Research Article

Greening the Bottom Line: Exploring the Impact of Sustainability Disclosure on Financial Performance

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Purpose: This study analyses the relationship between sustainability disclosure quality and financial indicators among mining companies listed on the Johannesburg Stock Exchange (JSE) in South Africa.

Design/Methodology/Approach: Disclosure quality was assessed using an index based on the Global Reporting Initiative (GRI) Mining and Metals Sector Supplement. The analysis focused on four financial indicators: liquidity, leverage, profitability, and company size.

Findings: Results show significant positive relationships between disclosure quality and both leverage and profitability, while no significant link was found with liquidity or company size. This highlights the role of transparent, high-quality disclosures in influencing certain financial aspects of mining companies.

Originality/Value: By applying a sector-specific disclosure index over a decade of reports, this study contributes to the literature on the financial relevance of sustainability reporting in an emerging-market context.

Practical and Social Implications: The findings suggest that early adoption of sustainability reporting regulations can strengthen transparency, improve financing outcomes, and foster accountability in the South African mining industry.

Research Implications: Future studies should expand to other sectors, include broader financial measures, and assess the effects of evolving sustainability standards.

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1. Introduction

The disclosure of sustainability information has evolved considerably over the past two decades, reflecting both global pressures for transparency and the introduction of new reporting frameworks. Developments such as the forthcoming IFRS S1 and S2 standards, effective from 2024, signal a move towards greater comparability and accountability in non-financial reporting[1]. At the same time, voluntary frameworks such as the Global Reporting Initiative (GRI) remain central in shaping disclosure practices and enhancing the quality of sustainability information[2][3].

The rationale for sustainability reporting lies in its ability to help companies acknowledge and communicate their impact on finite global resources, encompassing environmental, social, and governance dimensions. Beyond financial outcomes, transparent disclosure demonstrates responsible corporate citizenship, strengthens legitimacy, 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 wider societal and environmental responsibilities[6][7].

Despite these advances, the quality and consistency of sustainability reporting remain uneven. While evidence shows that high-quality sustainability disclosures can positively influence financial performance[8][9], studies also highlight contradictory results and question whether sustainability information reliably predicts financial outcomes[10]. This uncertainty indicates the need for sector-specific analysis, as industry characteristics may shape disclosure practices and their financial implications.

South Africa offers a particularly relevant context for such an investigation. As an emerging economy with a resource-intensive mining sector, the country faces the dual challenge of maximising economic gains while mitigating significant environmental and social impacts. Stakeholder engagement and transparent disclosure are especially important in this setting, where mining companies are under pressure to justify their operations and demonstrate alignment with broader societal values[11][12].

Against this backdrop, this study investigates the relationship between financial indicators and the quality of sustainability disclosures among South African mining companies. Its contribution lies in applying a comprehensive evaluation index based on the GRI Mining and Metals guidelines across a decade of reporting. By doing so, the study not only clarifies how sustainability reporting interacts with

financial performance but also provides a timely baseline for assessing the potential impact of the forthcoming IFRS sustainability standards. In this way, it adds to the global debate on whether sustainability disclosure serves merely as a compliance exercise or as a driver of long-term value creation[13].

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] underscores organisations' responsibilities to a wide range of stakeholders beyond shareholders, recognising that their actions directly influence value creation. In the context of sustainability reporting, stakeholders increasingly demand transparent disclosure of environmental, social, and governance impacts, which affects corporate legitimacy and access to resources[15][16]. This study aligns with stakeholder theory by examining how disclosure quality responds to these expectations, acknowledging the influence of regulators, investors, suppliers, customers, employees, and local communities[17][18].

Legitimacy theory, which complements stakeholder perspectives, argues that companies seek to align their activities with societal norms and expectations to maintain or regain legitimacy[19][20]. Transparency in sustainability reporting is a means of demonstrating accountability, enhancing reputation, and strengthening competitiveness[21][22]. In this study, legitimacy theory provides a basis for evaluating whether high-quality disclosure is used as a strategic tool to bolster reputation, mitigate legitimacy gaps, and contribute to the triple bottom line.

Impression management theory further extends this view by suggesting that companies actively shape stakeholder perceptions through the way they present information[23]. In sustainability reporting, impression management may involve selective disclosure or emphasis on positive achievements to enhance external perceptions and deflect criticism[24][25]. This study, therefore, considers impression management theory to explore whether companies use higher-quality disclosure as a strategic communication tool to influence stakeholder trust, reputation, and legitimacy.

These theories provide insight into how sustainability disclosure quality can influence stakeholder relationships, reputation, and financial performance.

3. Sustainability Reporting and Its Relationship to Financial Performance

Sustainability disclosures offer transparency on an organisation's economic, social, and environmental impacts[26]. The absence of universal standards results in lower reporting levels[27]. IFRS S1 and S2, introduced by the ISSB in June 2023, mark a move towards global sustainability disclosure requirements effective from January 1, 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[28][29]. Ameer and Othman[30] 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[31]. Additionally, emerging markets like South Africa may provide unique insights into the relationship between financial performance and sustainability disclosure[32]. Table 1 provides a summary of studies that have been conducted in this area.

Citation	Year	Country	Findings	Sector / Context
Ho & Taylor[33]	2007	USA & Japan	A significant positive relationship was identified between profitability and corporate social responsibility.	Cross-sector (multinational)
Jones et al.[34]	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 the company size, profitability, liquidity and sustainability reporting.	Banking
Liu & Anbumozhi[35]	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[36]	2009	Spain	A positive relationship was identified between leverage, profitability, company size and sustainability reporting.	Cross-sector
Aras et al.[37]	2010	Turkey	A positive relationship was identified between financial performance (return on equity) and sustainability reporting.	Cross-sector
Artiach et al.[38]	2010	Australia	A negative relationship was identified between firm performance (return on assets) and sustainability reporting.	Cross-sector
Dilling[27]	2010	Canada	A positive relationship was identified between company performance and sustainability reporting.	Cross-sector

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Citation	Year	Country	Findings	Sector / Context
Ameer & Othman[30]	2012	Malaysia	No relationship was identified between accounting and market-based performance variables and the reporting quality of sustainability reports.	Cross-sector
Lourenço & Branco[39]	2013	Brazil	A positive relationship was identified between profitability and sustainability reporting.	Cross-sector
Branco et al.[40]	2014	Portugal	A positive relationship was identified between financial performance and sustainability reporting.	Cross-sector
Husna[41]	2014	Indonesia	A negative relationship was identified between financial performance and sustainability reporting over the short term. A positive relationship was identified between financial performance and sustainability reporting over the long term.	Manufacturing firms
Nugroho & Arjowo[42]	2014	Indonesia	The relationship between financial performance and sustainability reporting was inconsistent.	Manufacturing
Garg[43]	2015	India	A negative relationship was identified between the company's size, financial performance (leverage) and sustainability reporting.	Cross-sector
Kasbun et al.[44]	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.[45]	2016	United Kingdom	A positive relationship was identified between financial performance (profitability and liquidity) and sustainability reporting. No relationship was identified between the book value, leverage and sustainability reporting.	Cross-sector

Citation	Year	Country	Findings	Sector / Context
Caesaria & Basuki[46]	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.[47]	2017	Brazil	A negative relationship was identified between financial performance and sustainability reporting.	Cross-sector
Goel & Misra[48]	2017	India	A positive relationship was identified between financial performance (return on assets and return on equity) and sustainability reporting.	Cross-sector
Kuzey & Uyar[49]	2017	Turkey	A significant relationship was identified between company size and sustainability reporting. A negative relationship was identified between liquidity, leverage and sustainability reporting. No relationship was identified between profitability and sustainability reporting.	Cross-sector
Lassala et al.[50]	2017	Spain	A positive relationship was identified between financial performance (return on equity) and sustainability reporting.	Financial institutions
Syed & Butt[51]	2017	Pakistan	A significant relationship was identified between company size and sustainability reporting.	Cross-sector
Ariyani & Hartomo[52]	2018	Indonesia	A positive relationship was identified between company size and sustainability reporting.	Manufacturing firms
Buallay[53]	2018	United Kingdom	A significantly positive relationship was identified between liquidity, company size and sustainability reporting.	Banking sector

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Citation	Year	Country	Findings	Sector / Context
			No significant relationship was identified between leverage, profitability and sustainability reporting.	
Hardika et al.[54]	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[55]	2018	Australia (Indonesia)	No relationship was identified between profitability and sustainability reporting.	Cross-sector (emerging markets)
Wardhani et al.[56]	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[57]	2020	United Kingdom	A positive relationship was identified between earnings per share, return on equity, company size, and environmental disclosure. No relationship was identified between return on assets and environmental disclosure.	Banking sector
Indrianingsih & Agustina[58]	2020	Indonesia	A significant positive relationship was identified between company size and sustainability reporting.	Manufacturing
Wang et al.[59]	2020	China	A positive relationship was identified between environmental information disclosure and financial performance (liquidity).	Manufacturing & heavy industry

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Citation	Year	Country	Findings	Sector / Context
Naeem & Brata[60]	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[61]	2023	Egypt	A positive relationship was identified between financial performance and sustainability reporting.	Cross-sector
Wu & Li[62]	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, which incorporates sustainability information, has been shown to strengthen the connection between environmental, social, and governance (ESG) disclosure and financial outcomes. For example, on the Johannesburg Stock Exchange (JSE), where integrated reporting is de facto mandatory, evidence suggests that comprehensive disclosure improves the accuracy of analysts' forecasts and enhances financial performance[63]. Similarly, Lee and Yeo[64] find that higher levels of integrated disclosure correlate positively with firm valuation.

However, the broader literature presents mixed and sometimes conflicting evidence. Several studies identify positive relationships between sustainability reporting and financial performance (e.g., [8][27][9][61][62]), while others report negative or insignificant associations[34][45][36][57]. Meta-analyses and broader reviews also highlight inconsistency, concluding that the value relevance of sustainability disclosure is only partially supported[65].

The sectoral focus of prior studies helps explain this divergence. As Table 1 shows, most studies have been conducted in cross-sector contexts (e.g., [37][48][49]) or in specific industries such as banking[53][57][8], manufacturing[52][41][58][9], and energy-intensive sectors[35]. Very few have focused explicitly on

mining and resource-intensive sectors, with Jones et al.[34] and Brown & Deegan[22] 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 GRI adherence tend to find stronger performance links[66]. Moreover, institutional settings matter: emerging markets with evolving governance structures and high stakeholder pressure (e.g., Indonesia, Turkey, South Africa) show different dynamics compared to developed economies[67]. 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[43].

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 can strengthen legitimacy, enhance stakeholder relationships, and contribute to long-term value creation[10][66].

4. Hypothesis Development

Liquidity measures a company's ability to settle its shorter-term debts. It can be assumed that a higher degree of liquidity garners stakeholder confidence in a company's ability to settle its shorter-term debts. Husna[41] indicates that sustainability reporting and liquidity are positively associated. This is also supported by Indrianingsih and Agustina[58], Wang et al.[59] and Naeem and Brata[60]. In contrast, Ho and Taylor[33] and Kuzey and Uyar[49] found that sustainability reporting and liquidity are not positively associated; further, Ariyani and Hartomo[52] and Nugroho and Arjowo[42] found no relation. Greater liquidity reflects a firm's financial strength[68]. Integrated reporting, including sustainability information, conveys this. Disclosure theory[69] emphasises timely and comprehensive information for effective capital markets. Employing such strategies reduces information asymmetry, lowering trader

risks[70]. Increased investor confidence enhances equity market liquidity[70]. Based on the findings of most of the research, the hypothesis related to this relationship can be stated as follows:

- H1: There is a relationship between company liquidity and the quality of sustainability information disclosure.

Leverage gauges a firm's ability to use debt for asset financing[71]. High leverage may deter investors due to increased interest costs[71]. Highly leveraged firms may disclose more to lower agency costs[33]. Wardhani et al.[56] note that high-leverage firms disclose to reassure creditors, aligning with impression management theory[72]. Kuzey and Uyar[49] found no positive link between sustainability reporting and leverage. Other studies report negative impacts[54][58], mixed findings[38], or no clear association[41][60][42][36][56]. Ariyani and Hartomo[52] and Branco et al.[40] found a positive relationship, suggesting that higher leverage leads to more sustainability disclosure. The hypothesis for this relationship can thus be stated as follows:

- H2: There is a relationship between company leverage and the quality of sustainability information disclosure.

Profitability reflects effective asset management and sustainable returns[73], instilling stakeholder confidence in a company's value-creation ability. Reverte[36] links sustainability reporting to economic resources. The link between sustainability reporting and profitability varies. Some authors suggest a positive association[30][40][27][41][44][42][62]. However, Ho and Taylor[33] and Buallay[57] find a negative link. Others report no relationship[37][45][58][60][36][56][49][52]. Legendre and Coderre[74] note a positive correlation with GRI framework adoption but not with disclosure transparency. The hypothesis for this relationship can be stated as follows:

- H3: There is a relationship between company profitability and the quality of sustainability information disclosure.

Company size matters, as larger firms engage in more business activities, have more stakeholders, and have a bigger environmental impact[75]. They also possess the resources to disclose environmental impact information[35][39]. Following legitimacy theory, Legendre and Coderre[74] argue that larger companies release higher-quality sustainability reports and embrace the GRI Standard to legitimise their operations. This view is supported by Branco et al.[40] and numerous other authors[51][55][37][60][33][56][38]

[36][49]. However, Hardika et al.[54] found a negative association between sustainability reporting and company size. Ariyani and Hartomo[52] and Indrianingsih and Agustina[58] found no relationship. The hypothesis for this relationship can be stated as follows:

- H4: There is a relationship between company size and the quality of the sustainability information disclosure.

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 its specific sustainability reporting requirements[76][11][12]. The sample covered data from 2012 to 2021, providing 10 years of data. The study period was deliberately defined as 2012–2021 in order 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. As such, 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 report standards. The study's results can serve as a baseline for future research and impact assessments post-ISSB standards. Table 2 summarises the final sample selection.

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[76][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[76] 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 using 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. This binary method has been widely applied in prior disclosure studies because it offers a transparent and replicable way to evaluate whether a specific reporting requirement has been addressed (e.g., [27][66]). 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. Any discrepancies were discussed and resolved jointly, ensuring consistency in scoring. Although not explicitly reported in the original version of the paper, this double-coding process

strengthens confidence in the validity and reliability of the measurement and addresses concerns of subjectivity or bias.

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 derived from liquidity (current assets/current liabilities), leverage (total debt/total equity), profitability (net income/total assets), and market capitalisation (size). Adjustments, such as natural logarithm calculation for size, ensured comparability between variables.

A fixed effects panel regression model was employed because the dataset consisted of repeated observations of the same companies over a ten-year period. 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[77]. 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 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. 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 for potential bias in the panel data. Evidence of serial correlation in the residuals was addressed by including an AR(1) correction term, which improved the efficiency of the estimates. In addition, tests for cross-sectional dependence were performed, given the possibility that sector-wide shocks—such as fluctuations in commodity prices —could affect all firms simultaneously. The results suggested that cross-sectional dependence was present but was controlled for through panel-robust standard errors.

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. Overall, 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[78].

6. Results

Table 3 provides an overview of the sustainability information disclosure quality landscape per category, over the 10 years, as 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	SR10			

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Category	Questions or tests (guiding statements)	Ref #	Total score possible	Average score (10-year period)	% of total score achieved
	replicated with similar results."				
	"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 estimates, or where that information can be found."	SR12			
	"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			

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Category	Questions or tests (guiding statements)	Ref #	Total score possible	Average score (10-year period)	% of total score achieved
	"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			
	"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[76]

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[27]. Figure 1 presents an overview of the sustainability information disclosure landscape, per the six categories, over 10 years.

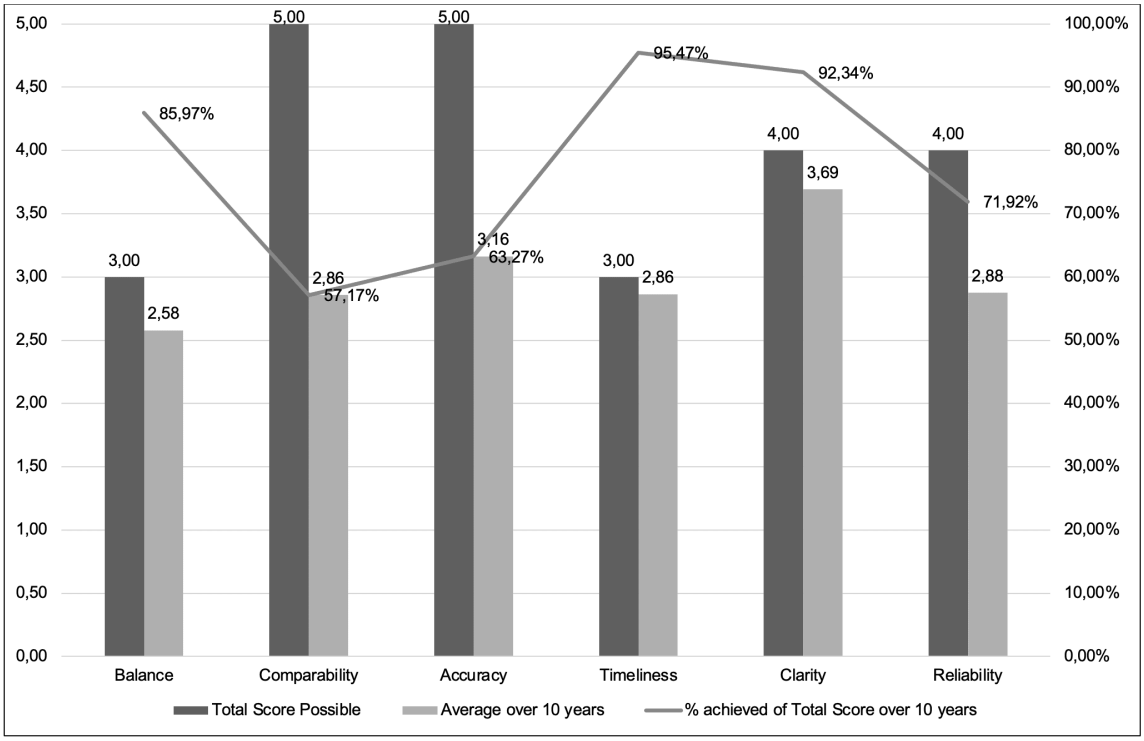

Figure 1. Overview of the sustainability information disclosure landscape per category over the 10 years.

Source: Authors' analysis

Observations on the sustainability information disclosure quality year-on-year data revealed that the total index scores improved from 2012 to 2021, indicating 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[33] 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 or be affected by its enterprise activities. Figure 2 presents an overview of the normalised sustainability

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information disclosure landscape data over the period. Scores were normalised to a score of 10 for consistency between the measures.

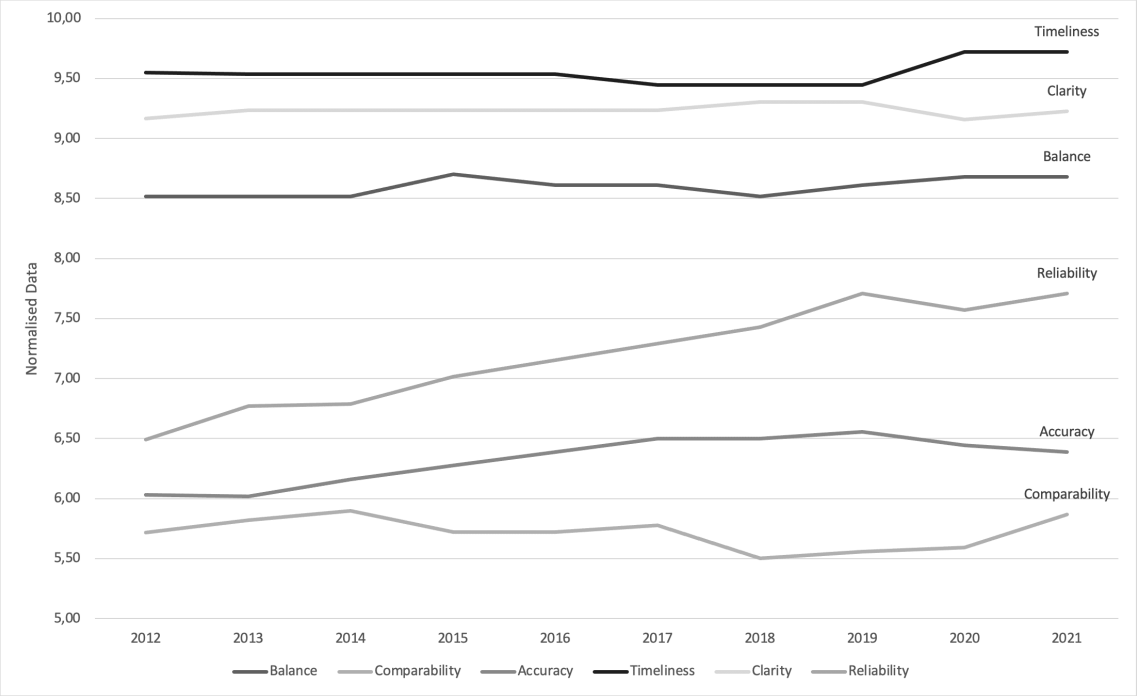

Figure 2. Overview of the normalised sustainability information disclosure data on average per category per year. *Source: Authors' analysis*

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[74]. 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.

	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	23.000	0.000	23.000	15.654	7.822	-1.084	-0.387

Table 4. Descriptive statistics

Note: 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

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 impact 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[79].

In contrast, leverage shows a narrower range (mean 0.899), which likely reflects similar risk appetites across firms, with 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[80][81].

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[82]. 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[83].

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 23 (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[27].

Additional distributional measures (standard deviation, skewness, and kurtosis) support these observations, highlighting non-symmetrical profiles and heavy-tailed distributions. Such patterns justify the use of data treatments before regression analysis. To address potential distortions, missing values were handled through mean imputation, a widely used method that replaces missing observations with the variable's mean to preserve sample size and reduce bias in regression analysis[84][85]. Companies with insufficient data were excluded, resulting in a final sample of 36 companies. In addition, outliers were winsorised at the 90% level (i.e., variables with values differing by more than 20% from the 5th and 95th percentiles were adjusted), thereby reducing the influence of extreme values while preserving the overall distribution[86][87]. These procedures ensured that the statistical analysis reflects the central tendencies of the data while limiting the undue influence of outliers.

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[88].

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 significance levels 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
PF	0.000	0.000	4.943	0.000
Size	0.070	0.070	0.989	0.323
Lag (AR(1))	0.623	0.119	5.239	0.000

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

Source: Authors' analysis

The regression model produced a high explanatory power, with an R^2 of 0.961 and an adjusted R^2 of 0.955, indicating that the independent variables collectively explain a substantial proportion of the variation in sustainability disclosure quality. While such high values can raise concerns about possible overfitting or multicollinearity, variance inflation factor (VIF) checks did not indicate problematic levels of

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multicollinearity among the independent variables. The similarity between the R^2 and adjusted R^2 further suggests that the model is not unduly overfitted to the sample. Nonetheless, it is important to acknowledge the possibility of endogeneity in the relationship—particularly the potential "chicken-and-egg" problem, whereby firms with higher profitability 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[52] findings of a significant relationship between leverage and sustainability reporting. However, Indrianingsih and Agustina[58] discovered a negative relationship between leverage and sustainability reporting. Ameer and Othman[30] emphasised the significant link between profitability and the impact of sustainability reporting on financial performance. Nugroho and Arjowo[42] observed a positive relationship between profitability and environmental disclosure. Husna[41] found a positive correlation between sustainability reporting and profitability but no notable link with leverage. Naeem and Brata[60] 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 relationship was found between sustainability reporting quality and companies' liquidity. The results were unexpected, as the researcher anticipated that liquidity would positively affect the quality of sustainability reporting disclosure. The results indicated that liquidity may not be categorically affected by the quality of sustainability disclosure. According to legitimacy theory, companies seek to garner stakeholder validation by disclosing a higher quality of sustainability information[89]. However, the results align with the findings from studies in China[33] and Turkey[49]. Further, the results contrast the view that information disclosure transparency mitigates the possibility of an imbalance in market knowledge, thereby improving the liquidity of company equity shares[70]. Finally, the results are also in contrast with those of Husna[41], Naeem and Brata[60], Wang et al.[59] and Indrianingsih and Agustina[58], who indicate that liquidity and sustainability reporting have a positive relationship.

H2 was **accepted**, as a significant positive relationship between sustainability reporting quality and company leverage was found. Thus, it was observed that leverage had a positive relationship with sustainability reporting quality, which aligns with the findings by Ariyani and Hartomo[52] and Branco et al.[40]. This can be expected from companies with higher leverage levels, as these companies will produce a higher level of detail and quality sustainability disclosure to stakeholders, to be more positively perceived according to impression management theory[72]. Therefore, companies disclosing higher quality sustainability information may gain access to more favourable debt financing terms, due to their positive market perception, resulting in a higher debt-to-equity ratio. This contrasts with the results from the studies in Indonesia[54][58] and Turkey[49], which indicate that leverage and sustainability reporting are negatively associated. A reason for the significant positive relationship between sustainability reporting quality and leverage may be that a higher level of quality and transparency in reporting sustainability information enhances relationships with stakeholders and, therefore, their perceptions of the company. An enhanced standing with stakeholders could increase stakeholder access to investment and reduce borrowing costs. Another reason for the relationship may be that, due to a higher level of quality reporting, investors find the company more reliable; therefore, the demand for investment in the company could increase its share price and reduce its capital costs, enabling the company to secure more debt and increase the leverage ratio.

H3 was **accepted**, as a significant positive relationship between sustainability reporting quality and companies' profitability was found. This result aligned with the expectation that increasing the quality of sustainability performance disclosure contributes to increased profitability and value for stakeholders. Stakeholder theory considers that companies acknowledge the expectations and perceptions of stakeholders[90]; therefore, if quality sustainability disclosure positively affects these expectations and perceptions, it could contribute to increased profitability due to an increase in investor sentiment or company reputation. This result from this study is supported by Ameer and Othman[30], Branco et al.[40], Dilling[27], Husna[41], Kasbun et al.[44], Nugroho and Arjowo[42] and Wu and Li[62]. However, it contrasts with the studies by Buallay[57] and Ho and Taylor[33].

H4 was **rejected**, as no significant relationship was found between sustainability reporting quality and company size. The results suggest that sustainability disclosure quality is not significantly affected by the size of companies. While stakeholder theory and legitimacy theory indicate that companies with larger market capitalisation and business activities may disclose more sustainability information due to the higher number of stakeholders and environmental impact[75], the results suggest that other factors

influence the quality of sustainability disclosure. Since no mandated regulatory requirement exists to report suitability information, companies' motivation to disclose sustainability information would complement shareholder wealth creation. This study result is supported by Ariyani and Hartomo[52] and Indrianingsih and Agustina[58]. However, it is in contrast to the results from the studies in Australia[38] [55], Brazil[39], Indonesia[60][56], Pakistan[51], Portugal[40], Spain[36], Turkey[49], China[35] and jointly from the United States of America and Japan[33]

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[64]. This aligns with the notion that comprehensive and quality sustainability disclosure fosters accountability, trustworthiness, and social responsibility over the long term[91]. Garg[43] 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 link between selected financial indicators and sustainability reporting quality among South African mining companies. This study addresses this by exploring the relationship using a quantitative approach, assessing sustainability disclosure quality through content analysis of integrated reports. Based on GRI guidelines, the evaluation index ensures a comprehensive analysis compared to previous studies.

Results reveal varying sustainability reporting quality among the companies, suggesting differing commitments to sustainable practices and stakeholder transparency in the South African mining industry. Most companies, on average, reported high-quality sustainability disclosures, emphasising efforts to comprehensively and transparently report their sustainability information and impacts.

South African mining companies focusing on high-quality sustainability reporting may experience positive effects on leverage and profitability. Improving the accuracy and comparability of sustainability disclosures is recommended for long-term sustainable financial benefits and alignment with stakeholder

expectations. Early adoption of sustainability reporting regulations is encouraged for quality disclosures, compliance, positive stakeholder connection, and transparency.

Stakeholders, including local communities, investors, businesses, regulators, and academics, can benefit from insights into the relationship between sustainability disclosure quality and financial indicators. This promotes transparency, responsible investment, and informed decision-making.

The study acknowledges several limitations. First, the analysis is based on a relatively small sample of 36 mining companies listed on the Johannesburg Stock Exchange, which restricts the generalisability of the findings. The focus on a single sector further narrows applicability, as mining has distinct capital structures, risk exposures, and stakeholder pressures compared to other industries. Second, the measurement of sustainability disclosure quality relied on a binary 0/1 scoring system. While this approach is transparent and reduces subjectivity, it does not differentiate between minimal and highly detailed disclosures, nor does it capture the depth, tone, or assurance of sustainability information.

From a statistical perspective, the treatment of missing data (mean imputation) and outliers (winsorisation) helped stabilise the dataset but may have influenced the distribution of key variables. Although a fixed effects panel regression model was employed—supported by diagnostic checks for heteroskedasticity, serial correlation, and cross-sectional dependence—the study did not incorporate more advanced estimation techniques such as generalised least squares (GLS), generalised method of moments (GMM), or Driscoll–Kraay standard errors. The absence of these robustness checks means that issues such as potential endogeneity or dynamic relationships cannot be fully addressed. In addition, the model's high explanatory power raises the possibility of overfitting, particularly the concern that more profitable companies may simply have greater resources to invest in higher-quality reporting.

Future research can address these limitations in several ways. First, expanding the analysis beyond mining to include diverse sectors would allow for comparison of sector-specific dynamics and strengthen the generalisability of results. Second, the use of alternative financial performance indicators, including long-term measures (e.g., return on equity, economic value added) and market-based indicators (e.g., Tobin's Q, market-to-book ratios), could provide additional insight into the financial implications of sustainability disclosure. Third, methodological refinements such as graded or weighted scoring systems, automated textual analysis, or assurance-adjusted indices would capture disclosure depth and quality more effectively than a binary measure. Fourth, future studies should incorporate more advanced econometric approaches to explicitly model endogeneity and dynamic effects, for example, by applying

instrumental variables, dynamic panel models, or two-stage estimation techniques to clarify the direction of causality between financial performance and disclosure quality.

Finally, as reporting frameworks continue to evolve, these findings can serve as a baseline for evaluating the impact of new standards, including the IFRS S1 and S2 requirements and the GRI 14: Mining Sector Standard (2024). Future research could explore how these 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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