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Research Article

Greening the Bottom Line: Exploring the Relationship Between Sustainability Disclosure and Financial Performance

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Purpose: This study examines the relationship between sustainability disclosure quality and financial indicators among mining companies listed on the Johannesburg Stock Exchange (JSE), providing insights into an African emerging-market context.
Design/Methodology/Approach: Sustainability disclosure quality was measured using an index based on the Global Reporting Initiative (GRI) Mining and Metals Sector Supplement. The analysis employed a balanced panel dataset (2012–2021) of 36 firms and applied fixed-effects panel regression to assess the associations with three financial indicators, namely liquidity, leverage, and profitability, as well as company size.
Findings: The results show significant positive relationships between disclosure quality, leverage, and profitability, while no significant associations were found with liquidity or company size. These findings suggest that transparent, high-quality disclosures may be more relevant to financing structures and profitability than to short-term liquidity or firm size.
Originality/Value: By applying a sector-specific disclosure index within the South African mining industry over a decade of reporting, this study contributes to understanding the financial relevance of sustainability disclosure in an emerging-market setting.
Practical and Social Implications: The findings suggest that the early adoption of sustainability reporting regulations can strengthen transparency, improve financing outcomes, and foster accountability in South Africa's mining sector, with broader lessons for resource-intensive industries in Africa.
Research Implications: Future research should extend to other sectors, incorporate additional financial and market-based measures, and evaluate the effects of evolving sustainability standards, including IFRS S1 and S2 and the GRI 14: Mining Sector Standard.

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1. Introduction

Over the past two decades, the disclosure of sustainability information has undergone substantial transformation in response to intensifying global pressures for transparency and the proliferation of new reporting frameworks. Recent developments such as the IFRS S1 and S2 standards emphasise the drive toward greater comparability and accountability in non-financial reporting[1]. Alongside these mandatory

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frameworks, voluntary initiatives—most notably the Global Reporting Initiative (GRI)—continue to shape corporate disclosure practices and influence the quality of sustainability information[2][3].

The rationale for sustainability reporting is grounded in its potential to help organisations acknowledge and communicate their environmental, social, and governance (ESG) impacts. Transparent disclosure strengthens corporate legitimacy, signals responsible corporate citizenship, and enhances competitiveness in increasingly stakeholder-driven markets[4][5]. The triple-bottom-line perspective—balancing people, planet, and profit—reinforces this integrated approach, encouraging companies to account for broader societal and environmental responsibilities[6][7].

Despite these advances, the quality and consequences of sustainability reporting remain uneven. Some studies report a positive association between high-quality disclosures and firm performance[8][9], whereas others reveal weak, negative, or insignificant relationships[10]. Recent evidence from small and medium-sized enterprises (SMEs) in Ghana also demonstrates mixed outcomes: environmental and economic sustainability practices enhanced performance, but social sustainability practices reduced it unless moderated by a strong internal control environment[11]. These conflicting findings highlight the need for context- and sector-specific analysis to clarify under which conditions sustainability disclosures translate into organisational benefits.

South Africa provides a particularly salient setting for such an investigation. As an emerging economy with a resource-intensive mining sector, the country faces the dual challenge of creating economic value while managing significant environmental and social impacts. Mining companies are under heightened scrutiny to justify their operations, engage stakeholders, and demonstrate alignment with broader societal values[12][13]. Moreover, integrated reporting is more advanced in South Africa than in many other emerging economies, with the Johannesburg Stock Exchange (JSE) playing a leading role in embedding disclosure requirements.

Against this backdrop, the present study examines the association between selected financial indicators and the quality of sustainability disclosures among JSE-listed mining companies. By applying a sector-specific evaluation index based on the GRI Mining and Metals guidelines over a decade of reporting, the study contributes to ongoing debates on the financial relevance of sustainability reporting and clarifies the mixed evidence observed in the literature. In doing so, it provides a timely baseline for evaluating the implications of the forthcoming IFRS sustainability standards in an African context.

The following sections elaborate on the theoretical foundation and the available literature, followed by a description of the research method and an explanation of the findings from the analysis. The final section provides a conclusion and recommendations for future research.

2. Theoretical Foundation

Stakeholder theory[14] provides the primary theoretical lens for this study. It underscores organisations' responsibilities to a broad range of stakeholders beyond shareholders, recognising that corporate actions directly influence value creation and long-term viability. In sustainability reporting, stakeholders increasingly demand transparent disclosure of environmental, social, and governance (ESG) impacts, shaping firms' access to resources and legitimacy[15][16]. Recent empirical work confirms that stakeholder pressures are a central driver of sustainability disclosure and its link to financial outcomes in emerging markets[17][18]. This study therefore applies stakeholder theory to examine how the quality of sustainability disclosure aligns with

and responds to the expectations of diverse groups—including regulators, investors, suppliers, customers, employees, and local communities—whose salience and claims condition corporate behaviour[19][20][21][22].

Complementing this perspective, legitimacy theory suggests that companies seek to align their activities with societal norms and expectations to secure or maintain legitimacy[23][24]. From this viewpoint, transparent sustainability disclosure functions as a mechanism for demonstrating accountability, strengthening reputation, and mitigating legitimacy gaps[25][26]. Recent reviews highlight that the financial pay-offs from sustainability practices are contingent on institutional contexts and legitimacy pressures rather than automatic[27][28], underscoring the importance of examining sector-specific settings such as South African mining.

Finally, impression-management theory extends these insights by highlighting the strategic dimension of corporate disclosure. It proposes that companies may actively shape stakeholder perceptions through selective emphasis or presentation of information, accentuating positive outcomes while minimising negative aspects[29][30][31]. The literature on corporate governance and CSR cautions that, alongside genuine accountability, firms may also use disclosure strategically to manage impressions or "greenwash" their activities[20][27]. This study therefore considers impression management as a complementary lens to understand whether higher-quality disclosure is also employed as a communication strategy to influence stakeholder trust and protect corporate legitimacy.

Taken together, these theories provide a framework for anticipating how sustainability disclosure quality may be associated with stakeholder relationships, corporate reputation, and financial performance, with stakeholder theory serving as the primary foundation.

3. Sustainability Reporting and Its Relationship to Financial Performance

Sustainability disclosures offer transparency on an organisation's economic, social, and environmental impacts[32]. The absence of universal standards results in lower reporting levels[33]. IFRS S1 and S2, introduced by the ISSB in June 2023, mark a move towards global sustainability disclosure requirements effective from 1 January 2024. Despite this, GRI Standards remain widely adopted for their accessibility and applicability[3].

Research suggests that sustainability reporting, particularly using the GRI framework, positively impacts financial performance[8], addressing information imbalances and increasing a company's value[34][35]. Ameer and Othman[36] found enhanced corporate financial performance through this approach. However, in South Africa, inconsistencies in applying GRI indicators across sectors underscore the need for alignment in sustainability reporting[37]. Additionally, emerging markets like South Africa may provide unique insights into the relationship between financial performance and sustainability disclosure[38]. Table 1 provides a summary of studies that have been conducted in this area.

Citation	Year	Country	Findings	Sector / Context
Jones et al.[39]	2007	Australia	A positive relationship was identified between firm size and corporate social responsibility. No relationship was identified between profitability and environmental disclosure.	Mining & resources
Weber et al.[8]	2008	Switzerland	A significant positive relationship was identified between leverage and sustainability reporting. No relationship was identified between company size, profitability, liquidity and sustainability reporting.	Banking
Liu & Anbumozhi[40]	2009	China	A significant relationship was identified between company size and sustainability reporting. An indecisive relationship between leverage and sustainability reporting was identified.	Energy-intensive industries
Reverte[41]	2009	Spain	A positive relationship was identified between leverage, profitability, company size and sustainability reporting.	Cross-sector
Aras et al.[42]	2010	Turkey	A positive relationship was identified between financial performance (return on equity) and sustainability reporting.	Cross-sector
Artiach et al.[43]	2010	Australia	A negative relationship was identified between firm performance (return on assets) and sustainability reporting.	Cross-sector
Dilling[33]	2010	Canada	A positive relationship was identified between company performance and sustainability reporting.	Cross-sector
Ameer & Othman[36]	2012	Malaysia	No relationship was identified between accounting and market-based performance variables and the reporting quality of sustainability reports.	Cross-sector
Lourenço & Branco[44]	2013	Brazil	A positive relationship was identified between profitability and sustainability reporting.	Cross-sector
Branco et al.[45]	2014	Portugal	A positive relationship was identified between financial performance and sustainability reporting.	Cross-sector
Husna[46]	2014	Indonesia	A negative relationship was identified between financial	Manufacturing firms

Citation	Year	Country	Findings	Sector / Context
			performance and sustainability reporting over the short term. A positive relationship was identified between financial performance and sustainability reporting over the long term.	
Nugroho & Arjowo[47]	2014	Indonesia	The relationship between financial performance and sustainability reporting was inconsistent.	Manufacturing
Garg[48]	2015	India	A negative relationship was identified between the company's size, financial performance (leverage) and sustainability reporting.	Cross-sector
Kasbun et al.[49]	2016	Malaysia	A positive relationship was identified between company size and sustainability reporting. A negative relationship was identified between liquidity, profitability and sustainability reporting.	Cross-sector
Qiu et al.[50]	2016	United Kingdom	A positive relationship was identified between financial performance (profitability and liquidity) and sustainability reporting. No relationship was identified between book value, leverage and sustainability reporting.	Cross-sector
Caesaria & Basuki[51]	2017	Indonesia	A positive relationship was identified between liquidity and sustainability reporting. A negative relationship was identified between leverage and sustainability reporting. No significant relationship was identified between profitability, company size and sustainability reporting.	Cross-sector
Ching et al.[52]	2017	Brazil	A negative relationship was identified between financial performance and sustainability reporting.	Cross-sector
Goel & Misra[53]	2017	India	A positive relationship was identified between financial performance (return on assets and return on equity) and sustainability reporting.	Cross-sector
Kuzey & Uyar[54]	2017	Turkey	A significant relationship was identified between company size and sustainability reporting.	Cross-sector

Citation	Year	Country	Findings	Sector / Context
			A negative relationship was identified between liquidity, leverage and sustainability reporting. No relationship was identified between profitability and sustainability reporting.	
Lassala et al.[55]	2017	Spain	A positive relationship was identified between financial performance (return on equity) and sustainability reporting.	Financial institutions
Syed & Butt[56]	2017	Pakistan	A significant relationship was identified between company size and sustainability reporting.	Cross-sector
Ariyani & Hartomo[57]	2018	Indonesia	A positive relationship was identified between company size and sustainability reporting.	Manufacturing firms
Buallay[58]	2018	United Kingdom	A significantly positive relationship was identified between liquidity, company size and sustainability reporting. No significant relationship was identified between leverage, profitability and sustainability reporting.	Banking sector
Hardika et al.[59]	2018	Indonesia	A positive relationship was identified between return on assets/profitability and environmental disclosure. No relationship was identified between liquidity (current ratio), leverage (debt-to-equity ratio) and environmental disclosure.	Cross-sector
Oktarina[9]	2018	Indonesia	A positive relationship was identified between financial performance and sustainability reporting.	Manufacturing
Sri & Arief[60]	2018	Australia (Indonesia)	No relationship was identified between profitability and sustainability reporting.	Cross-sector (emerging markets)
Wardhani et al.[61]	2019	Indonesia	A significant relationship was identified between company size and sustainability reporting. No relationship was identified between leverage, profitability and sustainability reporting.	Manufacturing
Buallay[62]	2020	United Kingdom	A positive relationship was identified between earnings per share, return on equity, company size, and environmental disclosure.	Banking sector

Citation	Year	Country	Findings	Sector / Context
			No relationship was identified between return on assets and environmental disclosure.	
Indrianingsih & Agustina[63]	2020	Indonesia	A significant positive relationship was identified between company size and sustainability reporting.	Manufacturing
Wang et al.[64]	2020	China	A positive relationship was identified between environmental information disclosure and financial performance (liquidity).	Manufacturing & heavy industry
Naeem & Brata[65]	2021	Indonesia	A positive relationship was identified between company size and sustainability reporting. No relationship was identified between leverage, profitability and sustainability reporting.	Cross-sector
Ebaid[66]	2023	Egypt	A positive relationship was identified between financial performance and sustainability reporting.	Cross-sector
Wu & Li[67]	2023	China	A positive relationship was identified between profitability and sustainability reporting.	Cross-sector

Table 1. Review of similar studies and their findings

Source: Author's summary.

Integrated reporting that incorporates sustainability information has been shown to strengthen the connection between environmental, social, and governance (ESG) disclosure and financial outcomes. On the Johannesburg Stock Exchange (JSE), where integrated reporting is de facto mandatory, comprehensive disclosure improves the accuracy of analysts' forecasts and enhances financial performance[68]. Similarly, Lee and Yeo[69] find that higher levels of integrated disclosure correlate positively with firm valuation. Recent evidence from emerging markets further supports this view: Mondal and Sahu[17] show that corporate social responsibility (CSR) initiatives improve firm performance and that board diversity and independence positively moderate this relationship, while Agarwala, Pareek, and Sahu[18] report that board independence enhances CSR outcomes. These studies reinforce the notion that transparent and well-governed sustainability reporting can create financial benefits in contexts with high stakeholder scrutiny.

However, the broader literature presents mixed and sometimes conflicting evidence. Several studies identify positive relationships between sustainability reporting and financial performance[8][33][9][66][67], while others report negative or insignificant associations[39][50][41][62]. Meta-analyses and systematic reviews also highlight this inconsistency, concluding that the value relevance of sustainability disclosure is only partially supported[70][27][20]. These reviews stress that the CSR–financial

performance link is contingent on contextual and governance factors rather than being universal.

The sectoral focus of prior studies helps explain this divergence. As Table 1 shows, most studies have been conducted in cross-sector contexts[42][53][54] or in specific industries such as banking[58][62][8], manufacturing[57][46][63][9], and energy-intensive sectors[40]. Very few have focused explicitly on mining and resource-intensive sectors, with Jones et al.[39] and Brown and Deegan[26] being notable exceptions. This sectoral imbalance underscores the novelty of examining the South African mining industry, where sustainability reporting is especially critical given the sector's economic significance and social–environmental impacts.

Differences in methodological approaches, disclosure measures, and financial indicators also contribute to inconsistent findings. Studies using quantity-based disclosure indices often produce weaker or inconsistent results, while those considering credibility, assurance, or adherence to frameworks such as the GRI tend to find stronger performance links[71]. Moreover, institutional settings matter: emerging markets with evolving governance structures and high stakeholder pressure (e.g., Indonesia, Turkey, South Africa, and India) show different dynamics than developed economies[72][73][28]. The time horizon is equally important: while some studies capture short-term financial responses, others suggest that sustainability disclosure pays off more clearly over the long term[48][27].

Taken together, the evidence indicates that the mixed results are not contradictions but reflect the complexity and context-dependence of sustainability reporting. The financial impact of disclosure depends not only on whether companies report but also on how, why, and in which context reporting occurs. This reinforces the importance of assessing disclosure quality rather than mere quantity: poor or superficial reporting may reduce credibility and yield no financial benefit, whereas transparent, high-quality disclosure—supported by robust governance—can strengthen legitimacy, enhance stakeholder relationships, and contribute to long-term value creation[10][71][20].

4. Hypothesis Development

Liquidity measures a company's ability to settle its short-term debts, and higher liquidity is often interpreted as a sign of financial resilience. From a stakeholder theory perspective, greater liquidity can enhance stakeholder confidence in a company's stability and capacity to meet obligations, reinforcing trust and legitimacy. This theoretical link is particularly relevant in South Africa's mining sector, where firms face intense scrutiny from investors, regulators, and communities. Therefore, demonstrating liquidity strength through transparent disclosure may contribute to validating stakeholder theory in an emerging-market setting, where financial stability and social legitimacy are closely intertwined.

Empirical evidence on the association between liquidity and sustainability reporting is mixed. Some studies suggest a positive association[46][63][64][65], while others find weak or no significant relationships[74][54][57][47]. The inconsistency indicates that the effect of liquidity may vary across contexts and sectors. In South Africa, where mining companies are central to economic and social development, disclosing liquidity-related sustainability practices could carry particular weight in maintaining investor confidence and access to financing.

From a practical standpoint, these insights suggest that JSE regulators could strengthen disclosure requirements by encouraging firms to link financial indicators such as liquidity explicitly with sustainability performance in their integrated reports. Integrating liquidity measures into sustainability disclosures allows mining

companies to reassure investors and creditors of their financial strength, reduce information asymmetry, and build long-term stakeholder trust. Based on this theoretical and empirical foundation, the following hypothesis is proposed:

- H1: Consistent with prior studies, liquidity is expected to be positively associated with the quality of sustainability disclosure, although some empirical evidence suggests this relationship may be weaker or insignificant.

Leverage reflects firms' reliance on debt to finance their assets[75]. From a legitimacy theory perspective, highly leveraged firms face greater pressure to reassure creditors and investors of their long-term viability, since high debt levels may raise concerns about financial stability and repayment capacity. One way to mitigate these concerns is through high-quality sustainability disclosure, which signals accountability, strengthens reputation, and reduces risk perceptions. In South Africa's mining sector, where capital intensity is high and reliance on debt financing is common, disclosure may be an important tool to maintain legitimacy among key financial stakeholders. This highlights the academic contribution of the study, as it tests the explanatory power of legitimacy theory in an emerging-market setting characterised by heightened stakeholder scrutiny.

Empirical findings on this association remain mixed. Several studies document a positive relationship between leverage and sustainability reporting, suggesting that disclosure reassures creditors[74][57][45]. Others report negative[59][63], mixed[43], or insignificant associations[46][65][47][41][61], reflecting variation across industries and institutional contexts. The South African mining industry provides a particularly relevant setting to re-examine this question, as firms operate under debt-related financial pressures and strong social expectations for legitimacy.

From a practical standpoint, JSE regulators could enhance disclosure requirements by encouraging firms to report explicitly how sustainability practices align with debt management and long-term financial stability. For mining companies, aligning sustainability disclosures with leverage management can reduce agency costs, reassure creditors, and preserve legitimacy. This may be especially important during commodity price downturns, when highly leveraged firms are most vulnerable to financial scrutiny. Based on this theoretical and empirical foundation, the following hypothesis is proposed:

- H2: Leverage is expected to be positively associated with the quality of sustainability disclosure, as highly leveraged firms may increase transparency to reassure creditors and mitigate perceptions of financial risk.

Profitability reflects a firm's ability to manage assets effectively and generate sustainable returns[76]. From a stakeholder theory perspective, profitable firms face stronger expectations from investors, employees, and communities to demonstrate responsible practices and transparent communication. At the same time, profitability provides firms with the resources necessary to invest in comprehensive sustainability reporting. By linking financial performance with disclosure practices, this study contributes theoretically by testing stakeholder theory in the South African mining context. In this emerging market, firms must balance resource extraction with accountability to diverse stakeholders.

Empirical evidence on this relationship is mixed. Several studies document a positive association between profitability and sustainability disclosure, suggesting that profitable firms are more likely to report extensively due to both resources and stakeholder expectations[36][45][33][46][49][47][67]. Other studies, however, identify negative associations[74][62] or no significant relationship[42][50][63][65][41][61][54][57]. These conflicting results highlight the need for context-specific testing, particularly in

South Africa's mining industry, where profitability is closely linked to investor confidence and community legitimacy.

From a practical standpoint, JSE regulators could encourage profitable firms to provide more detailed and assured sustainability disclosures, ensuring that financial strength is translated into greater accountability and transparency. For mining companies, profitability offers an opportunity to demonstrate to stakeholders that financial success is aligned with sustainable and socially responsible practices. Firms can leverage strong earnings to expand operations and invest in higher-quality reporting systems, assurance mechanisms, and stakeholder engagement processes, thereby reinforcing their legitimacy and long-term competitiveness. Based on this theoretical and empirical foundation, the following hypothesis is proposed:

- H3: Profitability is expected to be positively associated with the quality of sustainability disclosure, as more profitable firms have greater resources to meet stakeholder expectations and strengthen their reputation.

Company size plays an important role in shaping disclosure practices. Larger firms typically operate across more business activities, engage with broader stakeholders, and have a greater environmental and social footprint[77]. From a legitimacy theory perspective, such firms face heightened visibility and public scrutiny, creating stronger incentives to release high-quality sustainability reports to maintain or enhance legitimacy. Moreover, larger firms possess more resources to invest in reporting systems and assurance mechanisms[40][44]. By investigating the size–disclosure relationship in South Africa's mining sector, this study extends legitimacy theory into an emerging-market context, where firm visibility and stakeholder expectations are particularly salient.

Empirical evidence generally supports a positive association between firm size and sustainability disclosure, with larger firms producing more comprehensive reports[78][45][56][60][42][65][74][61][43][41][54]. However, contrary evidence also exists: Hardika et al.[59] found a negative relationship, while Ariyani and Hartomo[57] and Indrianingsih and Agustina[63] identified no significant link. These mixed findings highlight the importance of examining size effects in specific industries and institutional environments, such as South Africa's mining sector.

From a practical standpoint, JSE regulators could encourage larger firms to set a benchmark for reporting standards by requiring enhanced disclosure depth, independent assurance, and explicit links between financial performance and sustainability outcomes. For mining companies, size should be leveraged strategically: as larger firms are under greater scrutiny, demonstrating leadership in sustainability disclosure can help reinforce legitimacy, build community trust, and attract responsible investment. Smaller firms may also look to these leaders for best practices, raising overall reporting quality in the sector. Based on this theoretical and empirical foundation, the following hypothesis is proposed:

- H4: Company size is expected to be positively associated with the quality of sustainability disclosure, as larger firms face greater stakeholder scrutiny and possess more resources to provide extensive reporting.

Drawing on stakeholder theory, this study examines how financial characteristics relate to the quality of sustainability disclosure. Stakeholder theory suggests that firms with greater resources or higher visibility are under stronger pressure to meet stakeholder expectations for transparency and accountability[14][16]. Legitimacy theory complements this view by proposing that companies use disclosure to align their activities with societal norms and to reassure stakeholders of their long-term

viability[23][24]. Impression management theory further highlights how disclosure may be strategically framed to influence perceptions and mitigate reputational risk[29][30].

Within this framework, liquidity is expected to be positively associated with disclosure quality, as more liquid firms signal financial stability (H1). Leverage is anticipated to be positively associated with disclosure quality, as leveraged firms face incentives to reassure creditors and investors (H2). Profitability is expected to be positively associated with disclosure quality, since more profitable firms possess greater resources to respond to stakeholder expectations and enhance legitimacy (H3). Finally, company size is anticipated to be positively associated with disclosure quality, given that larger firms attract more stakeholder scrutiny and possess more capacity to disclose extensively (H4).

5. Research Method

The study focused on the 41 mining companies listed on the JSE in South Africa as of the end of 2021. Mining was chosen due to its significant social and environmental impact and specific sustainability reporting requirements[79][12][13]. The sample covered data from 2012 to 2021, providing 10 years of data. The study period was deliberately defined as 2012–2021 to exclude the 2007–2008 global financial crisis and its immediate aftermath, which created a structural break in financial markets and corporate reporting behaviour. By starting the analysis in 2012, we ensure that the dataset reflects a post-crisis period of relative stability, reducing the likelihood that the crisis would bias financial performance measures or sustainability disclosure practices. No additional structural break adjustments within the sample period were necessary. This timeframe aligns with the introduction of integrated reporting requirements and precedes the implementation of the ISSB sustainability reporting standards. The study's results can serve as a baseline for future research and impact assessments post-ISSB standards. The final balanced panel comprises 36 firms over nine years (324 firm–year observations). Although the study period covers 2012–2021, the first year of data could not be retained for all firms, as explained in Table 2. The analysis was conducted over nine years to maintain a fully balanced panel.

Sample selection	Companies included	Firm-years
Target population – all mining companies (based on basic materials and energy sectors) listed on the JSE	41	410
Companies not listed on the JSE for the full period under review	5	50
Firm-years removed due to missing values.	–	36
Total sample – units for analysis	36	324

Table 2. Sample selection units for analysis

Source: Authors' summary

This study focuses on sustainability disclosure quality, assessed using a GRI-based sustainability disclosure quality index[79][3]. Standardised data collection procedures, ensuring neutrality and transparency, utilised financial research databases (IRESS Research Domain, IRESS Expert) and company websites, with integrated reports being the primary source.

Based on 24 GRI Mining and Metals Sector Supplement guidance questions, the sustainability disclosure quality index employed content analysis, assigning one (met) or zero (not met) to each question, scoring each company's yearly ratings, and determining disclosure quality. A score of 19 or higher indicated favourable sustainability disclosure quality, while a score of nine or lower was unfavourable. Although the measurement tool applied in this study is based on the GRI[79] G3 Mining and Metals Sector Supplement, the sector-specific disclosures for mining and metals did not substantively change during the study period (2012–2021). When the GRI G4 Guidelines were issued in 2013, the supplement was only reformatted to align with the new structure; no new content was introduced. Similarly, when the GRI Standards replaced G4 in 2016 (becoming mandatory in 2018), the mining and metals sector guidance was not updated, but it continued to be used in its earlier form. The first comprehensive revision of mining-specific disclosures only occurred with the release of GRI 14: Mining Sector Standard in 2024, which falls outside the scope of this study. Therefore, while the broader GRI framework evolved over the period under review, the sector supplement relevant to mining companies remained static, making the use of the G3-based disclosure index consistent and appropriate for the timeframe analysed.

The study employed a 0/1 ("not met"/"met") coding approach to assess sustainability disclosure quality. To enable comparability, the cut-offs used to distinguish between "favourable" and "unfavourable" disclosure quality were applied consistently across all reports. While these thresholds are somewhat arbitrary, they follow approaches commonly applied in prior content analysis research (e.g., [33][71]). The emphasis was on identifying consistent patterns across companies and years, rather than making claims about the absolute superiority of one disclosure level over another. While it does not differentiate between basic and highly detailed disclosures, it is appropriate for this study's focus on compliance with sector-relevant reporting items rather than the subjective evaluation of narrative depth. The aim was to capture whether companies addressed key GRI mining and metals indicators consistently over time, thereby reducing potential coder interpretation bias that could arise from more graded scoring systems.

To enhance reliability, two coders conducted the coding independently, with the second coder reviewing all 324 company reports. To strengthen reliability, all reports were coded by one researcher and independently reviewed by a second coder. Any discrepancies were discussed and reconciled jointly to ensure consistency in scoring. Although a formal inter-coder reliability statistic was not reported, the double-coding procedure enhances confidence in the transparency and replicability of the index. Future work could extend this by calculating and reporting measures such as Cohen's kappa.

If referenced, the assessment considered integrated reports, supplemented by separate sustainability reports or supplements. The sustainability disclosure quality index evaluated reporting practices over ten years.

The four independent variables—company liquidity, leverage, profitability, and size—were operationalised as follows: liquidity (current assets / current liabilities), leverage (total debt / total equity), profitability (net income / total assets), and size (market capitalisation). Company size was transformed using the natural logarithm prior to regression analysis to improve comparability. For descriptive statistics, however, raw size values are reported to aid interpretability. This distinction explains why the magnitude of size differs between the descriptive, correlation, and regression tables. In addition, differences in statistical significance between the correlation matrix and regression results are expected, as correlations capture bivariate associations. In contrast, the regression models estimate relationships conditional on multiple predictors simultaneously.

A fixed-effects panel regression model was employed because the dataset had repeated observations of the same companies over ten years. This approach is widely used when the objective is to control for unobservable, time-invariant firm characteristics that could otherwise bias the results. Technically, the fixed-effects estimator is a within-group least squares method, meaning it is based on OLS but adapted specifically for panel data by removing firm-specific effects[80]. Thus, the study did not rely on pooled OLS, which would ignore firm-level heterogeneity, but on a panel-specific estimator designed for longitudinal data.

The analysis focuses on firm-level financial indicators and does not incorporate broader contextual factors that may influence sustainability disclosure quality, such as commodity price fluctuations, governance structures, assurance practices, or integrated-reporting intensity. Time fixed effects were also not included. While the fixed-effects specification mitigates unobserved heterogeneity at the firm level, these omitted influences could still confound the observed associations. Importantly, the relatively small sample size (36 firms over nine years, producing 324 firm–year observations) constrained the number of explanatory variables that could reasonably be included. Following the conventional guideline of at least 10 observations per variable[81], including multiple additional controls or dummies would have exceeded the data's explanatory capacity and increased the risk of overfitting. Therefore, the model specification prioritised the four financial indicators central to the research question, recognising that future research using larger datasets could accommodate a more extensive set of controls.

The choice of fixed effects over random effects was confirmed using the Hausman test, which indicated that the fixed-effects specification was more appropriate for this study. The relatively high overall R^2 values are consistent with the inclusion of firm-specific intercepts; therefore, the within-R^2, which reflects variation explained by the independent variables after accounting for firm effects, provides a more meaningful measure of explanatory power in this context. Year fixed effects were not included in the specification, but their use in future research may help to absorb macroeconomic and commodity-cycle shocks that affect all firms simultaneously.

The empirical design captures associations between financial indicators and disclosure quality but does not fully address potential endogeneity. Profitability and disclosure quality may be jointly determined, as more profitable firms have greater resources to invest in reporting. In contrast, higher-quality disclosure may influence access to capital and stakeholder perceptions. However, the fixed-effects specification mitigates some unobserved heterogeneity; issues such as reverse causality and omitted variables (e.g., assurance, integrated reporting intensity, governance structures, commodity price shocks, listing board, or firm age) cannot be fully ruled out. The results should therefore be interpreted as indicative of association rather than causal effects.

To ensure the robustness of the estimates, several diagnostic procedures were undertaken. Heteroskedasticity was tested using modified Wald tests, and heteroskedasticity-robust standard errors were applied to correct potential bias in the panel data. Evidence of first-order serial correlation in the residuals was addressed by including an AR(1) correction term, which improved estimation efficiency. Tests for cross-sectional dependence were also performed, reflecting the possibility of sector-wide shocks. The results suggested that cross-sectional dependence was present but was managed through the use of panel-robust standard errors. Although alternative approaches, such as firm-clustered or Driscoll–Kraay standard errors, were not applied due to data limitations, their use could further strengthen inference in future research.

Taken together, these steps strengthen the reliability of the model. While more advanced estimation methods, such as generalised least squares (GLS), generalised method of moments (GMM), or Driscoll–Kraay standard errors, could further address dynamic relationships and potential endogeneity, these were not implemented due to

data limitations. This study, therefore, emphasises the associations revealed by the fixed-effects specification, while recognising that future research could extend the analysis with more advanced panel estimation techniques. The fixed-effects framework, supplemented by these diagnostic checks and corrections, provides a suitable and reliable approach for analysing the relationship between financial indicators and sustainability disclosure quality in South African mining companies[82].

6. Results

Table 3 provides an overview of the sustainability information disclosure quality landscape per category, per the index data sourced.

Category	Questions or tests (guiding statements)	Ref #	Total score possible	Average score (10-year period)	% of total score achieved
"Balance"	"The report discloses both favourable and unfavourable results and topics."	SR1	3.00	2.58	85.97%
	"The information in the report is presented in a format that allows users to see positive and negative trends in performance on a year-to-year basis."	SR2			
	"The emphasis on the various topics in the report is proportionate to their relative materiality."	SR3			
"Comparability"	"The report and its information can be compared year-to-year."	SR4	5.00	2.86	57.17%
	"The organisation's performance can be compared with appropriate benchmarks."	SR5			
	"Any significant variation between reporting periods in the boundary, scope, length of reporting period or information covered in the report can be identified and explained."	SR6			
	"Where they are available, the report utilises generally accepted protocols for compiling, measuring and presenting information, including the GRI Technical Protocols for Indicators contained in the Guidelines."	SR7			
	"The report uses GRI Sector Supplements, where available."	SR8			
"Accuracy"	"The report indicates the data that has been measured."	SR9	5.00	3.16	63.27%
	"The data measurement techniques and bases for calculations are adequately described and can be replicated with similar results."	SR10			
	"The margin of error for quantitative data is insufficient to substantially influence the ability of stakeholders to reach appropriate and informed conclusions on performance."	SR11			
	"The report indicates which data have been estimated and the underlying assumptions and techniques used to produce the	SR12			

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Category	Questions or tests (guiding statements)	Ref #	Total score possible	Average score (10-year period)	% of total score achieved
	estimates, or where that information can be found."				
	"The qualitative statements in the report are valid based on other reported information and other available evidence."	SR13			
"Timeliness"	"Information in the report has been disclosed recently relative to the reporting period."	SR14	3.00	2.86	95.47%
	"The collection and publication of key performance information are aligned with the sustainability reporting schedule."	SR15			
	"The information in the report (including web-based reports) indicates the period to which it relates, when it will be updated, and when the last updates were made."	SR16			
"Clarity"	"The report contains the level of information required by stakeholders but avoids excessive and unnecessary detail."	SR17	4.00	3.69	92.34%
	"Stakeholders can find the specific information they want without unreasonable effort through tables of contents, maps, links or other aids."	SR18			
	"The report avoids technical terms, acronyms, jargon or other content likely to be unfamiliar to stakeholders and should include explanations (where necessary) in the relevant section or a glossary."	SR19			
	"The data and information in the report are available to stakeholders, including those with particular accessibility needs (e.g., differing abilities, language or technology)."	SR20			
"Reliability"	"The scope and extent of external assurance are identified."	SR21	4.00	2.88	71.92%
	"The organisation can identify the source of the information in the report."	SR22			
	"The organisation can identify reliable evidence to support assumptions or complex calculations."	SR23			

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Category	Questions or tests (guiding statements)	Ref #	Total score possible	Average score (10-year period)	% of total score achieved
	"Representation is available from the original data or information owners, attesting to its accuracy within acceptable margins of error."	SR24			
	Overall Sustainability Reporting Quality Score		**24.00**	**18.04**	**75.15%**

Table 3. Sustainability Information Disclosure (SID) Index and an overview of the SID landscape

Source: Authors' summary and representation of the Sustainability Reporting Guidelines & Mining and Metals Sector Supplement 2000-2010 GRI Final Version 3.0. MMSS Final Version[79].

Observations on the sustainability information disclosure quality index data revealed that out of the six categories, Timeliness (95.47%), Clarity (92.34%), and Balance (85.97%) achieved the highest average scores over the 10 years. In contrast, Comparability (57.17%) achieved the lowest average score. This was mainly due to the lack of utilisation of generally accepted protocols (GRI Technical Protocols) and the lack of a clear indication of employing GRI Sector Supplements. This supports and emphasises the absence of sole mandated sustainability reporting regulations employed by stakeholders, as highlighted by Dilling[33]. Figure 1 presents an overview of the sustainability information disclosure landscape, per the six categories, over 10 years.

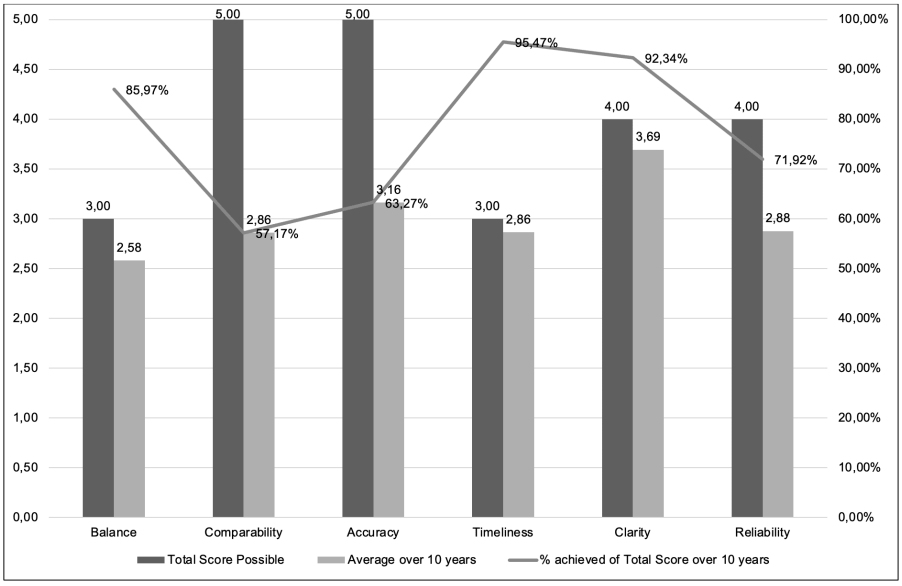

Figure 1. Overview of the sustainability information disclosure landscape per category over the 10 years. *Source: Authors' analysis*

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Observations on the sustainability information disclosure quality year-on-year data revealed that the total index scores improved from 2012 to 2021, indicating that companies acknowledge the importance of clear communication of sustainability information to their stakeholders. Therefore, companies respond to stakeholder requirements more transparently, as Ho and Taylor[74] indicated. The observations align with stakeholder theory, as defined by Freeman[14], where organisational stakeholders are any group that has a relationship with the organisation and can influence its value creation objectives or have an effect on or be affected by its enterprise activities. Figure 2 presents an overview of the normalised sustainability information disclosure landscape data over the period. Scores were normalised to a score of 10 for consistency between the measures.

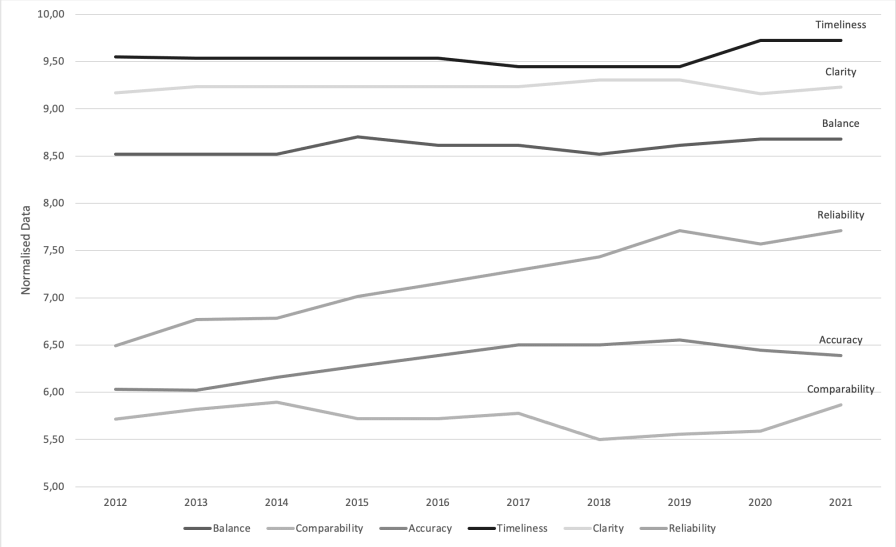

Figure 2. Overview of the normalised sustainability information disclosure data on average per category per year. *Source: Authors' analysis*

Over the review period, Reliability saw the most significant improvement in average total scores, aligning with legitimacy theory, as companies enhanced the quality and transparency of sustainability information disclosure[78]. Timeliness, Clarity, and Balance were consistently followed, while Accuracy and Comparability scored below average. Although Accuracy showed improvement, Comparability displayed minimal movement, emphasising the need for mandated and clear guidance on minimum sustainability information disclosure standards to enhance overall quality.

Descriptive statistics provide valuable insights regarding the variables, as shown in Table 4.

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	Range	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
LQ	209.660	0.120	209.780	6.812	23.821	6.06	39.642
LV	30.430	-3.730	26.700	0.899	2.337	7.908	73.698
PB	1,329.730	-1,257.060	72.670	-6.232	89.077	-10.489	134.289
Size (million)	1,183,670.135	0.000	1,183,670.135	54,867.557	142,359.240	4.332	21.859
SR quality	24.000	0.000	24.000	15.654	7.822	-1.084	-0.387

Table 4. Descriptive statistics

Source: Authors' analysis

The descriptive statistics reveal substantial variation across the financial indicators, which is consistent with the unique characteristics of the mining sector. Liquidity displays the widest spread (minimum 0.120; maximum 209.780; mean 6.812), reflecting the high upfront capital requirements of mining projects that affect current assets and liabilities. This wide range is not unexpected: some companies hold large current asset balances during investment phases, while others operate with lower working capital due to financing constraints. Such variation is well documented in the mining literature[83].

In contrast, leverage shows a narrower range (mean 0.899), which likely reflects similar risk appetites across firms, with a relatively conservative use of debt compared to equity. This pattern aligns with evidence that mining firms tend to limit debt exposure due to the substantial start-up investments and cyclical risks associated with the industry[84][85].

Profitability exhibits wide dispersion, ranging from highly negative to positive values (mean −6.232, standard deviation 89.077). This variability reflects the inherent volatility of the sector, where earnings are strongly influenced by fluctuating commodity prices, operational costs, and management practices[86]. The capital-intensive nature of the industry further constrains profitability, with operational challenges such as declining ore grades and rising extraction costs contributing to the spread[87].

Company size also varies substantially (mean ZAR 54.9 billion; maximum ZAR 1.18 trillion), reflecting the coexistence of small, mid-tier, and large multinational mining firms on the Johannesburg Stock Exchange. The largest firms are clear outliers in terms of market capitalisation, consistent with their global dominance and scale advantages.

Finally, sustainability reporting quality ranges from 0 to 24 (mean 15.654), indicating significant differences in disclosure practices. While most firms demonstrate relatively high-quality reporting, others provide minimal or no disclosures, reflecting differing levels of commitment to sustainability practices[33].

Additional distributional measures (standard deviation, skewness, and kurtosis) indicated that several variables were highly skewed and displayed heavy-tailed distributions, necessitating data treatment prior to regression analysis. Missing values were addressed through mean imputation, a commonly applied method that preserves

sample size by replacing missing observations with the variable mean[88][89]. While this approach ensured continuity in the panel, it may introduce bias when applied to skewed financial ratios, and this limitation is acknowledged. Companies with insufficient financial data across the full study period were excluded, resulting in a final panel of 36 firms.

To mitigate the effect of outliers, winsorisation was applied at the 5th and 95th percentiles, whereby observations falling outside this range were replaced with the corresponding percentile values[90][91] (Ghosh & Vogt, 2012). This approach, often referred to as "90% winsorisation," reduces the disproportionate influence of extreme observations while preserving the overall distribution of the data. This adjustment is particularly relevant in the mining sector, where financial indicators are prone to large fluctuations due to volatility in commodity prices.

Company size was log-transformed for the regression analysis to reduce skewness and enhance comparability across firms. For descriptive purposes, however, untransformed values are reported in the summary statistics to facilitate interpretation. These data treatments ensured that the regression models more accurately reflected central tendencies while limiting distortions from extreme observations, though future research may benefit from employing alternative imputation methods (e.g., multiple imputation) and robustness checks without imputed values. Reviewing correlation results between sustainability reporting quality and financial indicators (liquidity, leverage, profitability, and size) provides insights into the strength and direction of the relationships[92].

The correlation between the dependent and independent variables is presented in Table 5.

	LQ	LV	PB	Size	SR quality
LQ	**1.000**				
LV	(0.090)	**1.000**			
PB	0.007	0.012	**1.000**		
Size	-0.235*	(0.001)	0.268*	**1.000**	
SR quality	-0.429*	0.072	0.335*	0.616*	**1.000**

Table 5. Pearson correlation between the dependent and independent variables

*Note: * Correlation is significant at the 0.01 level (2-tailed). LQ is liquidity, LV is leverage, PB is profitability, Size is based on market capitalisation, and SR quality refers to sustainability reporting quality*
Source: Authors' analysis

Regarding sustainability reporting quality, a moderate negative correlation for liquidity and a low positive correlation for leverage were observed. In contrast, a moderate positive correlation for profitability and a strong positive correlation for size were observed concerning sustainability reporting quality. By examining the two-tailed significance values (p-value) associated with the correlation results, liquidity, profitability, and size were considered statistically significant (0.01), indicating that the correlation coefficient was unlikely to have occurred by chance.

A panel regression analysis model was used as the inferential statistical analysis to test the hypothesis-based relationship between selected company financial indicators and the level of suitability information disclosure. A panel regression analysis of the data was performed using the statistical package EViews for Windows, employing the ordinary least squares (OLS) method.

The regression model can be expressed as indicated by Equation 1:

$$SR = \alpha + \beta_1 LQ + \beta_2 LV + \beta_3 PB + \beta_4 Size + \varepsilon \qquad \text{(Equation 1)}$$

Where:

- SR = Sustainability reporting quality
- α = Constant or intercept
- β = Coefficient or slope indicates a positive or negative influence
- LQ = Liquidity
- LV = Leverage
- PB = Profitability
- Size = Company size
- Ɛ = Error term

The level of sustainability reporting quality could hypothetically be explained by the relationship with the selected company financial indicators as independent variables. The conclusions drawn from the hypothesis testing have been based on a significance level of 0.05. Table 6 summarises the outcomes obtained from the panel regression model.

Variable	Coefficient	Standard error	t-statistic	Probability
Constant (C)	16.642	1.639	10.154	0.000
LV	0.024	0.009	2.726	0.007
LQ	-0.000	0.002	-0.150	0.881
PB	0.000	0.000	4.943	0.000
Size	0.070	0.070	0.989	0.323

Table 6. Summary of the panel regression results

R^2 = 0.961; Adjusted R^2 = 0.955; N = 324; p < 0.001; F-statistic = 171.887
Note: LQ is liquidity, LV is leverage, PB is profitability, and Size is based on market capitalisation.
An AR(1) correction was applied to adjust for first-order autocorrelation in the residuals. The correction is a diagnostic adjustment and is therefore not reported as a separate regressor in the table.
Company size is reported in raw values for descriptive purposes but was log-transformed for regression analysis. Differences between correlation and regression results are expected, as correlations are bivariate, whereas regressions estimate relationships conditional on multiple variables.
Source: Authors' analysis

The regression model produced a high explanatory power, with an overall R^2 of 0.961 and an adjusted R^2 of 0.955. These values reflect the variance explained once firm-specific intercepts are included, which is typical of fixed-effects models. In this

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context, the more informative measure is the within-R^2, which captures the variation in sustainability disclosure quality explained by the independent variables after controlling for firm-level heterogeneity. While such high explanatory values can raise concerns about potential overfitting or multicollinearity, variance inflation factor (VIF) checks did not indicate problematic levels of multicollinearity among the independent variables. The close correspondence between the overall R^2 and adjusted R^2 also suggests that the model is not unduly overfitted to the sample. Nevertheless, the possibility of endogeneity remains, particularly the potential "chicken-and-egg" problem in which more profitable firms may have greater resources to invest in higher-quality sustainability reporting.

The p-value results for the two independent variables, leverage ($p < 0.007$) and profitability ($p < 0.000$), were deemed significant, indicating a meaningful relationship with the dependent variable, sustainability disclosure quality. By considering the model's inaccuracy, fitting the model led to an improvement in variable prediction, which the F-statistic reflects.

In the South African mining context, sustainability disclosure quality is closely tied to financial indicators, particularly leverage and profitability. This aligns with Ariyani and Hartomo's[57] findings of a significant relationship between leverage and sustainability reporting. However, Indrianingsih and Agustina[63] discovered a negative relationship between leverage and sustainability reporting. Ameer and Othman[36] emphasised the significant link between profitability and the impact of sustainability reporting on financial performance. Nugroho and Arjowo[47] observed a positive relationship between profitability and environmental disclosure. Husna[46] found a positive correlation between sustainability reporting and profitability but no notable link with leverage. Naeem and Brata[65] indicated that leverage and profitability do not affect sustainability reporting. Inconsistencies in these findings underscore the need for globally accepted or mandated reporting standards across industries.

H1 was **rejected**, as no significant association was found between sustainability reporting quality and company liquidity. Although a positive relationship was anticipated, the results suggest that liquidity does not play a consistent role in shaping disclosure practices among South African mining firms. This finding warrants reflection on the specific context of the industry. Mining is a capital-intensive sector characterised by large upfront investments, long project horizons, and exposure to commodity price volatility. These conditions often result in relatively low or unstable liquidity ratios, even for otherwise profitable firms. Consequently, short-term liquidity may not be the primary signal through which mining companies seek to demonstrate accountability to stakeholders. From a stakeholder and legitimacy perspective, disclosure practices in South Africa's mining sector may be more strongly driven by profitability and leverage, which directly influence investor confidence and creditor relations, rather than liquidity levels. In this setting, transparent sustainability disclosure may not be perceived as an effective tool for mitigating liquidity concerns, particularly since creditors and investors tend to focus on long-term solvency and project viability rather than current ratios. This may explain why liquidity did not emerge as a significant determinant of disclosure quality. The result also has economic implications. It suggests that, for South African mining companies, efforts to enhance sustainability reporting are unlikely to generate short-term liquidity benefits in equity or debt markets. Instead, disclosure appears to function more as a mechanism for reinforcing legitimacy and managing long-term financing relationships than for addressing immediate liquidity constraints. This diverges from findings in other contexts[46][64][65], where disclosure and liquidity are positively related, underscoring the importance of industry-specific conditions.

H2 was **accepted**, as a significant positive relationship between sustainability disclosure quality and company leverage was found. This indicates that South African

mining companies with higher debt levels tend to provide more detailed and higher-quality sustainability disclosures. From a legitimacy theory perspective, firms with greater leverage are under pressure to reassure creditors and investors of their long-term stability. High-quality disclosure can serve as a mechanism to reduce perceptions of financial risk and strengthen legitimacy among external stakeholders[93]. This finding is consistent with studies such as Ariyani and Hartomo[57] and Branco et al.[45], which also report a positive link between leverage and disclosure. However, it contrasts with evidence from Indonesia[59][63] and Turkey[54], where negative associations have been observed. The South African mining context may help explain this divergence. Mining is highly capital-intensive and reliant on debt financing for long-term projects. Firms may therefore use sustainability disclosure strategically to reinforce trust with lenders, signal accountability, and secure favourable financing terms. The economic implications are clear: by producing higher-quality sustainability disclosures, highly leveraged mining companies may reduce borrowing costs, gain access to debt on more favourable terms, and maintain investor confidence during periods of commodity price volatility. In this way, disclosure quality becomes not only a tool for legitimacy but also an economic resource in debt markets.

H3 was **accepted**, as a significant positive relationship between sustainability disclosure quality and company profitability was found. This result is consistent with stakeholder theory, which predicts that profitable firms face stronger expectations to demonstrate responsible practices while also having greater resources to invest in reporting[21][22]. By responding to these expectations, firms may reinforce their legitimacy and strengthen relationships with investors, employees, and communities. The result aligns with prior findings by Ameer and Othman[36], Branco et al.[45], Dilling[33], Husna[46], Kasbun et al.[49], Nugroho and Arjowo[47], and Wu and Li[67], though it contrasts with Buallay[62] and Ho and Taylor[74], who found negative associations. The South African context offers an explanation: in a resource-intensive industry marked by high social and environmental externalities, profitable mining companies may use sustainability reporting to demonstrate that financial success is achieved responsibly. High-quality disclosure can strengthen investor sentiment, support reputational capital, and enhance community acceptance—outcomes that are particularly valuable in South Africa, where mining operations often intersect with contested land use, labour issues, and community relations. The economic implication is that sustainability disclosure may support profitability indirectly by improving stakeholder trust and reducing reputational risks that could otherwise harm earnings. In South Africa, where mining profitability is heavily influenced by community stability and investor perceptions, transparent disclosure may function as a protective mechanism, safeguarding both financial performance and legitimacy.

H4 was **rejected**, as no significant association was found between sustainability disclosure quality and company size. Although stakeholder and legitimacy theory suggest that larger firms—by virtue of their broader activities, greater environmental footprint, and larger stakeholder base—would disclose more extensively[77], the South African mining context offers important insights into why this relationship may not hold. First, the mining sector in South Africa is dominated by a mix of very large multinational corporations and smaller local firms. Larger firms are already under constant scrutiny from investors, regulators, and global stakeholders, and thus have established disclosure processes, but this may not necessarily translate into higher variation in reporting quality compared to smaller peers. Smaller firms, meanwhile, may feel equally compelled to demonstrate legitimacy because of the high social and environmental sensitivities surrounding mining. In this way, size may not be the differentiating factor for disclosure quality that theory would predict. Second, the de facto requirement for integrated reporting on the Johannesburg Stock Exchange means that both large and small firms face similar institutional pressures to produce

sustainability disclosures. This regulatory environment may reduce the extent to which size drives disclosure behaviour, effectively levelling the playing field across firms. The economic implication of this finding is that larger market capitalisation does not guarantee superior disclosure quality in the South African mining industry. For investors and regulators, this suggests that sustainability disclosure quality cannot be assumed to scale with firm size. Instead, other factors—such as profitability, leverage, or governance practices—appear to be more meaningful drivers of disclosure. This finding aligns with Ariyani and Hartomo[57] and Indrianingsih and Agustina[63], who also found no significant relationship between firm size and disclosure quality, but contrasts with much of the international literature[43][44][65][61][56][45][41][54][40][74]. The divergence reinforces the importance of considering industry- and country-specific institutional factors when interpreting the size–disclosure relationship.

Data analysis reveals valuable insights into the relationship between sustainability disclosure quality and a company's financial indicators. Notably, leverage and profitability show the most statistically significant and robust connections with sustainability reporting quality. Mining companies that disclose high-quality sustainability information exhibit favourable profitability and leverage indicators. Therefore, improving sustainability reporting quality, detail, and transparency is encouraged for financial benefits[69]. This aligns with the notion that comprehensive and quality sustainability disclosure fosters accountability, trustworthiness, and social responsibility over the long term[94]. Garg[48] supports the idea of a positive relationship between sustainability reporting and long-term financial performance compared to the short-term.

7. Conclusions and Recommendations

Prior research has left gaps in understanding the association between selected financial indicators and sustainability reporting quality among South African mining companies. This study contributes to filling that gap by examining these associations through a quantitative approach, assessing disclosure quality using content analysis of integrated reports. Based on GRI guidelines, the evaluation index provides a structured and comparable measure across firms and years.

The results reveal variation in sustainability reporting quality across companies, reflecting differing commitments to sustainable practices and stakeholder transparency in the South African mining industry. On average, most firms reported relatively high-quality disclosures, suggesting an effort to communicate sustainability information in a comprehensive and transparent manner. Importantly, the findings indicate that sustainability reporting quality is positively associated with leverage and profitability, while no consistent associations were found with liquidity and size.

Theoretically, these results extend stakeholder theory in the South African context by demonstrating that higher-quality disclosure appears most relevant to financial indicators closely tied to resource availability (profitability) and external financing relationships (leverage). This supports the view that companies use disclosure to meet stakeholder expectations for accountability and to strengthen legitimacy among creditors and investors. At the same time, the absence of consistent associations with liquidity and size suggests that not all financial characteristics translate into disclosure incentives, contributing to a more nuanced understanding of how sustainability reporting interacts with firm-level dynamics in emerging markets.

From a practical perspective, the findings have implications for both regulators and companies. For JSE regulators and policymakers, the results highlight the need to continue strengthening integrated reporting standards and monitoring practices, particularly around the depth and assurance of sustainability disclosures. Regulators could consider encouraging or mandating assurance of sustainability reports to enhance credibility and comparability. For mining companies, the results underscore

the importance of aligning sustainability disclosure with financial strategy: firms with higher leverage may benefit from more transparent reporting to reassure creditors, while profitable firms can use high-quality disclosure to demonstrate responsible stewardship and reinforce investor trust. In both cases, disclosure quality should be viewed not as a compliance burden but as a strategic tool for building legitimacy and stakeholder confidence.

Nevertheless, the findings should be interpreted with caution given the study's limitations. The analysis is based on a relatively small sample of 36 mining companies listed on the Johannesburg Stock Exchange, which restricts generalisability. The focus on a single sector further narrows applicability, as mining has distinct capital structures, risk exposures, and stakeholder pressures compared to other industries. The measurement of disclosure quality relied on a binary 0/1 scoring system. While transparent and replicable, this measure does not capture the depth, tone, or assurance of sustainability information. The use of mean imputation, while preserving sample size, is a notable limitation as it can suppress the true variance in our highly skewed financial data, potentially affecting the precision of our estimates. Furthermore, while our fixed-effects model controls for time-invariant firm characteristics, the potential for endogeneity remains. It is plausible that a reverse causal relationship exists, where more profitable firms can afford to invest in higher-quality disclosure. Omitted variables, such as board-level governance quality or exposure to volatile commodity price cycles—a key external driver of performance in the mining sector—could also confound the observed associations. Therefore, our findings should be interpreted as evidence of a robust association rather than a causal link.

The study also did not explicitly control for broader contextual factors that may shape disclosure practices in South Africa's mining sector. These include commodity-price cycles, governance structures, the adoption and intensity of integrated reporting following the JSE's requirements, and the use of external assurance for sustainability reports. Nor were time fixed effects included to capture macroeconomic or industry-wide shocks. While firm fixed effects mitigate some unobserved heterogeneity, these omissions may confound the observed associations. Future research should incorporate time dummies, commodity-price proxies, governance indicators, and disclosure-related controls to better isolate the determinants of sustainability reporting quality.

Future studies could strengthen this work by expanding beyond mining to include diverse sectors, allowing for cross-industry comparisons. The use of additional performance indicators, including long-term measures (e.g., return on equity, economic value added) and market-based measures (e.g., Tobin's Q, market-to-book ratios), may provide further insight into financial implications. Methodological refinements such as graded or weighted scoring systems, automated textual analysis, or assurance-adjusted indices could also capture disclosure depth and quality more effectively. Moreover, econometric refinements—including instrumental variables, dynamic panel models, or two-stage estimation techniques—would help address endogeneity and clarify the direction of causality.

Finally, as reporting frameworks evolve, these findings provide a baseline for assessing the implications of new standards, including IFRS S1 and S2 and the GRI 14: Mining Sector Standard (2024). Future research could explore how such developments reshape disclosure practices across industries and in different economic contexts, particularly in emerging markets. Cross-country comparisons and studies incorporating stakeholder responses, capital market reactions, and financing terms would further enrich understanding of the interplay between sustainability reporting and financial performance.

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Statements and Declarations

Funding

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Potential Competing Interests

No potential competing interests to declare.

Data Availability

The data analysed in this study were derived from publicly available sources and proprietary databases. Financial data were obtained from the IRESS Research Domain and IRESS Expert databases, while sustainability and integrated reports were accessed from the respective company websites. The derived datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Reporting Guidelines

This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines where applicable.

Author Contributions

A.P.: Conceptualisation, Methodology, Data Curation, Formal analysis, Writing – Original Draft. E.d.T.: Conceptualisation, Supervision, Writing – Review & Editing. Both authors have read and agreed to the final version of the manuscript.

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