

MANAGERIAL OWNERSHIP, BOARD GENDER DIVERSITY, OCCUPATIONAL HEALTH, AND SAFETY RISK MANAGEMENT IN AN EMERGING ECONOMY

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Abstract

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The prevalence of occupational health and safety (OHS) risks among mining firms points to inadequate corporate governance (CG) mechanisms (Baxter, 2016). The purpose of this study is to bridge the existing research gap by examining the impact of women on corporate boards and managerial ownership (MO) on occupational health safety risk management performance incorporating firm size moderating variables panel data from the Johannesburg Securities Exchange (JSE) of thirty (30) purposively sampled mining firms for the period 2002–2018. To the best of our knowledge, the study is one of the first pragmatic investigations of the impact of women on corporate boards, and managerial ownership on OHS risk management performance in the South African mining sector. A multivariate regression analysis based on quantitative secondary panel data confirmed a positive impact of managerial ownership, and board gender diversity on the OHS risk management performance of mining firms in South Africa. The study has practical implications for the existing body of knowledge, academics, regulators as well as mining firms' corporate governance bodies in South Africa, which recommend that current regulatory bodies need to implement effective and sound strategies that may considerably improve the mitigation of OHS risks to attain the "zero harm" milestone by December 2024.

Keywords: Corporate Governance, Managerial Ownership, Board Gender Diversity, Total Asset Value, Total Employees, Occupational Health and Safety Risk Management

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1. INTRODUCTION

The role and significance of mining enterprises in both developing and developed economies have been and are continuously making an impact in the formulation and shaping of occupational health and safety regulatory framework (Reese, 2018). The sustainability of mining industries is founded on the occupational well-being of employees (Dougall & Mmola, 2015). Occupational risks broadly encompass health and safety risks. As such, health and safe working conditions play a crucial role in a sustainable mining industry that will have a positive multiplier effect on the economy as a whole. The mining industry is one of the most dangerous and ancient industries in the world (Chamber of Mines of South Africa [COMSA], 2016). Therefore, mining firms are obliged to constitute and operationalize corporate governance (CG) structures that can mitigate occupational health and safety (OHS) risk exposure. One of the ways of having effective board structures is to appoint an optimum number of women on the board and allow directors to own a certain percentage of the mining firms' equity. The inclusion of women in corporate boards found its roots in the critical mass theory and resource dependency theory. Also, managerial ownership (MO) is justified by the agency theory and opposed by the stewardship theory. Advocates for board gender diversity and managerial ownership argue that increasing women on board to a "critical mass" and offering a significant portion of the equity to top management and leadership improve the firm's overall performance including OHS risk management as women are generally risk averse (Gennari, 2018; Kanter, 1977a, 1977b).

Despite the significant increase in women serving on mining corporation boards, miners are exposed to health and safety risks that are impacting the firm's sustainable operations (Department of Mineral Resources [DMR], 2019). Also, an increase in managerial ownership is believed to improve firm performance as it reduces the agency problem (Jensen & Meckling, 1976). However, employees in the mining sector across the globe are continuously facing occupational injuries, diseases, and death due to the hazardous nature of the mining environment besides the increase in board gender diversity and managerial ownership (DMR, 2019). Christie and Gilder (2014) allude that health and safety risks do impact the well-being of employees, society, and the financial and non-financial performance of mining firms. As such, more attention should be directed to occupational risk mitigation strategies to ensure the health and safety of providers of human capital.

The research question and phenomenon, this study will address is:

RQ: To what extent do board gender diversity and managerial ownership influence occupational health and safety risk management performance in the mining sector of South Africa?

The need for an accident and incident-free environment in the mining sector has intensified over the past two decades (Baxter, 2016). The emergence of the zero-harm principle has been manifested by its inclusion in regulatory, corporate governance, and organizational management

blueprints as well as risk management frameworks (COMSA, 2017). Despite concerted efforts, mining firms still experience deaths and injuries of employees and loss of production hours due to accidents and occupational diseases. According to McNally (2017), miners are exposed to health and safety hazards such as rock falls, toxic gases, dust, extreme noise levels, excessive vibrations, heat, and dangerous chemicals. Therefore, there is a need for significant and effective governance of occupational health and safety risks in the sector through the improvement of board gender diversity and managerial ownership.

Employees are considered invaluable, vital, and crucial resources for business enterprises (Baxter, 2016; Soni & Vyas, 2015). As such, corporate governance structures in the mining sector need to implement occupational risk mitigation strategies that are robust, adding value and creating a balance between cost and reward (Baxter, 2016). Allowing directors to own company stocks and increasing board gender diversity are regarded as some of the best corporate governance practices by mining firms to reduce the occurrence and the impact of health and safety risks (Boa et al., 2018). Thus, assisting mining firms towards the achievement of the "zero harm" milestone by the year 2024.

The paper details vital contributions to the body of existing literature by delivering a broad viewpoint on the impact of CG on OHS risk management performance in the mining sector of South Africa. For that reason, it presents valuable evidence on how board gender diversity and managerial ownership impact total injuries frequency rate (TIFR) and new cases of occupational diseases (NCOD) taking into account the effect of total employees and total assets in the mining sector of South Africa.

The rest of the paper is structured into the following sections. A comprehensive literature review was undertaken in Section 2, and the research methodology was applied in Section 3. The discourse of empirical results was presented in Section 4. The conclusion and recommendations form the final section of the paper.

2. LITERATURE REVIEW

2.1. The concept of corporate governance

The concept of CG has been defined differently by various proponents of corporate governance grounded on their theoretical viewpoints. The Corporate Governance Committee (CGC, 2020) defines CG as the set of control mechanisms to promote and protect the interests of various stakeholders of a company. Additionally, the Institute of Directors of Southern Africa (IoDSA, 2016) states that CG "is the exercise of ethical and effective leadership by the governing body towards the achievement of governance outcomes such as ethical culture, good performance, effective control, and legitimacy" (p. 11). Cadbury (1992) echoes that corporate governance is the measures taken to attain equilibrium between the social and economic objectives of stakeholders and the company by the governing body. Corporate governance consists of internal and external mechanisms. For the purpose

of the study, managerial ownership and board gender diversity are the internal corporate governance proxies utilised to examine the impact of CG on OHS risk management performance in the mining sector of South Africa.

2.2. Occupational health and safety (OHS)

The concept of OHS risks has been defined by different academics, researchers, and institutions differently. Radu et al. (2019) define OHS risk management as the discipline of the expectancy, acknowledgment, assessment, and control of risks emanating from a workplace that could harm workers' health and safety, considering the potential influence on immediate societies and the overall surroundings. As defined by the International Standards Organisation (ISO, 2018), health and safety risk is the probability that an employee may be injured, killed, or suffers adverse health effects if subjected to occupational hazards. Moreover, occupational health and safety hazards faced by mineworkers are, among others, accidents, rock falls, gas explosions, structure failures, hazardous chemical and gas exposure, malfunctioning equipment, excessive noise levels, whole-body vibrations, musculoskeletal disorders, thermal stress, and exposure to silica (Minerals Council South Africa [MCSA], 2018; Bao et al., 2018; Mining Review Africa [MRA], 2020).

Every year, approximately 2.2 million employees die because of occupational accidents and diseases, and 270 million suffer grave injuries worldwide (Preis & Webber-Youngman, 2021). Additionally, 160 million fall ill for a short or long time from work-related reasons (Reese, 2018). Furthermore, in the South African mining sector, occupational diseases such as tuberculosis (TB) and silicosis also take a toll on the mineworkers. In 2017, 387,355 mineworkers were screened for TB, and 2,367 were diagnosed with TB (MCSA, 2018). On the same note, fatalities recorded in 2017 in the South African mining sector were 86 (COMSA, 2017). TB prevalence rate in the mining sector is significantly increased by inhalation of silica dioxide in crystalline forms such as quartz, cristolomite, or tridymite (MCSA, 2018; MRA, 2015).

A significant number of empirical studies on the relationship between OHS risks and CG (MO and board gender diversity) were done with inconsistent results (Khan et al., 2014; Ganson, 2014; Hove-Sibanda et al., 2017; Gennari, 2018). These studies were performed in different industries of various countries using different methodologies with inconsistent findings.

2.3. Theoretical perspectives of corporate governance and hypothesis development

Existing literature pertaining to this study identified four underpinning theories to illustrate the impact of board gender diversity, and MO, on a firm's OHS risk management: agency theory, resource dependency theory, critical mass theory, and stewardship theory. In the current paper, on the one hand, agency theory and stewardship theory form the basis of the relationship between MO and OHS risk management performance. On the other hand,

critical mass theory and resource dependency theory are the basis for exploring the relationship between board gender diversity and OHS risk management performance.

2.3.1. Managerial ownership (MO)

The company's ownership structure is categorized into internal (managerial) and external (shareholder) ownership structures. Internal ownership or managerial ownership (MO) is well-defined as the proportion of equity held by top management, whereas external ownership refers to the proportion of total equity held by outsiders (Din et al., 2013). Ownership structure plays a critical role in corporate governance efficacy and OHS risk performance in firms as it is strongly linked to agency and stewardship roles of corporate boards (Wachira, 2019).

According to Jensen and Meckling (1976), agency theory is based on the possible conflict of interests between shareholders (principals) and the management (agents) of firms. The agency theory provides insight into how CG structures monitor and resolve the conflicts of interest between agents and principals. The agency perspective of the board of directors is that managerial ownership strengthens the monitoring role reducing agency costs and enhancing risk management performance (Amin & Hamdan, 2018). Pamungkas (2020) drew on agency theory to determine the impact of managerial ownership and firm performance and confirmed a positive relationship. Performance indicators applied to embroil risk management, profitability, and firm value.

In the context of stewardship theory, as propagated by Donaldson and Davis (1989), the board of directors act responsibly if left to act on their own as stewards of the firm's resources. The stewardship theory posits a strong relationship between the level of satisfaction among board members and company success. Board members are driven by both intrinsic and extrinsic motivational factors to improve shareholder value. The stewardship theory advocates the appointment of directors from within the company and acting independently from the influence of shareholders. As such, board members should not be part of ownership as they are expected to act responsibly without the influence of the owners of the company. However, stewardship theory results in agency problems as members of the board of directors tend to pursue their own interests at the expense of the firm's overall performance.

Earlier studies were done in various countries on the impact of ownership structure on the performance of firms with inconsistent findings (Amin & Hamdan, 2018; Al Farooque et al., 2020). As such, the impact of ownership structure on OHS risk management performance in the South African mining sector is a crucial question that must be validated empirically by the succeeding hypotheses:

H1: There is a negative relationship between managerial ownership (MO) and total injuries frequency rate (TIFR) in the South African mining sector.

H2: There is a negative relationship between MO and new cases of occupational diseases (NCOD) in the South African mining sector.

2.3.2. Board gender diversity (GD)

Gender is considered one of the most contentious issues of board characteristics, particularly on risk management, existing theories attempt to enlighten the importance of women as board members, considering a variety of views (Sotola, 2019). A female board member is considered to be more involved, committed and meticulous, less egocentric in decision-making, which guarantees more efficacy for the board (Wachira, 2019; Sotola, 2019).

The number of women on the board is one of the proxies used to measure board gender diversity and balance besides nationality, race, age, and qualifications (Gennari, 2018). The appointment of women on corporate boards across the globe is mainly influenced by voluntary and mandatory targets. However, mandatory board gender diversity quotas have been widely adopted in European countries such as Norway, whilst South African firms are required to adopt voluntary quotas. Discovery Limited Board recommended board gender diversity for both short-term and long-term to be 25% and 30%, respectively, in Johannesburg Securities Exchange (JSE)-listed firms on June 30, 2020. Furthermore, the inclusion of women in board rooms is premised on the critical mass theory (Kanter, 1977, 1977b), and resource dependency theory (Pfeffer & Salancik, 2003) as alluded to in the succeeding sections of the paper.

In the context of critical mass theory, women's representation in corporate boards should reach a threshold of a minimum of three to minimise tokenism effects (Brahma et al., 2021). The inclusion of fewer than two women on corporate boards is considered tokenism (Kanter, 1977a, 1977b). As alluded to by the critical mass theory, the dearth of women on corporate boards is a practice in that females lack the appropriate skills and knowledge to be appointed to corporate boards (Kanter, 1977a). However, when women on board constitute a critical mass, interpersonal relations are enhanced as well as information overload shortfalls are minimised. Thus, until a certain threshold or "critical mass" of female directors within the board is not realised, there is a high probability that innovative perspectives, for example, OHS risk management strategies of females will not be taken into consideration by the board. Proponents of board gender diversity suggest that the inclusion of women in corporate boards beyond tokenism enhances firm performance including OHS risk management. Brahma et al. (2021) carried out a study to investigate the impact of board gender diversity on firm performance and found a positive relationship. Brahma et al. (2021) posit that the presence of women on board improves monitoring ability, and managerial accountability and reduces agency costs as they think independently in the absence of external corporate governance mechanisms. Hove-Sibanda et al. (2017) investigated the impact of board gender diversity on firm competitiveness and firm performance including OHS risk management of one hundred and fifty-two (152) small and medium enterprises (SMEs) in South Africa, Gauteng area, and found a positive relationship.

Resource dependency theory as promulgated by Pfeffer and Salancik (2003) posits that firms thrive to hire board members the best complement their existing resources and who can bring in new forms of human and social capital. Proponents of board gender diversity argue that increasing women's representation in corporate boards is of greater value as the variety in perceptive functions and principles between the female and male directors impact firm performance and board decision-making process positively (Gennari, 2018; Lleras-Muney et al., 2019; Marinova et al., 2016; Brahma et al., 2021). Most importantly, Gennari (2018) asserts that the increased inclusion of women on the board of directors by many firms is a clear commitment towards the 2030 Corporate Sustainability Agenda Goal Five (5): women on boards. Brahma et al. (2021) suggest that board gender diversity strengthens the connection between, the firm and its outside environment. Also, board gender diversity assists sustain vital resources such as human capital, legitimacy, and communication channels among others. As such, a firm needs to focus on forming a board consisting of individuals possessing a wide and deep scope of expertise across relevant demographics and arguing legal standing and reputation to the firm. In this study, JSE-listed mining firms as prescribed by the resource dependency theory, need to increase the proportion of women representation in their boards to assist in OHS risk management performance.

The lines of literature on board gender diversity cover different areas. The extant literature on the impact of gender diversity covers different areas: the association between gender diversity and a firm's financial performance (Brahma et al., 2021), gender diversity and corporate sustainability (Yarram & Adapa, 2021), and gender diversity and risk management (Bufarwa et al., 2020). For the purpose of this study, the link between CG and OHS risk management in the South African mining sector was investigated using the following hypotheses:

H3: There is a negative relationship between board gender diversity (GD) and TIFR in the mining sector of South Africa.

H4: There is a negative relationship between GD and NCOD in the South African mining sector.

3. METHODOLOGY

The study utilised quantitative research based on GD, MO, and OHS panel data of 510-firm observations for the period from 2002 to 2018 collected from JSE-listed mining firms' online integrated reports. Although quantitative methodology by means of multivariate regression analysis and descriptive statistics was predominantly applied, the nature of the study permits the use of a mixed method approach or qualitative by means of a survey.

3.1. Panel data

Quantitative secondary data on corporate governance mechanisms and OHS risk management performance proxies for JSE-listed mining firms were collected from integrated annual reports and

sustainability reports for the period from 2002 to 2018. Corporate governance proxies utilised in the study were managerial ownership (*MO*) and board gender diversity (*GD*), whereas, OHS risk management performance proxies were total injuries frequency rate (*TIFR*) and new cases of occupational diseases (*NCOD*). However, the study incorporated firm characteristics as moderating factors in the form of total asset value (*TA*) and total employees (*TE*). Based on that criteria, 30 mining companies qualified to be considered, and annual and sustainability reports were accessed from their respective websites.

3.2. Data and model

The current study examines the impact of *MO* and *GD* which are predictor variables on OHS risk management performance that are response variables and are measured by *TIFR* and *NCOD*. For this study, panel data was employed as the data combines time series and cross-sectional features (Young, 2017; Mukwarami, 2021). The benefit of using the panel data analysis technique is its ability to accommodate more data variables and deliver greater freedom to a larger extent. The estimated multiple regression models adopted were as follows:

Model 1

$$Y_1 = \beta_0 + \beta_1 GD + \beta_2 MO + \beta_3 TA + \beta_4 TE + \varepsilon \quad (1)$$

Model 2

$$Y_2 = \beta_0 + \beta_1 GD + \beta_2 MO + \beta_3 TA + \beta_4 TE + \varepsilon \quad (2)$$

where,

Y_1 = Occupational safety risk management performance as measured by *TIFR*;

Y_2 = Occupational health risk management performance as measured by *NCOD*;

β_0 = Y-intercept;

GD = Board gender diversity;

MO = Managerial ownership;

TA = Total asset value;

TE = Total employees;

β_3 - β_4 = Slope;

ε = Error term.

Board gender diversity (*GD*) is the percentage of women on the board of directors (Ararat et al., 2021). *GD* is calculated as follows:

$$GD = \frac{\text{Number of female directors}}{\text{Total number of directors}} \times 100 \quad (3)$$

According to Endri and Fathony (2020), *MO* is the proportion of firm equity that is owned by management who are actively engaged in company policy, decision, and strategy formulation and implementation. *MO* is expressed as the percentage of the number of equity held by management from the total firm's equity in issue:

$$MO = \frac{\text{Number of shares owned by management}}{\text{Total number of shares in issue}} \times 100 \quad (4)$$

Yarram and Adapa (2021) define OHS risk management as the discipline of the expectancy, acknowledgement, assessment, and control of risks emanating from a workplace that could harm workers' health and safety, considering the potential influence on immediate societies and the overall surroundings. OHS risk management was expressed in *TIFR* and *NCOD*. *TIFR* refers to the total number of fatalities, lost time injuries, substitute work and other injuries requiring medical attention per million hours worked by both employees and contractors (AngloAmerican, 2018; Lonmin Plc, 2018). *TIFR* is the most comprehensive safety measure in the mining sector as it takes account of all fatal-injury frequency rate (FIFR) and lost time injury frequency rate (LTIFR) (Dougall & Mmola, 2015). "NCOD is the sum of occupational diseases due to asbestosis, noise-induced hearing loss (NIHL), silicosis, coal-workers' pneumoconiosis, chronic obstructive airways disease, occupational tuberculosis, occupational asthma, hand/arm vibration syndrome, musculoskeletal disorders, dermatitis, occupational cancers and other occupational diseases" (AngloAmerican, 2018, p. 206).

The moderating variables employed in the study are total assets (*TA*) and total employees (*TE*). Total asset value is the value of all assets owned by the company expressed in monetary terms. As alluded to by Baxter (2016), *TA* owned by a specific company is one of the proxies to measure firm size. *TE* refers to the total number of full-time and part-time employees of the company including contractors. The current study focuses on the impact of *CG* on OHS risk management, implying that employees are at the core of the research focus.

4. RESULTS

4.1. Descriptive statistics

The outcomes of descriptive statistics were generated from panel data collected from annual reports of thirty (30) JSE-listed firms for the period ranging from 2002 to 2018. The descriptive statistics of the six (6) variables employed in this study are presented in Table 1, with 510 observations.

The occupational safety risks data as measured by total injuries frequency rate (*TIFR*) showed a mean of 7.21133 per million hours worked, while the standard deviation was 6.018619. However, the standard deviation is less than the mean indicating that most data variables are bundled around the mean. This indicates a slight variability in *TIFR* in the JSE-listed mining firms for the period ranging from 2002 to 2018. The *TIFR* data showed a maximum of 33.91 per million hours worked and a minimum of 0.

Table 1. Descriptive statistics

	<i>TIFR</i>	<i>NCOD</i>	<i>GD</i>	<i>MO</i>	<i>TA</i>	<i>TE</i>
Mean	7.211333	257.0176	13.39045	2.825157	7.82E + 10	22416.96
Median	5.350000	66.00000	13.00000	0.240000	1.46E + 10	11398.00
Maximum	33.91000	3942.000	62.00000	70.58000	1.99E + 12	287043.0
Minimum	0.000000	0.000000	0.000000	0.000000	876000.0	153.0000
Std. Dev.	6.018619	499.2880	12.62967	7.181498	2.49E + 11	27978.79
Skewness	1.363004	3.473318	0.721395	4.953500	5.428138	2.978261
Kurtosis	4.912817	17.49788	3.125217	34.45084	34.48377	20.00760
Jarque-Bera	235.6623	5491.942	44.56808	23105.21	23568.08	6900.696
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	3677.780	131079.0	6829.130	1440.830	3.99E + 13	11432648
Sum of the Sq. Dev.	18437.90	1.27E + 08	81189.89	26251.12	3.15E + 25	3.98E + 11
Observations	510	510	510	510	510	510

Source: Researchers' construct.

The occupational health risks data as measured by new cases of occupational diseases (*NCOD*) showed a mean of 257.0176 and a standard deviation of 499.288 as shown in Table 1. The standard deviation is more than the mean inferring that there is great variability in terms of *NCOD* among JSE-listed mining firms. The maximum *NCOD* was 3942 and a minimum of 0.0000, implying that the data range for *NCOD* was equal to the maximum value.

The board gender diversity (*GD*) data showed a mean of 13.39045% and a standard deviation of 12.62967%. When comparing the standard deviation to the mean, the standard deviation is less than the mean implying that the data is clustered around the mean confirming less variability among JSE-listed firms for the period ranging from 2002 to 2018. The maximum percentage of board gender diversity was 62, while the minimum percentage was 0.00.

The data for managerial ownership expressed in terms of the percentage of managerial shareholding in a business entity showed a mean of 2.825157. The mean is too low confirming that most of the shares of JSE-listed mining firms are owned by external shareholders. However, the data showed a standard deviation of 7.181498%, implying a greater variability among JSE-listed mining firms from 2002 to 2018 in terms of managerial ownership.

The maximum total asset (*TA*) value was R1.99 trillion and a minimum of R876 million. The mean for *TA* value was R7.82 billion, whilst the standard deviation was R24.9 billion confirming less degree of variability among 30 JSE-listed firms for the period from 2002 to 2018 in asset investment. The slight variability among JSE-listed firms in total asset value reflects a narrow gap as expressed in terms of *TA*. Total employees (*TE*) is one of the variables that measure the size of firms, with a maximum value of 287,043 and a minimum of 153 employees. The data for *TE* showed a mean of 22,416.96 employees which is less than the standard deviation of 27,978.79 employees, inferring little variability among the 30 JSE-listed firms in terms of *TE*.

4.2. Inferential statistics

4.2.1. Correlation analysis

The relationship between each dependent variable, and independent and control variables was conducted using a correlation matrix as shown in Table 2. In this study, the correlation coefficients

amid variables were determined to construct by construct. As illustrated in Table 2, *GD*, *MO*, *TA*, and *TE* are negatively correlated to *TIFR* with a value close to zero confirming a weak and negative linear relationship. The negative relationship between *CG* and control variables and *TIFR* suggests that increasing women on board beyond tokenism and percentage shareholding by board members decrease occupational safety risks exposure in the mining sector.

Moreover, *GD*, *TA*, and *TE*, and a weak negative linear relationship with *MO*, suggest that an increase in *GD*, *TA*, and *TE* will result in a slight increase in *NCOD* lending support to Khatib et al.'s (2021) study that confirms a positive relationship between *GD* and overall firm performance. As such, the negative relationship between *MO* and *NCOD* suggests that mining firms need to increase managerial ownership so as to mitigate occupational health risks. Additionally, the relationship between *MO* and *NCOD* suggests that an increase in shareholding by management is likely to decrease the agency problem and cascades to a reduction in *NCOD* frequency rate. Furthermore, the association between *TE* and *TA*, and *NCOD* suggests that an increase in *TA* and *TE* translates into an increase in *NCOD* as more employees are employed and more assets are utilised chances of occupational diseases increase. The positive relationship between *TA* and *TE*, and *NCOD* calls for corporate governance bodies in the mining sector to apply strict and comprehensive health and safety measures that match an increase in *TA* and *TE* to mitigate OHS risks.

The correlation analysis links to the hypotheses of the current study as follows.

The study results concurred with the first hypothesis (*H1*) and hence the acceptance of the hypothesis. The results found a negative relationship between *GD* and *TIFR* at a 10% significant level.

According to the study outcomes as shown in Table 2, *GD* and *NCOD* are positively correlated. The results are not consistent with the second hypothesis (*H2*), hence, the *H2* is rejected.

The study concurred with the third hypothesis (*H3*) and thus being consistent with agency theory (Jensen & Meckling, 1976) that asserts that managerial ownership improves firm performance due to the elimination of the agency problem.

The fourth hypothesis (*H4*) suggested a negative relationship between *MO* and *NCOD* in the South African mining sector. Though the relationship was found to be negative and weak it concurred with the *H4* of the study.

Table 2. Correlation matrix

Variable	TIFR	NCOD	GD	MO	TA	TE
TIFR	1	0.14267	-0.1617	-0.04046	-0.09349	-0.07912
NCOD	0.14267	1	0.013826	-0.11002	0.025852	0.437309
GD	-0.1617	0.013826	1	-0.21086	0.056304	0.084829
MO	-0.04046	-0.11002	-0.21086	1	0.046706	-0.105
TA	-0.09349	0.025852	0.056304	0.046706	1	0.38577
TE	-0.07912	0.437309	0.084829	-0.105	0.38577	1

Source: Researchers' construct.

4.2.2. Bivariate analysis for NCOD and all predictors

This sub-section deliberates bivariate analysis for NCOD and all explanatory variables. NCOD was regressed against each explanatory variable as shown in Table 3 confirming a negative relationship between NCOD and CG variables (GD and MO). The negative association between NCOD and CG variables suggests that an increase in women's representation in CG structures and managerial ownership of JSE-listed mining firms resulted in a decrease in occupational diseases. Therefore, JSE-listed mining firms have been increasing board gender diversity beyond sole representation as one of the OHS risks migrating strategies.

Table 3. Bivariate analysis for NCOD and all predictor variables

Variable	-1	-2
	NCOD	NCOD
GD	-4.720** (-2.87)	
MO		-1.105 (-0.38)

Note: Standard error in parentheses. *** $p > 0.01$, ** $p < 0.05$, and * $p < 0.1$.

4.2.3. Bivariate analysis of TIFR and all predictor variables

The TIFR was regressed against each predictor variable as depicted in Table 4. confirming a significant and negative association between TIFR and GD (-0.0878) at a 10% significant level suggesting that JSE-listed mining firms made frantic efforts in attaining the health and safety 2024 milestone of zero harm by increasing women representation in the board of directors. The involvement of women in CG structures has been found to be significant in reducing TIFR as acknowledged by previous studies (Bufarwa et al., 2020).

The relationship between MO and TIFR as shown in Table 4 confirms a significant and negative association (-0.0878) at a 10% significant level. The results of the current study are in tandem with previous studies, which affirm that an increase in MO improves the overall performance of firms including OHS risk management performance (Al Farooque et al., 2020). Jensen and Meckling (1976) assert that an increase in MO reduces agency problems simultaneously improving firm performance in all dimensions. Therefore, the results of the study suggest that JSE-listed mining firms increased MO as one of the OHS risks mitigation strategies.

Table 4. Bivariate analysis for TIFR and CG variables

Variable	-1	-2
	TIFR	TIFR
GD	-0.0780*** (-3.56)	
MO		-0.0878* (-2.28)

Note: Standard error in parentheses. *** $p > 0.01$, ** $p < 0.05$, and * $p < 0.1$.

4.2.4. Multivariate analysis: Examining of CG and OHS variables' relationship

The multivariate analysis offers a description of a linear relationship between embroiling at least two predictor variables (Young, 2017). Diagnostic tests were conducted to guarantee the adequacy of regression models used: multicollinearity, serial correlation, heteroscedasticity and normality tests. As such, panel data was confirmed to be free from regression assumption violations, and therefore, the study utilised ordinary least squares (OLS) to analyse the association between CG and OHS risk proxies. Also, a feasible generalised least square (FGLS) was employed to consolidate the estimated OLS outcomes to confirm the strength of the testing techniques used as shown in Table 5.

Table 5. Corporate governance and OHS risks

Variable	OLS		FGLS	
	1	2	3	4
	TIFR	NCOD	TIFR	NCOD
GD	-0.0773*** (-3.56)	-4.531** (-2.77)	-0.0773*** (-3.59)	-4.531** (-2.77)
MO	-0.0930** (-2.43)	-0.0583 (0.02)	-0.0930** (-2.43)	-0.0583 (0.02)
TA	-0.294 (-1.53)	-26.55 (-1.82)	-0.294 (-1.53)	-26.55 (-1.82)
TE	0.384 (-1.5)	155.6*** (-7.67)	0.384 (-1.5)	155.6*** (-7.67)
Constant	14.98*** (-4.78)	-767.9** (-3.26)	14.98*** (-4.78)	-767.9** (-3.26)
N	510	510	510	510

Note: T-statistics is in parentheses. * $p < 0.01$, ** $p < 0.05$, *** $p < 0.1$.

Source: Researchers' construct.

Examining the relationship between GD and OHS risks variables

Board gender diversity's (GD) association with TIFR (-0.0773***) and NCOD (-4.531**) confirmed a negative and significant relationship at 1% and 5% significant levels, respectively. The negative association between GD, TIFR, and NCOD suggests that an increase in women's representation in the board improves risk management performance and OHS is not an exception. Since 2002, listed mining firms in South Africa have shown an upward trend in terms of women's representation in

the board resulting in *NCOD* and *TIFR* decrease. The outcomes of the current study are consistent with the previous studies (Agyemang-Mintah & Schadewitz, 2019; Perryman et al., 2016; Nguyen et al., 2015; Gyapong et al., 2016). Agyemang-Mintah and Schadewitz (2019) confirm that gender diversity beyond tokenism improves both financial and non-financial performance and strengthens the corporate governance policies of firms. IoDSA (2016) echoes that one of the crucial benchmarks in CG structure's performance is mirrored by OHS risk management performance. Moreover, Perryman et al. (2016) point out that corporates with increased board gender diversity proved to have a low-risk appetite and high performance. Per se, the study results propound that a higher women representation at the board level in the mining sector contributes positively to the management of OHS risks. As such, mining firms in South Africa made strides in achieving the health and safety milestone of "zero harm" by appointing qualified and experienced women to their boards of directors.

Examining the relationship between MO and OHS risks variables

Managerial ownership (*MO*) confirmed a negative and significant relationship with *TIFR* (-0.0930*) at a 1% significant level and a negative insignificant association with *NCOD* (-0.0583). An increase in the percentage of shareholding by directors translates into decreased safety risks (*TIFR*) incidences in the South African mining sector. However, the percentage of shares owned by directors has a weak influence on health risk incidences. Thus, the study results advocate that any change in *MO* does not influence *NCOD* significantly. Firms with poor OHS risk management tend to experience bad reputation and ultimately loss in share value. Various studies were conducted to investigate the relationship between *MO* and firm risks with inconsistent and diverging results (Al Farooque et al., 2020; Amin & Hamdan, 2018). Tying directors' compensation to share prices expose directors to risks they can control such as OHS risks encourage corporate boards to implement, monitor and evaluate comprehensive risk management strategies, policies, and guidelines so as to safeguard their wealth (Al Farooque et al., 2020). Increasing managerial ownership is believed to reduce agency problems and costs resulting in improved firm performance (Jensen & Meckling, 1976). The results of the study were consistent with a plethora of studies that were carried out across the world in different economic sectors (e.g., Bouras & Gallali, 2017; Berke-Berga et al., 2017) that confirmed a significant and negative relationship between *MO* and OHS risks.

However, certain studies found a positive and significant relationship between *MO* and OHS risks (Jusoh, 2016). Jusoh (2016) asserts that *MO* reduces firm performance including OHS risk management performance as *MO* compromises board independence and accountability and consequently decreases overall company performance. On the other strand, a study by Zondi and Sibanda (2015) found that *MO* has no impact on the OHS risks of selected JSE-listed companies. Thus, confirming the outcomes of this study that found a negative and insignificant

relationship between *MO* and *NCOD*. As such, the results put forward that JSE-listed mining firms are not required to concentrate on varying managerial ownership as a mechanism to mitigate occupational health risks (*NCOD*).

The relationship between firm size moderating variables and OHS risks variables

OLS and FGLS estimators confirmed an insignificant and negative relationship between *TA* and *TIFR* (-0.294) and *NCOD* (-26.55). Accordingly, the results suggest that JSE-listed mining firms need not to increase or decrease their asset values so as to reduce OHS risks. However, *TE* and *TIFR* showed a positive (0.384) and insignificant relationship. On the other hand, *TE* and *NCOD* showed a positive and significant relationship (155.6***) at a significant level of 10%. Thus, the results demonstrate that an increase in employees has the potential to increase new cases of occupational diseases. In this regard, corporate governance structures are obliged to formulate, implement, monitor, and evaluate comprehensive and robust OHS risk management practices that match the size of the workforce. Failure to match the increase in employees by appropriate and effective OHS risk management practices by CG bodies in the mining sector will result in failure to achieve pre-defined health and safety milestones, in this case, the "zero harm" by 2024.

5. DISCUSSION

One of the objectives of the study was to determine the relationship between *GD* and OHS risks in the mining sector of South Africa. The attainment of this objective was confirmed through testing of *H1* and *H2* and it was found that *GD* is negatively and significantly associated with *TIFR* and *NCOD* as shown in Table 5. The results suggest that the presence of at least three women in the board of directors leads to a considerable improvement in OHS risk management performance in the South African mining sector. To be in line with the critical mass theory, mining firms in South Africa are recommended to appoint at least three women with appropriate skills, knowledge, and experience in their boards as one of the key strategies to mitigate OHS risks. In tandem with earlier studies, the study found that women improve OHS risk management performance (Mohd & Ousama, 2021).

The other objective of the study was to determine the relationship between *MO* and OHS risks in the mining sector of South Africa. Table 5 presents the results of the study showing a negative and weak relationship between *MO* and OHS risks (proxies *TIFR* and *NCOD*), suggesting that ownership of shares by directors has a slight effect on OHS risk management performance. According to the existing literature (Jusoh, 2016; Berke-Berga et al., 2017; Doorasamy, 2021), managerial ownership reduces agency problem as directors are encouraged to act in the best interest of shareholders in turn improving firm performance. Therefore, *H3* and *H4* are accepted. Moreover, it is of paramount importance to offer directors share option schemes to increase their shareholding to an optimum level at the same time motivating them to formulate, implement and

monitor effective OHS risk management practices. Increasing managerial ownership to optimum levels would work as a mechanism to promote and protect the health and safety of miners and improve the overall performance of the mining firms in South Africa.

6. CONCLUSION

The study contribute to the existing literature by examining the relationship between GD, MO, and OHS risk variables of JSE-listed mining firms. The results confirmed a negative and insignificant relationship between GD, MO, and TIFR. GD and MO were found to be significantly and negatively associated with TIFR and NCOD. The negative and insignificant relationship between certain CG variables and OHS risks confirm that more attention is needed on CG mechanisms to eliminate or reduce OHS risks. Moreover, the agency theory (Jensen & Meckling, 1976) justifies the results of the study. Directors as managers of corporates need to align their interests with those of shareholders to eliminate agency problem and improve the overall performance of firms. The significant and negative relationship between MO and OHS risks confirms that managers need to own shares of the company to align their interests with those of shareholders.

Furthermore, the results of the study offer support to the critical mass theory that argues that women in the board should reach a certain threshold to be involved effectively in the management of the firm. Considering study findings, the study offers a basis for mining firms to realign their CG mechanisms with a strategic risk management plan, especially OHS risk management to ensure the well-being of miners. To ensure OHS risks are eliminated or mitigated to the lowest possible levels, the study made a valuable contribution to the existing literature by closing a knowledge gap as best to our knowledge no empirical study has been done on the relationship between CG and OHS risk management performance using the same approach. Intrinsically, it is vital for mining firms to realign their board gender diversity and managerial ownership with OHS risk management as safe and health mining environments are crucial for economic growth and development.

As shown in Table 5, the FGLS and OLS results show a negative impact of GD on TIFR and NCOD, whilst, MO confirmed a positive impact on both TIFR and NCOD. However, the results could have been improved if structural equation modelling was employed. The study utilised quantitative secondary data pertaining to CG and OHS risk variables to attain its objectives. Though, the employment of both primary and secondary data would ensure policymakers and management of mining firms gain a deep understanding of the role played by CG in OHS risk management.

Based on the study results, mining firms in South Africa are expected to constitute a board of directors that comply with relevant codes, guidelines, and laws in terms of size, independence, managerial ownership, and gender diversity to ensure the health and safety of miners. As such, mining firms are encouraged to appoint a board that suits their unique health and safety context. Additionally, the board must be diverse in terms of

nationality, skills, knowledge, age, gender, and race to bring in diverse competencies so as to improve organisational performance, especially in risk management performance. Most importantly, JSE-listed mining firms are recommended to appoint women beyond tokenism to allow active and effective participation of women in OHS risk management. Correspondingly, managerial ownership should be used by JSE-listed mining firms to reduce agency problems at the same time contributing towards effective OHS risk management. Moreover, in line with the critical mass theory mining firms are recommended to appoint at least three female directors to overcome shortfalls of tokenism and sole representation thereby enhancing OHS risk management practices.

Furthermore, the mining CG structures are recommended to ensure reporting of fatalities, near misses, injuries, and first aid promptly. Conduct occupational health and safety training sessions across the enterprise on a regular and continuous basis to increase awareness and reduce OHS risk exposure. Occupational health and safety training is the basic building block of health and safety culture thereby reducing OHS risk exposure. Also, prepare management for the initial rise in incidents and rates.

As well, CG mechanisms in South African mining firms are encouraged to invest in physical and social capital that enhances OHS risk management performance. Moreover, evaluate and rebuild the incident investigation system as necessary to ensure that is timely, comprehensive, and operational. The incident investigation system should get to the underlying causes and shun pointing fingers at employees. Moreover, the board of directors is expected to offer various channels for personnel to bring submissions, fears, or complications forward. One of the channels must be the chain of command and warrant no consequences. Hold middle and floor managers accountable and responsible for being sluggish. Bring into line management and supervisors by means of instituting common health and safety goals and objectives set against production. On the same hand, mining firms are recommended to appraise, monitor and restructure any incentives and disciplinary structures related to occupational health and safety risk management as needed.

Ensuring health and safety are operational aptly is one of the prerogatives for mining leadership and management so as to improve the well-being of employees. Furthermore, CG mechanisms are tasked to offer caring concern to the potential impact of mining undertakings on immediate environment besides on the safety of the public. To be specific, this should embroil the control of subsidence, vibration, fly-rock, dust, hazardous impurities in the water, air or soil, the safe and effective management of waste and restoration of mine locations.

The primary objective of the study is to examine the impact of MO and GD on OHS risk management performance in the South African mining sector. However, the CG structures are recommended to take suitable actions to eliminate or mitigate OHS risks emanating from contact with physical, chemical or biological hazardous elements. Also, such measures should embrace technical and

organisational realistic to pertinent mining activities, to the plant, machinery, equipment, or structures. As such, the measures should also consist the use of protective equipment and clothing by employees.

The main limitation of the study is a reasonably reduced sample size. Though, it was constituted based on three criteria, namely South Africa as a geographical area, the listing status of firms, and the mining industry as the economic sector only. Additionally, data analysis was based on JSE-listed only excluding non-listed mining firms taking into account the availability of data in the public domain. Moreover, the study focused on two CG variables only: board gender diversity and managerial ownership.

Future research will overcome the aforementioned limitations by using secondary CG and OHS data of all the JSE-Listed firms over the same study period to disclose additional dynamics as well as to enhance the results robustness. Also, future studies may focus on investigating the impact of CG on both financial and OHS risk management performance of firms at the cross-country level by means of different research methodologies incorporating more CG variables such as board size, independence, and committees among others.

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