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BOD characteristics and their impact on the link between ESG disclosure and integrated reporting disclosure quality: a study of Egyptian non-financial firms

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Abstract

This study examines the impact of environmental, social, and governance (ESG) disclosure on integrated reporting disclosure quality (IRDQ) and the moderating role of board of directors (BOD) characteristics. Prior research on ESG disclosure and IRDQ has been limited, especially in emerging economies like Egypt. Furthermore, the influence of BOD attributes has been underexplored. This study aims to address these gaps. A sample of 34 Egyptian non-financial companies under ESG disclosure mandates from 2015 to 2021 is analyzed using regression analysis. The results show a significant positive association between ESG disclosure and IRDQ. Furthermore, BOD gender diversity and size are found to positively moderate the ESG–IRDQ relationship. These findings highlight that appointing more women on boards and increasing board size can improve IRDQ when firms engage in ESG disclosure. However, the small sample size of ESG-mandated companies and inherent limitations in constructing disclosure indices constrain the generalizability of results. Overall, this study provides timely empirical evidence on ESG adoption within the unique Egyptian context and its influence on integrated reporting (IR). It contributes to literature by identifying specific BOD characteristics that enhance IRDQ. The results offer practical insights into how companies, regulators, and stakeholders can leverage board diversity and size as well as ESG disclosure to improve IRDQ.

Keywords Environmental, social, and governance (ESG), Integrated reporting disclosure quality (IRDQ), Board of directors (BOD)

JEL Classification M14

Introduction

Stakeholder theory posits that a company has responsibilities extending beyond its shareholders [1]. Corporate disclosure and transparency play vital roles in maintaining accountable relationships with stakeholders, according to this theory [2]. In the context of the global

shift from the fourth to the fifth industrial revolution, with a focus on human–machine integration, Egypt has embarked on a vision for 2030, aligning its trajectory with the fourth industrial revolution. These transformations have significantly impacted the accounting profession, resulting in ongoing developments in accounting disclosure to reflect the dynamic global landscape. It is crucial for organizations nowadays to realize the importance of innovation management to improve sustainability performance [3] and to realize stakeholder perceptions toward corporate social responsibility (CSR) activities [4, 5]; thus, CSR is used to reduce agency problems between stakeholders and managers [6]. Accounting disclosure

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now serves as a pivotal means of communicating a company's ethical and social conduct, offering both financial and non-financial information to stakeholders [7–9].

Historical data alone are insufficient to portray the evolving economic landscape comprehensively [10]. Non-financial disclosure is indispensable for capturing the holistic performance of an organization, with environmental, social, and governance (ESG) performance increasingly aligning with global norms and stakeholders' expectations [11]. ESG disclosure has become instrumental for companies in communicating their sustainability performance to stakeholders [8, 9]. Yet, research on ESG disclosure practices in emerging economies, especially their impact on integrated reporting disclosure quality (IRDQ), remains limited [12]. We want to fill in this gap by looking into the connection between ESG disclosure and the quality of integrated reporting (IR) for Egyptian non-financial companies. We will focus on how the characteristics of the boards of directors (BOD) affect this relationship. The central study questions are: What is the impact of ESG disclosure on IRDQ, and how do BOD characteristics moderate this relationship? This study aims to provide empirical evidence on ESG adoption and its influence on transparent IR in the unique context of the Egyptian market.

Prior research has predominantly examined developed economies, but relatively less attention has been given to developing economies where the standards for non-financial disclosure are still evolving [13]. Furthermore, the role of BOD characteristics in influencing sustainability reporting remains underexplored, especially within the Middle East and North Africa region [14]. This study aims to bridge these gaps by offering timely insights from an emerging economy and underscoring the significance of BOD characteristics in shaping IR practices.

The heightened awareness of environmental disasters, such as pollution, deforestation, global warming, and climate change, as well as natural and biological crises like tsunamis, earthquakes, and pandemics, has amplified the demand for high-quality disclosure. Stakeholders are increasingly recognizing the significance of this information, particularly concerning their investment decisions [15]. While this information was traditionally incorporated into annual reports, CSR reports, environmental and sustainability reports, and company websites, ESG factors have now become crucial in evaluating a company's financial viability [16]. The COVID-19 pandemic has revealed the role of CSR in handling adverse economic effects and their impact on firm performance [4]; it is believed that CSR increases firm value by considering the equality of stakeholders' rights [6]. CSR practices are important for enhancing green environmental

responsibility and green innovations to achieve higher sustainable business performance [5].

ESG disclosure is gaining attention in the business world as it encompasses comprehensive information that companies provide about their ESG performance and evaluates their sustainability practices. Companies that integrate these principles into their operations are likely to benefit from improved public perception, enhanced customer loyalty, and a positive workplace culture. Research has demonstrated that companies with strong ESG disclosure often exhibit high corporate financial performance and valuation multiples, reduced volatility, and lower costs of capital. However, the intricate relationship between ESG disclosure and financial performance remains incompletely understood [17], Duque-Grisales and Aguilera [18]. As articulated by Ziolo et al. [19], a financial system that neglects social and environmental factors is unsustainable and hinders the effective financing of sustainable development goals aimed at minimizing ESG risks. ESG poses a challenge to financial institutions, especially banks, and since 1992, the United Nations Environmental Program Financial Initiative has recommended ESG integration, considering environmental risks alongside reputational, ethical, and prestige risks.

ESG transcends CSR, encompassing ESG aspects in addition to social considerations [20]. ESG includes environmental factors like water, climate, and energy; social factors like human rights and gender balance; and governance factors such as investor protection and ethics [16]. ESG disclosure enhances non-financial transparency [21, 22], reputation [23], and financial performance [24], ultimately improving competitiveness and the relationships with financial capital providers [25], i.e., stakeholders and market reputation [26]. Farooque et al. [16] clarified the complex endogenous relationship between ESG disclosure, board diversity, and ownership variables after the 2011 Egyptian revolution. Albitar et al. [20] state that the United Nations Sustainable Stock Exchange (SSE) expects all US firms to disclose ESG information.

ESG disclosure has become an integral component of financial reporting as investors and stakeholders demand more information regarding a company's ESG performance. Investors and stakeholders increasingly recognize these factors as critical indicators of a company's performance and risk. Encouraging companies to adopt these standards would provide investors and stakeholders with consistent and comparable ESG information. However, the lack of standardization and comparability in ESG disclosure makes it challenging for investors to evaluate a company's true performance and compare it with others in the same industry. To address this challenge, various

organizations have developed frameworks and guidelines to facilitate consistent and comparable reporting.

Investors are seeking information on how companies manage their environmental and social impacts, holding them accountable for these impacts [27]. IR offers a platform for companies to communicate their sustainability performance and objectives (The International Integrated Reporting Council (IIRC) [28]), showcasing their contributions to the broader sustainability agenda. IR has become indispensable for merging financial and non-financial disclosures, addressing the limitations of corporate reporting [11]. IR represents a single report that enables companies to integrate financial and non-financial information in a holistic, sustainable manner, incorporating details on ESG performance. The IIRC defines IR as "a concise communication about how an organization's strategy, governance, performance, and prospects, in the context of its external environment, lead to the creation of value over the short, medium, and long term" (IIRC [28], p. 8).

In the 1970s, the Securities and Exchange Commission (SEC) initiated the IR concept [10]. The IIRC has formulated the IR guidelines and issued an International Integrated Reporting Framework (IIRF) comprising seven guidelines and eight content elements [11, 29]. The IR components include six forms of capital: human, intellectual, natural, relationship, manufacturing, and financial, facilitating value creation through the business model and organizational strategy [10]. IR can replace other reports like social and environmental responsibility reports [30], reducing costs and time while maximizing market returns [31] and value [32]. One key aspect of IR is the inclusion of ESG information, representing a holistic corporate report that integrates financial and non-financial information.

IR's significance lies in its ability to provide stakeholders with a more comprehensive view of an organization's activities, encompassing financial performance, social and environmental impacts, and governance practices. Companies adopting IR may benefit by aligning their business strategies with long-term goals, enhancing value creation [33]. ESG's impact on IR on the Egyptian Stock Exchange (EGX) includes a heightened emphasis on sustainability [34]. It also enhances transparency and accountability, fostering trust with investors and stakeholders and ultimately contributing to improved risk management and decision-making.

IR has various impacts on stakeholders, contingent on the specific information disclosed and the context of the presentation. For investors, IR offers a comprehensive view of corporate financial and non-financial performance, potentially influencing investment decisions. Consumers gain insights into social and environmental

impacts affecting their purchasing choices. Employees have access to information on governance practices and stakeholder engagement, which can impact job satisfaction and morale. Additionally, IR can influence other stakeholders, including regulators, non-governmental organizations (NGOs), and local communities, by providing information on an organization's activities and impacts in these domains [35].

While IR promises substantial benefits, it also presents challenges and limitations. Data availability and reliability are central challenges in integrating financial and non-financial information. Standardization is another hurdle, as universal guidelines for IR are lacking, leading to inconsistency in reporting. Preparing an integrated report can be resource-intensive, and companies operating in the Egyptian market may encounter unique obstacles when adopting IR, such as challenges in measuring and reporting specific ESG indicators or facing opposition from stakeholders. Investigating these obstacles and identifying potential solutions is imperative for a comprehensive understanding of ESG's impact on IR and for identifying potential barriers or facilitators to IR adoption in Egypt [10, 25, 36].

Mandates for IR adoption vary across countries, with developing nations often lacking such requirements due to limited resources [11]. The application of IR also varies from country to country due to a lack of compliance frameworks [37]. While most literature concentrates on the level of IR disclosure, the determinants and factors of IR have received less attention. Thus, exploring the gap in corporate disclosure among countries is essential to enhancing the quantity, quality, credibility, accountability, and comprehensiveness of disclosure [38, 39].

In recent years, companies have recognized the importance of social and governance (ESG) disclosure as a way to communicate their sustainability efforts to stakeholders [8, 9]. However, there is research on how ESG disclosure practices impact IRDQ in emerging economies [10, 11]. IR allows companies to present ESG information in a cohesive manner. However, its adoption varies across countries due to the absence of frameworks for compliance [11, 37]. To bridge this research gap, this study focuses on examining the relationship between ESG disclosure and IRDQ in Egypt. Additionally, it investigates how BOD characteristics moderate this association to provide evidence on the adoption of ESG practices and its impact on IR. The findings from this study will offer insights for enhancing transparency and disclosure practices that prioritize stakeholders' interests [25, 27]. Stock exchange markets are expected to continue experiencing growth in the adoption of IR and the incorporation of ESG factors [40]. Rising investor demand for corporate sustainability information and the increasing recognition

of ESG's importance in the investment process drive this trend. As more companies embrace IR, it is expected that it will become the norm in stock exchange markets, promoting a transition toward a more sustainable and responsible business environment [33].

This study builds upon a growing body of recent research examining the relationship between ESG disclosure, IR, and financial performance outcomes. Sun et al. [41] analysis of Chinese firms finds that those with higher ESG disclosure quality and more innovative IR practices exhibited superior return on assets, suggesting financial incentives behind sustainability transparency. Similarly, Hichri [42] shows that for European ESG firms, IR, and audit quality were positively associated with value relevance, again highlighting potential performance upsides.

However, as Singhanian and Saini [43] discuss, institutional support for mandatory ESG disclosures in emerging economies continues to lag developed nations. Thus, while strategic leaders in countries like Egypt acknowledge the merits of IR, practical adoption remains contingent on internal governance capacities and external regulatory directives. Bhatia et al. [44] study reveals key firm characteristics like ownership, profitability, and board independence that shape IR adoption in developing country contexts.

Roberts et al. [45] outline how integrated risk disclosures must continuously evolve to account for unexpected crises, as underscored by the recent pandemic. As Egyptian companies balance aspirations for transparency with pragmatic constraints, policymakers and business leaders alike need empirically grounded insights to inform sustainable, stakeholder-centric disclosure practices. By situating this study's inquiry within current research, we aim to extend timely evidence on how ESG disclosure and IR interact to impact performance.

The primary objective of this study is to explore the influence of ESG disclosure on the quality of IR in non-financial firms in Egypt. To address this overarching goal, we have formulated specific research questions: Firstly, we examine what is the impact of the extent of ESG disclosure on IRDQ in Egyptian non-financial firms (RQ1)? And secondly, we investigate how would board of director characteristics, specifically gender diversity and size, moderate the relationship between ESG disclosure and IRDQ? (RQ2).

The goal of this study is to give some background on the current state of ESG disclosure in the Egyptian market. It will do this by looking at how widespread IR is and whether there are any programs or rules that require or encourage ESG reporting. It investigates how BOD characteristics moderate the relationship between ESG disclosure and IRDQ. The study has the potential to contribute significantly to the existing knowledge base on

ESG reporting and offer insights into the unique context of the Egyptian market. Limited research has examined the impact of ESG disclosure on IRDQ in Egypt. This study strives to address this gap by providing empirical evidence on the relationship between ESG disclosure and IR, as well as the moderating role of BOD characteristics. The findings will offer practical insights for improving stakeholder-oriented transparency and disclosure practices.

The study emphasizes three key theoretical advances: Firstly, the study contributes to the literature by offering timely empirical evidence on ESG adoption and reporting quality within the relatively understudied context of the Egyptian market [10, 25]. While research in emerging economies has been limited, prior studies have predominantly focused on developed economies. This study helps address this geographic literature gap. Secondly, the study underscores the theoretical importance of BOD for enhancing transparent sustainability disclosures [11, 27]. By highlighting board gender diversity as a moderator influencing IRDQ, we extend our theoretical understanding of how board composition strategies can strengthen ESG engagement. Finally, through its findings and recommendations, our study advances stakeholder theory in relation to sustainability reporting. We provide insights into how companies can leverage ESG disclosure and board diversity to maintain accountability to stakeholders through IR [8, 9]. To sum up, the study adds to stakeholder theory about ESG disclosure and IR by using new data from an emerging economy at the right time and focusing on the traits of boards of directors.

The relevance of examining this issue in the Egyptian context is underscored by the country's ongoing economic reforms and commitment to a sustainability vision aligned with global industrial transformations. As Egypt responds to stakeholder expectations for ethical behavior and non-financial transparency, insights from this research become imperative. Moreover, the study contributes to a broader understanding of ESG adoption by extending empirical evidence and practical implications from an emerging Middle Eastern economy. Notably, by spotlighting the moderating impact of specific BOD characteristics, such as gender diversity, this research provides valuable theoretical and practical insights into how corporate governance strategies can enhance the connection between sustainability disclosure and transparent IR. In conclusion, this study's focus is on the Egyptian context to explore the under-examined moderating mechanisms, and their contribution to stakeholder theory regarding ESG disclosure. Accordingly; this study positions a significant addition to existing literature, with potential implications for informing regulators and business leaders in Egypt on improving IR practices.

The study comprises six sections. The initial section focuses on exploring the basis of the research variables, while the second part delves into conducting a literature review and establishing hypotheses. Following that, we will provide an explanation of the methodology employed in this study. The subsequent section will present the findings obtained from the investigation. Lastly, sections five and six are dedicated to engaging in a discussion and presenting a summary, respectively.

Theories support IR/ESG and the role of corporate governance (CG) in their development

IR is supported by various accounting theories, such as stakeholder, agency, institutional, legitimacy, and resource-based theories. These theories are overlapped together [46], and there is no single theory that explains IR, thus, Baalouch et al. [47] recommend a framework for multi-theories to be used. While the stakeholder theory reflects the environmental and sustainability perspectives, the agency theory reflects the governance perspective [15, 41].

Stakeholder theory uses IR to address varied stakeholder needs. It tackles the growing need for managers to focus on non-financial external issues, including ESG, resource scarcity, and market and economic changes. The key is connecting these external factors to non-financial internal ones like organizational strategy and future planning. Integration enables a complete long-term company assessment. IR meets stakeholders' expectations by integrating external facts and internal strategies, providing a holistic view of a company's future sustainability and success, according to stakeholder theory [43].

The achievement of the organizational objectives is at the stakeholder's core, not just profitability or maximizing the stakeholder's wealth. Stakeholder theory links industry classification and company size to CSR disclosures [48]. The stakeholder theory thinks about all stakeholders without any discrimination, on the other side, the shareholder theory [11] is concerned with the owners' perspective and their value-adding from a contractual relationship, and it decides the priority for the owners through the financial statements. The CSR represents the shareholder theory as a reflection of the traditional management system.

Ulupui et al. [49] define the stakeholder theory as a theory that "postulates that an organization or company should not only pay attention to the proprietors of the firm and profitability but also take care of society, the environment, and the economy in which it functions." IR came as a lifeline for the sustainability report's weaknesses. Stakeholders who are the main organizational survivors [50] think that IR satisfies their needs as they want more disclosure about corporate long-term

performance and value creation, and they want to make decisions based on both long- and short-term organizational performance [29, 51]. Larger firms have higher environmental and CSR disclosures due to their better structure and the pressure they face from both stakeholders and governmental regulatory bodies [52, 53]. In addition, the industry classification is critical to ESG disclosure, and the more polluted industries, such as consumer goods, gas, and oil, face much more pressure to increase their transparency.

Under the stakeholder theory, it is crucial to investigate the effect of BOD characteristics such as diversity, chief executive officer (CEO) duality, and size on ESG disclosure. Literature found that companies with a larger BOD are engaged more in CSR activities and thus have more disclosure regarding this information [54], and [55]. Literature supports the idea that the more diversity the board has, the more disclosure it has [56]. It is found that the more females included in the board, the more sociable and responsible the company is [57]. In addition, females are found to be more sensitive about social issues [58] and more active checkers for executives [59]. Both board independence and female existence increase CSR disclosure [60–65]. Stakeholder theory supports the relation between CEO duality and CSR disclosure; Khan et al. [54] find that powerful CEOs have more substantial control over the company and accordingly more CSR disclosures.

The shareholder theory led to another theory, which is the agency theory, which assumes that the administration and management of any organization are working according to the shareholders' interests [11]. It is assumed that shareholders have concerns regarding ESG disclosure and asymmetrical information. Stakeholder-agency theory constitutes the relation between stakeholders and managers [66–68], and it is considered by Tauringana and Chithambo [69], p. 427 as "a nexus of contracts between resource holders and seekers." The main conflict between managers and stakeholders is regarding allocating resources and environmental issues. In the same vein is the signaling theory, which assumes that managers and shareholders cannot reach the same information [70]. IR is supposed to decrease the asymmetry of information and thus decrease the information gap between managers and stakeholders.

The agency theory supports the notion that CEO compensation affects CSR disclosure; Hong et al. [71] find that executive compensation enhances the CEO's involvement in more social activities in alignment with shareholders' interests. Another theory that supports IR is the institutional theory, which cares about the stakeholders' concerns and considers the social and political forces that affect the firm's value. Institutional theory reflects the

organizational behavior to its surrounding environment within the value creation supply chain, and then, the IR connects the organization with its society [29].

IR is supposed to follow the legitimacy theory in connecting legitimacy to organizational activities [72] by linking financial and ESG disclosure for more transparency and accountability. Legitimacy is concerned with the compliance of both social norms and formal laws, and thus, legitimation and institutional theory are interrelated [16]. Accordingly, companies that have ESG disclosures would gain legitimacy from their stakeholders [16]. Finally, the resource-based view theory allows companies to develop their strategy by improving their environmental and social conditions. This theory is concerned with board diversity and its impact on internal resource allocation [16].

Literature review and hypotheses development

ESG and IR

There is an acceptable number of studies that investigated IR literature such as Velte and Stawinoga [30] who examine the importance of IR especially after the financial crisis 2008–2009 through examining 44 IR published empirical studies after the adoption of IIRC IR framework in 2013. They show how IRDQ is enhanced by certain factors such as the market reactions. Vitolla et al. [73] introduce an IR classification framework through a systematic review for the IR literature and reveal IR problems from practice, lack of sustainability consistent framework and principles, conflict of interest, and the absence of IR focus. On the other hand, Landau et al. [74] study the value relevance of IR in stock index of European stocks (STOXX Europe) 50 companies from 2010 to 2016 and found a negative impact on market value, suggesting an increase in IRDQ would enhance market value.

Albitar et al. [20], who explore the relationship between ESG disclosure and financial performance (FP) before and after IR in financial times stock exchange (FTSE) 350 between 2009 and 2018, illustrate a positive relationship between ESG disclosure and FP both before and after IR implementation, with voluntary disclosure leading to better performance. They also identify moderation effects for corporate governance (CG) mechanisms, including gender diversity, board size, and ownership concentration on the ESG disclosure-FP nexus.

Atkins and Maroun [75] explore the initial IR and ESG mandatory responses of South African investment industry companies listed on the Johannesburg Stock Exchange (JSE) through interviews with 20 experts. The results show that the new reporting framework improves traditional reporting in terms of understanding sustainability and reporting non-financial information. From the studies that supports the same results are Bernardi and

Stark [76], who study the effect of ESG mediation on IR effectiveness in South Africa for the period 2008–2012. It shows that the ESG disclosure level affects the level of IR within the context that IR is mandatory in South Africa.

Conway [77] study shows the impact of the 2011 mandatory IR on FP, risk, and institutional shareholding in South American listed companies and investigates the effect of IRDQ on ESG disclosure. Conway [77] finds that since mandatory reporting, the IRDQ increased, leading to an increase in ESG disclosure, followed by a decrease in FP and risk and higher institutional shareholding. He then compares the results with those of two African countries, i.e., Egypt and Nigeria, which have not adopted IR between 2006 and 2015, in 90 firms on the JSE, 40 on the Nigerian Stock Exchange (NGSE), and 27 on the EGX, and concluded that the two African countries are not inappropriate due to dissimilar general market behaviors. Caglio et al. [78] study the IR benefits of integrating ESG information with financial information in a single report. They investigate the IR mandatory effects since 2010 in South African listed companies. They find that IR readability is associated with higher stock liquidity and market valuation. The results find that shareholders are interested in the ESG dimensions of FP.

Hoang [79] studies IR and integrated thinking (InTh) with integrating ESG and decreasing risk, and he concluded that adopting IR provides the shareholders with better ESG disclosure. Mervelskemper and Streit [80] examine the impact of ESG reporting on its value in the capital market by analyzing the IR. The results find that ESG is valued more when the company publishes an ESG report. They find that IR has a higher impact on ESG and CG performance than stand-alone reports.

Umoren et al. [81] study the ESG practices of 40 Nigerian listed companies in 2013 and 2014 to determine the need for IR. The results show that ESG disclosure was 53%, and it is affected by the type of auditor, but not by the company size or profitability. They find that IR is required to integrate the ESG disclosure with financial information in one report. According to the previously mentioned literature, this study is willing to test the following hypothesis:

H_1 There is a significant positive relationship between ESG disclosure and IRDQ

ESG/IR and BOD characteristics

The relation between BOD characteristics and FP is extremely studied in the literature in a huge number, such as Siagian and Tresnaningsih [82], who show that BOD independence increases financial disclosure and financial performance in Malaysian companies, following the same line as Songini et al. [83] and Elshandidy et al. [84], who

agree to find that there is a positive relationship between the number of independent directors and both voluntary and mandatory disclosure.

From the studies linked between IR and BOD by Chouaibi et al. [12] study, which examines the relationship between BOD characteristics and IRDQ from the annual reports of 253 European listed companies selected from the ESG index from 2010 to 2019, the results show that BOD size, independence, and diversity have a positive and significant effect on the IRDQ, as well as that a non-executive independent chairman has a positive and significant impact on the IRDQ.

Fayad et al. [85] illustrate BOD characteristics, including expertise, gender diversity, size, the presence of executives, and activity in IRDQ in 64 Malaysian companies from 2017 to 2020, with a total of 173 IR reports. They find that gender diversity, larger BOD sizes, and more non-executives lead to a higher IRDQ; however, board meetings have a negative impact on IRDQ, and professional expertise has no effect. The research also explores the impact of executive and non-executive BOD composition on ESG disclosure and finds that it reduces agency costs and increases IRDQ; thus, companies with more non-executive directors have better IR quality. Lastly, they believe that having financial expertise within the BOD is crucial for enhancing the IRDQ level.

In the same vein, Fayad et al. [85], Gyapong et al. [86], Ghafran and O'Sullivan [87], Agnihotri et al. [88], and Vafeas [89] declare that active BOD, or what is known as BOD meeting frequency, may be an indicator of more efficiency in monitoring disclosure, more meetings request more information and improve management supervision functions. Fayad et al. [85] and Vitolla et al. [73] conclude that the greater number of BOD meetings results in more reliable IR.

However, the relationship between ESG disclosure and IR is still complex and may vary depending on the specific context and circumstances of an organization. The impact of ESG disclosure on IR may be moderated by factors such as the quality of the ESG disclosure, the level of external assurance provided, or the level of stakeholder engagement.

Raimo et al. [15] illustrate that there is no ideal BOD size to represent more monitoring or supervision activities. They show that the larger the BOD is, the more efficient the BOD becomes in carrying out its duties. A larger BOD represents more members with expertise and relations, different interests, and wider environmental information dissemination in its IR [85]. Raimo et al. [15], and Meen and Stallum [90] present that under the stakeholder theory, the monitoring skills for the BOD increase as the number of independent members increases. The monitoring skills are more

for non-financial skills such as CSR, ESG, and sustainable aspects because the independent member is not involved in daily operations, and they are not facing competitive pressures.

Albitar et al. [20] show that under agency theory, the size of the BOD represents different views and is considered representative of different backgrounds and experiences. Albitar et al. [20] believe that the large number of BOD members increases monitoring and controlling, which serves the shareholders' interests, and ESG disclosure increases as well. Husted and de Sousa-Filho [17], Javaid Lone et al. [63], and Allegrini and Greco [91] present that there is a significant positive impact of BOD size on ESG disclosure; however, Orazalin [92] and Gianararakis et al. [93] do not find any relation between them.

The impact of BOD size on environmental disclosure level has conflicting results; some studies [44, 64, 66, 69, 94] find a positive relationship and some others find a negative impact (Prado-Lorenzo and García-Sánchez [95]), and other sets of studies find no relationship [96, 97].

Farooque et al. [16] compare two periods: the pre-revolution (2007–2011) for a total of 160 observations and the post-revolution (2012–2014) for a total of 99 observations, to examine the impact of both BOD diversity and ownership structure on ESG disclosure in firms. They illustrate a significant positive impact in the pre-revolution period only.

Manita et al. [98] state that BOD diversity is an ethical requirement for any company to succeed, and they investigated the relationship between ESG score as a proxy for CSR and BOD diversity in 379 firms that made up the Standard & Poor's (S&P) 500 Index from 2010 to 2015. They find an insignificant relationship between them. Farooque et al. [16] clarified the role of BOD diversity in improving performance, economic and financial outcomes, firm value, and the decision-making process. Farooque et al. [16] declare that diversity enhances oversight and monitoring and increases BOD effectiveness, and they recommend studying its impact on ESG and CSR reporting. Wasiuzzaman and Wan Mohammad [99] find a positive effect of BOD diversity on the ESG report, as well as Frias-Aceituno et al. [55] find a positive impact of BOD diversity on IR.

However, Ahmad et al. [100] find an insignificant impact of BOD diversity on CSR. I believe that women's presence in the BOD increases disclosure transparency and the social responsibilities carried by the company. Females are more participative, socially constructive, and communicative [101]. Fayad et al. [85] refer to the woman's values that improve IR quality through voluntary and mandatory disclosure. Raimo et al. [15] declare that women focus on life quality and sustainability.

Rao et al. [64] examine the effect of CG on the level of environmental information in 96 Australian companies listed on the Australian Stock Exchange, and they found a positive impact for BOD gender diversity, independence, size, and institutional ownership on the environmental disclosure level. In the same vein, Trireksani and Djajadikerta [94] measured the environmental disclosure of mining companies listed on the Indonesia Stock Exchange and concluded that there is a significant positive impact of the BOD size on environmental disclosure and an insignificant effect on both board independence and diversity. Tauringana and Chithambo [69] examine the environmental disclosure of 215 companies listed on the London Stock Exchange and the impact of director ownership, ownership concentration, and BOD characteristics on it. They find that board size has a positive impact, director ownership and ownership concentration have a negative impact, and board independence has no impact. Giannarakis et al. [102] use Bloomberg ESG disclosure to measure environmental disclosure, and they found that BOD independence, independent director presence, and youngest director age have a positive effect on environmental transparency.

Ezhilarasi and Kabra [96] analyze the annual reports of highly polluted Indian companies searching for environmental disclosure information, and they could not find any relation between board size, domestic institutional ownership, and CEO duality on environmental transparency, but they found a significant relationship between environmental disclosure and foreign institutional ownership. Baalouch et al. [47] examine standalone annual reports, and they find a positive impact for both the environmental audit and BOD gender diversity on environmental disclosure quality, and they find a negative effect of board independence on environmental disclosure and no effect for the existence of an environmental committee.

Gerged [66] examined the environmental disclosure in the Jordanian companies' annual reports, and they found that BOD independence, size, foreign ownership, and CEO duality have a positive impact on environmental information disclosure, while institutional ownership, managerial ownership, and ownership concentration have a negative impact. Raimo et al. [15] examine the impact of CG mechanisms on IR environmental disclosure through a control analysis of 30 items to measure the environmental information disclosure level of 129 international firms. They find a positive impact on board gender diversity, board size, and CSR committee existence on the level of environmental disclosure. They do not find any relation to board independence on the ESG disclosure level.

Other studies, such as Prado-Lorenzo and García-Sánchez [95], Peters and Romi [103], and Liao et al. [104], use what is known as the Carbon Disclosure Project to measure environmental disclosure. Prado-Lorenzo and García-Sánchez find a negative impact for both the annual number of board meetings and the board size and a positive impact for CEO duality on environmental disclosure. In addition, they do not find any effect on board independence or gender diversity. Peters and Romi [103] find that the presence of both the sustainability officer and the environmental committee has a positive impact on environmental transparency. Liao et al. [104] find a positive effect of BOD independence, environmental committee, and BOD gender diversity on environmental transparency.

Several gaps in the existing literature motivate the current study. The current body of literature on ESG disclosure practices and implications in developing economies is somewhat limited, mostly concentrating on established markets [10, 25]. Furthermore, there is a lack of comprehensive research on the impact of board diversity on sustainability reporting, particularly in the Middle East and North Africa [11, 27]. Furthermore, there is a limited body of research that has investigated the correlation between ESG disclosure and the quality of IR, specifically within the Egyptian context. This is evident in the studies conducted by Khatib et al. [8] and Zamil et al. [9]. Furthermore, it is important to conduct an inquiry into the possible hurdles and corresponding solutions pertaining to the adoption of IR in Egypt, as highlighted by Ahmed et al. [37]. A pressing need exists for research aimed at improving the consistency and comparability of ESG disclosure to facilitate more informed decision-making by stakeholders, as argued by Albitar et al. [20]. The objective of this research is to fill these knowledge gaps by presenting current empirical data from Egypt on the adoption of ESG policies. Specifically, this study focuses on the importance of board diversity and intends to provide recommendations for enhancing transparent sustainability reporting standards.

Overall, the literature concluded that there is a positive association between ESG disclosure and IR, but the extent of this relationship may be influenced by BOD characteristics. Further research is needed to better understand the complex relationship between these variables and to identify the specific factors that may contribute to the relationship between ESG disclosure, IRDQ and BOD characteristics. Accordingly, the research hypothesized the following main and sub hypotheses:

H₂ BOD characteristics are moderating the relationship between ESG disclosure and IRDQ.

H2-a There is a significant positive relationship between ESG disclosure and IRDQ with BOD size as a moderator.

H2-b There is a significant positive relationship between ESG disclosure and IRDQ with BOD meetings as a moderator.

H2-c There is a significant positive relationship between ESG disclosure and IRDQ with gender diversity as a moderator.

Data and methodology

Sample and data collection

The primary objective of this study is to investigate the correlation between the disclosure of ESG factors and the quality of IR. Additionally, this study seeks to explore the potential moderating influence of BOD characteristics on this connection. The selection of previous studies has used correlation and regression methodologies to examine comparable study inquiries. Regression analysis was selected because it effectively simulates the interrelationships among ESG disclosure, IRDQ, board diversity,

and control variables simultaneously. Previous scholarly investigations extensively used this methodology to examine analogous research inquiries. [10, 36, 105]. The present work utilizes regression analysis to examine the predicted relationships in accordance with recognized methodological precedent.

Non-financial enterprises publicly listed on EGX and included in the ESG index constitute the study population. The data collection period encompasses the years 2015–2021, which marks the start of the implementation of Sustainable Development Goals (SDGs). We obtained the data by gathering information from the published financial statements and websites of publicly traded companies, as well as reputable online sources like Mubasher.info, Investing.com, and Reuters.com. The exclusion of companies within the financial industry was implemented due to their specialized nature. The final sample comprises 34 non-financial companies spanning across 12 sectors, resulting in a total of 238 observations per firm-year, as shown in Fig. 1.

In order to assess the extent of ESG disclosure, a comprehensive index was developed by conducting a content analysis of sustainability reports using the guidelines provided by the Global Reporting Initiative (GRI). The assessment of the IRDQ index was based on a disclosure checklist that was weighted to account for the comprehensiveness of the report. We determined the measure of

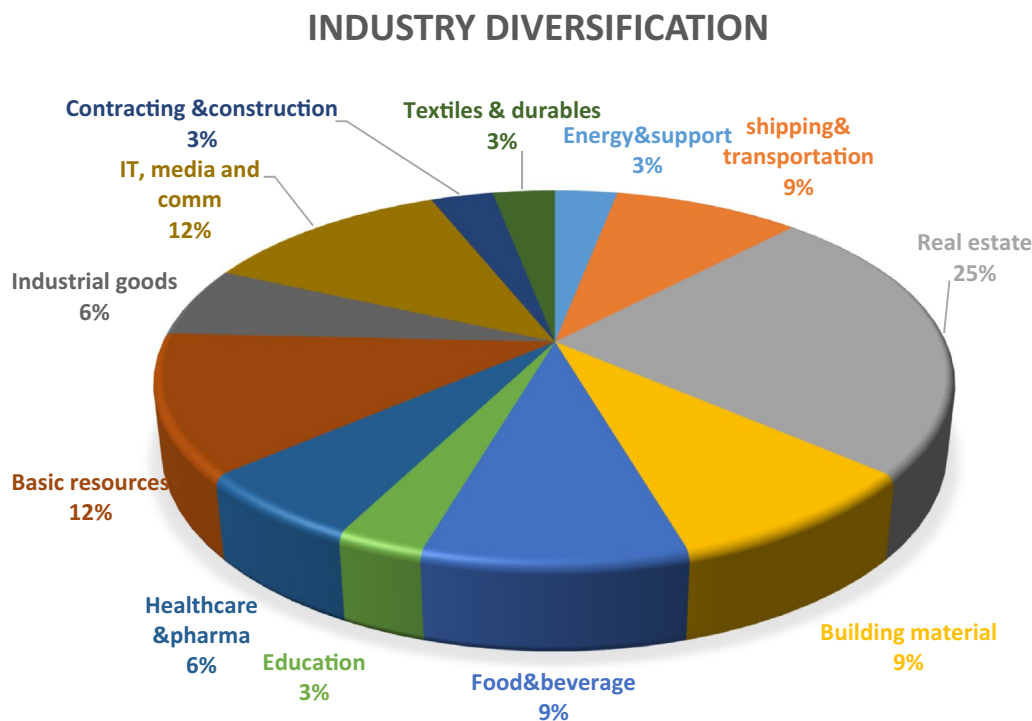


Fig. 1 Sample industry diversification

board gender diversity by calculating the proportion of female directors. The control variables included factors such as business size, leverage, profitability, and industry.

We assess the adequacy of the models by evaluating the goodness of fit using R-squared values. The regression model used an interaction term between ESG disclosure and board diversity to examine the potential moderating effect. When the interaction term has statistical significance, we can infer the presence of a moderating influence.

This methodology section aims to provide a clear and justified account of the quantitative approach employed to address the research questions concerning ESG disclosure, IR, and board diversity. We will achieve this by providing information on the sample, variables, statistical methods, and diagnostic tests.

Study variables and research models

The selection of variables for the regression model was conducted with careful consideration, taking into account theoretical frameworks and previous empirical studies that have examined the many elements that

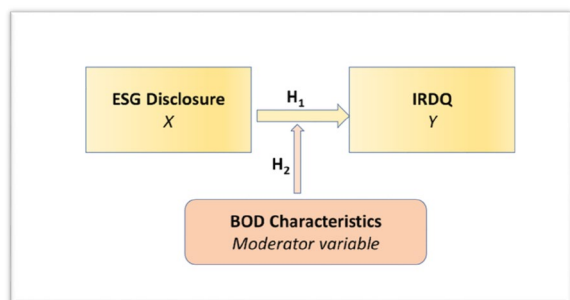


Fig. 2 Research framework: it shows BOD characteristics moderating role on the impact of ESG disclosure on IRDQ

influence sustainability disclosures and reporting quality. The selection of the independent variable, ESG disclosure, was based on the study’s objective of investigating its association with the quality of IR. The dependent variable used for evaluating transparency outcomes is the quality of IR.

The inclusion of BOD characteristics as a moderator variable was justified by conceptual reasons suggesting that attitudes toward diversity might have an impact on the adoption and implementation of sustainability initiatives. Control variables such as company size, profitability, leverage, and industry are included in the analysis due to previous research indicating their propensity to influence the relationships under investigation [10, 36, 105]. Figure 2 illustrates the BOD characteristics moderating role on the impact of ESG disclosure on IRDQ.

To provide a concise overview, the regression model incorporates explanatory variables that possess both theoretical and empirical significance in connection to the study goals. This is done to systematically examine and evaluate the predicted correlations. The rationale for including each indicator is substantiated by established theories and research that affirm its impact on the quality of ESG disclosure and/or IR. Table 1 illustrates the research models and the variables and their measures.

To test the hypothesis (H₁) the first regression model is used:

$$ESG_{i,t} = \alpha + \beta_1 IRDQ_{i,t} + \beta_2 FS_{i,t} + \beta_3 Fg_{i,t} + \beta_4 Prt_{i,t} + \beta_5 Lev_{i,t} + e \tag{1}$$

To test the hypothesis (H₂) the second regression model is used:

Table 1 Research variables and measures

Variables	Measurements	References	
Independent variable			
ESGD	The S&P/EGX ESG index	El-Deeb et al. [36]	
Dependent variable			
IRDQ	IR index	El-Deeb [10]	
Moderating variables			
BOD characteristics	Gender Diversity	Percentage of Female members in BOD	Kamenjarska and Ivanovski [110]; Dedunu and Anuradha [111]
	BOD meeting	Number of annual meeting for BOD	Kamenjarska and Ivanovski [110]; Yassin [112]
	BOD Size	Number of BOD members	Kamenjarska and Ivanovski [110]; Yassin [112]; Shahwan [113]
Control variables			
Firm size	Log total assets		
Firm age	Number of operating years for the company		
Profitability	Net income/total assets		
Financial leverage	Total liabilities/ total assets		

$$\begin{aligned}
 ESG_{i,t} = & \alpha + \beta_1 IRDQ_{i,t} * GDIV_{i,t} + \beta_2 IRDQ_{i,t} * BOD_M_{i,t} \\
 & + \beta_3 IRDQ_{i,t} * BOD_M_{i,t} + \beta_4 FS_{i,t} + \beta_5 Fg_{i,t} \\
 & + \beta_6 Prt_{i,t} + \beta_7 Lev_{i,t} + e
 \end{aligned}
 \tag{2}$$

where $ESG_{i,t}$ = Environmental, Social, and Governance performance level, α = Model constant, β_1 – β_5 = regression coefficients, $IRDQ$ = Integrated reporting disclosure quality. $GDIV_{i,t}$ = Gender diversity, $BOD_M_{i,t}$ = BOD meeting, $BOD_S_{i,t}$ = BOD size, $FS_{i,t}$ = Firm size, $Fg_{i,t}$ = Firm age, $Prt_{i,t}$ = Profitability, $Lev_{i,t}$ = Leverage, $IRDQ_{i,t} * GDIV_{i,t}$ = The moderating effect between $IRDQ$ and Gender diversity of the firm (i) within the time period (t), $IRDQ_{i,t} * BOD_M_{i,t}$ = The moderating effect between $IRDQ$ and BOD meeting of the firm (i) within the time period (t), $IRDQ_{i,t} * BOD_M_{i,t}$ = The moderating effect between $IRDQ$ and BOD size of the firm (i) within the time period (t).

Data analysis

Descriptive analysis

Table 2 presents the descriptive statistics of the research variables (ESG Index Score, IR Index Score) and BOD characteristics (Gender diversity, number of BOD meetings and BOD size) for 34 companies for 7 years (2015–2021). During this time frame it can be noticed that the minimum and maximum values of ESG and IR

Table 2 Descriptive statistics

	Minimum	Maximum	Mean	Std. Deviation
ESG_Index	0.01009	0.51000	0.0592585	0.07428008
IR_Index	0.00720	0.85809	0.2314541	0.17944331
Gender_Diversity	0.0000	0.3000	0.089537	0.0997713
Number_of_meetings	1	6	3.51	1.688
Number_of_members	3	21	9.37	4.383
Valid N (listwise)	238			

Table 3 Pearson correlations among research variables

	ESG_Index	IR_Index	Gender_Diversity	Number_of_meetings	Number_of_members
ESG_Index	1				
IR_Index	0.348**	1			
Gender_Diversity	-0.195**	-0.076	1		
Number_of_meetings	0.110	0.005	-0.069	1	
Number_of_members	0.109	0.144*	-0.193**	-0.069	1
VIF	2.14	1.32	1.68	1.96	2.04

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

index score are getting better with minimum values of 0.01009 and 0.00720 and maximum values of 0.51000 and 0.85809, respectively, which reflect the increased awareness about the necessity of non-financial disclosures within the recent years. In addition, Table 2 shows the descriptive statistics of the BOD characteristics during the 7 years’ time where it can be noticed that minimum value of female existence in Board of directors is zero and the maximum is 30% with mean of 0.895 and standard deviation of 0.99 which reflect the success of Egypt vision 2030 of empowering women. Furthermore, it is obvious that there is a tendency toward more meetings and larger board size as minimum and maximum values of number of meeting and members are 1 and 3, while maximum values are 6 and 21, respectively.

It is crucial to note, however, that descriptive statistics only provide a summary of the data and do not shed light on the causality of observed patterns or the relationships between the variables. Therefore, additional analysis for the interrelationships between the variables and potential causes of the observed trends are in the next section.

Correlation among variables

Table 3 indicates that there are several significant correlations between the variables under consideration. First, there is a significant positive correlation between the ESG and $IRDQ$ indices. This indicates that companies with higher ESG scores tend to have higher IR scores as well. Companies with strong ESG practices are more likely to have a comprehensive and transparent approach to $IRDQ$ practices, resulting in higher IR scores. Secondly, a significant negative correlation exists between ESG and gender diversity. This indicates that companies with higher ESG scores have less gender diversity on average. Thirdly, there is a weak negative correlation between gender diversity and the IR index score. This indicates that there is no statistically significant correlation between gender diversity and $IRDQ$ scores.

The correlations between the remaining two BOD characteristics (number of meetings and number of members) and the ESG index score and IR index score are insignificant. This indicates that there is no significant relationship between these characteristics and ESG or IRDQ scores for the companies under study. In addition, the variance inflation factor (VIF) is low, indicating that multicollinearity does not pose a problem for the regression analysis. Overall, the results in Table 3 provide valuable insights into the relationships between the investigated variables through suggesting that ESG practices and gender diversity are crucial factors to consider when implementing IR practices.

Regression results

The regression analysis is used to test the research hypotheses, where regression models were developed to examine the impact of the ESG disclosure index score on IRDQ index. In addition, a second regression model is developed to examine the moderating effect of BOD characteristics on the relationship between ESG and IRDQ.

Testing first hypothesis (ESG on IR)

Table 4 displays the regression analysis results examining the effect of ESG Index Score on the quality of IR Index Score in Egyptian non-financial companies. Statistical significance at the 1% and 5% levels is determined using linear regression and the t-statistic of each coefficient. The results indicate that the ESG Index score has a substantial positive effect on the quality of the IR index score for Egyptian non-financial companies. Specifically, the regression analysis reveals that the ESG Index score and the control variables explain 19.7% of the variation in the Quality of IR index score. This indicates that ESG factors

play a significant role in determining the character of these companies’ IR practices.

In addition, Fisher’s (F) statistics validate the model’s effectiveness within a significance threshold of less than 1%, indicating that the model suits the data well and is statistically significant. Therefore, the obtained empirical evidence strongly supports the first hypothesis, implying that there is a positive correlation between the ESG Index score and the quality of the IR index score in Egyptian non-financial companies.

Testing second hypothesis (ESG on IR and BOD moderating)

The results of the regression analysis examining the moderating effect of BOD characteristics on the relationship between ESG index score, and IR index score are presented in Table 5. The analysis reveals that both gender diversity and board size moderate the relationship between ESG index score and IR index score with a significance level of less than 0.05.

Discussion

The objective of this study was to address two central research questions: (1) What is the impact of ESG disclosure on IRDQ in Egyptian non-financial firms? and (2) How do board of director characteristics pertaining to gender diversity and size moderate this relationship? The regression analysis revealed a significant positive association between ESG disclosure scores and IRDQ, affirming our first hypothesis. Within the context of developing markets, the findings of this research provide valuable insights into the interconnections between ESG practices, characteristics of the BOD, and the IRDQ in non-financial enterprises operating in Egypt. The aforementioned results provide valuable insights into the impact of ESG practices and BOD characteristics on IR within the unique setting of developing markets.

The research is in accordance with the perspective that there exists a noteworthy positive association between ESG practices and IRDQ. The regression analysis conducted highlights the noteworthy positive influence of ESG index scores on IRDQ. This finding underscores the possible beneficial outcomes that might arise from the implementing ESG practices in developing economies such as Egypt; the aforementioned results provide crucial confirmation for the prevailing worldwide inclination toward sustainability. This finding aligns with and expands upon similar studies by Mervelskemper and Streit [80] as well as Hoang [79], which also concluded a favorable link between sustainability practices and transparent IR. Putting this in the context of an emerging economy confirms that the global focus on ESG is spreading to developing markets, which can lead to more trust from stakeholders and more credibility for organizations.

Table 4 Regression analysis for impact of ESG on IR

Panel A					
Model	Unstandardized coefficients		Standardized coefficients	t	Sig
	B	Std. Error			
(Constant)	-0.050	0.082		-0.607	0.544
ESG_Index	0.672	0.149	0.278	4.516	0.000
Log_FIRM_SIZE	0.014	0.009	0.103	1.640	0.102
Log_FIRM_AGE	0.039	0.012	0.195	3.171	0.002
ROA	0.118	0.054	0.129	2.165	0.031
Leverage	-0.112	0.056	-0.121	-2.012	0.045
Adj. R Square	19.7%	F	12.310	Sig	0.000

a. Dependent Variable: IR_Index

b. Predictors: (Constant), ESG_Index, Log_FIRM_AGE, ROA, Leverage, Log_FIRM_SIZE, Div_Moderating, Number_of_members_moderating, Number_of_meeting

Table 5 Regression analysis for impact of ESG on IR and BOD characteristics moderating variable

	Unstandardized coefficients		Standardized coefficients		t	Sig
	B	Std. Error	Beta			
(Constant)	−0.084	0.083			−1.011	0.313
ESG_Index	1.077	0.662	0.449		−1.628	0.105
Div_Moderating	6.405	2.871	0.185		2.231	0.027
Number_of_meeting_moderating	0.014	0.068	0.030		0.204	0.839
Number_of_members_moderating	0.092	0.038	0.365		2.425	0.016
Log_FIRM_SIZE	0.018	0.009	0.129		2.059	0.041
Log_FIRM_AGE	0.033	0.012	0.167		2.666	0.008
ROA	0.135	0.054	0.149		2.482	0.014
Leverage	−0.117	0.056	−0.127		−2.103	0.037
Adj. R Square	22.7%	F	8.493		Sig	0.000

a. Dependent Variable: IR_Index

b. Predictors: (Constant), ESG_Index, Log_FIRM_AGE, ROA, Leverage, Log_FIRM_SIZE, Div_Moderating, Number_of_members_moderating, Number_of_meeting

Organizations operating within these particular markets have a higher propensity to embrace complete and transparent IR methodologies, primarily via the prioritization of strong ESG policies. This not only improves their IR scores but also demonstrates a dedication to sustainability, a topic that is becoming more important in the international corporate environment. Companies operating in these industries that possess high ESG ratings have a greater capacity to comprehend and address their sustainability-related risks and opportunities. This profound comprehension, in return, cultivates efficient communication via information retrieval methods. In the context of developing markets, where stakeholders may exhibit heightened interest in sustainability, the implementation of an improved IRDQ framework may foster the development of trust and boost the perceived credibility of organizations.

Regarding the second research question, we discover an interesting insight. While board gender diversity was found to positively moderate the ESG-IR relationship, as hypothesized, the direct association between diversity and IR was unexpectedly negative. The research indicates a modest inverse relationship between gender diversity and IR index scores in developing economies, suggesting that gender diversity may not have a substantial influence on IR scores within this particular setting. This contrasts with some prior literature emphasizing diversity's benefits for transparency and disclosure quality [104]. The significance of considering the particular dynamics of developing markets in the interpretation of the correlation between ESG practices, gender diversity, and IR is shown by this subtle observation. This finding challenges the prevailing

notion in developing markets that organizations with a focus on ESG factors promote diversity and inclusion. This observation suggests that inside certain markets, corporations may place more emphasis on environmental and social concerns, rather than prioritizing diversity and inclusion [12].

Likewise, the relevance of BOD size as a moderating factor implies that in developing economies, a bigger BOD would possess enhanced capabilities to comprehend the complexities associated with sustainability-related risks and possibilities. Consequently, this facilitates enhanced dissemination of sustainability-related information for IRDQ. The significance of these features of the BOD is emphasized by the distinct requirements and obstacles encountered in growing markets. This finding regarding BOD size as a positive moderator affirms this characteristic's role in harnessing varied expertise to strengthen IR, which is likely particularly beneficial given complex sustainability challenges in emerging markets.

The results pertaining to the features of BOD serve to underscore the distinctive dynamics seen in developing economies. Chouaibi et al. [12] found that the link between ESG disclosure and IR index scores is influenced by gender diversity and BOD size, especially within the specific context being examined. The inclusion of a wider range of viewpoints and experiences inside the BOD has a favorable influence on the quality of decision-making and the overall level of IRDQ. In the context of developing markets, the inclusion of varied viewpoints is of utmost importance due to its potential to assist firms in effectively navigating intricate social and environmental obstacles.

The findings of the research indicate that the frequency of BOD meetings does not have a substantial effect on the correlation between ESG disclosure and IR index scores, especially in developing markets. This observation underscores the unique dynamics seen in these markets. The proposition is that within developing markets, the effectiveness of ESG may be more driven by structural variables rather than the number of meetings.

Although the aforementioned findings provide useful insights into the distinctive dynamics of developing economies, it is essential to practice prudence when extrapolating these results to other settings. The linkages between ESG practices, BOD characteristics, and IRDQ are subject to various difficulties and opportunities in emerging markets [76, 80, 106]. Overall, relating the empirical results back to the original research questions and comparing them with existing studies reinforces this study's contributions while also highlighting areas warranting deeper investigation in future research.

In conclusion, the results of the research have substantial consequences for economies in the process of development. The authors emphasize the significance of considering the particular context while analyzing the interaction between ESG practices, BOD features, and IRDQ. The findings presented in this study provide significant insights for businesses operating in developing economies, as they traverse the intricate terrain of sustainability and IR.

Conclusion

The research focuses on the moderating role of BOD characteristics in the relationship between the ESG disclosure index level and the level of IRDQ. IR is a tool that provides stakeholders with a holistic understanding of a company's ability to create value over time. However, identifying the determinants of IR is crucial to ensure high-quality disclosure, as its quality remains a significant issue. This research aims to identify the specific BOD characteristics that influence IR quality, as BOD characteristics have been identified as potential determinants of IR quality. The study identifies possible determinants of IRDQ related to BOD characteristics, such as BOD size, the number of BOD meetings, and the presence of women. The authors then develop two hypotheses regarding the association between these determinants and IRDQ. The authors analyzed data from 34 non-financial companies from 2015 to 2021, for a total of 236 observations. The research used regression analysis with lagged explanatory variables to test the relationship between the independent variables, control variables, and the IR disclosure quality score, which is the dependent variable.

The aforementioned factors indicate that the integrity of IR continues to be a major concern. To assure the quality of disclosure, it is essential to pay attention to its determinants, such as corporate governance. Previous research on voluntary disclosure and IR suggests that BOD plays a crucial role in determining and influencing the IRDQ [73, 107]. Despite the fact that the quality of both disclosure and IR is an important issue for both academia and practice, only a small number of studies have examined it, with inconsistent findings and no shared theoretical framework.

Recent studies conducted in China and Europe suggest that sustainable participation contributes to increased transparency, supporting the correlation between ESG disclosure and reporting quality [102, 108]. However, it is worth noting that the influence of board diversity differs from a previous study conducted in the Gulf area, which found that gender diversity had no significant effect on sustainable practices [37]. This observation implies that the influence of variety may be contingent on broader contextual variables. The research findings reveal that IRDQ is positively associated with the level of the ESG disclosure index score. The research also found that leverage is significant in all models, but with a negative sign, and that firm size, firm profitability, and firm age are significant determinants of IR quality.

In order to enhance comprehension, further research endeavors may explore the correlation between ESG reporting and rising economies on a broader scale. Researchers should use qualitative methodologies to investigate the impediments and driving forces that impact the implementation of IR within country settings, such as Egypt. Researchers should include more country contexts in the research to examine the generalizability of diversity effects. Future research should include controlling any confounding factors that are associated with the quality of national governance.

The present research makes a number of significant contributions to IR research. In the first place, it contributes to a greater understanding of underdeveloped issues, specifically the IR quality determinants. By going deeper into this topic, the research provides valuable insights into the key factors that influence the quality of IR, thereby enabling businesses to enhance their communication with stakeholders.

Secondly, the research identifies a number of significant BOD-related determinants of IRDQ. Specifically, the research concludes that BOD size and BOD diversity are significant IRDQ-influencing factors. These findings can serve as a launching point for future research that seeks to investigate the relationship between BOD characteristics and IRDQ in greater depth.

Thirdly, the research interprets the findings critically by referencing various theories. The research contributes to the theoretical advancement of the field of IR research by situating the study's findings within a broader theoretical framework. In addition, this interpretation of the results provides a foundation for future studies that can build upon the present research by identifying research gaps.

In summary, this research provided novel findings about the current status of ESG adoption in Egypt and its influence on the quality of IR. The results of this study provide a valuable contribution to the existing body of research on sustainable involvement and board diversity. Furthermore, these insights can enhance stakeholder-oriented disclosure processes.

Limitation and future research directions

Although this study offers many contributions, it is not exempt from some limitations. The limited sample size of ESG-required enterprises in Egypt may have implications for the generalizability of the results and suggests a need for caution in extending the results broadly [40]. Furthermore, it is important to consider that the outcomes of creating disclosure indices may be influenced by measurement restrictions, as pointed out by Davison [109]. Among these problems are the lack of connection between the company's strategy, business model, performance, and future prospects, the inadequate use of descriptive tools such as diagrams and maps; the absence of information regarding corporate governance, stakeholder relationships, and materiality processes; inadequate explanations of the business model; and the limited application of external audit practices.

To enhance the validity of the results, future research could consider larger samples spanning diverse industries. Moreover, the inherent subjectivity of constructing disclosure indices highlights the potential sensitivity of findings to measurement variations. To strengthen the study's robustness, employing multiple approaches in index formulation could serve as a valuable check.

Conceptually, the study focuses specifically on gender diversity and size as moderators, leaving room for exploration of additional governance attributes. Incorporating factors like board independence, financial expertise, or stakeholder representation could unveil further nuances in the relationship between ESG and transparency. From an institutional point of view, directly comparing results from emerging markets to those from developed economies could help us understand the underlying factors that affect the links between sustainability and disclosure in different areas. Methodologically, while the regression analysis effectively models direct effects, the study recognizes the need to explore potential circular associations over time through panel data analysis. On a substantive

level, supplementing quantitative findings with qualitative insights, such as interviews with board members or executives, could offer a richer understanding of the motivations behind governance choices and their impact on disclosure outcomes. In conclusion, by acknowledging and addressing these limitations and recommendations, the study lays the groundwork for future research to deepen our understanding of how ESG disclosure influences IR transparency in emerging markets through governance mechanisms.

Within the realm of political considerations, there are several intriguing constraints that have the potential to facilitate future investigations. These include the exploration of complicated dynamics within particular geopolitical situations, the critical examination of the impact of individual political leaders on policy results, and the analysis of the complex interplay between political conduct, voter preferences, and policy choices. In addition, conducting a thorough investigation into the influence of political forces on global affairs, comparative analysis of political systems, and the dynamic function of media in influencing political communication presents promising opportunities for extensive scholarly inquiry. These aforementioned limitations provide a rich context for exploring the complex dynamics through which politics shapes governance, policy-making, and social consequences within an always-changing global landscape.

Given these constraints, future research efforts have the potential to enhance our understanding of the intricate influence of politics on both a domestic and international level. This research has the potential to provide valuable insights to decision-makers, academics, and the general public on the dynamic nature of the political landscape. They may shed light on the consequences for policy development, governance, and overall societal welfare. By doing so, they contribute to our capacity to effectively traverse the intricate interactions of political elements in the contemporary global context.

Policy recommendations and implications

The policy recommendations in our research include numerous important areas. Policymakers should require data sharing and stakeholder engagement to increase transparency and accountability. The recommendations also include fiscal incentives and penalties to encourage ecologically friendly and socially responsible actions. Multi-sector collaboration is essential for sustainable development. Policymakers should aggressively foster partnerships and multi-stakeholder platforms. The recommendations empower civil society, improve monitoring, emphasize education and awareness, and build policy review and adaptation procedures. The research provides a complete framework for governments,

Table 6 Summary of results and their relation to literature

Research hypotheses	Expected sign	Results' sign	Result	Proponents from literature	Opponents from literature
H ₁	+ve	+ve	Accept	Atkins and Maroun [75], Mervelskemper and Streit [80], Bernardi and Stark [76], Hoang [79], Conway [77, 106], Albitar et al. [20], Caglio et al. [78],	N/A
H ₂	+ve	+ve	Partially Accepting	Siagian and Tresnaningsih [82], Elshandidy et al. [84], Albitar et al. [20], Songjini et al. [83], Fayad et al. [85], Chouaibi et al. [12], Allegrini and Greco [91], Javaid Lone et al. [63], Husted and de Sousa-Filho [17]	N/A
H ₂ -a	+ve	+ve	Accept	Chouaibi et al. [12], Fayad et al. [85], Raimo et al. [15], Gerged [66], Albitar et al. [20], Husted and Sousa-Filho [17], Trireksani and Djajadikerta [94], Javaid Lone et al. [63], Tauringana and Chithambo [69], Rao et al. [64], Allegrini and Greco [91]	Halme and Huse [97], Giannarakis et al. [93], Ezhilarasi and Kabra [96] and, Peters and Romi [103], Liao et al. [104]
H ₂ -b	+ve	Insignificant+ve	Reject	Fayad et al. [85], Gyapong et al. [86], Vafeas [89], Ghafran and O'Sullivan [87]	Prado-Lorenzo and García-Sánchez [95], Peters and Romi [103], Liao et al. [104]
H ₂ -c	+ve	+ve	Accept	Chouaibi et al. [12], Farooque et al. [16], Fayad et al. [85], Raimo et al. [15], Wasuzzaman and Wan Mohammad [99], Manita et al. [98], Baalouch et al. [47], Ben Barka and Dardour [56], Frias-Aceituno et al. [55], Rao et al. [64]	

organizations, and stakeholders to address sustainability and governance issues, encouraging a future of openness, accountability, and ethical governance.

The above recommendations show a commitment to linking intellectual research to policy implementation. This emphasizes the necessity for empirically supported recommendations to address complex issues. The goal is to provide decision-makers with the tools and information to promote sustainability and accountability. In future, an honest and ethical government will promote social wellbeing.

The study findings have significant and diverse ramifications that span several academic and practical areas. This work makes a valuable contribution to the existing body of knowledge by enhancing our understanding of the complex factors that influence the quality of IR. This study explores the substantial impact of board features, namely size and diversity, and elucidates their crucial role in creating the IRDQ. The aforementioned discoveries contribute to the current corpus of knowledge within the field of IR study, providing a foundation for future investigations into the interplay between governance and IR. Furthermore, this study highlights the significance of contextualizing these findings within the framework of pertinent theories, thus contributing to the advancement of the theoretical landscape in this particular sector. These contributions play a crucial role in providing guidance for future research efforts and facilitating a more comprehensive investigation of the connections between corporate governance, sustainability, and transparency.

This research has significant implications for enterprises, politicians, and stakeholders from a practical perspective. This highlights the importance of promoting diversity within corporate boards and optimizing board size as tactics to improve the IRDQ, therefore strengthening the quality of disclosures pertaining to sustainability and governance. These results emphasize the importance of fostering BOD characteristics that include a range of opinions and skills, particularly for businesses. Furthermore, governments have the opportunity to use these valuable insights in order to formulate regulatory measures and provide incentives that effectively promote the adoption of responsible governance practices by corporations. The study ultimately contributes to the advancement of sustainable and transparent corporate governance by providing a framework for encouraging accountability and ethical behavior inside firms and facilitating responsible engagement with stakeholders (Table 6).

Abbreviations

AI	Artificial intelligence
BOD	Board of directors

BOD_M	BOD meeting
BOD_S	BOD size
CEO	Chief executive officer
CG	Corporate governance
CSR	Corporate social responsibility
ESG	Environmental, social, and governance
FP	Financial performance
FTSE	Financial times stock exchange
FG	Firm age
FS	Firm size
F	Fisher's statistics
GDIV	Gender diversity
IR	Integrated reporting
IRDQ	Integrated reporting disclosure quality
InTh	Integrated thinking
IIRF	International Integrated Reporting Framework
JSE	Johannesburg Stock Exchange
NGSE	Nigerian Stock Exchange
NGOs	Non-governmental organization
PRT	Profitability
S&P	Standard & Poor's
STOXX Europe	Stock Index of European Stocks
EGX	The Egyptian stock exchange
IIRC	The international integrated reporting council
SEC	The Securities and Exchange Commission
VIF	Variance inflation factor

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Author contributions

ZA performed the theoretical framework and literature review of the research and was a major contributor in writing the manuscript and data collection; MS analyzed and interpreted the statistical data regarding the two models and was a major contributor in writing the conclusion and discussion of the manuscript. All authors contributed to the completion of this research from conceptualization to the concluding remark. All authors read and approved the final manuscript.

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Availability of data and materials

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Declarations

Ethics approval and consent to participate

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Competing interests

The authors declare that they have no competing interests.

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