and approved by the ethics committee.

The sample study participants identified were technical women in the authors' network. The participants being largely from the authors network may introduce a potential bias speaking to experiences of black women geologists in the age group of 25 to 35. To deal with this potential bias, the author interviewed participants across the different organisations at different

levels of management. These participants recommended other potential interviewees. Some participants were contacted via professional platforms such as LinkedIn.

3.4 Data Analysis

All completed written questionnaires were collected from the interviewees and stored on a password protected personal computer. Analysis of the data included examining all the interviews and identifying key themes and subthemes. The author compared the themes that emerged from the sentiments of the interviewees with previous research on the topic of underrepresentation of women in mining.

3.5 Criteria for Validation of Research

Participants who were interviewed were technical women who have worked, or currently work, in a top 10 listed mining company in South Africa. While this data may not be statistically representative of all the women in mining, it is expected that the results will be sufficiently valid to provide insight into the issues involved and highlight potential solutions.

It is anticipated that some of the findings of this study will be different from some of the conclusions highlighted in the literature survey. If this happens, the results/conclusions sections of this Research Report will attempt to understand why, by comparing the experiences of the participants in this study with those of pre-existing studies.

While there is extensive research on the inclusion of women in mining, there is only a limited number of peer-reviewed journal articles on the topic of the composition of technical women at executive and board levels of mining companies. Further, corporate policies and information regarding the makeup of specific boards of directors are not published in journal format. Non-peer reviewed references comprises of research reports published by credible international organisations, company Integrated Annual Reports and corporate websites.

3.6 Ethical Issues/Clearance

Ethical clearance was obtained from the University of Witwatersrand's Ethics Committee, prior to embarking on the study. This was done in compliance with regulations governing research, to ensure that the study would be conducted with consideration given to the participant's rights and that these would not be violated (Appendix C).

Prior to receiving the questionnaire, participants were informed of the purpose of the study. Participants were informed that their decision to participate was voluntary and that their responses and personal details would be kept anonymous and confidential. All interviews were conducted through a written questionnaire.

The companies mentioned in the study were not contacted as the information used in the study was publicly available. The company documents referred to are all company annual and sustainability reports for

Anglo American, Anglo American Platinum, Anglo Gold Ashanti, BHP Billiton, Glencore, Goldfields, Impala Platinum, Kumba Iron Ore, Sibanye Stillwater, and South32.

4 RESULTS AND DISCUSSION

4.1 Introduction

Through thematic analysis, the research identified four key themes outlined in Table 4.1. This Results Chapter will look at each of these themes separately. In each section, comments from the participants have been incorporated to support the suppositions.

Table 4.1. Themes and subthemes identified by study.

THEME	SUB-THEME
Theme 1: Women still play a supporting role in mining	1. Executive vs board representation 2. Role's women hold in executive roles
Theme 2: Policies and political will	1. Men had a head start 2. Geographical differences 3. Policies are not reflective of the lived experiences
Theme 3: The problem is retention not attraction	1. Systemic biases 2. Lack of female success 3. Lack of exposure and Opportunities 4. Lack of advocacy for technical women
Theme 4: Not all women in mining are equal	1. Technical women are changing to non-technical roles in mining 2. Different worlds for women in mining

4.2 Women Still Play Supporting Roles in Mining

A key research finding is that women still play a supporting role in mining. This is demonstrated by the overall composition of both executive and company board of directors and the nature of roles held by women in executive and board positions.

4.2.1 Executive vs board representation

The companies under discussion have a combined total of 85 executive directors and 94 directors sitting on the various boards. Figure 4.1indicates that there is a higher representation of women on boards than at executive director level, with total female representation being 37% and 25% respectively. Company D is the only mining company in the top ten with a female CEO. Four companies, namely Company's G, H, I and J have female CFO's.

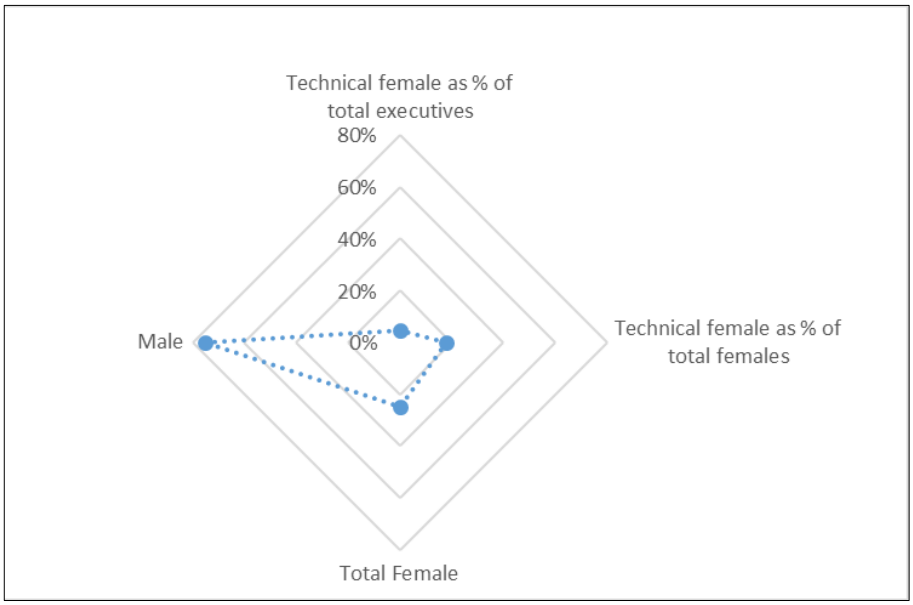


Figure 4.1. Gender representation of executive directors of the top 10 listed mining companies on the JSE in South Africa.

While many of the women interviewed for this study expressed an interest in serving in an executive role, they also expressed being discouraged by the lack of technical female representation in senior management. Interviewees believed that many women occupying executive roles were not technical women who had worked their way up the corporate ladder in mining.

"*Mining boards especially are filled with too many lawyers, accountant and environmentalists – who get poached from other boards – because "it's all about relationships" and not because they are the best fit/candidate*." **Interviewee 11**

4.2.2 Types of roles held by women in executive positions

Table 4.2 shows that only 18% of female executives hold a technical role such as Chief Executive Office, Chief Technical Officer of President of Operations. This in contrast to 76% of female executives hold non-technical support roles, primarily Human Resources Corporate Affairs and Legal.

The support roles that are held by women in executive suites are not exclusive to mining. All the executive women in non-technical roles are brought in from other industries and are not groomed within a mining company to rise through the ranks.

"There is still a patriarchal perception of women leading in senior and executive roles. Women are generally appointed to these roles based on

quota requirements to fulfil "soft-skill" portfolios. In many, if not most, executive boardrooms the mining sector is still a "boys club" where women's roles are perceived to be supportive and not leading." ***Interviewee 6***

Table 4.2. Executive roles held by women in the top 10 listed mining companies on the JSE in South Africa.

Role	Position	Numbers	
Technical	Chief Executive Officer	1	4
	Chief Technical Officer	2	
	President Operations	1	
Nontechnical (support)	Chief Financial Officer	4	18
	Chief Commercial Officer	1	
	Group Director	1	
	Legal	3	
	Human Resources	5	
	Corporate Affairs	4	
Total			22

The nature of the support role played by women on company boards and in executive roles is reflected in the qualifications of such women. Women with

technical qualifications are underrepresented at both board and executive director level. As illustrated in Figure 4.2 and Figure 4.3, 24% of women on boards have a technical qualification and 23% of executive directors have a technical qualification. The data shows that at the highest levels in mining companies, women with non-technical qualifications are in the majority.

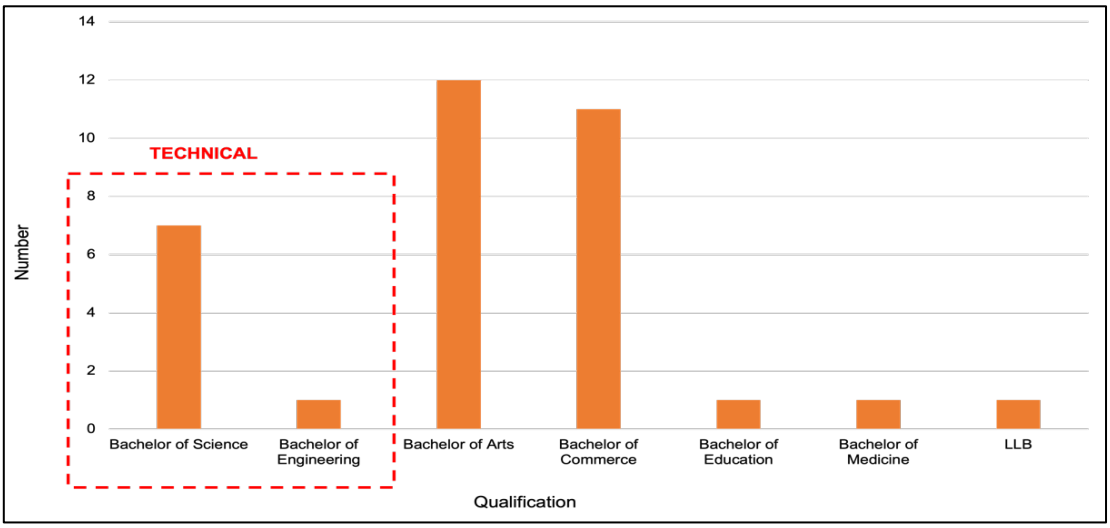


Figure 4.2. Qualification of female board of directors of the top 10 listed mining companies on the JSE in South Africa.

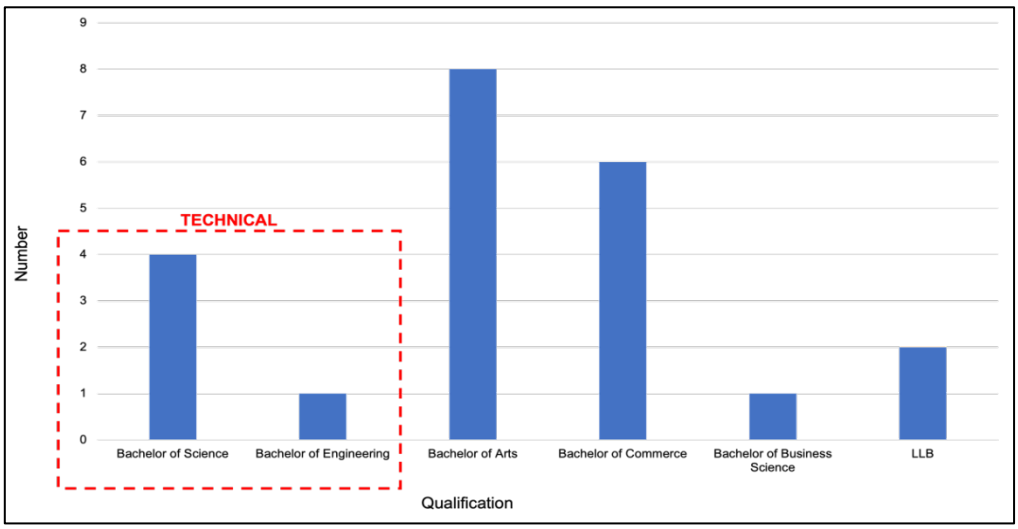


Figure 4.3. Qualification of female executive directors of the top 10 listed mining companies on the JSE in South Africa.

4.2.3 Discussion

Women continue to play a support function in mining

Research into the participation of women in senior leadership positions such as the PricewaterhouseCoopers (2014) report, 'Mining for talent', deep dives into the gender composition of boards and executives of mining companies globally. This study showed that even in the boardrooms of the top 10 largest mining companies in South Africa, women still play a support role in mining. This is highlighted by the key differences of a board of directors and executive directors and the types of roles women hold as directors.

Board vs executive

Listed companies primarily have two types of directors, namely, executive directors who serve on executive committees and non-executive directors on an organisation's board. The difference is that boards play an oversight and advisory role to the company while the executive committee is responsible for the operation of the business.

NedonBoard (2015, p.1) defines an executive director as "*An executive director is a member of the board of a firm who also has management responsibilities. Executive directors hold a position on the board of directors and are company employees, as well as a board member. They have 'executive responsibility' for running the company's business."*

NedonBoard (2015, p.1) defines a non-executive director as *"A board member without responsibilities for daily management or operations of the company or organisation. The company appoints non-executive directors through a letter of appointment and does not employ them. Non-executive directors challenge, question and monitor the CEO and senior management. They bring an independent perspective to decision-making and hold senior management to account, whilst also supporting and mentoring the CEO and senior management."*

The PricewaterhouseCoopers (2015) study showed 94% of female directors in the top 100 mining companies were non-executive directors while only 6% were executive directors. The data of this study shows that in the companies observed in this study, on average females represent 25% of all executive directors and 36% of all board of directors. Women having a higher representation on boards shows that women still play a support role in mining due to the different roles of executive directors and non-executive directors in the decision-making process for core functioning of a company.

The high representation of men in executive roles indicates that primary decisions for mining companies are still in the hands of men. The methods of operating and the day-to-day activities that impact on mine workers and company employees are largely dictated by male executives. This is supported by digging deeper into the roles women hold within executive committees of mining companies. The study found that most female

executives in the top 10 listed mining companies in South Africa were in roles that are in support to the core mining roles held by male executives.

Composition of executive roles

The qualification of female executive and non-executive directors in the companies were primarily Bachelor's degrees in Art and Commerce. 40% of all female directors had a Bachelor of the Arts degree, 24% hold a Bachelor's in Commerce while 20% had a Bachelor's in Science and 4% had a Bachelor's in Engineering. The core function of mining requires technical qualifications, namely in Science and Engineering, the qualifications where female directors have low representation in. The qualifications of female directors can be attribute to the fact that historically boys had been encouraged to take STEM subjects while girls were not. The smaller pool of women with the relevant technical qualifications may be a reason for the underrepresentation of women in core mining director roles.

The finding that 'women still play a support role in mining companies' is supported by analysis of the types of roles women hold within executives. Women are overly represented in roles that are a support to mining activity, namely, human resources, legal and finance, this correlates with research results of PricewaterhouseCoopers (2015). This study showed that the roles held by executive women in the top 100 mining companies in the world were primarily represented in human resources (HR) and finance and underrepresented in core mining functions. Of the 102 female executives in

the PricewaterhouseCoopers (2015) study, 22 were HR, 19 in finance and only one CEO. The results of this research report reflects the results of PricewaterhouseCoopers study with five women in Human Resources, four in finance and only one CEO of the 22 female executives. With 82% representation of women in this study in non-technical executive roles proves that women still primarily play a support function in mining.

4.3 Policy and Political Will

The mining industry, through the International Labour Organisation (ILO), had historically adopted Convention 45 (of 1935) which barred women from working underground on mines. Table 4.3 shows that over the years, most countries repealed and denounced this policy allowing for women to have careers throughout the entire value chain of the mining industry.

Table 4.3. Dates on which different regions ratified and then denounced the ILO 45 of 1935.

Country	**Year Ratified**	**Year Denounced**
Canada	1966	1978
Australia	1953	1988
United Kingdom	1936	1988
South Africa	1936	1996
Chile	1946	1997

Source: International Labour Organization, (2017)

In addition to repealing the ILO Convention 45 in 1996, South Africa has not only advocated for the inclusion of women in the industry but set quotas and reporting requirements for mining companies. This has been accomplished using legislative frameworks such as the MPRDA (2002) and Mining Charter (2004). Most participants (63%) stated that they were aware of the policies in South Africa that speak to the inclusion and advancement of women in mining.

Alongside South African laws and policies, most mining companies have internal diversity policies that promote the inclusion of historically disadvantaged and minority groups. Most interviewees believed that while their respective companies have policies that are aligned with South African policies on the inclusion and advancement of women, they also believe that they are not effective due to the underrepresentation of these groups in the most senior levels of companies. Interviewees believed that both country and company policy were vague when discussing the advancement of previously disadvantaged groups, such as through the advocating for a certain percentage of women in executive roles and not clearly stating the representation of technical women. Many interviewees believe that mining companies have not invested in the development of technical women into senior roles as they have the option to fill these positions by women from other industries.

While mining companies and the South African government publish numbers showing the growing representation of women in the industry, they

do not include details of the types of roles these women hold. Neither do they track the progress of female talent from the time they enter the mining industry.

4.3.1 Men had a head start

Men have been honing their technical skills since mining began in 1867 in South Africa. However, women have been allowed to work underground in mining operations only since 1996, giving men more than a 100-year head start. It is suggested that this feature is primarily responsible for the significant underrepresentation of technical women in executive and board roles.

4.3.2 Geographical differences

This study found that there is a difference in technical female representation in the different jurisdictions of the companies in this study (Table 4.4). Two of the companies have a primary listing in the United Kingdom (UK) and two have a primary listing in Australia with the remaining six having a primary listing in South Africa. Companies with a listing and operations in Australia had a higher representation of technical women at both executive and board level.

Table 4.4 Female representation at executive and board level by jurisdiction.

	Female Executive Directors (%)	**Technical Female Executive Directors (%)**	**Female Board Members (%)**	**Technical Female Board members (%)**
Australia	47%	33%	31%	17%
South Africa	19%	6%	36%	4%
United Kingdom	11%	0%	44%	13%

None of the companies in this current study have mining operations in the UK, rather having a primary or secondary listing in the region. The representation of technical women in Australia can be directly correlated to Table 4.3 above. Australia repealed ILO Convention 45 before South Africa, allowing women to fully participate in mining and therefore has a higher representation of technical females at executive and board level.

Globally government intervention and policies have played a crucial role for the inclusion and advancement of women in mining. This first started with different governments around the world banning and denouncing of the ILO Convention 45.

This study found that, in regions where ILO Convention 45 was repealed and denounced first, there is a higher representation of technical women

represented at executive management and board level. The Australian based companies have the highest female representation in executive level and highest technical female representation at both executive and board level.

Australian companies have a higher representation of female executives than board members while UK and South African based companies have higher female board representation than at executive level. As established earlier, non-executive directors on boards play an advisory role while executives play an active role in the management of the business. Women in Australian based companies have a greater impact on the business of mining than peers in South Africa and the United Kingdom

Previous research by PricewaterhouseCoopers (2013) highlighted the significance of policies and female representation in different mining jurisdiction. Research showed that South Africa and Australia have gender equality and reporting legislation. PricewaterhouseCoopers (2014, p8) stated "*In Australia, the ASX Corporate Governance Council Principles and Recommendations were re-issued to include recommendations on gender equality. Companies listed on the ASX must: develop and disclose to the public a diversity policy; establish measurable objectives for achieving gender equality which are assessed annually; and disclose in their annual reports the percentage of women on their board and in senior management. Compliance with these corporate governance principles is not mandatory but noncompliance must be disclosed in the company's annual report*."

In South Africa government policies were put in place to redress some historical inequalities such as the exclusion of women in mining. These policies have advocated for the upward mobility of women in mining to all levels of management. South Africa is now a signatory of “ILO’s Convention 176 (Safety and Health in Mines, 1955), which covers the rights of all workers” (Minerals Council South Africa, 2021, p.1). Convention 176 states, *“Contrary to the old approach based on the outright prohibition of underground work for all female workers, modern standards focus risk assessment and risk management, and provide for sufficient preventive and protective measures for mineworkers, irrespective of gender, whether employed in surface or underground sites.”*

Countries that implemented policy and regulation allowing women access to technical skills and experience within the mining industry have greater representation of technical women at both executive and board roles. The study showed that companies that operate or are listed in Australia have a higher representation of technical females in executive roles than South Africa.

The roles held by female executives in South Africa are primarily support roles such as Human Resources, female executives in Australia are equally represented in both support and core technical mining functions. It can be deduced that due to Australia has a higher representation of technical women in executive and board roles because the country had inclusive

policies before South Africa and thus had a greater pool of technical women than South Africa.

4.3.3 Policies are not reflective in the lived experiences

While 57% of participants stated that they were aware of internal company policies that spoke to the advancement of women, most expressed that they believed that these policies were not well implemented.

"*On paper they (policies) do support the transition, however there are certain behaviours and conducts that suggest that they don't support*." **Interviewee 24**

"*Implementation of inclusion and diversity depend on the leadership that is there. There will be some managers who are supportive and some who are not*." **Interviewee 2**

"*Policies in South Africa and in mining companies are not effective in my view. Mostly it's about talk shows, thereafter we go back to our usual comfort spots. No follow up on what was committed to. People who benefit are those around Johannesburg, but mining personnel are disadvantaged because we are remote*." **Interviewee 8**

4.3.4 Discussion

Policies and Political Will Matter

The study also highlighted the difference in women representation in senior management roles in different geographies because of political will.

Government laws and policies have played a crucial role in the inclusion of women in mining and are required for the continued upliftment of women into senior roles.

Men had a head start

The history of boys and men being encouraged to pursue technical careers coupled with the exclusion of women by policy is the primary reason for the overrepresentation of men in the technical industries such as mining. The primary reason for the large representation of men in board and executive roles is because there is greater pool of men, due to having a head start, with the relevant qualifications and experience.

In its over 150-year-old history of mining in South Africa, women have only been allowed to fully participate, that is in core mining and mining support functions, for 25 years. With women being allowed to pursue technical careers in mining only in recent history, the number of women with the relevant experience would be low hence the large underrepresentation of technical women at executive and board level.

Prior to 1996 while universities may have been producing female graduates due to laws prohibiting women from working on underground mining operations, many graduates pursued careers as professors in universities and conducting research. This, while male peers were honing their technical skills and building their career profiles. It is for this reason that the pool of men deemed qualified to hold roles as directors is much larger.

Policies are not a lived experience

Participants in the study highlighted that while the South African government has national policies put in place and adopted by the organisations they worked for, they were not a lived experience every day on mining operations.

The study shows that policies do not immediately change people's attitudes and biases that are entrenched in male dominated industries such as mining. Participants highlighted language in policy speaking to inclusion and diversity women experience harsh and hostile working conditions that make them feel unwanted and excluded. Participants also mentioned that while policies set targets for higher female representation in management roles, women are still underrepresented, and men promote men and give men the opportunities to take up senior positions.

4.4 The Problem is Retention Not Attraction

The mining industry has made great strides in increasing the participation of women in the industry. As illustrated in Figure 4.4, between 2010 and 2020, female representation has almost doubled from 8% to 14%. This has taken place while the total number of employees in the industry has declined as mining size and significance continues to decline in the South African economy. This rise in female participation in the industry has been through initiatives such as the offering of bursaries and internships.

While the participation of women in mining has increased, indicating that the industry is becoming more attractive to women, this is not a reflected in senior positions. Many of the participants noted that technical women are attracted to, and entering, the industry. However, they are not remaining either in these technical roles or in the mining industry. The problem is, thus, not attraction but rather retention of female talent.

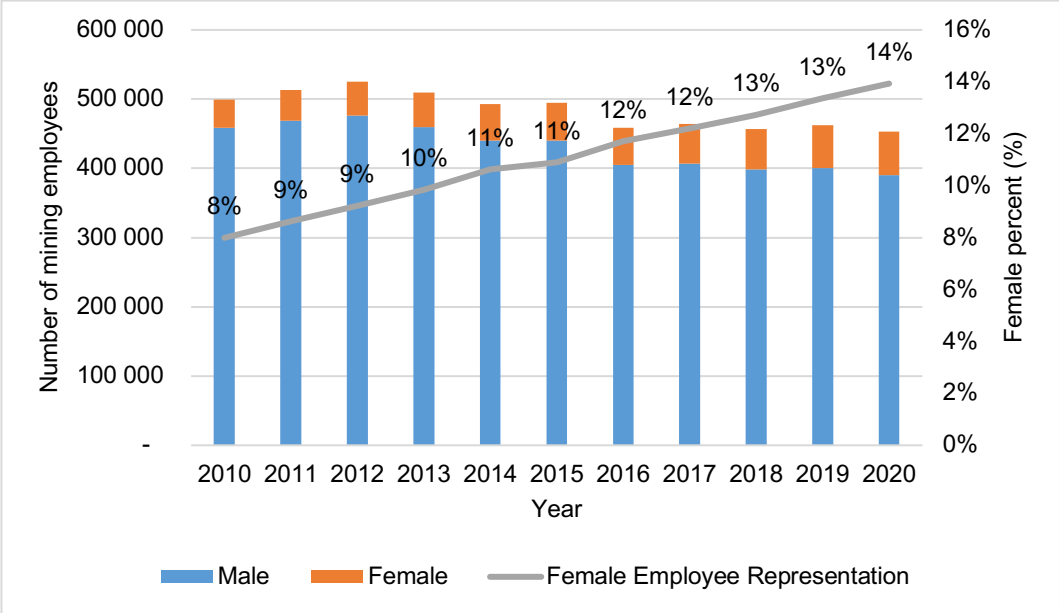


Figure 4.4 South African mining employment numbers by gender from 2010 to 2020. Source: Minerals Council South Africa (2021)

Figure 4.5 illustrates that some 60% of participants remained in their technical roles in a mining company. This means that 40% of study participants have abandoned their technical jobs, with 17% transitioning from technical to non-technical roles within the mining industry and a significant 23% changing industry entirely.

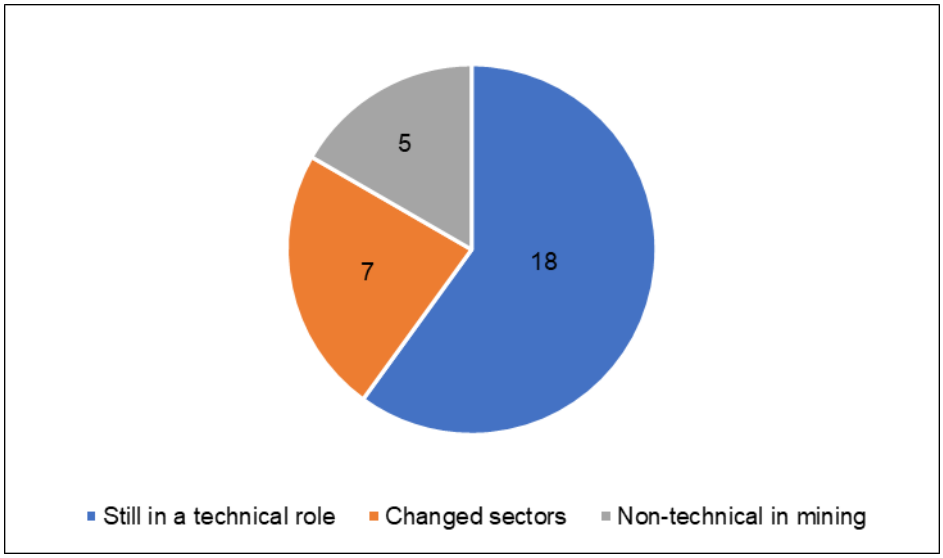


Figure 4.5 Number of participants current role profiles.

Table 4.5 indicates the industries to which women have migrated after leaving the mining industry. It is apparent that the financial services and consulting industries are preferred destinations.

The reasons for such lack of retention are numerous and varied. Study participants highlighted specific issues such as systemic biases, safety, lack of role models, lack of mentorship, lack of opportunities for growth and development, lack of confidence and lack of advocacy.

Table 4.5 Industries technical women changed to from mining.

PARTICIPANT	ROLE IN MINING	NEW INDUSTRY
Interviewee 4	Mining Engineer	Investment banking (Finance)
Interviewee 9	Rock Engineer	Energy (Consulting)
Interviewee 11	Mining Engineer	Finance
Interviewee 14	Geologist	Management Consulting
Interviewee 16	Mechanical Engineer	Petrochemicals
Interviewee 27	Metallurgist	Healthcare
Interviewee 30	Metallurgist	Management Consulting

4.4.1 Systemic biases

Behavioural resistance

With the industry primarily designed for men, there are certain systemic biases that continue to be perpetuated. A key finding has been that some men, knowingly or unknowingly, create a hostile working environment for women in technical roles in mining. This has resulted in the development of behavioural resistance to working with, and reporting to, women.

"*As a young shift supervisor, I experienced behavioural resistance underground and in the mining boardroom. My miners underground at first did not want to follow my instructions without male mine overseer present*

and I was questioned in mine manager meetings on simple tasks my male counterparts were not questioned on." **Interviewee 23**

"*Not specifically the fault, always, of men, exclusively, but inherent in the structure of the systems, legacies*" **Interviewee 15**

Personal life changes and lack of support

In accordance with South African labour laws, mining companies have maternity leave policies in place that support women during this period. Most interviewees did not express any issues with standard maternity policies rather the treatment and lived experience of women during the pregnancy period and once they are mothers. One of the reasons interviewees believed that women do not have the same opportunities as their male peers is the personal life changes that occur during their career, namely pregnancy and motherhood.

On a mining operation, a pregnant woman may not work in dangerous working areas such as underground due to identified hazards and dangerous chemicals present. Once pregnant, women cannot go underground for the nine-month period and during the chosen breastfeeding period. This could result in women losing over a year's technical experience underground. Interviewees expressed that many operations do not have a plan in place to provide experience in other skillsets required to rise to an executive role.

"*I was once told that as I go on maternity leave, I lose out three or four months of a year, so I am a quarter of a year behind my male peers in terms of knowledge, experience etc*." **Interviewee 7**

Mining companies are obligated to provide safe work for women on surface during their pregnancy. However, interviewees expressed that some of the work provided by mining companies is not meaningful nor contributing to their development.

"*When I was pregnant, it felt like there was no plan. I was helping the geologists log core in the core yard and sitting in the planning office watching them draw on plans for 7 months*." **Interviewee 23**

The key challenges identified by interviewees of technical women once they become mothers include the attitude of male colleagues and managers, lack of organisational support and changed priorities.

a) Attitude of male colleagues and managers.

Participants expressed that many male colleagues and senior managers assume that after getting married and becoming mothers, women no longer are ambitious nor willing take on new tasks and projects. Interviewees felt that male counterparts make women feel different once they fall pregnant or become mothers, by making them feel guilty for taking time off for childcare purposes or by passing them up for opportunities as they believe that they will not be as committed to the task as their male peers.

"*In the organization I work for, women fear falling pregnant for fear of being overlooked. I have experienced high level managers making comments about falling pregnant at work, and insinuating that those women cannot 'move up or move forward*" **Interviewee 26**

"Giving birth to my first child disturbed my whole development progress, right now I feel like I should have progressed a lot in my career if it was not for my pregnancy." **Interviewee 1**

b) Lack of organisational support.

Due to mining operations being designed with men in mind and the societal norm of women being the primary caregiver, facilities for mothers were not put in place. Participants highlighted that on-mine operations (as opposed to their corporate head offices in urban areas) did not have childcare facilities on or near the operations. On-mine operations also do not have pumping rooms on site for women who were still in a breast-feeding stage.

"*There are no initiatives that the organization has had over the years to try and support women who become mothers, even after suggestions have been made – for example an aftercare service for children when women (who may need it) have to work overtime or long hours*." **Interviewee 17**

"*I chose to work in mining. I do not expect working hours to accommodate me. However, I must drive 40km to my operation. There is no day care near the operation. Therefore, I must drop my son off at the day care close to my*

house before driving to work. A day care for mine employees on site or close to the site would make a big difference" **Interviewee 3**

c) Changed priorities

Some interviewees had mentioned that reason for leaving their technical roles once becoming mothers had not been because of a lack of institutional support, rather a change in personal priorities. Some interviewees said they chose not to apply for more senior roles taking on more responsibilities as they chose to put their family lives first.

"*Where in the past I was very driven, my priorities in life are changing. I have come to notice that I would rather have a happy family than be an unhappy CEO. There is, of course, a balance that can be struck between the two, but I would rather tend more toward a mid-tier manager with a balanced family life than a CEO with an unbalanced family life. Of course, if you could have both, that would be a different story*." **Interviewee 13**

Pay parity

Interviewees highlighted that patriarchy in mining is entrenched by pay parity. Interviewees stated that company policies talking to the inclusion an advancement of women were disingenuous as women in the industry continue to be underpaid in comparison to their male peers. Interviewees mentioned that this well-known pay parity further emboldens men to see female peers as subservient to them, making working conditions more difficult for women.

"*We still see on a continuous basis that there is still a discrepancy on remuneration packages where men still get paid more than females.*" **Interviewee 14**

Safety

Some technical women such as exploration geologists work in remote areas while some engineers and metallurgists work shifts that require travel to and from operations at night or awkward early morning hours. These conditions pose a safety threat to women. While travelling at night is also dangerous for men, women are often preyed on preferentially due to the scourge of gender-based violence in South Africa.

"*A major concern is travelling alone at odd times of the night – I had to do on numerous occasions which is dangerous*" **Interviewee 12**

4.4.2 Lack of female success

Some 83% of all the interviewees expressed that they aspired to become an executive director or serve as an independent director on a board of a mining company. While many women aspired to reach these levels in their careers, they mentioned feeling discouraged by a lack of visibility of women who started their careers in technical roles and worked their way into the executive suite and thus not knowing the path to achieve this.

"*Not seeing anyone (female) succeed or a clear plan to succeed makes technical women not see the potential for growth within the organization."* **Interviewee 2**

"*Women are made to look inferior to be able to take on roles and multiple excuses are always used like you don't have a masters or international experience or cross commodity experience etc. etc. it's always some new unattainable excuse or that you only been here for five years it's not long enough or need cross functional experience*" **Interviewee 5**

"*The higher up the hierarchy of many mining organizations, the fewer the roles are occupied by women. The empowerment is not happening rapidly enough which discourages many women to change roles and some even career paths*." **Interviewee 22**

Some interviewees mentioned that other industries such as financial services and consulting had a higher representation of women in key decision-making roles in comparison to mining companies. Seeing women thriving in other industries inspired some participants of the study to change industries, leaving mining.

"Seeing women represented at all levels of management in other sectors inspired me to leave mining as I had executive aspirations for myself and thought I could achieve this in that sector." **Interviewee 4**

Lack of mentorship and sponsorship

Study participants highlighted the challenges of working in a male dominated environment and the need for mentorship and guidance to manoeuvre in the industry. Interviewees mentioned wanting to seek advice on managing their careers, balancing work life balance and pathways to take for success. Interviewees mentioned having difficulties finding technical senior female leaders as mentors due to the small number of women in these positions.

"*As a young female graduate, I did not have a senior female mentor whom I could ask advise on how to navigate my career from an underground geologist to hopefully one day CEO.I also did not have a sounding board for some issues that I faced with my male counterparts and senior managers*."

Interviewee 28

Participants believed that their male peers had better opportunities in receiving mentorship from senior male leaders. Male friendships and relationships foster mentorship and sponsorship for roles and opportunities that may occur in the workplace.

"*Due to the inherent differences between men and women and the typical tendency of genders to form camaraderie type relationships among themselves (especially typical between males), chances of males gaining advantages in terms of opportunities to prove themselves in a certain role under male supervision, are higher than the same trust being given to a*

fellow female. Senior roles in mining are predominantly still filled by male persons, who typically seem more comfortable trusting a male junior with a role to stretch his capabilities than a female counterpart. These slight advantages can eventually lead to a male progressing through his career faster than his female colleague and reaching an executive role quicker." **Interviewee 25**

While mentorship is a relationship formed primarily for career guidance, it can also provide advocacy within an organisation resulting in the sponsorship of female employees. Just as with mentorship, interviewees also believed the lack of technical women in senior roles also leads to the lack of sponsorship of women.

"*If women are underrepresented in board rooms, who is putting our names forward for opportunities or suggesting reserving certain roles for women with potential within the business*." **Interviewee 24**

"*Men advance quickly as they are the most preferred gender. Women advance slowly as there are roles they must take care of at home. A woman's career development might get delayed due to pregnancy or anything else as such*." **Interviewee 1**

4.4.3 Lack of exposure and opportunities

While 83% of participants in the study stated that they aspire to be a director of mining company, 86% expressed that they do not believe that women

and men have equal opportunities to obtain such roles. Most interviewees believed that women are rarely given the opportunity to be exposed to executive roles.

"*I left the mining industry for financial services because it didn't seem as though there would be long-term opportunities in mining at the time that I left*." **Interviewee 11**

An interviewee stated that she wanted to study a Master of Business Administration (MBA) to develop herself and widen her skillsets for more opportunities that may arise in the business and *"I was told that they will not fund my studies if I don't study geology."* **Interviewee 28**

Women are overlooked for opportunities primarily because of motherhood:

"Motherhood is the biggest challenge because you get prejudiced and frowned upon. You are overlooked for opportunities because you will be a "burden" due to motherhood needs." **Interviewee 3**

One of the primary reasons for the lack of exposure and opportunities according to interviewees is stagnation in the mining industry. On mining operations, many senior managers remain in the same position for many years. As a result, women in junior positions do not have the opportunity to act in, or take on, a senior role. Due to this, women see no growth opportunities and leave technical roles.

"*There was no growth and opportunities to venture out at the time and acquire a more "useful" skill that had the potential to set me apart was more appealing. I felt there was nothing more to learn as all the senior roles were occupied by old males mostly white who had been in the company for years as such, no real prospects. So really a choice between being stagnant or keep growing albeit outside your industry."* **Interviewee 16**

"*I have worked for 10 years with directors and board members, but I have never been given an opportunity to serve at an executive level*." **Interviewee 6**

There is a rotation of the same individuals on the boards of many companies in South Africa. Board members serving on the companies in the study served on multiple boards with some rotating from one mining company to another when their term ends.

"*Generally, board roles for listed companies especially are not advertised but work more on recommendations from other board members. If a board is mainly made up of a certain group, the same people who are in those networks are recommended. I also find that the pool of women who sit on boards are recycled, and it is generally women who are also already within the right networks, or women with political reach. Opportunities for fresh perspectives and by association increased diversity are not there for the reason mentioned above. Also, traditionally company directors were Chartered Accountants (CAs) and that has continued even if there is a*

sufficiently wide talent pool of women from technical and other non-technical disciplines (not CAs) who are available." **Interviewee 4**

Lack of confidence among women

Interviewees stated that men primarily have a greater level of confidence and are more self-promoting than women. Therefore, they are more visible considered for opportunities while their female peers may be overlooked.

"*Lack of confidence in women. I could possibly even mention that women tend to be more reticent and less self-promoting (I know this is a generalisation) so it is difficult to advance. A mining role requires a certain toughness and ruthlessness that I think some women find hard. Many women leave before getting to top positions. I lacked confidence as a younger person and was not as pushy as my male colleagues. This is partly my personality, but it is also influenced by the discrimination faced at work*." **Interviewee 21.**

4.4.4 Lack of internal and external advocacy

Due to an underrepresentation of women and technical women in executive and board roles, interviewees believed that there is little to no advocacy for technical women to be empowered, developed, exposed to opportunities, and promoted into senior roles outside the guidelines placed by government. Women in Mining South Africa (WiMSA) is a non-profit organisation that was founded in 2010 (Women in Mining SA, 2020). The organisation aims to support the personal growth, leadership, and career

development of women in mining in South Africa (Women in Mining SA, 2020). While 73% of interviewees stated that they were aware of WiMSA, 87% of the interviewees did not believe that organisation was effective, with quotes reading:

"*One organization I am aware of is WiMSA – I don't believe they're effective because I have not seen initiatives of theirs that progress women in the mining industry*." **Interviewee 26**

"*Many of these organisations produce reports on stats on the lack of the advancement of women in mining, a number of events are hosted but none really provide solutions that incentivizes mining companies to advance technical women into companywide decision-making positions*." **Interviewee 4**

4.4.5 Discussion

Retention, not Attraction

The directive from the South African government, through the MPRDA and Mining Charter, to mining companies to create inclusivity by diversifying its workforce led to an increase of bursaries, vocational and holiday training opportunities for people of colour and women, primarily in technical degrees and roles. This has translated in the increase in the number of historically disadvantaged individuals entering the mining workforce. According to the Minerals Council South Africa (2021), in 2010 women accounted for 8% of

the workforce and 14% in 2020, that is a 5.8% compound annual growth rate over this 10-year period. These numbers prove that both government and organisation's efforts have led to the mining industry becoming an attractive employment opportunity for women.

Retention remains a problem for the mining industry

The study, as with previous research, showed that the mining industry still has a problem in retaining female talent in technical roles; it also showed where they go and why. Campbell (2007) spoke to the high demand for women who are STEM graduates in industries outside of mining and the study showed that participants who had left the mining industry migrated to finance and management consulting.

Researchers such as Campbell (2007) and PricewaterhouseCoopers (2015) highlighted some attractive traits of industries outside of mining for technical women which were mentioned by participants in this study. Participants highlighted being attracted to industries such as finance due to the high representation of female leaders and decision makers. Participants mentioned being attracted to other industries because of they presented the opportunity to succeed due to having the relevant qualifications, and experience without the systemic biases barriers placed against women in mining.

Systemic Biases

Previous studies into the challenges faced by women in mining highlighted faced issues such as not having personal protective equipment (PPE) that accommodated women's bodies, on site washrooms and ablution facilities. When questioned on the challenges women in mining face, participants in this study did not highlight these basic infrastructural flaws, noting that many changes had been brought about by new labour practices. While mining operations have built female changerooms and now have size inclusive PPE for women, this has not yet translated into addressing the deep systemic biases in the industry.

Hostile work environment

Past research such as Kuykendall & Darden (2020) and Pimpa & Moore (2018) discussed the workplace culture of the mining industry. The study shows that while it is true that government and industry have made great strides for the inclusion of women in the industry, an issue that has greatly contributed to the issue of retention of female talent is the hostile working environment created by men. Every interviewee mentioned the hostility and difficult work environment caused by male peers. While not all male peers create a challenging working environment, the ones that do counteract all the good that other male peers do.

Due to male dominance in the mining industry, certain systemic and unconscious biases held by men creating a difficult work environment for women. Participants in this study highlighted that there are still male peers

who do not believe that women belong in the mining industry or have the skill and abilities to lead in technical roles. As participants stated in the study, this has led to men creating a hostile work environment for technical woman in core mining functions.

A reason for this continued behaviour of creating an inhospitable environment for women can be attributed to the fact that men still largely make decisions for the business and for women. The underrepresentation of technical women in board rooms means the issues and challenges faced by technical woman on operations are not largely discussed in the boardroom and therefore, not addressed.

Pay parity

The gender pay gap is a global issue that is observed across different industries. As the research by Martin & Barnard (2013) shows, participants highlighted that salary inequalities continue to entrench patriarchy in the industry and allowing men to believe that their female peers are not their equals. The pay parity between male and female peers in the same role feeds the inhospitable environment created by men on mining operations.

Motherhood and Personal Life changes

The industry is still in its infancy in understanding women's needs during transitions of marriage and motherhood. Most women stated that the hostility increased when announcing a pregnancy or coming back from maternity leave. Interviewees felt that the attitude of their male peers

changed once they got married, pregnant and became mothers. This can be attributed to men's implicit bias, assuming that, because of personal life changes such as marriage and motherhood, they will no longer value their careers. This results in women being overlooked for opportunities that may require more commitment outside of the everyday roles and responsibilities as it is assumed that their priorities would be their families. Some study participants who had become mothers stated that they had not stated wanting to participate in new projects or not taking on more responsibilities – it was simply assumed by managers. The assumption being that women would prioritise their personal lives over their responsibilities in the workplace as their personal lives change.

Safety

Botha (2016) speaks to the sexual harassment experienced by women with men making sexually loaded comments or asking for sexual favours. None of the participants in the study mentioned feeling unsafe around their male peers or in their operating environment. This speaks to the work done by mining companies and government on the awareness of harassment and creating reporting systems and consequences for abusers. One candidate had mentioned feeling unsafe on the road when driving home after a shift that might end in the early hours of the morning or very late at night.

Lack of female success

Interviewees mentioned that they believed that one of the reasons for the underrepresentation of technical women in executive roles is because the

industry does not have clear career guidelines for women to rise to executive roles. In addition, a lack of technical women in executive roles means limited numbers of women's voices advocating for technical women's needs in executive suites, coming from a place of personal experience and empathy. Consequently, when the company is formulating policies that speak to the advancement of women, diversity and inclusion, the loudest voices are those of men. This may result in key issues faced by women not being addressed (or not being addressed correctly) resulting in the loss of young technical women to other industries or non-technical roles within mining.

Lack of mentorship and sponsorship

Participants also highlighted the lack of mentorship for females, with senior male leader being more likely to form a brotherhood with junior male peers, offering them career guidance, mentorship and even sponsorship. Due to the higher representation of men in the technical fields of mining across all spheres of leadership, it is perceived that young men entering the space have a greater pool of "older brothers" and mentors to choose from, far more so than their female peers.

Lack of exposure and opportunities

Participants mentioned a key factors for the mining industries challenge in retaining technical female talent is stagnation in the mining industry. Due to the small number of senior roles in an industry that is structurally in decline in South Africa, many senior roles are held by the same individuals for very

long periods of time. This results in fewer opportunities for juniors to move into senior leadership roles resulting in stagnation. Participants mentioned transitioning into growing industries such as finance and consulting due to the opportunities to rise through the ranks seem more plentiful than in mining.

Lack of advocacy for technical female leadership

A new finding in this research not detailed in previous work is the need for, and importance of, advocacy. Apart from regulations and policies setting clear guidelines, advocacy is required for the advancement of women in mining.

The Association of Black Securities and Investment Professionals (ABSIP) is an influential force in the transformation of the Financial Industry lobbying for black and female (historically disadvantaged groups) candidates when a listed company is seeking to appoint an executive or board member (The Association of Black Securities and Investment Professionals, 2022). The Black Business Council (BBC) is an independent organisation representing professionals, business associations and chambers. BBC advocates for the transformation of the South African economy by calling for the appointment of black professionals and inclusion of black entrepreneurs when business opportunities that arise (Black Business Council, 2022). The mining industry does not have such a group advocating for historically disadvantaged groups.

Participants in the study identified Women in Mining South Africa (WiMSA) as an external organisation that can advocate for technical women in mining. WiMSA is a non-profit organisation that aspires create a network for women and to support and develop the progression of women working in the South African mining industry (Women in Mining SA, 2020). The majority of the participants in the study believed that WiMSA was an ineffective organisation that had not made inroads with mining companies, nor advocated for female candidates in executive and board roles. Participants describe the organisations as being a platform for women to come together, network and discuss what are the challenges facing women in mining. However, this does not go far when these challenges are not shared with mining companies to bring about the required change.

A group that could advocate for women in mining are trade unions. South African trade unions such as the National Union of Mineworkers (NUM) and Association of Mineworkers and Construction Union (AMCU) are very vocal in the mining industry to advocate for fair labour practices and dignified conditions and wages for all mining employees. The trade unions, however, have not been at the forefront of lobbying and advocating for technical women, their advancement in the workplace and the placement of women in senior roles. This could be attributed to the fact that these unions are largely run by men without female voices raising female issues.

Another reason for the lack of advocacy from labour groups could be based on their history and reasons for formation. Trade unions especially in the

mining industry were formed to ensure fair and safe working conditions for labourers. Historically, unions in mining have lobbied for the most vulnerable mine workers and not mining professionals such as geologists and mining engineers and this may be a reason for the lack of advocacy for professional technical women.

4.5 Not all Women in Mining are Equal

4.5.1 Technical women are migrating into non-technical roles in mining

Most interviewees (60%) were still in their technical roles in their respective mining operations. Seven interviewees had left the mining industry while five interviewees had moved to non-technical roles within their mining companies (refer Table 4.5).

"*Organization such as WiMSA are trying to empower women in mining. However, they are taking a blanket approach to everything which is ineffective because the issues faced by women in the technical vs non-technical space are not the same. Similarly, the issues between corporate technical and site based technical disciplines are also not the same. To be effective some the interventions/initiatives need to be targeted at the specific nuances that exist*." **Interviewee 10.**

4.5.2 Different worlds for women in mining

One of the key outcomes of the questionnaire highlighted the fact that many women were not necessarily leaving the mining industry, but rather leaving

their technical roles for non-technical roles within the mining industry. When questioned, 71% of women who had changed into non-technical roles expressed that they would have preferred to stay in their technical role. The primary reason for move is because interviewees believed that women who worked in the corporate offices of mining companies had better working conditions and access to better facilities than woman on remote operations.

The working environment for technical women on mining operations are vastly different to women in non-technical roles in corporate environments. All the mining operations of the sampled companies are in remote areas while their head corporate offices are in urban areas, namely, Johannesburg, Melbourne, Perth and London.

"*The mining operation is rigid and inflexible. It is a harsh environment. In the corporate office women can thrive as everyone behaves in a formal corporate fashion, while we were subject to overt sexism from male counterparts on the mine. Women in corporate offices have a safe space where they can express themselves, while women on the mine do not have these liberties.*" **Interviewee 21**

"*I chose to leave my job on a platinum mining operation and moved to a non-technical role in my company's head office in Johannesburg for a better quality of life. Johannesburg, being a metropolitan area has better schools for my children than Rustenburg. In my corporate role I can come to work at 9am thus I am able to drop my children off at school and have the flexibility*

to pick them up after school, which I did not have while working strict shifts on the mine." **Interviewee 28**

The career trajectory of women on remote operations is impacted by a change in their personal lives while this is not the same for women in corporate offices. When women fall pregnant on a mining operation, they may not work in high-risk areas. Often, mining companies do not have a detailed plan of work and/ or training women can do during this period. During a pregnancy, a technical woman can lose up to a year in experience as women may not enter these high-risk zones while breastfeeding their babies. This is not the case for women in non-technical roles who work in corporate offices.

The clear differences in challenges faced by women in technical and non-technical roles in mining companies illustrates why there is a higher retention rate of non-technical women, why technical women move to non-technical roles and why non-technical women have a higher representation in executive and board roles of mining companies.

4.5.3 Discussion

Not all Women in Mining are Equal

This study highlighted that, women in mining are not a homogenous group. There are two distinct groups of women in mining, technical women working on mining operations and non-technical women in mine support functions at mine offices and in corporate offices. A key finding of the study revealed

that has not been discussed extensively in previous research is that some technical women choose not to leave the mining industry rather leave their technical roles for non-technical roles.

In annual company reports mining companies often report on the diversity of the business with statistics showing the percentage of female employees. These reports talk to female representation from entry level to board level. The term ‘women in mining’ is widely used as an umbrella term to cover all women in a mining company, the numbers reported by companies rarely distinguish between technical and non-technical women. The comments by the participants in this study have highlighted that there are specific issues that they face with respect to working conditions, not faced by non-technical women within the same organisation.

Location

Mining operations are often located in remote locations while corporate offices of mining companies are usually located in cities or large metropolitan areas, and this plays a major role in the different experiences of women in mining. Previous researchers such as Lahiri-Dutt (2015) have spoken at length about the remote location of mining operations as being one of the key challenges in attracting women to the industry. This study found that location of mining operations is also responsible for the challenge in retaining women in their technical roles in mining companies. The companies in this study all have corporate offices in large metropolitan cities working in such urban areas allows women the opportunity to have a better

quality of life close to many amenities, recreational activities, better quality of schools and healthcare. Metropolitan areas offers more and better options in comparison to remote mining locations with limited access consequently, there are technical women transitioning into non-technical roles in company corporate offices.

Work environment

Participants in the study who had transitioned from technical roles on mine sites to non-technical roles in corporate offices highlighted the difference in working conditions between the two environments. The corporate nature of most mining companies head offices is very different to that of mining operations. Due to a combination of a greater representation of women in corporate offices and the professional office setting, participants stated that corporate offices presented a less hostile environment. The study highlighted that, participants who had transitioned into non-technical roles felt more confident to speak up and challenge old ideas in a corporate office, as they felt safer to do so. This environment of diversity and inclusivity has been a draw card for many technical women who have been made to feel unwelcome and unwanted on male-dominated mine sites.

Pregnancy and motherhood

Participants in the study also highlighted differences in the attitude of male peers and flexibility towards pregnancy and motherhood between the onsite and corporate environment. Technical women on mining operations fall behind their technical male peers. When a technical woman falls pregnant

on a mining operation, she is barred (for safety reasons) from working in high-risk areas such as underground, the pit, plant, workshops, and core yards for the nine-month duration of her pregnancy. Once a woman gives birth, she is off site for four months maternity leave. If a woman chooses to breastfeed her child for six months, she may not return to the high-risk areas for the duration of her breastfeeding period. This means that, for each child, a woman could potentially lose up to 14 months of technical work experience.

In sharp contrast, women in non-technical roles do not have to lose this time as they often work in corporate offices that are not deemed high risk zones. Women in corporate offices can work in their role until the time comes for maternity leave. Upon returning to work, they can simply step back into their roles with the loss of only some four months.

Women on operations often work awkward hours with shifts starting as early as 6am and some engineers can be called out for breakdowns in the early morning or late at night. These working hours mean that female primary caregivers often cannot drop off or pick up their children from school. This is a contrast to women who work in corporate offices that often have more comfortable working hours allowing for morning drop offs and flexible enough to pick up their children and complete any work from home.

Apart from corporate offices being near childcare facilities there are difference in amenities offered on site for women. Some mining corporate

offices have lactation rooms for women who have returned to work and are still breastfeeding, while this cannot be found on most mining operations in South Africa. Some companies have also implemented in-office childcare in corporate offices and not on mine sites, such as companies A and C.

Flexibility of the corporate environment also allows women to complete their work from home while most technical work must be done on site. This allows women in corporate environments to have a better work-home life balance.

5 CONCLUSIONS AND RECOMMENDATIONS

Women have made many strides in the mining industry globally. Today women account for 15% of the South African mining workforce and occupy roles senior and top management positions (Minerals Council South Africa, 2021). The results of this research, however, shows that, even with all the progress that has been made, technical women in mining have yet to impact South African boardrooms to the same extent as men.

The study was largely in line with previous research that interrogated the underrepresentation of women in mining. The main factor highlighted by this study is that women still play a support role in the mining industry due to the low representation of women in technical and core mining roles in executive and board teams of the company's analysed. The results showed the significance of policy and government interventions for the inclusion and advancement of women in mining. The theme of retention not attraction highlighted the great strides the mining industry has made to attract female talent and highlighted the challenges to retain it to factors such as systemic biases, lack of female success, lack of exposure and opportunities and the lack of advocacy for technical women. The results also showed that not all women in mining are equal, highlight the difference experiences of technical women on mines and those in non-technical corporate roles.

5.1 Conclusions

The study found that technical women are underrepresented in executive and board roles of the top 10 largest listed mining companies in South Africa. Based on the findings of the study, men had a head start in the mining industry. This is the primary reason for the large numbers of men in the core function of mining and in the most senior positions of mining organisations.

Currently most executive roles and board director roles in the top 10 largest mining companies are held by men, more so the roles that drive the business of mining. These roles are held by individuals who have the relevant technical qualifications and experience in mining. Due to the historical context of boys being encouraged to take on STEM subjects and careers and the banning of women in technical roles on mining operations has resulted in a greater pool of men to take on leadership roles in a mining company.

The greater pool of men in leadership roles allows young technical men to have access to a greater number and more varied group of potential male mentors and sponsors who are invested in their careers and pave the way for their progression. This cannot necessarily be said for technical women. While many women have received mentorship and sponsorship from male leaders, without a large representation of technical women in the most senior roles in mining, young technical women do not have as clear of a path to the boardroom that their male peers do. The continuous cycle of

men promoting men will continue to lead to the exclusion of women and hostility against women in predominantly male spaces.

While the mining industry may not be as attractive to young women such as the financial services industry, much has been done to increase female representation. While the representation of technical women at executive and board level may be low now due to the historical context of women being excluded from fully participating in the industry, this study highlights that this is not likely to improve significantly in the short term.

The study shows that focus of mining companies should not only be on the attraction of technical women to the industry but also the retention of this talent. Women are coming into the industry but not staying and that can be attributed to many factors such as the inhospitable environment created by male peers and lack of organisational support during pregnancy and motherhood.

The study also demonstrates that some technical women are choosing not only to leave the industry but also changing to a more diverse and inclusive part of a mining company - the corporate office. Teams in corporate offices are more diverse and women in non-technical teams face less of a hostile environment as experienced by many on mining operations

5.1.1 Future research considerations

Future research is recommended regarding the underrepresentation of technical women in executive and board roles of mining companies. The following needs to be considered in any future research on this topic:

- The study only interviewed technical women from South Africa. Further researcher could include interviews with women in other jurisdiction and/or different sized companies to have a view of the differences or similarities of technical women on mining operations around the world.
- Include a greater number of women in the age ranges 40-60 years old. These are the common ages of executive and board members.
- Do men have the same problems? Especially modern men (millennials), where they also need to take care of children, where they also may want to be near amenities – where they also give up these things for the sake of their jobs?
- Interviews with executive recruiters and board members who have a role of hiring mining company executives.
- Interact with mining companies for their views.
- Is there a difference in experiences of women of different racial groups in the mining industry?

5.2 Recommendations

The study through participant interviews highlighted that a key contributing factor to the underrepresentation of technical women in executive and board

roles is mining industries challenge of retaining female talent. The highlighted challenges faced by women in mining that if address could improve companies' abilities to retain and advance woman.

The recommendations based on the outcomes of the study are as follows:

- The study showed that some men in the mining industry still view the industry as being for men, because it requires physical strength (Botha & Cronje, Workplace opportunities for women employed in core mining activities, 2014). Mining companies can address this through investing in digitalisation and mechanization of mines and minework.
    - Mechanisation of mines takes strength, which men have primarily used as an excuse to marginalize women in the industry, out of the equation and allows for greater inclusion.
    - Digitalisation allows for certain mining activity to take place remotely and allows for technical women to be in an urban area with the benefits of working in a corporate office and yet still performing technical minework.
- Mining organisations can break down gender stereotypes and biases instilled in the industry by decreasing the gender pay gap and ensuring men and women are paid for their education and skills, rather than their gender.
- Mining companies should drive the values of inclusion and diversity equally on operations and corporate offices. Consistent communication

and messaging to company employees around the importance of inclusion is important to reinforce and reiterate a good corporate culture.

- Where possible, the experience of women working at either operations or in a corporate office should be similar when in the workplace. Some corporate offices have amenities in the office such as lactation rooms and onsite childcare facilities, this should also be available on site for women working in the same organisation.
- Intentional development programs and executive training are required for the advancement of technical women in the mining industry. Training and development that gives technical woman more than technical skills and which allows them also to fully understand the business of mining required to make decisions at executive and board level. Technical women in mining also need to be incentivized to study further in business programs such as MBA's and Chartered Financial Analysts (CFA's). With the study highlighting stagnation during the childbearing period, this time could better be used for training and development. Training and development should go beyond programs and education but should also include shadowing and acting opportunities in senior roles within the organisation.
- Intentional development and advancement of technical women in mining will come from holding mining executives accountable for this. The gender diversity of a company's employees at all levels of management should be a key performance indicator for company leaders, having a direct impact on their performance bonus.

- In South Africa, through the MPRDA, Mining Charter and JSE's reporting recommendations, mining companies have targets on the representation of women. The monitoring and evaluation systems from government and the JSE need to dig deeper than looking at percentages of female representation. Monitoring and evaluation should look at the composition of the representation and should compare the number of technical female entrants into companies with the number of women that have moved into managerial levels.
- Participants in the study highlighted internal company policies not speaking directly to the issues women face on mining operations. Mining companies should allow technical women with experience on mining operations to lead formulation of internal policies that speak to the needs of and the advancement of women and they should then lead the teams that provide oversight.

While government and the mining industry may put measures in place that incentivise the inclusion and advancement of women, the true power lies in the hands of technical women themselves. *"The mining industry on its own requires an individual to operate out of their standard self, e.g.: working shifts, working overtime, the mines run 24 hours operations, so we as women need to accept that if we want to thrive in it. The question is more on women, what are we willing to do and sacrifice for us to ensure that we reach executive and board levels. What support systems are we willing to build so we are able to climb the corporate ladder."* Interviewee 2

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APPENDIX A: Directors Qualifications as Reported in Company Reports

Directors' qualifications are reported in company reports (see section 3.6 for list of companies and source documents in reference list)

Company A

Table A-1: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	M	54	BSc (Chemistry)	Yes
Executive 2	Chief Financial Officer	M	53	BAcc, CA	No
Executive 3	Chief Commercial Officer	F	50	BCom (Hons), MBA	No
Executive 4	Chief External Affairs Officer	M	54	BEc, LLB	No
Executive 5	President Operations, Petroleum	F	51	BSc Physics, MSc in International Management (Oil and Gas)	Yes
Executive 6	Chief Technical Officer	F	53	BSc (Hons) in Geology and MSc in Mining Engineering	Yes
Executive 7	Chief People Officer (Human Resources)	F	50	BA (Hons)	No
Executive 8	President Operations, Minerals Americas	M	54	BEng, MBA	Yes
Executive 9	President Operations, Australia	M	53	BSc, Metallurgy	Yes
Executive 10	Chief Legal, Governance and External Affairs Officer	F	50	BA (Hons), MA, LLB, BCL	No

Table A- 2: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	56	BEng, FIEA, FAICD	No
BBoard Member 2	Independent Director	M	54	BSc Chemistry	Yes
Board Member 3	Independent Director	M	53	BAcct, FCPA, MAICD	No
Board Member 4	Independent Director	M	68	AO, MBA, BE, FAICD	Yes
Board Member 5	Independent Director	M	66	MSc (Mining and Minera Engineering), BSc (Hons) (Geology), AMP	Yes
Board Member 6	Independent Director	F	63	BA (Hons), MRes, Hon. DSc	No
Board Member 7	Independent Director	M	61	BS, MBA	Yes
Board Member 8	Independent Director	F	61	MBA, BA	No
Board Member 9	Independent Director	M	66	DipBus (Gordan), FCA, FAICD	No
Board Member 10	Independent Director	M	67	BEng	Yes
Board Member 11	Independent Director	F	58	MA	No
Board Member 12	Independent Director	M	53	BASc (Computing), Honorary Doctor of Laws	No

COMPANY B

Table A-3: Executive Directors

	Job Title	*Gender*	*Age*	*Qualification*	*Technical*
Executive 1	*Chief Executive Officer*	*M*	*47*	*BCom Accounting, CA (SA)*	*No*
Executive 2	*Chief Financial Officer*	*M*	*50*	*Bachelor of Business*	*No*

Table A-4: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	64	Not listed	
Board Member 2	Independent Director	M	75	BSc Mining Engineering	Yes
Board Member 3	Independent Director	M	78	MA Accounting, LLB	
Board Member 4	Independent Director	F	64	BA, AMP	No
Board Member 5	Independent Director	F	72	BCom	No
Board Member 6	Independent Director	F	65	BSc, MSc Geology, MBA	Yes
Board Member 7	Independent Director	M	50	BCom Accounting, CA (SA)	M
Board Member 8	Independent Director	M	63	BCom Economics	No

COMPANY C

Table A- 5: Executive Directors

	Job Title	*Gender*	*Age*	*Qualification*	*Technical*
Executive 1	*Chief Executive Officer*	*M*	*62*	*BE (Mining-Hons), FAusIMM, FREng, CEngFIMMM, DBA (Hon), DoL (Hon)*	*Yes*
Executive 2	*Chief Financial Officer*	*M*	*57*	*BBus (Acc), FCA, FGIA, FCG, MAICD*	*No*
Executive 3	*Technical Director*	*M*	*63*	*MBA, BASc (Eng), FREng, FIMMM*	*Yes*
Executive 4	*Group Director - People and Organisation*	*M*	*57*	*MSc*	*No*
Executive 5	*Group Director - South Africa Corporate Relations*	*F*	*56*	*BA(Hons)*	*No*
Executive 6	*CEO of Base Metals*	*M*	*55*	*MBA, MSc*	*Yes*
Executive 7	*CEO of Bulk Commodities and Other Minerals*	*M*	*58*	*BEng (Chemical)*	*Yes*
Executive 8	*Group Director - Corporate Relations*	*F*	*53*	*LL.L (Law)*	*No*
Executive 9	*Group General Counsel and Company Secretary*	*M*	*57*	*LL.B, BA (Hons)*	*No*

Table A- 6: Board of Directors

	Job Title	**Gender**	**Age**	**Qualification**	**Technical**
Board Member 1	Independent Director	M	64	BSc	No
Board Member 2	Independent Director	M	72	PhD Quantitative Analysis	No
Board Member 3	Independent Director	M	63	BEng (Mining)	Yes
Board Member 4	Independent Director	M	58	MBA, BSc (Hons) Mech Eng	Yes
Board Member 5	Independent Director	F	66	BA (Hons)	No
Board Member 6	Independent Director	F	61	BSc, MSc, MBA	Yes
Board Member 7	Independent Director	F	72	BSc, PhD	No
Board Member 8	Independent Director	F	53	Bachelors in English and History	No

COMPANY D

Table A-7: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	F	50	BEng (extractive metallurgy), MBA, PrEng	Yes
Executive 2	Chief Financial Officer	M	47	BCompt (hons), CA(SA)	No
Executive 3	Executive head: asset reliability, safety and health	M	49	BEng (mechanical), MBA	Yes
Executive 4	Executive Head of Corporate Affairs	F	53	BA Communication	No
Executive 5	Executive head: technical and operational excellence	M	44	BEng (Mining), MBA	Yes
Executive 6	Executive Head of Human Resources	F	51	BA (Law), Masters Diploma in HRM , MBA , HR Executive Program (Harvard), Executive program in Strategy & 0rganisation (Stanford)	No
Executive 7	Executive head: projects and environment	M	53	BSc (chemical engineering), executive development programme	Yes
Executive 8	Executive head: processing	M	55	PrEng, BSc eng (chem), BCom, MBA	Yes
Executive 9	Executive head: market development, PGMs, Anglo American plc	M	59	Master's degree in economics	No
Executive 10	Executive head: marketing, PGMs, Anglo American plc	M	50	BEng (extractive metallurgy), MBA	Yes

Table A-8: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	62	BCom, CA(SA)	No
Board Member 2	Independent Director	F	48	Bcom, CA (SA), Master's in Accounting (taxation)	No
Board Member 3	Independent Director	M	68	BCom, CA(SA)	No
Board Member 4	Independent Director	M	63	BEng (Mining)	Yes
Board Member 5	Independent Director	F	61	BSc (Engineering)	No
Board Member 6	Independent Director	M	66	FCCA (UK)	No
Board Member 7	Independent Director	F	41	BA (Hons), MA, MSc Economics and Economic History, PhD Economics	No
Board Member 8	Independent Director	M	70	P.Eng. BSc (Hons) Mining FSAIMM	Yes
Board Member 9	Independent Director	M	63	BEng, MBA	Yes
Board Member 10	Independent Director	M	57	BA Business (Accounting)	No

COMPANY E

Table A-9: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	M	61	BSc Mech Eng (Ind Opt), University of the Witwatersrand; BCompt, University of South Africa; PrEng	Yes
Executive 2	Chief Financial Officer	M	47	BCom, University of Johannesburg; MBA, North-West University; ACMA and CGMA	No
Executive 3	Chief Operating Officer	M	45	BSc (Hons), PhD (Geology), University of the Witwatersrand; MBA, Warwick Business School (UK); PrSciNat	Yes
Executive 4	Chief Technical Officer	M	56	National Higher Diploma (Metalliferous Mining), Technikon Witwatersrand; BSc (Mining Engineering), University of the Witwatersrand; South African Mine Manager's	Yes

				Certificate of Competency	
Executive 5	Executive Corporate Affairs	M	48	BA Hons (Employment Relations), University of Johannesburg; BTech (Human Resources), Peninsula Technikon; Human Resources Executive Programme, University of Michigan	No
Executive 6	Executive Vice President: US PGM operations	M	58	BSc (Mechanical Engineering), University of Natal; BSc (Mining Engineering), University of the Witwatersrand; PrEng; South African Mine Manager's Certificate of Competency (Metalliferous); South African Mechanical Engineer's Certificate of Competency	Yes

Executive 7	Executive Vice President: SA PGM operations	M	44	ND Metalliferous Mining, NHD Metalliferous Mining, Managers Certificate of Competency, Junior Management Programme (JMP), Management Development Programme (MDP), Baccalaureus Technology, University of Johannesburg Degree: Mining Engineering, Advanced Management – Duke Corporate Education Programme (LIA), London	Yes
Executive 8	Executive Vice President: SA gold operations	M	48	Stanford Executive Program, Stanford University Graduate School of Business; MBA (cum laude), Gordon Institute of Business Science; BSc (Mining), University of the Witwatersrand	Yes
Executive 9	Chief Legal Officer	M	43	LLB	No

Executive 10	Chief Organisational Growth Officer	M	51	Diploma in Labour Relations; MDP (Adv Labour Law); MBA, University of South Africa	No
Executive 11	Chief Commercial and Development Officer	M	46	École Centrale Paris, Institut d'Etudes Politiques de Paris	No

Table A-10: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	69	BA, BA (Hons), M Phil, D Phil, Catholic University of Leuven, Advanced Management Programme, Harvard University	No
Board Member 2	Independent Director	M	65	MA (Natural Sciences, Geology), Trinity College, University of Cambridge; MSc (Mineral Exploration and Management), Stanford University FGS, FSAIMM, FAusIMM	Yes
Board Member 3	Independent Director	M	63	BSc (Hons) (Engineering), University of Cape Town; BA (PPE); MA (Oxford)	Yes
Board Member 4	Independent Director	F	53	BA (Hons) Communication Science and Finance, Bridgewater University, United States; MBA (Strategic Planning and Finance) DeMontford University	No
Board Member 5	Independent Director	F	63	Ph.D., Analytical Chemistry, Colorado State University; B.Sc., Chemistry, Maryville College	Yes
Board Member 6	Independent Director	M	60	BSc (Hons) (Geology), Southampton University, International Executive Programme, INSEAD (France)	Yes

Board Member 7	Independent Director	F	53	CA (SA)	No
Board Member 8	Independent Director	M	64	BCom, Rhodes University; CTA; CA (SA)	No
Board Member 9	Independent Director	F	66	BA, University of Cape Town	No
Board Member 10	Independent Director	M	60	BA, University of South Africa; MA, Thames Valley University; MA, University of London; MBA, California Coast University	No
Board Member 11	Independent Director	M	62	BCom, University of Fort Hare; BCompt (Hons), University of South Africa Advanced Management Programme, INSEAD; CA (SA)	No

COMPANY F

Table A-11: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	M	50	BEng (Chemical), BEng (Hons)	Yes
Executive 2	Chief Financial Officer	M	47	BCompt (Hons), CA(SA), ACA, CA(Z)	No
Executive 3	Chief Operating Officer	M	48	MBA, BTech (Mining Engineering)	Yes
Executive 4	Executive Head of Safety and Sustainable Development	M	58	BTech (Safety Management), MBA	No
Executive 5	Executive Head of Corporate Affairs	M	50	Bsoc Science, MA, MSc, PhD	No
Executive 6	Executive Head of Technical and Projects	M	44	BSc (Geology), MEng (Mining), GDE (Rock Engineering), PrSciNat	Yes
Executive 7	Executive Head of Human Resources	F	54	BAdmin, BAdmin (Hons), MAP	No
Executive 8	Executive Head of Marketing and Seaborne Logistics	M	52	MSc (Applied Physics), PhD (Materials Science and Engineering)	No
Executive 9	Executive Head of Strategy and Business Development	M	49	BCom, BCompt (Hons), CTA, CA(SA)	No

Table A-12: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	58	PhD, Mphil, MSc, Bcom (Hons), CA(SA)	No
Board Member 2	Independent Director	M	61	Bcom, MBA, HND (Metalliferous mining)	Yes
Board Member 3	Independent Director	F	70	BA, BA (Hons)	No
Board Member 4	Independent Director	M	60	BCompt (Hons), MComm (Dev Fin), Hdip in Tax law, CA(SA)	No
Board Member 5	Independent Director	F	47	BCom (Hons, CA(SA), MBA	No
Board Member 6	Independent Director	F	60	BSc (Hons) in Geology and BAccSci (Hons)	Yes
Board Member 7	Independent Director	F	58	BA (Law), LLB	No
Board Member 8	Independent Director	M	58	BEng (Chemical)	Yes
Board Member 9	Independent Director	M	53	BSc (Eng) Mech, GDE (Eng Management)	Yes

COMPANY G

Table A-13: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief executive officer	M	54	BSc Mining Engineering	Y
Executive 2	Chief financial officer	F	48	BCom, HDipAcc, CA(SA)	N
Executive 3	Executive: Human resources	F	43	BA Psychology, Honours Political Science, UJ	N
Executive 4	Executive: Health and Safety	M		Not listed	
Executive 5	Company Secretary	M	40	BA Industrial Psychology, BA (Hons0	N
Executive 6	CEO: Zimbabwe	M	58	CIMA, CIS, MBA	N
Executive 7	CEO: Rustenburg operations	M	54	N.Dip Metalliferous Mining; BCom Economics, B.Tech Mining	Y
Executive 8	Executive: Corporate development	F		BBusSc Actuarial Science, CFA	N
Executive 9	Chief operating officer	M	52	Not listed	Y
Executive 10	Executive: Refining and Marketing	M	44	BSc Chemical Engineering, Diploma Industrial Engineering, MBA	Y
Executive 11	Executive: Corporate Affairs	M	52	BEng Engineering	Y
Executive 12	CEO: Canada	M		BSc, Economics; MSc Finance	N

Table A-14: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	F	65	B Proc, B Juris, LLB, LLM	N
Board Member 2	Independent Director	M	68	BSc (Hons) Mining engineering, MBA	Y
Board Member 3	Independent Director	F	59	BCom, BAcc, CA(SA)	N
Board Member 4	Independent Director	M	65	MSc Chemical Engineering, BCom	Y
Board Member 5	Independent Director	M	60	BSc (Mining Engineering), BCom (Hons)	Y
Board Member 6	Independent Director	M	62	MSc, PhD (Oriental and African Studies)	N
Board Member 7	Independent Director	F	46	BCompt (Hons), CA(SA), MBA	N
Board Member 8	Independent Director	M	70	MSc Mining Engineering	Y
Board Member 9	Independent Director	M	64	BCompt (Hons), CA(SA)	N
Board Member 10	Independent Director	F	42	BCom (Hons), CA(SA)	N

COMPANY H

Table A-15: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer and Managing Director	M	49	BBUS, FCPA	No
Executive 2	Chief Development Officer	M	47	BE (Mining), MBA	Yes
Executive 3	Chief Legal Officer and Company Secretary	F	48	BA (Hons), LLB, MAICD, FGIA, FCG	No
Executive 4	Chief Operating Officer	M	51	MBA	Yes
Executive 5	Chief Operating Officer	M	55	Bcom, MBL	No
Executive 6	Chief Commercial Officer	M	48	BSc, CPA	No
Executive 7	Chief Sustainability Officer	F	53	BCom	No
Executive 8	Chief Technical Officer	F	50	BSc (Chemical), MEng, DEng	Yes
Executive 9	Chief Financial Officer	F	50	BCom, CA, GAICD	No

Table A-16: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	F	64	BEd, LLB (Hons)	No
Board Member 2	independent Director	M	49	BBUS, FCPA	No
Board Member 3	Independent Director	M	64	Bcom, FCA, FAICD	No
Board Member 4	Independent Director	M	59	BSc (Engineering (Civil)), MSc (Engineering (Project Management))	Yes
Board Member 5	Independent Director	F	63	BEng (Extractive Metallurgy), PhD (Extractive Metallurgy), FAusIMM, FTSE, GAICD	Yes
Board Member 6	Independent Director	F	65	CA(SA), DCom (Honoris Causa), BCompt (Hons), HDip Banking Law, BA (Econ)(Hons), BA (Arts)	No
Board Member 7	Independent Director	M	68	Dip Elect Eng, MBA, FAICD, FTSE	Yes
Board Member 8	Independent Director	M	66	BSc, MSc	Yes

COMPANY I

Table A-17: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	M	61	PhD Economics	No
Executive 2	Chief Financial Officer	F	53	BCompt, BCompt (Hons), CA(SA), Senior Executive Programme (Harvard)	No
Executive 3	Executive Vice President: Corporate Affairs and Sustainability	M	47	Not listed	No
Executive 4	Executive Vice President: Group Planning and Technical	M	64	BSc (Hons), MAusIMM, MAICD	Yes
Executive 5	Chief Operating Officer: International	M	54	BSc (Min. Eng)	Yes
Executive 6	Chief Operating Officer: Africa	M	42	BSc Eng (Electrical), MBA	Yes
Executive 7	Executive Vice President - Group Human Resources	F	52	BSSc, Advanced HR Executive Development Programme, Post Graduate Diploma in Business Management and an MBA	No
Executive 8	Executive Vice President - General Counsel and Compliance	F	43	BProc, LLB, LLM (Corporate Law)	No

Table A-18: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	F	64	MSc (Economics), BCom (Economics), Banker Diploma, Certified Associate of the Institute of Bankers (South Africa)	No
Board Member 2	Independent Director	M	64	Bcom, FCA, FAICD	No
Board Member 3	Independent Director	M	59	BSc (Engineering (Civil)), MSc (Engineering (Project Management))	Yes
Board Member 4	Independent Director	F	66	BA, Juris Doctor	Yes
Board Member 5	Independent Director	F	55	Pr.Eng, BSc, MBA	No
Board Member 6	Independent Director	M	68	Dip Elect Eng, MBA, FAICD, FTSE	Yes
Board Member 7	Independent Director	M	66	BSc, MSc	Yes
Board Member 8	Independent Director	M	58	BA, MA, PhD	No

COMPANY J

Table A-19: Executive Directors

	Job Title	Gender	Age	Qualification	Technical
Executive 1	Chief Executive Officer	M	57	BSc (Hons), MBA	Yes
Executive 2	Chief Financial Officer	F	40	CA(SA)	No
Executive 3	Mining Executive	M	52	Btech Mining Engineering, MBL	Yes
Executive 4	Mining Executive	M	42	Pr.(Cert) Eng. (Professional Engineer), BSc (Hons) Mining, MBA	Yes
Executive 5	Executive Commercial	M	55	FCMA	Yes
Executive 6	Executive Business Development	M	52	BSc (Hons), MSc	Yes
Executive 7	Executive Human Resources	M	45	BSocSc (Hons)	No
Executive 8	Executive Sustainability	M	51	BTech (Quantity Surveying), MBA, Diploma in Project Management, Senior Mnaagement Development Programme	Yes

Table A-20: Board of Directors

	Job Title	Gender	Age	Qualification	Technical
Board Member 1	Independent Director	M	48	CA(SA)	No
Board Member 2	Independent Director	M	52	MSc (Mining Engineering)	Yes
Board Member 3	Independent Director	F	66	BCom (Hons)	No
Board Member 4	Independent Director	M	64	MSc (Chemical Engineering)	Yes
Board Member 5	Independent Director	M	58	CA(SA)	No
Board Member 6	Independent Director	F	66	CA(SA)	No
Board Member 7	Independent Director	F	45	MBA (Finance), MBBCh (Bachelor of Medicine and Bachelor of Surgery), MIoDSA	No
Board Member 8	Independent Director	M	60	BA (History and Sociology)	No
Board Member 9	Independent Director	M	64	BA, ELP, MAP, PDP	No
Board Member 10	Independent Director	M	48	CA(SA), CFA (AIMR), AMP (INSEAD)	No
Board Member 11	Independent Director	M	75	BSc (Mining Engineering), BSc (Chemistry)	Yes

APPENDIX B: Questionnaire

Underrepresentation of Technical Women Questionnaire

This questionnaire was sent to a variety of women with a technical qualification who have held, or currently hold, a technical role in a mining company. The questionnaire is designed with the intention of understanding the experience of women in mining. The information has been used for the express purpose of completing this MSc Research Report.

No personal data or information is requested and nothing in the questionnaire can be used to identify respondents, thereby ensuring complete anonymity. Once the MSc degree has been conferred, all the completed questionnaires will be destroyed/deleted, and no copies will be kept for any purpose.

Should you have any concerns whatsoever in respect of this questionnaire or my Research Report, please contact me directly (Noluthando Zulu, 0782275330, thando.zulu@angloamerican.com or znoluthando@gmail.com) or my supervisor (Prof Tania R Marshall, 082 611-3388, tania.marshall@wits.ac.za) or Ms Thobile Sedumeni (Thobile.sedumeni@wits.ac.za)

1. Age

- 25-35
- 36-45
- 46-55
- 56-65

2. Qualification

- Mining Engineer
- Geologist
- Engineer (Mechanical/Electrical)
- Metallurgist/Chemical engineer/minerals process engineer
- Other

o If other, specify:

3. Institution where qualification was obtained

- University
- Technikon

4. Do you currently work for one of the top 10 listed companies in SA?

- Yes
- No

5. How many years have you been working for a top 10 listed company?

_____

6. Have you worked for any other company before this one? If so, how long? _____

7. Are you still in your technical role?

- Yes
- No

8. How long have you been in this role? _____

9. Have you changed sectors (e.g. from mining into finance)

- Yes

o If yes, specify the industry: _____

- No

10. Have you changed into a non-technical role within the mining sector? _____ How long have you been in this non-technical role? _____

11. Would you like to remain in the non-technical role or be in a technical role? _____

12. Why did you leave the mining sector or your technical role? _____
_____
_____

13. Do you believe South Africa has policies that are progressive for the inclusion of women in mining?

- Yes
- No

14. Does your company have policies for career progression and advancement of women?

- Yes
- No

15. Do you believe your companies policies are aligned with the South African governments policies on the inclusion and progression of women?

_____

16. Do you believe South Africa has organizations that empower women in mining or advocate for the advancement of women in mining?

- Yes
- No

17. Do you believe these organizations are effective/not and give reasons?

_____

_____

_____
_____
_____

18. Are you currently an executive director or board member (non-executive director)?

- Yes
- No

19. Do you aspire to advance into an executive director or board role(non-executive director)?

- Yes
- No

20. Do you believe male and female peers have the same opportunity to advance to executive roles?

- Yes
- No

Give reasons:

_____
_____
_____
_____
_____

21. Have changes in your personal life (e.g marriage and motherhood) changed your career objectives?

- Yes
- No

Give reasons:

_____

_____

_____

_____

_____

22. Do you believe your company, or the mining companies you have worked for are supportive of women as they transition in their personal lives (into marriage and motherhood)?

- Yes
- No

Give reasons:

_____

_____

_____

_____

_____

23. Do you believe that women would advance in mining companies if companies provided support to women as their personal lives evolve?

- Yes
- No

24. What support do you believe mining companies can provide to women to retain them in the sector and to see the advancement of technical women to executive board levels?

_____
_____
_____
_____
_____
_____

APPENDIX C: Ethical Clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF MINING ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE **PROTOCOL NUMBER: EMINN/2022/29**

PROJECT TITLE The underrepresentation of technical women in executive and board roles in the 10 largest listed mining companies in South Africa

INVESTIGATOR	Noluthando Zulu
SCHOOL/DEPARTMENT OF INVESTIGATOR	School of Mining
DATE CONSIDERED	29 March 2022
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	Minimal Risk
EXPIRY DATE	28 March 2025

ISSUE DATE OF CERTIFICATE 29 March 2022 **CHAIRPERSON**
(Mr H Thomas)

cc: Supervisor: Professor Tania Marshall

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES