Estimation of the Integrated Reporting Quality Model with an Environmental, Social, and Governance (ESG) Approach

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Abstract

The present study aims to estimate and explicate a model of integrated reporting quality based on an environmental, social, and governance (ESG) approach. In the first stage, a set of initial indicators of integrated reporting quality was identified through the analysis of in-depth expert interviews and a systematic review of the research literature. Subsequently, to screen, validate, and achieve expert consensus, the fuzzy Delphi technique was employed. For this purpose, the perspectives of 18 experts in the fields of reporting, accounting, sustainability, and corporate governance were collected over three rounds of fuzzy Delphi and analyzed using triangular fuzzy numbers. The results of the fuzzy Delphi indicated that all 35 identified indicators possessed sufficient importance, with the defuzzified values of all indicators exceeding the threshold level of 0.7. Furthermore, the examination of the mean differences between the second and third Delphi rounds demonstrated an appropriate convergence of expert opinions and the fulfillment of the stopping criterion for the Delphi process. To assess the degree of agreement among experts, Kendall's coefficient of concordance was utilized, the results of which indicated a significant increase in the level of consensus and agreement in the final rounds. In the quantitative section of the study, data were collected through a questionnaire from a sample of 466 respondents. The demographic characteristics of respondents in terms of gender, age, and education level were examined, confirming an appropriate sample distribution. Descriptive statistics indicated that the mean values of environmental, social, and governance indicators were at a relatively high level. The Kolmogorov–Smirnov test also confirmed the normality of data distribution. For inferential data analysis, structural equation modeling using the partial least squares approach was applied. The results of the measurement model evaluation indicated that the constructs possessed satisfactory reliability and validity, as Cronbach's alpha, composite reliability, average variance extracted (AVE), and the HTMT index were all within acceptable ranges. Additionally, the absence of multicollinearity among variables was confirmed using the variance inflation factor (VIF). In the structural model, the results indicated that environmental, social, and governance indicators had a positive and significant effect on integrated reporting quality. The coefficient of determination demonstrated an acceptable level of explained variance for the dependent variable, and overall model fit indices confirmed the appropriate fit and strong predictive power of the model. Finally, the results of the importance–performance map analysis (IPMA) indicated that governance indicators had the highest level of importance, while environmental indicators exhibited the highest level of performance. The findings of this study can provide a practical foundation for improving integrated reporting quality and for supporting decision-making by managers, policymakers, and stakeholders in the domains of sustainability and corporate governance.

Keywords: *Integrated reporting, fuzzy Delphi, partial least squares, corporate sustainability, corporate governance*

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1. Introduction

Integrated reporting has emerged as one of the most important developments in contemporary corporate reporting because it responds to the growing inadequacy of purely financial reporting in explaining organizational value creation. Traditional financial statements mainly reflect past financial performance, while investors, regulators, managers, and other stakeholders increasingly require information about environmental responsibility, social performance, governance quality, risk exposure, strategic orientation, and long-term sustainability. In this context, integrated reporting provides a broader reporting logic by connecting financial and non-financial dimensions of corporate performance and by explaining how organizations create, preserve, or erode value over time. The growing attention to integrated reporting is closely related to the expansion of environmental, social, and governance (ESG) disclosure, because ESG information enables users of reports to evaluate corporate accountability beyond short-term profitability and to assess the extent to which firms manage sustainability-related opportunities and threats. Recent literature reviews emphasize that integrated reporting has become a central framework for organizing multidimensional corporate information, improving stakeholder communication, and strengthening the relevance of sustainability-oriented disclosure in decision-making processes [1]. Therefore, the quality of integrated reporting is not merely a technical reporting issue, but a strategic and governance-related concern that influences corporate transparency, legitimacy, and accountability.

The increasing importance of ESG-oriented reporting reflects a broader transformation in corporate responsibility and capital market expectations. Firms are no longer evaluated only on financial outcomes; instead, their environmental policies, social commitments, governance structures, ethical standards, and risk-management practices are increasingly viewed as determinants of organizational credibility and long-term competitiveness. ESG disclosure offers a structured way to communicate such information, but the usefulness of disclosure depends heavily on its quality, completeness, comparability, accuracy, and integration with financial and strategic information. Studies have shown that ESG activities and their disclosure play a significant role in improving corporate transparency and strengthening stakeholder trust, particularly in markets where sustainability reporting is still developing and where investors require more reliable non-financial information [2]. From this perspective, integrated reporting quality can be understood as the extent to which ESG-related and financial information are coherently connected in a report that reflects the organization's governance, strategy, performance, and future outlook.

The environmental dimension of integrated reporting has become particularly important because corporate activities are increasingly assessed in relation to climate change, resource consumption, pollution, energy efficiency, carbon emissions, waste management, and investment in green projects. Environmental disclosure allows stakeholders to evaluate how firms identify, manage, and communicate ecological risks and responsibilities. ESG-related innovations can also improve corporate ESG performance by encouraging companies to adopt new technologies, revise operational processes, and disclose environmental impacts more systematically [3]. In addition, evidence from the Chinese context suggests that innovation in ESG disclosure may generate value when it is embedded in integrated reporting practices and when firms use disclosure as a mechanism for demonstrating strategic sustainability orientation rather than as a symbolic reporting exercise [4]. Accordingly, environmental indicators are essential components of an integrated reporting quality model because they reveal whether the firm's reporting framework captures material ecological impacts and communicates them in a measurable and decision-useful manner.

The social dimension of ESG reporting is equally important because organizations operate within a network of employees, customers, communities, suppliers, and broader social institutions. Social indicators such as employee satisfaction, workforce diversity and inclusion, training, workplace safety, employee turnover, wage fairness, social responsibility initiatives, charitable participation, and stakeholder responsiveness reflect the human and relational foundations of sustainable value creation. Integrated reporting quality depends on whether such social information is presented clearly, consistently, and in connection with the firm's strategy and governance mechanisms. High-quality integrated reporting should therefore demonstrate how social performance contributes to organizational resilience, stakeholder legitimacy, and long-term value. Research on ESG performance and financial reporting quality confirms that environmental, social, and governance performance is increasingly connected to the perceived quality of corporate reporting, because non-financial performance indicators can improve users' understanding of managerial accountability and the

sustainability of financial outcomes [5]. Thus, social indicators are not supplementary disclosures; they are part of the informational infrastructure required for evaluating corporate sustainability.

Governance indicators represent a particularly critical pillar in integrated reporting because governance determines the credibility, reliability, and strategic orientation of corporate disclosure. Board independence, board meeting attendance, audit committee activity, executive compensation structure, anti-corruption compliance, financial and audit violations, risk disclosure, shareholder accountability, litigation, senior management turnover, and executive ownership all influence the extent to which users can trust reported information. Studies indicate that board characteristics and ESG disclosure are closely associated with integrated reporting quality, suggesting that strong governance mechanisms enhance the credibility and completeness of integrated reports [6]. Similarly, corporate governance has been shown to play a central role in integrated reporting quality when ESG considerations are incorporated into the reporting model [7]. This implies that the governance dimension is not simply one component among others; rather, it functions as an enabling mechanism that affects how environmental and social information is measured, controlled, assured, and communicated.

The relationship between ESG reporting and financial reporting quality has also received growing scholarly attention. Financial reporting quality is traditionally associated with reliability, relevance, faithful representation, and reduced information asymmetry. However, contemporary reporting environments require a broader interpretation of quality that includes ESG performance and sustainability-related disclosure. Studies conducted in the Iranian capital market context indicate that corporate governance, social, and environmental activities can affect the financial reporting quality of listed companies [8]. Related evidence also shows that ESG performance may influence corporate financial performance, particularly when financial reporting quality is emphasized as a key condition for credible disclosure [9]. These findings suggest that ESG-based integrated reporting can strengthen the informational value of corporate reports by connecting sustainability performance with financial outcomes and by improving the interpretability of organizational performance for investors and other stakeholders.

Audit quality and assurance mechanisms are also central to the quality of ESG and integrated reporting. As non-financial information becomes more important for decision-making, users increasingly demand assurance regarding the reliability of ESG disclosures. Without credible assurance, sustainability information may be perceived as selective, symbolic, or vulnerable to managerial bias. Research on audit quality shows that auditing mechanisms can affect ESG performance and reporting quality by enhancing the credibility of sustainability-related information and reducing the likelihood of opportunistic disclosure practices [10]. Moreover, reviews of non-financial information assurance highlight that assurance practices are becoming an essential part of sustainability accounting and integrated reporting, although methodological and regulatory challenges remain in ensuring consistency, comparability, and reliability across organizations [11]. Therefore, any model of integrated reporting quality with an ESG approach should consider the importance of reliable measurement, validation, and governance-based assurance mechanisms.

Another important issue in ESG-oriented integrated reporting is the relationship between disclosure, earnings management, and corporate governance. When ESG reporting is weakly governed, companies may use sustainability disclosure to mask poor financial reporting practices or to construct a favorable public image without substantive accountability. Conversely, strong governance mechanisms can moderate the relationship between earnings management and ESG reporting by encouraging more transparent and disciplined disclosure. Evidence from companies listed on the Tehran Stock Exchange indicates that the relationship between earnings management and ESG reporting should be examined in light of the moderating role of corporate governance [12]. This highlights the importance of governance indicators in integrated reporting quality models, particularly in emerging markets where reporting incentives, enforcement mechanisms, and stakeholder expectations may differ from those in more mature capital markets.

Investor decision-making represents another major reason for developing a rigorous model of integrated reporting quality. Investors increasingly use ESG and integrated reporting information to evaluate risk, growth potential, reputational capital, and long-term value creation. Research shows that integrated reporting quality influences investors' decision-making by providing more comprehensive information about organizational performance and future prospects [13]. ESG scores may also enhance market value, as evidence from Pakistan suggests that stronger ESG performance can contribute to market value improvement when investors perceive ESG

information as credible and value-relevant [14]. These findings indicate that integrated reporting quality has practical implications for capital allocation, investor confidence, and market valuation. Therefore, identifying valid indicators of integrated reporting quality can help firms communicate more effectively with capital market participants.

The debate between integrated ESG reporting and standalone ESG reporting is also relevant to the present study. Standalone ESG reports may provide detailed sustainability information, but they can remain disconnected from financial strategy, governance, and value creation unless they are linked to the broader reporting architecture of the firm. Comparative evidence suggests that integrated reporting and standalone ESG reporting differ in their ability to connect sustainability performance with financial and strategic information [15]. Integrated reporting is valuable precisely because it attempts to overcome fragmentation by presenting environmental, social, governance, and financial information within a unified logic of value creation. However, this advantage depends on reporting quality. If integrated reports merely combine disconnected sections without meaningful relationships among indicators, their usefulness remains limited. Therefore, constructing and estimating a model of integrated reporting quality requires identifying indicators that capture both ESG substance and integration quality.

Measuring integrated reporting quality is methodologically challenging because quality is a multidimensional construct. It includes completeness, reliability, comparability, relevance, balance, strategic connectivity, stakeholder orientation, governance credibility, and forward-looking information. Studies on measuring integrated reporting quality in Europe have attempted to develop structured assessment frameworks, including balanced scorecard-based approaches, to evaluate the extent and quality of integrated reporting practices [16]. These efforts show that integrated reporting quality cannot be assessed through a single indicator; rather, it requires a multidimensional measurement model that includes both quantitative and qualitative elements. The use of expert-based methods such as fuzzy Delphi is especially appropriate in this area because expert judgment can help identify, refine, and validate indicators where theoretical consensus is still evolving and where reporting practices differ across institutional contexts.

The Iranian corporate reporting environment provides a particularly meaningful setting for examining integrated reporting quality with an ESG approach. The increasing attention to corporate social responsibility, professional ethics, sustainability, corporate governance, and financial reporting quality in Iran reflects the growing relevance of ESG-oriented reporting for listed companies. Domestic studies have examined the effect of ESG disclosure on firm performance with attention to internal control mechanisms, indicating that internal governance and control systems may shape the effectiveness and credibility of ESG disclosure [17]. Other studies have emphasized the position of ESG activities and disclosure in contemporary corporate reporting, suggesting that sustainability-oriented reporting is becoming an important concern for managers, accountants, auditors, and policymakers [2]. These developments indicate the need for an empirically validated model that can identify the most important ESG-based indicators of integrated reporting quality and support more systematic reporting practices.

Despite the expansion of ESG and integrated reporting research, several gaps remain. First, many studies examine ESG disclosure, corporate governance, financial performance, or financial reporting quality separately, while fewer studies provide an integrated model that connects environmental, social, and governance indicators specifically to integrated reporting quality. Second, existing models are often developed in international contexts and may not fully reflect the institutional, regulatory, and market conditions of emerging economies. Third, there is a need for models that combine expert consensus methods with quantitative validation, because integrated reporting quality requires both conceptual refinement and empirical testing. Conceptual work on ESG reporting quality emphasizes that the quality of ESG reporting can affect financial reporting and stakeholder decision-making, but further empirical modeling is needed to identify the specific indicators that should be prioritized in integrated reporting frameworks [18]. Therefore, a combined fuzzy Delphi and structural equation modeling approach can provide a stronger basis for estimating an ESG-based integrated reporting quality model.

In light of these considerations, the present study is positioned at the intersection of integrated reporting, ESG disclosure, corporate governance, sustainability accounting, and financial reporting quality. It assumes that integrated reporting quality is shaped by a set of environmental, social, and governance indicators that must be theoretically grounded, expert-validated, and empirically tested. By using expert interviews, systematic literature review, fuzzy Delphi analysis, and partial least squares structural equation

modeling, the study seeks to move beyond general discussions of ESG disclosure and develop a validated model that identifies the relative importance and performance of ESG dimensions in explaining integrated reporting quality. Such a model can assist managers in improving disclosure practices, help policymakers design more effective reporting requirements, support auditors and assurance providers in evaluating non-financial information, and provide investors with more reliable information for decision-making.

The aim of this study is to estimate and explain a model of integrated reporting quality based on environmental, social, and governance indicators.

2. Methodology

Based on the analysis of expert interviews, a total of 35 indicators were ultimately identified for estimating the integrated reporting quality model with an environmental, social, and governance (ESG) approach. To screen the identified indicators, ensure their significance, and select the final set of indicators, the fuzzy Delphi method was employed. The importance of the indicators was assessed from the perspective of experts. Although experts utilize their cognitive abilities and competencies to perform comparisons, it should be noted that the traditional process of quantifying human judgments does not fully capture the nature of human thinking. In other words, the use of fuzzy sets provides greater compatibility with linguistic and sometimes ambiguous human expressions; therefore, it is more appropriate to employ fuzzy sets (through the application of fuzzy numbers) for long-term forecasting and decision-making in real-world contexts (Karaman et al., 2009). In this study, triangular fuzzy numbers were used to fuzzify expert opinions. Expert judgments regarding the importance of each indicator were collected using a seven-point fuzzy scale.

Table 1. Coding of Open Codes in the Delphi Technique

No.	Open Coding
C1	Greenhouse gas emissions (CO_2, CH_4, N_2O)
C2	Energy consumption intensity
C3	Share of renewable energy in total energy consumption
C4	Water consumption
C5	Waste recycling rate
C6	Environmental pollutant emission intensity
C7	Expenditures on environmental initiatives
C8	Hazardous waste generation
C9	Natural resource consumption intensity
C10	Consumption of plastics and non-renewable materials
C11	Rate of recycled material usage in production
C12	Carbon emission reduction rate compared to the previous year
C13	Percentage of company assets invested in green projects
C14	Employee turnover rate
C15	Employee satisfaction with working conditions
C16	Number of formal employee complaints regarding discrimination and inequality
C17	Average employee tenure
C18	Ratio of employee wages to the legal minimum wage
C19	Number of employee training hours
C20	Workforce diversity and inclusion rate
C21	Employee safety and incident rate
C22	Level of participation in social responsibility activities
C23	Participation in charitable and social programs
C24	Ratio of independent board members
C25	Average board member attendance at meetings
C26	Number of meetings held by audit and supervisory committees
C27	Ratio of CEO compensation to average employee compensation
C28	Level of transparency in financial and non-financial disclosures
C29	Compliance score with anti-corruption and ethical regulations
C30	Number of identified financial or audit violations during the year
C31	Level of disclosure of company risks (financial, environmental, social, and governance)
C32	Shareholder responsiveness rate in general assemblies
C33	Number of legal cases filed against the company during the year

C34	Rate of executive-level management changes
C35	Share ownership rate by executive managers

Table 2. Seven-Point Fuzzy Scale for Indicator Valuation

Linguistic Variable	Fuzzy Value	Fuzzy Numerical Scale
Completely unimportant	$\tilde{1}$	(0, 0, 0.1)
Very unimportant	$\tilde{2}$	(0, 0.1, 0.3)
Unimportant	$\tilde{3}$	(0.1, 0.3, 0.5)
Moderate	$\tilde{4}$	(0.3, 0.5, 0.75)
Important	$\tilde{5}$	(0.5, 0.75, 0.9)
Very important	$\tilde{6}$	(0.75, 0.9, 1)
Extremely important	$\tilde{7}$	(0.9, 1, 1)

3. Findings and Results

The analysis of findings began with the fuzzy Delphi rounds. In the first round, the opinions of 18 experts were collected for the 35 open-coded indicators of integrated reporting quality with an environmental, social, and governance approach. Expert judgments were converted into triangular fuzzy numbers based on the seven-point fuzzy scale. The aggregation of expert opinions was performed using fuzzy averaging, and the following aggregation relations were considered:

$$F_{AGR} = (\min\{l\}, \prod m, \max\{u\})$$

$$F_{AGR} = (\min\{l\}, \frac{\sum m}{n}, \max\{u\})$$

$$F_{AVE} = (\frac{\sum l}{n}, \frac{\sum m}{n}, \frac{\sum u}{n})$$

For each indicator j, the aggregated triangular fuzzy number was expressed as follows:

$$\tau_j = (L_j, M_j, U_j)$$

$$L_j = \min(X_{ij})$$

$$M_j = \sqrt[n]{\prod_{i=1}^{n} X_{ij}}$$

$$U_j = \max(X_{ij})$$

In these relations, $i$refers to the expert; X_{ij}denotes the evaluation value assigned by expert $i$to criterion j; $L_j$is the minimum evaluation value for criterion j; $M_j$is the geometric mean of expert evaluations for criterion j; and $U_j$is the maximum evaluation value for criterion j. In this study, the fuzzy mean method was applied.

Defuzzification was conducted to convert aggregated triangular fuzzy values into crisp values. Several methods are available for defuzzification. One common method is as follows:

$$x_m^1 = \frac{L + M + U}{3}$$

Another method for defuzzifying the mean of triangular fuzzy numbers is:

$$F_{ave} = (L, M, U)$$

$$x_m^1 = \frac{L + M + U}{3}; x_m^2 = \frac{L + 2M + U}{4}; x_m^3 = \frac{L + 4M + U}{6}$$

$$\text{Crisp number} = Z^* = \max(x_{max}^1, x_{max}^2, x_{max}^3)$$

In the present study, the center-of-area method was used for defuzzification:

$$DF_{ij} = \frac{(u_{ij} - l_{ij}) + (m_{ij} - l_{ij})}{3} + l_{ij}$$

According to this rule, defuzzified values greater than 0.7 were accepted, while indicators with values below the threshold were rejected.

Table 3. Results of the Three Fuzzy Delphi Rounds for the Open-Coded Indicators

Code	Round 1 Crisp Value	Round 1 Result	Round 2 Crisp Value	Round 2 Result	Round 3 Crisp Value	Round 3 Result
C1	0.776	Accepted	0.776	Accepted	0.744	Accepted
C2	0.904	Accepted	0.904	Accepted	0.794	Accepted
C3	0.738	Accepted	0.738	Accepted	0.925	Accepted
C4	0.928	Accepted	0.928	Accepted	0.875	Accepted
C5	0.777	Accepted	0.777	Accepted	0.776	Accepted
C6	0.803	Accepted	0.803	Accepted	0.904	Accepted
C7	0.890	Accepted	0.847	Accepted	0.738	Accepted
C8	0.918	Accepted	0.827	Accepted	0.928	Accepted
C9	0.866	Accepted	0.896	Accepted	0.777	Accepted
C10	0.932	Accepted	0.752	Accepted	0.803	Accepted
C11	0.847	Accepted	0.932	Accepted	0.890	Accepted

C12	0.896	Accepted	0.872	Accepted	0.918	Accepted
C13	0.778	Accepted	0.892	Accepted	0.866	Accepted
C14	0.741	Accepted	0.928	Accepted	0.932	Accepted
C15	0.813	Accepted	0.761	Accepted	0.847	Accepted
C16	0.928	Accepted	0.733	Accepted	0.896	Accepted
C17	0.778	Accepted	0.744	Accepted	0.778	Accepted
C18	0.731	Accepted	0.794	Accepted	0.741	Accepted
C19	0.708	Accepted	0.925	Accepted	0.813	Accepted
C20	0.932	Accepted	0.875	Accepted	0.928	Accepted
C21	0.827	Accepted	0.776	Accepted	0.778	Accepted
C22	0.752	Accepted	0.904	Accepted	0.731	Accepted
C23	0.872	Accepted	0.738	Accepted	0.708	Accepted
C24	0.761	Accepted	0.928	Accepted	0.932	Accepted
C25	0.744	Accepted	0.928	Accepted	0.741	Accepted
C26	0.918	Accepted	0.803	Accepted	0.752	Accepted
C27	0.866	Accepted	0.890	Accepted	0.872	Accepted
C28	0.932	Accepted	0.918	Accepted	0.761	Accepted
C29	0.847	Accepted	0.866	Accepted	0.744	Accepted
C30	0.896	Accepted	0.932	Accepted	0.918	Accepted
C31	0.778	Accepted	0.847	Accepted	0.866	Accepted
C32	0.741	Accepted	0.896	Accepted	0.932	Accepted
C33	0.813	Accepted	0.778	Accepted	0.847	Accepted
C34	0.928	Accepted	0.741	Accepted	0.896	Accepted
C35	0.778	Accepted	0.813	Accepted	0.778	Accepted

In the second round, all crisp values were greater than 0.7; therefore, none of the indicators was rejected. The fuzzy Delphi analysis continued in the third round, and again all 35 indicators were accepted. Since no factor was removed in this round, the next step was to examine the stopping criterion of the Delphi process. A common stopping rule in Delphi studies is to compare the mean scores of the final two rounds. If the difference between two consecutive rounds is smaller than the threshold value of 0.2, the survey process can be stopped.

Table 4. Difference Between the Results of the Second and Third Delphi Rounds

Code	Second-Round Result	Third-Round Result	Difference	Result
C1	0.744	0.776	0.032	Accepted
C2	0.794	0.904	0.110	Accepted
C3	0.925	0.738	0.187	Accepted
C4	0.875	0.928	0.053	Accepted
C5	0.776	0.777	0.001	Accepted
C6	0.904	0.803	0.101	Accepted
C7	0.738	0.847	0.109	Accepted
C8	0.928	0.827	0.101	Accepted
C9	0.777	0.896	0.119	Accepted
C10	0.803	0.752	0.051	Accepted
C11	0.890	0.932	0.042	Accepted
C12	0.918	0.872	0.046	Accepted
C13	0.866	0.892	0.026	Accepted
C14	0.932	0.928	0.004	Accepted
C15	0.847	0.761	0.086	Accepted
C16	0.896	0.733	0.163	Accepted
C17	0.778	0.744	0.034	Accepted
C18	0.741	0.794	0.053	Accepted
C19	0.813	0.925	0.112	Accepted
C20	0.928	0.875	0.053	Accepted
C21	0.778	0.776	0.002	Accepted
C22	0.731	0.904	0.173	Accepted
C23	0.708	0.738	0.030	Accepted
C24	0.932	0.928	0.004	Accepted
C25	0.741	0.928	0.187	Accepted

C26	0.752	0.803	0.051	Accepted
C27	0.872	0.890	0.018	Accepted
C28	0.761	0.918	0.157	Accepted
C29	0.744	0.866	0.122	Accepted
C30	0.918	0.932	0.014	Accepted
C31	0.866	0.847	0.019	Accepted
C32	0.932	0.896	0.036	Accepted
C33	0.847	0.778	0.069	Accepted
C34	0.896	0.741	0.155	Accepted
C35	0.778	0.813	0.035	Accepted

The results showed that the difference between the second and third rounds was below 0.2 for all indicators. Therefore, the Delphi rounds were terminated. Kendall's coefficient of concordance was then used to assess the consistency of expert judgments.

Table 5. Kendall's Coefficient of Concordance

Delphi Round	Number of Indicators	Number of Experts	Kendall's Coefficient	Degrees of Freedom	Significance Level
First round	35	18	0.622	34	0.001
Second round	35	18	0.758	34	0.001

The Kendall coefficient in the first Delphi round was 0.622, indicating a moderate level of agreement among experts. In the second round, the coefficient increased to 0.758, indicating a good level of consensus. The significance value was 0.001, showing that the results were statistically reliable at the 95% confidence level. Therefore, the fuzzy Delphi process was stopped, and the identified indicators were used for the final analysis.

The demographic characteristics of the respondents were examined using descriptive statistics. Of the 466 respondents, 242 were female, representing 52% of the sample, and 224 were male, representing 48%. In terms of age, 61 respondents were younger than 25 years, accounting for 13% of the sample; 167 respondents were between 26 and 35 years old, representing 36%; 223 respondents were between 36 and 50 years old, representing 48%; and 15 respondents were aged 51 years or older, representing 3%. Regarding education level, 89 respondents had less than a bachelor's degree, 117 had a bachelor's degree, 144 had a master's degree, and 116 had a doctoral degree.

Table 6. Descriptive Statistics, Normality Test, and Importance Test of the Main Research Variables

Variable	Mean	Standard Deviation	Variance	Skewness	Kurtosis	Kolmogorov–Smirnov Statistic	Significance	T Statistic	Confidence Interval: Lower Bound	Confidence Interval: Upper Bound
Environmental indicators	3.86	0.744	0.553	0.961	1.933	0.326	0.066	93.395	3.78	3.95
Social indicators	3.84	0.791	0.626	-0.651	0.296	0.353	0.064	87.191	3.75	3.93
Governance indicators	3.77	0.871	0.759	-0.649	0.138	0.330	0.059	77.838	3.68	3.87

The descriptive statistics showed that the mean values of the main variables were relatively high, indicating that the "high" response option was dominant among respondents. The highest mean belonged to environmental indicators. The skewness and kurtosis values were within the range of -2 to +2, indicating symmetry and acceptable normality of the data. The Kolmogorov–Smirnov test also confirmed normality, since the significance levels for all variables were greater than 0.05. Therefore, there was no reason to reject the null hypothesis of normal data distribution. The importance test also showed that all identified factors were significant from the respondents' perspective, as all significance levels were below 0.05.

Structural equation modeling was used for inferential analysis. Since partial least squares analysis is derived from linear regression, the assumptions related to regression data were also examined. Before evaluating structural relationships, multicollinearity was assessed using the variance inflation factor (VIF). If the VIF value is greater

than 5, the level of inflation is considered critical, while the ideal value is 3 or lower.

Table 7. Multicollinearity, Reliability, and Convergent Validity of the Research Variables

Variable	VIF	Cronbach's Alpha	AVE	CR	Rho
Environmental indicators	1.170	0.865	0.530	0.801	0.765
Social indicators	1.045	0.790	0.566	0.852	0.814
Governance indicators	1.161	0.737	0.601	0.782	0.785

The VIF values for all research components were below 3; therefore, multicollinearity was not present among the research variables. The results also confirmed reliability and convergent validity. Cronbach's alpha values for all variables were above 0.7, indicating acceptable reliability. The average variance extracted values were above 0.5, confirming convergent validity. Composite reliability values were also greater than both AVE and 0.7, indicating that the model constructs had acceptable reliability and validity. The homogeneous reliability coefficient, or Rho, was also above 0.7 for all constructs.

The outer model was evaluated through Cronbach's alpha, composite reliability, convergent validity, and discriminant validity. Cronbach's alpha ranges from 0 to 1, and values above 0.7 are acceptable, while values below 0.6 are undesirable (Cronbach, 1951). Composite reliability is considered a more accurate reliability criterion than Cronbach's alpha because indicators with higher factor loadings receive greater weight in its calculation. Values above 0.7 are acceptable (Werts et al., 1974). Convergent validity was assessed using AVE, where values above 0.5 are acceptable (Hair et al., 2019). The following conditions were confirmed:

$$CR > 0.7$$
$$CR > AVE$$
$$AVE > 0.5$$

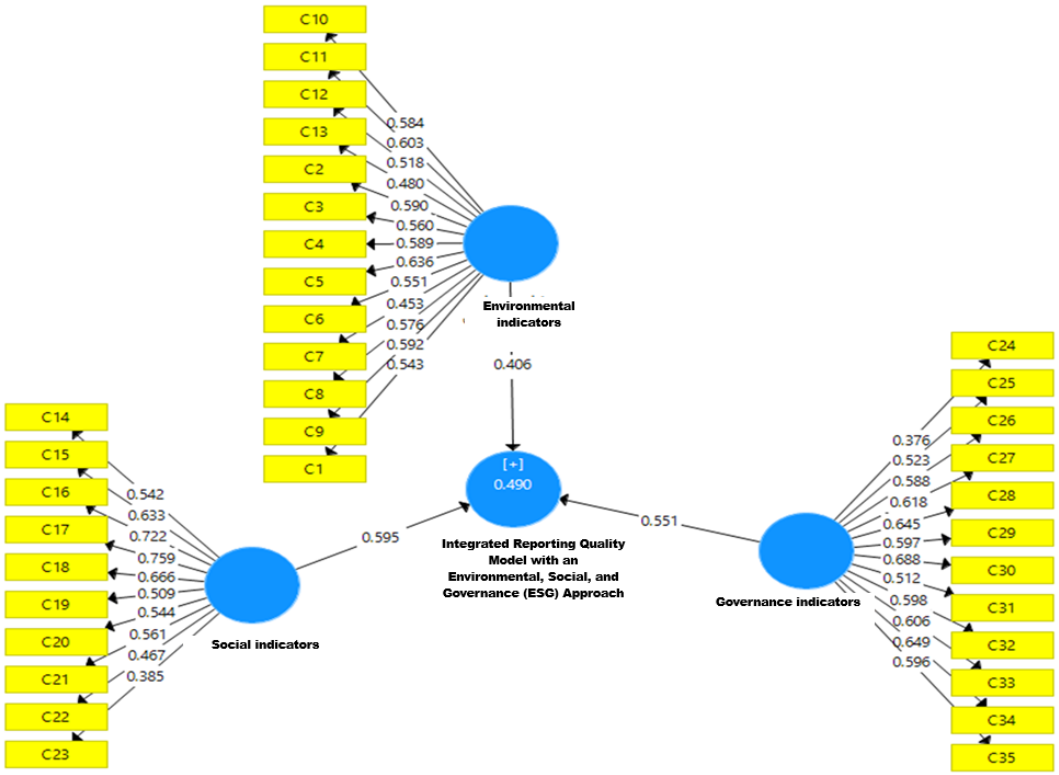

Figure 1. Factor Loadings of the Research Model (Outer Model)

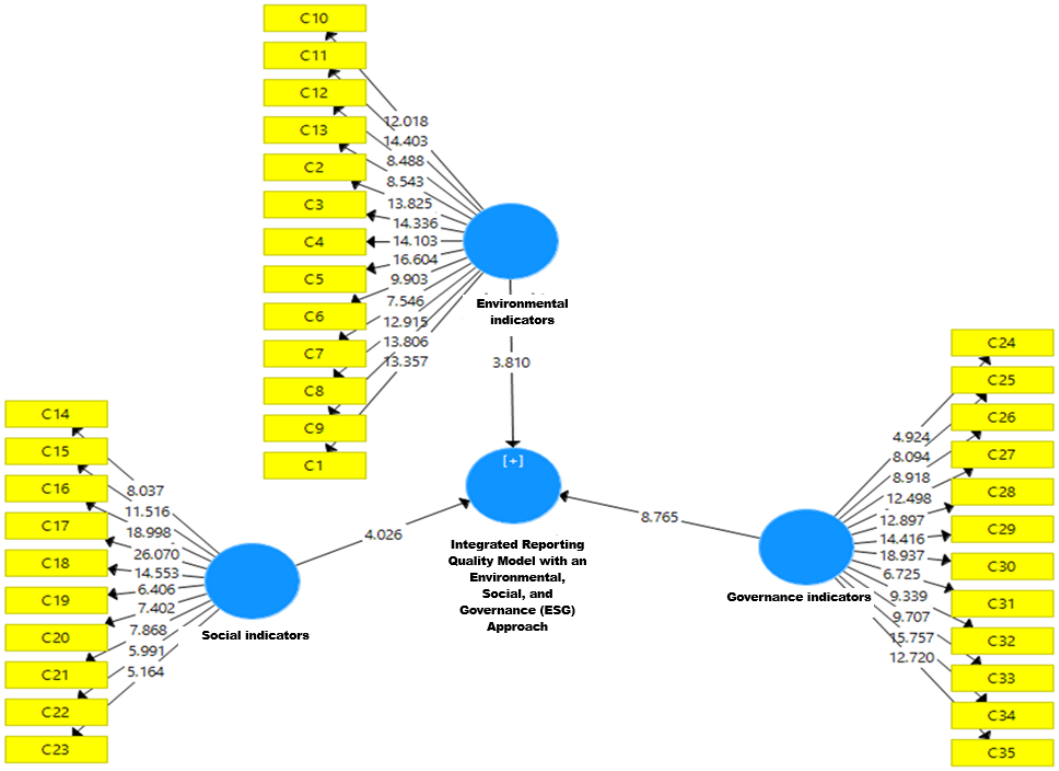

Figure 2. Bootstrapping T Statistics of the Research Model (Outer Model)

Discriminant validity was assessed using the Fornell–Larcker criterion and the HTMT criterion. In the Fornell–Larcker approach, acceptable discriminant validity is established when the square root of AVE for each construct is greater than its correlations with other constructs. Recent studies by Henseler et al. (2015) indicate that the Fornell–Larcker criterion may not perform adequately when factor loadings differ only slightly; therefore, the HTMT criterion was also used. In the HTMT approach, values below 0.9 indicate acceptable discriminant validity.

Table 8. Discriminant Validity Based on the Fornell–Larcker and HTMT Criteria

Criterion	Environmental Indicators	Social Indicators	Governance Indicators
Fornell–Larcker: Environmental indicators	0.889		
Fornell–Larcker: Social indicators	0.470	0.891	
Fornell–Larcker: Governance indicators	0.676	0.553	0.890
HTMT: Environmental indicators			
HTMT: Social indicators	0.805		
HTMT: Governance indicators	0.630	0.817	

The Fornell–Larcker results showed that the diagonal values were greater than the values below them, confirming discriminant validity. The HTMT values were also below 0.9, confirming acceptable discriminant validity based on this criterion.

After confirming the measurement model through reliability, convergent validity, and discriminant validity, the structural model was evaluated. In the structural model, unlike the measurement model, the focus is not on observed variables but on latent variables and their relationships. The model fit was assessed using R^2, F^2, Q^2, and the goodness-of-fit index.

The coefficient of determination was obtained as follows:

$$R^2 = 0.467$$

This value shows that 47% of the variance in the dependent construct was explained by the effects of the independent variables. Based on Chin's (1998) classification, values of 0.19, 0.33, and 0.67 indicate weak, moderate, and strong explanatory power, respectively.

Therefore, the explanatory power of the model was acceptable.

The overall goodness of fit was calculated as follows:

$$GOF = \sqrt{Avg(Communalities) \times R^2}$$

$$Avg(R^2) = 0.467$$

$$GOF = \sqrt{0.712 \times 0.467} = 0.576$$

Based on the GOF value, the overall model was confirmed. The effect size criterion was calculated using Cohen's F^2:

$$F^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

In this formula, $R^2_{included}$refers to the path coefficient when the predictor variable is included, and $R^2_{excluded}$refers to the path coefficient when the predictor variable is excluded. The Q^2criterion was also used to assess the predictive power of the model. According to Hair et al. (2019), values of 0, 0.25, and 0.50 indicate weak, moderate, and strong predictive power, respectively.

Table 9. Structural Model Fit, Effect Size, Predictive Power, and Hypothesis Testing

Variable / Path	Q^2	F^2	Path Coefficient	T Statistic	Significance Level	Status
Environmental indicators	0.700	0.544	0.406	3.810	0.000	Confirmed
Social indicators	0.652	0.537	0.595	4.026	0.000	Confirmed
Governance indicators	0.728	0.380	0.551	8.765	0.000	Confirmed

The Q^2values showed that the predictive power of the research constructs was strong. The F^2values also indicated acceptable effect sizes. The hypothesis testing results showed that all path coefficients were above 0.3 and all significance levels were below 0.05. Therefore, at the 95% confidence level, all research hypotheses were confirmed. Environmental indicators, social indicators, and governance indicators each had a positive and significant effect on integrated reporting quality.

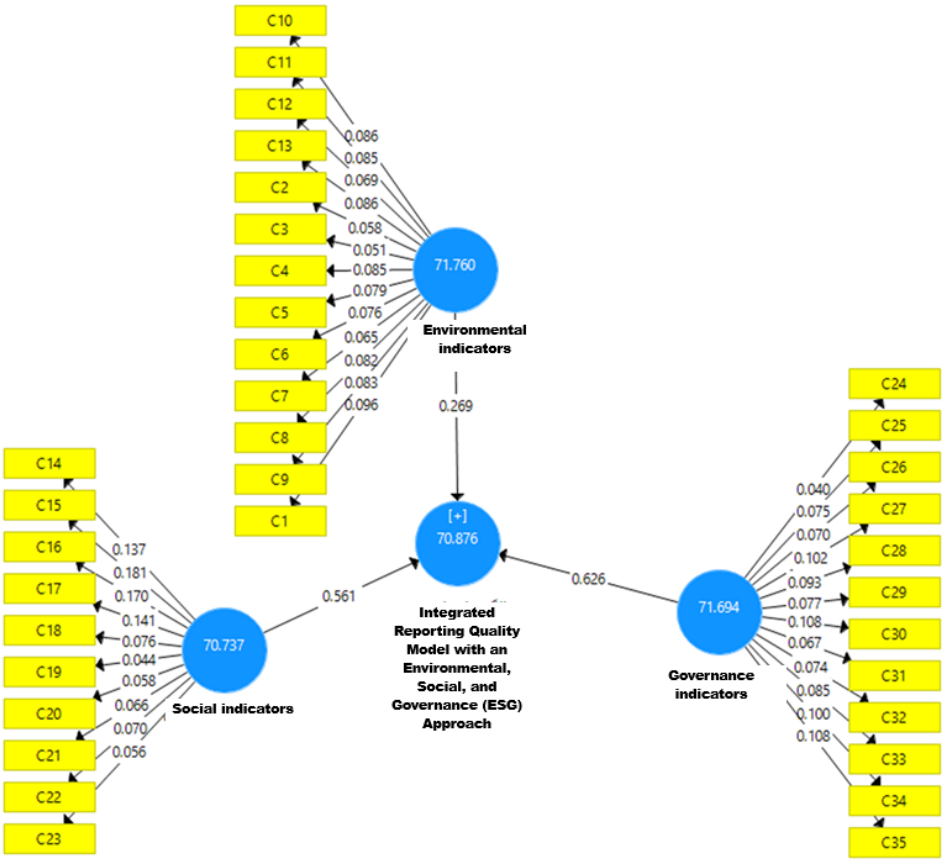

Figure 3. Output of the Model in IPMA Analysis (Performance)

The importance–performance map analysis (IPMA) was conducted using SmartPLS. IPMA compares the total effects of the structural model, representing importance, with the average latent variable scores, representing performance. This procedure identifies constructs with relatively high importance and relatively low performance, thereby indicating priority areas for managerial improvement.

Table 10. Importance–Performance Results of the Main Model Indicators

Indicator	Importance	Importance Rank	Performance	Performance Rank
Environmental indicators	0.269	3	71.760	1
Social indicators	0.561	2	70.737	3
Governance indicators	0.626	1	71.694	2

The IPMA results showed that governance indicators had the highest importance value, equal to 0.626. Environmental indicators had the highest performance value, equal to 71.760. Overall, the IPMA model showed that the importance and performance of the components were aligned, indicating that the model was standard and suitable for interpreting the determinants of integrated reporting quality.

4. Discussion and Conclusion

The findings of the present study confirmed that the integrated reporting quality model with an environmental, social, and governance approach is a multidimensional structure in which all three ESG dimensions play a significant role. In the qualitative and expert-validation phase, 35 indicators were identified and assessed through the fuzzy Delphi technique. The results of the three Delphi rounds showed that all indicators obtained defuzzified values higher than the acceptance threshold, and no indicator was removed. This finding indicates that experts considered environmental, social, and governance indicators to be essential components of integrated reporting quality. The convergence of expert opinions between the second and third rounds, along with the improvement in Kendall's coefficient of concordance, also confirmed that the expert panel reached an acceptable level of consensus. This result is consistent with the growing literature emphasizing that integrated reporting quality cannot be reduced to financial disclosure alone, but must be evaluated through a broader set of sustainability, governance, and accountability indicators [1, 16].

The results of the descriptive analysis showed that the mean scores of environmental, social, and governance indicators were all relatively high. Among these dimensions, environmental indicators had the highest mean score, suggesting that respondents perceived environmental reporting practices as more visible or more developed than the other dimensions. This result aligns with the increasing emphasis on climate-related disclosure, energy consumption, carbon reduction, waste management, and green investment in contemporary ESG reporting. Previous studies have similarly indicated that environmental disclosure has become a central component of corporate sustainability reporting and integrated reporting, especially because environmental performance is more directly connected to measurable operational indicators and regulatory expectations [3, 4]. The relatively high status of environmental indicators in the present study also supports the view that ESG-related innovation and environmental disclosure can improve the informational value of integrated reports when they are linked to long-term value creation [4].

The findings further showed that social indicators were also evaluated at a high level. This result highlights the importance of human capital, employee satisfaction, workforce diversity, occupational safety, training, social responsibility, and community participation in integrated reporting quality. The confirmation of social indicators suggests that stakeholders increasingly expect firms to report not only on financial and environmental outcomes but also on their social relationships and responsibilities. This finding is compatible with prior evidence that ESG performance contributes to improved reporting quality by expanding the scope of corporate accountability beyond traditional financial measures [5, 8]. It also supports the argument that high-quality integrated reporting must disclose how organizations manage their relationships with employees, society, and other stakeholder groups as part of sustainable value creation.

Governance indicators were also confirmed as a significant and essential dimension of the model. The structural model and the IPMA results showed that governance indicators had the highest importance score among the three ESG dimensions. This means that although environmental indicators showed the highest performance,

governance indicators had the strongest strategic priority in explaining integrated reporting quality. This finding is theoretically important because governance mechanisms determine the credibility, reliability, and accountability of both financial and non-financial disclosure. Board independence, audit committee activity, transparency, anti-corruption compliance, risk disclosure, shareholder responsiveness, and executive compensation structures directly affect whether stakeholders can trust the information reported by firms. This result is aligned with previous studies showing that board characteristics and corporate governance quality are strongly associated with integrated reporting quality and ESG disclosure credibility [6, 7].

The results of the measurement model showed that the research constructs had acceptable reliability and validity. Cronbach's alpha, composite reliability, AVE, and Rho values were all within acceptable ranges, confirming internal consistency, convergent validity, and construct reliability. Discriminant validity was also confirmed through the Fornell–Larcker and HTMT criteria. These results indicate that environmental, social, and governance indicators were empirically distinguishable but theoretically connected dimensions of integrated reporting quality. This supports the multidimensional nature of ESG-based integrated reporting and confirms that each dimension contributes unique explanatory value to the model. Previous studies have similarly emphasized that integrated reporting quality requires coherent measurement frameworks capable of capturing the interdependence of financial, environmental, social, and governance information [16, 18].

The structural model results showed that all three dimensions had positive and significant effects on integrated reporting quality. Environmental indicators had a positive and significant effect, confirming that firms with stronger environmental reporting practices are more likely to produce higher-quality integrated reports. This is consistent with studies showing that environmental and ESG disclosure innovation enhances ESG performance and strengthens the usefulness of integrated reports [3, 4]. The result also supports the argument that environmental reporting is no longer a symbolic component of corporate communication; rather, it is becoming a necessary part of accountability, risk disclosure, and strategic reporting. In this sense, environmental indicators improve integrated reporting quality by making ecological risks, resource efficiency, emissions, and sustainability investments more transparent and measurable.

The positive and significant effect of social indicators on integrated reporting quality indicates that social performance is also an important determinant of reporting quality. This finding means that firms can improve integrated reporting by providing clearer and more reliable information about employees, workplace conditions, diversity and inclusion, safety, social responsibility, and community engagement. The result corresponds with previous research showing that ESG activities and disclosure can improve financial reporting quality and strengthen stakeholders' understanding of corporate performance [8, 9]. It also suggests that social indicators help integrated reports reflect the broader relational and institutional environment in which firms operate. Therefore, integrated reporting quality depends not only on environmental metrics and governance arrangements but also on the extent to which companies disclose their social commitments and human-capital practices.

The positive and significant effect of governance indicators was particularly notable. Governance indicators showed a strong path coefficient and the highest importance in the IPMA results, indicating that governance is the most strategically influential dimension in the model. This finding is consistent with studies emphasizing the role of governance mechanisms in improving ESG disclosure quality, reducing opportunistic reporting, and strengthening the credibility of corporate reports [6, 7]. It also aligns with evidence that corporate governance can moderate the relationship between earnings management and ESG reporting, suggesting that strong governance structures reduce the risk of symbolic or manipulative disclosure [12]. Therefore, governance appears to function as both a direct component of integrated reporting quality and an enabling mechanism that supports the credibility of environmental and social disclosure.

The model's coefficient of determination showed that the ESG dimensions explained an acceptable proportion of the variance in integrated reporting quality. The GOF value also confirmed the overall adequacy of the model, while the Q^2 values demonstrated strong predictive power. These findings indicate that the proposed model is not only statistically valid but also practically meaningful. The strong predictive power of the model supports the use of ESG indicators as a reliable basis for evaluating integrated reporting quality. This result is compatible with prior studies showing that ESG reporting and integrated reporting quality influence investors' decision-making and market valuation [13, 14]. When integrated reports present credible ESG information,

they reduce information asymmetry and help investors assess long-term organizational value more accurately.

The IPMA results added an important practical interpretation to the findings. Governance indicators had the highest importance, while environmental indicators had the highest performance. This means that firms may already be performing relatively well in environmental disclosure, but governance indicators should receive greater managerial attention because of their stronger influence on integrated reporting quality. Social indicators occupied an intermediate position in importance but had the lowest performance among the three dimensions, indicating that social reporting may require further improvement. This finding is consistent with comparative research showing that integrated reporting is more useful than standalone ESG reporting when it connects sustainability information with governance, strategy, and value creation [15]. Therefore, the practical strength of integrated reporting lies not merely in disclosing ESG data, but in aligning that data with governance systems and strategic decision-making.

The results also support the importance of assurance, audit quality, and internal control mechanisms in ESG-based integrated reporting. Although the present model focused on ESG indicators, the significance of governance indicators implies that credible reporting requires strong monitoring and assurance structures. Prior studies have shown that audit quality affects ESG performance and financial reporting quality, while non-financial information assurance improves the reliability and usefulness of sustainability disclosure [10, 11]. Similarly, internal control systems can shape the relationship between ESG disclosure and firm performance by improving the reliability of reported information [17]. Accordingly, the confirmation of governance indicators in the present study suggests that future improvements in integrated reporting quality should be accompanied by stronger assurance, auditing, and internal governance mechanisms.

Overall, the findings confirm that integrated reporting quality is best understood as a comprehensive construct shaped by environmental responsibility, social accountability, and governance credibility. The empirical confirmation of all three ESG dimensions supports the conceptual argument that high-quality integrated reporting must combine sustainability information with financial and strategic information in a coherent reporting framework. The findings are consistent with previous studies that emphasize the role of ESG disclosure in improving financial reporting quality, corporate performance, market value, and stakeholder decision-making [9, 14, 18]. Therefore, the proposed model can contribute to the development of more systematic integrated reporting practices, particularly in emerging markets where ESG disclosure standards are still evolving and where firms require practical frameworks for improving reporting quality.

One limitation of this study is that the data were collected from a specific sample and institutional context; therefore, the generalizability of the results to other markets, industries, or regulatory environments should be approached with caution. Another limitation is that the study relied on questionnaire-based quantitative data after the expert-validation phase, which may be influenced by respondents' perceptions and self-reporting tendencies. In addition, although the fuzzy Delphi technique enabled expert consensus and the PLS-SEM approach provided statistical validation, the study did not examine longitudinal changes in integrated reporting quality over time.

Future research is suggested to test the proposed model in different industries, countries, and capital market environments to compare the stability and applicability of the ESG-based integrated reporting quality indicators. Longitudinal studies can also examine whether improvements in environmental, social, and governance indicators lead to sustained improvements in integrated reporting quality across reporting periods. Future studies may also incorporate moderating or mediating variables such as audit quality, ownership structure, internal control quality, firm size, digital reporting capability, and regulatory enforcement to provide a more detailed understanding of how integrated reporting quality develops.

From a practical perspective, managers should prioritize governance indicators because they showed the highest importance in explaining integrated reporting quality. Firms should strengthen board independence, audit committee effectiveness, anti-corruption systems, risk disclosure, shareholder responsiveness, and transparency in financial and non-financial reporting. At the same time, companies should maintain strong environmental performance and improve social reporting practices, particularly in relation to employee welfare, diversity, workplace safety, training, and social responsibility. Policymakers and regulators can also use the proposed indicators as a basis for designing clearer ESG reporting guidelines and improving the comparability and credibility of integrated reports.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

References

[1] S. P. Cruz, R. Dias, M. Varela, and R. Galvao, "Integrated Reporting: A Literature Review," *Revista de Gestao Social e Ambiental,* 2024, doi: 10.24857/rgsa.v18n4-134.

[2] R. Falahati, "The Importance and Position of Environmental, Social, and Governance Activities and Their Disclosure," presented at the Proceedings of the Fifteenth International Conference on Management, Accounting, and Economic Development, 2025. [Online]. Available: https://civilica.com/doc/2379705.

[3] L. Zhang, Y. Li, and H. Chen, "The Impact of ESG-Related Innovations on Corporate ESG Performance," *Sustainability Accounting, Management and Policy Journal,* vol. 15, no. 4, pp. 721-742, 2024.

[4] Y. Sun, C. Xu, R. Ding, and Y. Cao, "Does Innovation in Environmental, Social, and Governance Disclosures Pay Off in China? An Integrated Reporting Perspective," *Borsa Istanbul Review,* 2023.

[5] E. Navidi Abbaspour and S. A. Mousavi, "The Effect of Environmental, Social, and Governance Performance on Financial Reporting Quality," presented at the Proceedings of the First Regional Congress on Current Issues in Intelligent Accounting, Auditing, Financial, and Tax Systems: Challenges and Opportunities, Tabriz, 2024. [Online]. Available: https://civilica.com/doc/2182385.

[6] A. Abdelmonem and M. Eldib, "ESG Disclosure, Board Characteristics, and Integrated Reporting Quality: Evidence from Egypt," *Journal of Accounting in Emerging Economies,* vol. 14, no. 2, pp. 289-308, 2024.

[7] S. Kolak, S. Sarioglu, and F. Demir, "Corporate Governance and Integrated Reporting Quality with an ESG Approach," *Journal of Corporate Governance and Sustainability,* vol. 15, no. 1, pp. 45-68, 2025.

[8] H. Amiri, H. Shirbandi, and P. Akbari, "Investigating the Effect of Corporate Governance, Social, and Environmental Activities on the Financial Reporting Quality of Companies Listed on the Tehran Stock Exchange," presented at the Proceedings of the Twenty-Seventh National Conference on New Approaches in Management, Economics, and Accounting, Babol, 2025. [Online]. Available: https://civilica.com/doc/2294219.

[9] F. Ghaemi and M. R. Abbasi Estemal, "The Effect of Environmental, Social, and Governance Performance on Corporate Financial Performance with Emphasis on Financial Reporting Quality," presented at the Proceedings of the First National Conference on Professional Ethics and Social Responsibility in Management and Financial Sciences with an Islamic Approach, Urmia, 2025. [Online]. Available: https://civilica.com/doc/2441736.

[10] M. Sheikh Najafi and T. Azizzadeh, "The Effect of Audit Quality on Environmental, Social, and Governance Performance with Emphasis on Financial Reporting Quality," presented at the Proceedings of the First National Conference on Professional Ethics and Social Responsibility in Management and Financial Sciences with an Islamic Approach, Urmia, 2025. [Online]. Available: https://civilica.com/doc/2441689.

[11] M. B. Farooq, A. S. A. Azantouti, and R. Zaman, "Non-Financial Information Assurance: A Review of the Literature and Directions for Future Research," *Sustainability Accounting, Management and Policy Journal,* vol. 15, no. 1, pp. 48-84, 2024, doi: 10.1108/SAMPJ-03-2023-0166.

[12] M. Aghagol Aliabadi, M. Sirani, and R. Yarifard, "Examining the Relationship Between Earnings Management and Environmental, Social, and Governance (ESG) Reporting Considering the Moderating Role of Corporate Governance in Companies Listed on the Tehran Stock Exchange," presented at the Proceedings of the Twelfth International Conference on Management and Accounting of Iran, Hamedan, 2025. [Online]. Available: https://civilica.com/doc/2304708.

[13] M. Durak, S. Sarioglu, and H. Yilmaz, "Integrated Reporting Quality and Investors' Decision-Making," *International Journal of Accounting and Finance,* vol. 14, no. 3, pp. 112-130, 2024.

[14] R. Ahmed, S. Khan, and T. Patel, "ESG Scores and Market Value Enhancement: Evidence from Pakistan," *Journal of Sustainable Finance and Investment,* vol. 15, no. 2, pp. 198-216, 2025.

[15] J. Lee, H. Park, and S. Kim, "A Comparative Study of Integrated Versus Standalone ESG Reporting," *Journal of International Financial Management and Accounting,* vol. 35, no. 1, pp. 55-78, 2024.

[16] O. H. A. Nada and Z. Gyori, "Measuring the Integrated Reporting Quality in Europe: Balanced Scorecard 2024," *Journal of Financial Reporting and Accounting,* no. ahead-of-print, 2023.

[17] E. Nazarian Jazi and M. Sadeghi, "The Effect of Environmental, Social, and Governance Disclosure on Firm Performance Considering the Role of Internal Control in Companies Listed on the Tehran Stock Exchange," presented at the Proceedings of the Fourth International Conference on Management, Commerce, Economics, and Accounting, 2024. [Online]. Available: https://civilica.com/doc/2103014.

[18] A. Bahram and R. Hassan, "A Conceptual Framework for ESG Reporting Quality and Its Impact on Financial Reporting," *Asian Journal of Business Ethics,* vol. 14, no. 1, pp. 67-89, 2025.