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Article in *Future Business Journal* · July 2024

DOI: 10.1186/s43093-024-00340-6

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The moderating role of board gender diversity on the association between audit committee attributes and integrated reporting quality

Mohamed Samy El-Deeb^{1*} and Lana Mohamed²

Abstract

Purpose The main objective of the research is to examine the influence of audit committee attributes on the integrated reporting quality (IRQ) and to investigate whether this association is moderated by board gender diversity in the manufacturing and non-manufacturing sectors. The study specifically investigates the association between audit committee independence, meetings frequency, financial expertise, audit committee size, and integrated reporting quality.

Design/methodology/approach The data collection was from the financial statements and corporate governance reports of 54 Egyptian firms listed on the stock market [EGX100] for the period of 2018–2022. The study used pooled effect modelling and performed data analysis using the STATA software.

Findings For the manufacturing sector, the results showed a significant impact of audit committee independence and meetings frequency on IRQ, while audit committee size and financial expertise showed insignificant association with IRQ. Board gender diversity moderates the association between audit committee meetings only and IRQ. In contrast, audit committee financial expertise and meetings frequency significantly impact IRQ, while audit committee independence and size showed an insignificant impact on IRQ in the non-manufacturing sector. Also, board gender diversity moderates the association between audit committee and IRQ. The findings highlight the significance of AC attributes and provide guidance to firms to strengthen their audit committees in order to provide high quality of integrated reports to increase investor trust in the Egyptian business environment as it is now mandatory by the government.

Originality/value This research offers unique perspectives on the association between variables in Egypt. This study is one of the first investigations on the impact of audit committee attributes and board diversity on integrated reporting quality within the context of Egyptian listed companies. Comprehending the ways in which audit committee attributes impact the integrated reporting quality in the manufacturing and non-manufacturing sectors can enable organizations to devise focused approaches that comply to the unique operational, regulatory, and investor demands in each sector.

Keywords Integrated reporting quality (IRQ), Audit committee (AC) independence, Audit committee financial expertise, Audit committee frequency of meetings, Audit committee size and board gender diversity

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JEL Classification M14, G32, O16

Introduction

The efficiency and reliability of the capital market are derived from corporate disclosure. Several popular ways are known on how firms disclose their information. Firms may disclose information through reports like: corporate social responsibility, management, and financial statements. Dramatic changes occurred in the need to fulfil market information due to new businesses needs and nature. Traditional reporting is widely known among stakeholders as an insufficient method to provide the necessary information. Scandals and financial crises have led to increased doubt among financial report users by shifting the need for the required information, which has put firms under additional pressure. Firms and standard setters are now obliged to have a high-quality form of corporate reporting to stay competitive in the market. The information should demonstrate corporate integrity and control, and its scope should not be limited to presentations that focus on the past. The increased demand for high-quality and innovative reports requires firms to take this matter into real consideration and provide new types of information [68].

Financial reports of high quality are essential for stakeholders and investors to make critical decisions regarding the firm they operate for. On the contrary, low-quality financial reports result in ruining a firm's reputation; thus, the price of shares will be reduced, leading to a decreased level of firm performance. Also, low-quality financial reports that do not meet modern businesses needs may result in taking misleading decisions due to the misleading reports resulting in legal problems for firms [20].

Accounting intellectuals started to find it attractive to study and debate the topic of integrated reporting due to its emergence as a topical subject. The main focus of current studies on integrated reporting is to identify the benefits and progress as well as the challenges endured by firms implementing integrated reporting. On the other hand, economic and political aspects, as well as the legal system and cultural aspects, are being investigated by other studies on the success of implementing integrated reporting [14].

Robust corporate governance is known to have a competent audit committee. Good operating audit committee makes sure that management is fulfilling its duties. The audit committee is in charge of aiding the board of commissioners in all of their work and overseeing the application of accounting and financial rules. The audit committee is crucial in establishing accountability and transparency by decreasing information asymmetry. The execution of excellent integrated reports that satisfy the

requirements and expectations of stakeholders is directly related to having a robust audit committee [47].

The supervision of the audit committee, monitoring activities, and control on behalf of the shareholders favour the transmission of higher-quality information based on the agency theory perspective. Its importance has been recognised and confirmed over the past years by several professional declarations [48].

In light of the increased awareness of women's rights, board gender diversity was selected as a moderating variable in this research to investigate its impact on the association between audit committee attributes and integrated reporting quality in both sectors. Previous research has shown that the presence of women on a board significantly affects decision-making regarding sustainability and integrated reporting. According to agency theory, including female directors on a board can increase the knowledge, experience, and abilities necessary for effective monitoring. It is expected that a greater number of female directors will lead to a wider dissemination of integrated knowledge, which can help reduce information asymmetry and agency problems [46]. Additionally, having women's representatives on the board can aid in the selection of a high-quality audit committee, resulting in better integrated reports for the public.

Juma et al. [27] have reported that many firms around the world have adopted integrated reporting. The highest quality of integrated reports is provided by countries such as South Africa, Germany, and the Netherlands, followed by France, Italy, the UK, and South Korea. On the other hand, the lowest quality of integrated reports is provided by the USA, Brazil, and Japan. However, developing countries still rely on traditional reporting and some voluntary environmental, social, and governance reports. Therefore, it is important to investigate how Egyptian firms listed in the stock exchange market perform in terms of integrated reporting and how audit committee attributes might impact its quality.

To measure integrated reporting quality in Egypt, the researcher utilised an index taken from ElDeeb's [21] paper, which identified 7 main categories and each category is composed of several items totalling 43 items to be used for measuring the extent to which a firm complies with the integrated reporting framework. The 43 items in details are presented in appendix [Appendix 1]. The percentage of compliance exhibited by each firm was then calculated, and the firm with the highest percentage was considered the best report producer and was deemed to have the highest compliance with integrated reporting, indicating its high quality. As the measurement of integrated reporting quality is still relatively unexplored in Egypt, this approach provides

a useful starting point for evaluating the integrated reporting quality among Egyptian firms.

Despite the importance of integrated reporting to stakeholders and management, the previous discussion suggests that it is not widely used in the Egyptian economy. Because of this, integrated reporting is not widely accepted in Egypt's financial sector. Reports of high quality that are made available to the public do wonders for a company's reputation, drawing the attention of additional would-be investors. The importance of this reporting method must be widely disseminated, and firms should be strongly encouraged to adopt it. Keeping in mind the fact that an efficient board of directors cannot select and appoint members to the audit committee if the board itself is inefficient.

In addition, the Egyptian market was specifically chosen because of its significance as an investment destination. The goal of the study is to determine whether these listed companies' effective integrated reporting influences local investors as well as foreign investors (FDI) and, consequently, attracts more capital to the Egyptian economy. Therefore, the results could provide insightful information to both listed and non-listed businesses hoping to improve their reputation and draw in foreign investment, which would help Egypt's economy as a whole.

The selection of Egypt as the focal point of this study is a deliberate effort to bridge significant gaps identified within the extant literature, particularly regarding the Egyptian market's unique characteristics. While the impact of audit committee attributes on integrated reporting quality has been extensively discussed in various contexts, there remains a noticeable absence of empirical research within the Egyptian business environment. This study aims to address this gap, offering new insights into how listed firms in Egypt can leverage these insights to attract investment and enhance their market standing. To the best of the researcher's knowledge, no theoretical framework currently exists in Egypt that explores the influence of audit committee attributes on integrated reporting quality, especially when considering the moderating role of board gender diversity. Moreover, this research pioneers in examining the variance in compliance across manufacturing and non-manufacturing sectors within the Egyptian context. The anticipated outcomes of this study are poised to contribute significantly to future research, potentially reshaping the understanding of board gender diversity's effect on strengthening the relationship between audit committee attributes and integrated reporting quality. Despite its critical importance, the moderating effect of board gender diversity in this relationship remains underexplored.

Following the introduction and justification for the study's geographical focus, it is pertinent to elucidate the methodological approach, particularly the rationale behind the sample size and the subsequent structure of the paper. The study zeroes in on a subset of the top 100 companies listed on the Egyptian Exchange, specifically the EGX100 index, chosen for their market capitalization and liquidity. This selection is grounded in the objective to extract valuable insights from leading entities in the Egyptian market, where integrated reporting is a mandated requirement for listed companies. This mandate underscores a commitment to sustainability and transparency, positioning these firms as attractive investment propositions. Focusing on the EGX100 not only underscores the strategic significance of integrated reporting for entities aspiring for stock market listing but also addresses the logistical challenges inherent in data collection.

Given the EGX100 represents the pinnacle of the Egyptian corporate sector, the study initially aimed to encompass all 100 companies. However, due to the considerable challenge in acquiring comprehensive and accurate data, the sample was narrowed to 54 firms. This decision was informed by a need to balance the practicality of data collection with the desire to obtain meaningful insights. The meticulous selection process acknowledges the intensive resources required to collect detailed information across a broad spectrum of companies while ensuring a comprehensive analysis of the chosen firms.

The rest of the paper will be presented as follows, "[Literature Review and Hypotheses Development](#)" Section literature review examines current audit committee attribute-IRQ research. For more integrated reporting, it promotes a strong audit committee. Board gender diversity moderates audit committee independence, financial expertise, meeting frequency, and size. Several researchers' research works give theoretical and empirical support for these claims. "[Methods](#)" Section covers the study's research design. In "[Results](#)" Section, analysis and results are discussed. The paper concludes with its primary findings and implications. It shows how audit committee features affect integrated reporting quality and suggests additional research. The findings, suggestions, and study limitations are given in "[Results and Discussion](#)" Section.

Literature review and hypotheses development

Audit committee attributes and integrated reporting quality

Importance of corporate governance in integrated reporting
Recent financial crises and scandals have prompted the development of effective mechanisms for the protection rights of investors and their assets. Corporate governance

is known to be the main source of response to any difficulties facing firms. Also, the quality of economic, social and environmental information is ensured by robust corporate governance [49].

Accountability is a critical concept in corporate governance, linking corporate reporting and governance to provide stakeholders with information. Also, it can be beneficial in reducing information asymmetry resulting from agency problems [50]. The enhancement of voluntary disclosure quality can be promised by a strong mechanism of corporate governance which minimizes the level of agency conflicts [11]. The occurrence of globalization, financial crises, and climate change received a great response from the significant role played by corporate governance. It also aids in helping rebuild the associations with investors and other stakeholders [51]. A comprehensive picture of performance in an organization is provided by integrated reporting. It presents non-financial and financial information to stakeholders which makes it easier regarding the decision-making process. Corporate governance helps firms create sustainable values in addition to financial ones, rebuilding stakeholders' trust [12].

Impact of audit committee attributes on integrated reporting quality

India is widely known with its popular firms operating as part of the manufacturing sector. A study conducted by Makri et al. [33] illustrated that audit committee independence has an insignificant impact on integrated reporting quality. The study had a planned method whereby a checklist was developed based on the Integrated Reporting Council (IIRC) framework. The checklist was utilized in the evaluation of disclosures done from the 1st of July 2014 and 30th of June 2017. The regression analysis was the primary statistical means through which the factors affecting the integrated reporting (IR) and each of its components were examined. Thus, if future researchers in India tried to examine the same variable with the same listed companies in the non-manufacturing sector, different results could be obtained.

Meutia et al. [37] examine impact of characteristics of audit committees on sustainability reporting (SR) in Indonesian commercial banks (between 2015 and 2019). Using cross-sectional and time-series analyses on the dataset that contains 74 banks, the study is interested in financial expertise, size, independence and the frequency of meetings guided by the legitimacy, stakeholders, and agency theories. Findings suggest a nuanced relationship: however it shows that FIN expertise relates inversely to SR disclosure, but committee independence, bank size, age, and auditor choice positively relate to SR disclosure. The article highlights the need for banks to take care in

appointing the members of audit committees with a preference for non-financial expertise particularly in sustainability to enhance SR oversight. Through this study, there is an understanding of the variables affecting the SR disclosure in the Indonesian commercial banks, giving emphasis to how audit committee features impact on SR disclosure.

Sun et al. [43] examined how integrated reporting application can differ between industries with the help of strong audit committees. The data sample used for this study came from 7168 firm-year observations representing 1169 listed companies in China taken between 2006 and 2019. The ILES GD metric was grounded on data collected from company reports, mainly annual reports and stray ESG/CSR/sustainability reports. The content analysis method was adopted.

Machmuddah et al. [32] investigated the impact of audit committee qualities on integrated reporting compliance in Indonesia. The researcher employed the non-probability sampling technique to choose research sample which had 18 listed firms on the Indonesia Stock Exchange from 2017 to 2019. Secondary data were employed for the analysis. The statistical method used was path analysis assisted by SPSS software.

The results showed that firms operating in the manufacturing sector have showed less compliance to the components of integrated reports than those operating in the non-manufacturing sector. Thus, less investors were interested to invest in the manufacturing sector due to its low quality of reports.

Previous research has indicated that independent audit committees are associated with higher-quality integrated reports, as they pressure the board and management to disclose material information. Non-executive directors on the audit committee also aid in protecting stakeholders' interests by reviewing management's public declarations to ensure they are accurate and complete [1, 29, 47]. Seventeen different industries in China were used in the sample. There was a huge illustration in the paper on how integrated reporting is crucial to be applied and how it affects the decision making of investors. Apparently, firms in the manufacturing sector took the highest percentage of complying to most of integrated report framework components resulting in the best sector to produce integrated reports. Thus, investors are now more interested in putting their money and trust in all firms operating in the manufacturing sector.

As mentioned by Uwuigbe et al. [44], the work of audit committees is crucial for firm governance and accurate financial reporting. Given that integrated reporting quality encourages more thorough and transparent data about a firm, the involvement of the audit committee is essential. The audit committee must examine and evaluate all

financial statements, including those that use integrated reporting. It is recommended that the audit committee and sustainability committee jointly evaluate the sustainability data presented in integrated reports [47].

Lasdi and Oematan [30] examined the effect of corporate governance on integrated reporting in a manufacturing firm located in Indonesia. The research object was manufacturing companies listed in the Indonesia Stock Exchange (IDX) between 2017 and 2020. The samples were picked by purposive sampling method. The data analysis technique of this research was multiple linear analysis.

Results of the study revealed that audit committee has an insignificant impact on integrated reporting in the chosen manufacturing firm. However, if the authors took in consideration increasing the sample size to more than one manufacturing firm, the results would have been different.

A study provided in Indonesia highlights that firms in the manufacturing sector are more likely to implement good integrated reports. The research population consists of 150 businesses that operated between 2015 and 2017. Purposive sampling was used to choose a subset of businesses for the investigation. Specifically, only 51 of the 150 businesses were chosen as research samples. Independent audit committees play a crucial role for a successful implementation of sound integrated reports. The study took in consideration the agency theory perspective [2]. Independent audit committees are essential to avoid any conflict of interests. A conflict of interest arising may result in working on behalf of management and neglecting shareholder's needs.

Adelowotan and Udofia [52] empirically examined the influence of corporate characteristics on integrated reporting in Nigerian listed companies. Ninety listed firms were included and content analysis was undertaken. Sample period was from 2013 to 2017 and analysed subsequent to the usage of disclosure methodologies. Hypotheses were tested using panel least square regressions. The findings support the argument that there is a powerful linkage between corporate dimension and integrating reporting. Although this study does not indicate the impact of audit committee attributes on integrated reporting quality, yet it provides a valuable insight. The study shows that manufacturing companies have lesser compliance with the integrated reporting framework, whereas other industries like service and finance have high compliance with integrated report framework. The present research contributes on the literature by providing a new perspective to the manufacturing sector and the compliance of with the integrated reporting framework.

Dian et al. [18], through the year 2016–2017, examined the quality of integrated reports in European firms using 63 firms. Content analysis methodology was employed to measure the quality of 126 varied integrated reports. This study, though, misses the audit committee attributes, but still has a valuable insight. It revealed that the best quality of reports amounting to 27% came from firms operating within the manufacturing sector. This proves that firms really functioning in the manufacturing industry in Europe have better quality of combined reports, demonstrating more conformity.

Sector-specific analysis

Up to the researcher's knowledge, previous literature concerning the impact of audit committee attributes on integrated reporting quality in the manufacturing sector was low in number. Also, not all audit committee attributes were taken in consideration to monitor its effect on integrated reporting quality. Only the independence attribute of audit committee was considered regarding its impact on IRQ in the manufacturing sector. All other attributes of audit committees like financial expertise, size and frequency of meetings were not mentioned in previous studies. In contrast to the several studies focusing on the manufacturing sector, the rest of the studies referenced above did not disclose what sector does their sample belong to. Which makes it clear that there are little number of articles that focused clearly on the division of its sample into sectors. The manufacturing sector was the main focus due to its historical dominancy and its huge contribution to the employment rate which affects a country's GDP. For instance, if few studies tackled the impact of both variables in the manufacturing sector with minimal or no attention on disclosing whether the sample was divided into different sectors or not. It was challenging to find any further studies that combined all attributes together with the moderating variable (board gender diversity). As a conclusion from this analysis, the need to encourage firms to focus more on dividing its sample to manufacturing and non-manufacturing sectors has increased.

Structure of the remaining literature

The remaining literature will focus mainly on the impact of each audit committee attribute on integrated reporting quality moderated by board gender diversity without considering references in firms operating in any sector due to the low number of clear studies. This can bridge the gap in literature by starting to write more about both variables in the manufacturing and non-manufacturing sectors and how each sector can differ from the other in

terms of results. Also, up to the researcher's knowledge no previous studies were conducted in Egypt tackling the impact of all variables together divided into manufacturing and non-manufacturing sectors. The real contribution here is to fill this gap.

Hypotheses structure

It is noteworthy that the hypotheses presented under each category in the following literature exhibit a consistent pattern as we delve into the thorough analysis of the association between audit committee attributes and integrated reporting quality. H1 and its associated sub-hypotheses specifically concern the manufacturing sector, whereas H2 and its related subhypotheses deal with the non-manufacturing sector. This differentiation aims to enable a deeper understanding of how audit committee attributes affect integrated reporting quality in various industrial contexts by facilitating a sector-specific analysis.

H1 There is a significant positive association between audit committee attributes and integrated reporting quality in manufacturing sector.

H2 There is a significant positive association between audit committee attributes and integrated reporting quality in non-manufacturing sector.

AC Independence and IRQ

There is an association between audit committee's members' independence and its ability to monitor financial reports as per the study conducted with a population that consisted of 145 worldwide enterprises that implemented integrated reporting (IR). The reports were obtained from the International Integrated Reporting Council (IIRC) website to guarantee adherence to the IIRC structure. The reports were selected at random. The sample was diverse in terms of firm size (small, medium, and big), year (2011–2018), and geography (Europe, Asia, America, Africa, and Oceania). Normality tests were performed utilizing statistical analyses such as the Kolmogorov–Smirnov test, skewness, and kurtosis values [70]. Audit committee independence, according to Cooray and Senaratne [16] and Songini et al. [69], allows for discretion and removes conflicts of interest. Financial reporting fraud can be monitored more effectively by independent audit committees, according to agency theory. Members of the committee who are independent are more likely to deliver reliable financial reports. Such explanations suggest that an audit committee's independence helps in having more disclosed information in its integrated reports.

Integrated reports require close supervision and monitoring due to its complexity, which stems from the need to collect both financial and non-financial data to demonstrate interdependence across functional areas of corporate management. Thus, the audit committee's ability to supervise and monitor the process of information gathering and presentation may be enhanced by making the committee more independent [55]. This study addressed this gap by examining the influence of audit committee qualities on integrated reporting quality (IRQ) using agency theory principles. The regression analysis was performed on a sample of 125 worldwide enterprises.

Financial and non-financial firm disclosure is both improved by an audit committee's ability to operate independently. Since they do not have any ties to the top levels of management, independent members are better able to perform the roles of monitoring and oversight [55].

H1.1 There is a significant positive association between audit committee independence and integrated reporting quality in manufacturing sector.

H2.1 There is a significant positive association between audit committee independence and integrated reporting quality in non-manufacturing sector.

AC financial expertise and IRQ

Members of the audit committee believe that having professional accounting and financial knowledge is essential [26]. Several studies have demonstrated that the level of accounting and finance competence among audit committee members has an impact on the committee's efficacy [3, 5, 9]. Experts in finance or accounting making up the audit committee members are important since they make it easier for management and external auditors to handle any potential conflicts. The audit committee consists of finance and accounting experts dedicated to minimizing the risks faced by the company. In fact, the audit committee's monitoring capabilities would decline if its members lack this skill [67]. According to Kakanda et al. [28], audit committees' ability to supervise integrated reporting and the entire financial reporting process will be impacted if they did not have an experience in finance or accounting [22]. This article used a sample of South Africa's top 100 listed corporations to assess integrated reporting quality using the International Integrated Reporting Council methodology from 2013. The data were analysed using content analysis, ordered probit regression, and logistic regression techniques.

H1.2 There is a significant positive association between audit committee financial expertise and integrated reporting quality in manufacturing sector.

H2.2 There is a significant positive association between audit committee financial expertise and integrated reporting quality in non-manufacturing sector.

AC meetings frequency and IRQ

The frequency of meetings is critical to ensure that corporate governance practices are carried out properly. The audit committee's ability to effectively monitor is strengthened by its practice of holding frequent meetings. Accounting records and internal control procedures can be regularly monitored due to the audit committee's regularly scheduled meetings [25]. Regular audit committee meetings are essential for effective audit quality oversight of financial reporting processes and internal control. Audit committees that meet regularly are better able to fulfil their role as regulators. Regular audit committee meetings were found to be associated with high-quality integrated reporting in earlier studies [70].

H1.3 There is a significant positive association between audit committee meetings frequency and integrated reporting quality in manufacturing sector.

H2.3 There is a significant positive association between audit committee meetings frequency and integrated reporting quality in non-manufacturing sector.

AC size and IRQ

Erin and Adegboye [22] used a sample of South Africa's top 100 listed corporations to assess integrated reporting quality using the International Integrated Reporting Council methodology from 2013. The data were analysed using content analysis, ordered probit regression, and logistic regression techniques. The results claim that conflicting results have been found regarding the size of an audit committee and how it impacts a firm's reporting [17, 31]. While some research [4, 31] showed a favourable correlation between audit committee size and the quality of financial and non-financial reporting, others [10, 53] found no correlation at all.

Particularly in terms of financial reporting, the size of the audit committee is strongly correlated with the calibre of integrated reporting. Larger audit committees can offer more viewpoints, more knowledge, and more effective financial reporting and integrated reporting

monitoring. According to the research mentioned above, the size of the audit committee is essential for assuring the dependability and accuracy of financial reporting.

H1.4 There is a significant positive association between audit committee size and integrated reporting quality in manufacturing sector.

H2.4 There is a significant positive association between audit committee size and integrated reporting quality in non-manufacturing sector.

Board gender diversity and IRQ

The effect of audit committee attributes on integrated reporting quality has been the subject of prior research; however, up to the researcher's knowledge, a moderating effect of profitability was only examined on the audit committee size and its association with IRQ, not on all audit committee attributes. But a moderating role of board gender diversity on the association between all audit committee attributes and IRQ has not yet been examined. This section of the literature focuses on how board gender diversity can strengthen the association between audit committee attributes and integrated reporting quality.

Qaderi et al. [39] used data from all publicly traded companies in Bursa Malaysia that implemented an integrated reporting (IR) strategy between 2017 and 2020 to examine the effects of board of directors' attributes on the volume and quality of IR disclosure. To investigate the relationships, multivariate ordinary least squares (OLS) regression was used. The International Integrated Reporting Council's criteria were followed to create an index consisting of 100 elements, which was used to quantify the quality of the IRQ. Gender diversity was determined by dividing the number of female directors on the board by the total number of directors (BGEND). The results of the study indicated that increased IR disclosure was positively and significantly correlated with board size, independence, gender diversity, and non-executive compensation. This suggests that the board of directors plays a monitoring role in mitigating agency problems and safeguarding the interests of stakeholders. Multiple directorships did not, however, impact IR disclosure. Additionally, the analysis demonstrated that the existence of a sustainability committee had a moderating influence on the link between board-IR disclosure and IR disclosure and favourably impacted IR disclosure.

In order to investigate the impact of board of directors' characteristics on integrated reporting quality, Fayad et al. [23] examined a total of 64 firms between 2017 and

2020, resulting in a total of 173 integrated reports. The total number of women on the board (BGN) was used to quantify board gender diversity, and an IR disclosure index's content analysis approach was used to measure IRQ. The results demonstrated a positive relationship between IRQ and the board's activity, gender diversity, and size.

H1.5 Board gender diversity is positively moderating the association between audit committee attributes and integrated reporting quality in manufacturing sector.

H2.5 Board gender diversity is positively moderating the association between audit committee attributes and integrated reporting quality in non-manufacturing sector.

Strengths and limitations of previous literature

Literature review offers a systematic assessment of audit committee attributes impact on the integrated reports quality across different geographic locations and industries. It concentrates on a wide range of research conducted in India, Indonesia, China, South Africa, and Malaysia to give a global picture of the subject.

Application of various research methods, including regression analysis, content analysis, and path analysis, validates the conclusion and an enhanced sense of the correlation between the characteristics of audit committees and integrated reporting quality is fostered.

The literature review identifies major gaps in the extant audit committee characteristics-integrated reporting quality research. They include absence of sector-specific analyses in many studies, variation in measurement approaches employed by different studies, small samples which may hinder widespread application of the conclusions.

Comparison between previous literature and Egyptian listed firms

The prior literature may vary from Egyptian listed firms in several aspects. It is important, to begin with, that various cultural, institutional, and regulatory peculiarities of Egypt can be vastly different from those in other previously researched countries. Such processes can alter the composition and structure of audit committees which in turn influences the quality and extent of integrated reporting standards. Also, the evolution of integrated reporting frameworks and practices in Egypt might be not the same as other locations; hence, the value and success of audit committee attributes in guaranteeing integrated reporting quality will change. On the contrary, the specific economic realities, market dynamics, and stakeholders expectations of Egypt are different from

those of other nations and are also full of challenges for the listed companies. Hence, examining Egyptian listed firms would induce insights specific to their special context while also adding to a closer comprehension of the region's disaggregated reporting practices. Through taking into consideration the specific context of Egyptian firms, including regulatory frameworks, cultural factors, and industry characteristics, researchers can make a better assessment of the relationship between audit committee attributes and integrated reporting quality. Such a narrowing down will be of considerable importance for both academics and practitioners operating in the Egyptian market.

Methods

This study used an inductive methodology to examine the research goals. This study investigates the influence of audit committee attributes on the integrated reporting quality within a selected group of Egyptian firms throughout the period from 2018 to 2022. The use of panel data analysis is employed to evaluate the impact of the audit committee on the integrated reporting index, taking into consideration the moderating influence of board gender diversity. The study is performed individually for two distinct sectors, namely manufacturing and non-manufacturing.

Sample and data collection

The dataset comprises secondary sources. The dataset consists of 54 publicly traded companies listed on the Egyptian stock market throughout the period from 2018 to 2022. Stratified random sampling is used in order to obtain a representative sample, which is separated into two distinct strata: 33 manufacturing firms and 21 non-manufacturing firms. The analysis of the effects of audit committee attributes on integrated reporting quality, as well as the potential moderating effect of board gender diversity on this association, is guided by insights derived from agency theory.

The technique of stratified random sampling involves the division of a population into smaller, more homogeneous groups known as strata, prior to the selection of a sample. The use of this approach serves to mitigate the presence of sampling bias, hence enhancing the representativeness of the sample in relation to the broader population. Stratified random sampling offers enhanced accuracy in data gathering as compared to ordinary random sample by ensuring representation from all demographic groups. The use of this approach mitigates the risk of sample bias, which has the potential to compromise the reliability of the research results [41].

The objective of this methodology is to use a sampling procedure that is capable of effectively selecting samples

from a population characterized by non-uniform data distribution [13]. The populations under analysis consist of companies who have published comprehensive financial reports spanning the period from 2018 to 2022 and have furnished the necessary data for examination. The variables under consideration include the following: integrated reporting quality, firm size, firm age, female board representation, audit committee size, financial expertise, independence, and meetings frequency. The variables chosen for the study were based on their pertinence to the research objectives and on their effect on integrated reporting quality. Each variable was selected according to the current literature and theoretical frameworks as well as its relevance to corporate governance and integrated reporting. Firm size and age were included as control variables because they affect organizational behaviour, and financial reporting methods are also known. Multi-national organizations may possess greater resources to adopt the complete comprehensive reporting framework. The board gender diversity was used as a moderating variable to explore the possible effect on the connection between audit committee attributes and integrated reporting quality. Taking the increased recognition of diversity as a critical determinant of board effectiveness, especially in its dimensions of transparency and accountability, as given, the variable was seen to be relevant to the research’s goals.

The audit committee’s structure and attributes are critical to the research since they play an important role in

supervising financial reporting and disclosure processes. Variables such as audit committee size, financial expertise, independence, and meeting frequency were chosen because they are critical to ensure the audit committee’s effectiveness and independence in carrying out the committee’s oversight duties.

Integrated reporting quality (IRQ) is the dependent variable in the study since it is the major focus of our research. This variable is critical for measuring organizations’ openness, accountability, and disclosure policies, which can be affected by corporate governance.

Stratified sampling is a robust and straightforward technique that may be effectively used in several contexts. Additionally, it might be classified as a kind of pooled effect modelling. Stratified sampling involves the division of a population into distinct strata [45].

Study variables

Research models

The pooled effect modelling approach is simple to use. The procedure can be applied using a variety of software tools. Since it is a flexible method that can be used with a range of data formats and is simple to apply, it enables the selection of samples that are representative of the entire population even when the data are not evenly distributed. The pooled effect modelling method is a potent tool for picking samples from populations with irregular data distributions, in the end. It is a flexible and simple strategy that holds up under a number of presumptions.

Table 1 Research variables and measurements

Variables	Measurement	References
<i>Independent variable</i>		
Audit committee attributes	Audit Committee Size=The number of audit committee members Audit Committee Financial Expertise=Number of directors with financial experience/qualification in the audit committee Audit Committee Independence=Number of non-executive directors in the audit committee Audit Committee Meetings=Number of meetings held by the audit committee in a year	Erin and Adegboye [22]
<i>Dependent variable</i>		
Integrated reporting quality	Based on an Index divided into 7 main components: Organizational overview Opportunities and risks Strategy and resource allocation Business model Governance Performance Future outlook	El-Deeb [21]
<i>Moderating variable</i>		
Gender diversity	Gender Diversity: Total number of women on the board	Fayad et al. [23]
<i>Control variables</i>		
Firm size	Firm Size= Log of total assets	Nicola et al. [55]
Firm age	Age= Number of years since the establishment of the firm	
Profitability	ROA= Net Income/Total Assets	

Therefore, Stata was used in this paper. Descriptive analysis, pooled effect OLS analysis, and Pearson correlation analysis had been used to analyse the data (Table 1).

Pooled OLS model is one of the algorithms built to deal with the panel data analysis. Adekeye et al. [54] explained that pooled OLS can be expressed in terms of following function

$$y_{it} = X_{it}\beta + \omega_{it}, i = 1, \dots, N \text{ and } t = 1, \dots, T$$

where X is matrix of independent variables, β represent coefficients, and ω_{it} is the vector of errors. The pooled effect model presents its optimal solutions when there is no panel effect of data. We took into account a number of aspects while choosing the best panel data analysis model, including how well each model's underlying assumptions matched the features of the dataset. The pooled OLS model was chosen since it performs well under situations where data lack a panel effect. The choice of the particular model was made because that underlying assumption in our data is that there are no noteworthy cross-sectional or time-series relationships in it. The assumption was acceptable as we had features from different firms over a period of time. What is more, the pooled OLS model is easy to understand, in the given way that it makes it a convenient option for our analysis.

To test whether pooled OLS model is the optimal model for explaining the phenomenon when compared to other panel regression models as random and fixed effect model, a Lagrange multiplier test should be used. The Lagrange multiplier test is highly effective for comparing pooled effect models. This versatile, non-parametric test is straightforward to use, provided its assumptions are satisfied.

The final research models that will present the dataset would be:

$$IRQ_{it} = \beta_0 + \beta_1 ROA + \beta_2 \text{ Firm Size} + \beta_3 \text{ Firm Age} + \beta_4 \text{ Gender Diversity} + \beta_5 \text{ AC size} + \beta_6 \text{ AC FE} + \beta_7 \text{ AC Indep} + \beta_8 \text{ AC Meetings}$$

After investigating the significance of the variables, the moderator will be added in Model 2:

$$IRQ_{it} = \beta_0 + \beta_1 ROA + \beta_2 \text{ Firm Size} + \beta_3 \text{ FirmAge} + \beta_4 \text{ Gender Diversity} + \beta_5 \text{ AC size} + \beta_6 \text{ AC FE} + \beta_7 \text{ AC Indep} + \beta_8 \text{ AC Meetings} + \beta_9 \text{ BGD} * \text{ AC size} + \beta_{10} \text{ BGD} * \text{ AC FE} + \beta_{11} \text{ BGD} * \text{ ACIndep} + \beta_{12} \text{ BGD} * \text{ AC Meeting}$$

Model 1 aims to examine the influence of audit committee attributes on integrated reporting quality (IRQ). The key independent variables representing audit committee attributes are: AC size—The number of directors on the audit committee, used to measure committee size.

A larger audit committee may have greater collective oversight capabilities. AC FE—The number of audit committee members with financial expertise, used to measure the committee's financial proficiency. Financial expertise is expected to enhance the committee's effectiveness in assessing reporting quality. AC Indep—The number of independent directors on the audit committee, measuring the committee's overall independence from management. Greater independence should improve oversight objectivity. AC Meetings—The annual number of audit committee meetings, indicating the committee's overall diligence. More frequent meetings may lead to higher quality oversight. The control variables of firm size, firm age, and profitability (ROA) are included as they may also explain variations in IRQ.

Model 2 incorporates an additional moderating variable, board gender diversity (BGD), which interacts with the key independent variables. This allows examination of whether the audit committee's impact on IRQ is influenced by the extent of gender diversity on the full board. In summary, the models aim to isolate the specific relationships between audit committee characteristics and IRQ, while controlling for other factors. The inclusion of moderating effects provides further depth into how these relationships may be contingent on board gender diversity.

Research framework

After reviewing the literature, a research model is conducted (Fig. 1) to illustrate the association between integrated reporting quality and audit committee attributes with the moderating role of board gender diversity. The quality of integrated reporting (IRQ) is the dependent variable and is measured using an index of 43 items taken from ElDeeb [21], and the independent variable is the

audit committee's attributes, which is divided down into the following subcategories: the audit committee's finan-

cial expertise, independence, meeting frequency, and size [55]. For instance, the model investigates the impact of audit committee attributes on the quality of integrated reporting by first examining the impact of each attribute

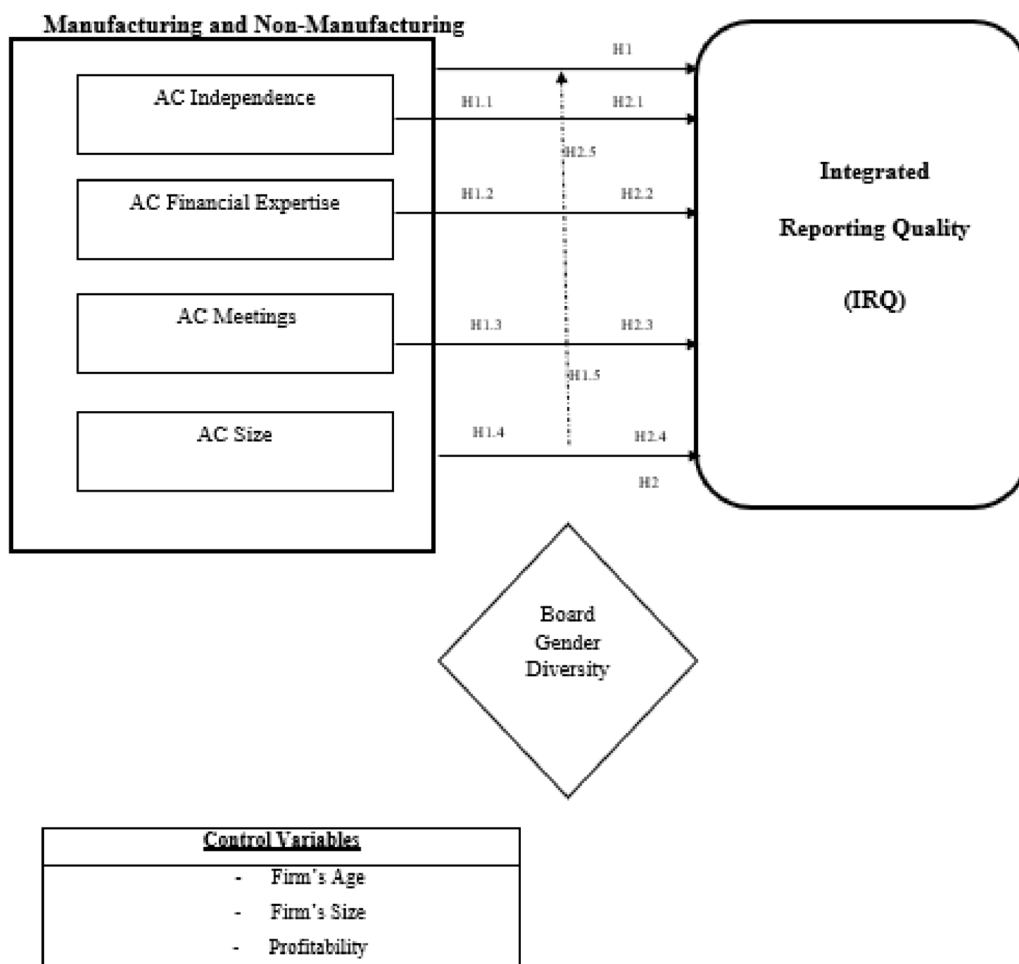


Fig. 1 Theoretical framework of the research

on the quality of integrated reporting separately and then analysing the impact of all attributes combined [56].

Independent members of an audit committee are thought to be responsible for more detailed disclosures in annual reports; hence, this attribute is often used to describe the level of independence inside an audit committee [14]. It is measured by counting the number of members who are independent inside the committee that have no special interests in the outcome of the audit [57]. Next, financial expertise refers to the amount to which members of an audit committee are experienced in finance and accounting, which is considered an attribute that increases the number of items disclosed in integrated reports measured by the number of members who are finance and accounting experts inside the committee.

Furthermore, the third attribute known as meeting frequency is believed to impact report quality because a higher level of monitoring discourages agents from behaving dishonestly or in favour of principles. It is measured by calculating the number of meetings held by the

audit committee annually. The frequency of meetings is measured by calculating the number of meetings held by the audit committee annually. In addition, the size of the audit committee increases the probability that any issues with the reporting process will be discovered and corrected due to the great number of members having a great variety of talents and viewpoints. How many people on the audit committee are present is the measurement used [70].

Moreover, board gender diversity is used as a moderator to assess the effect of audit committee attributes on the quality of integrated reporting. Women's representation on the board is measured by their number [58]. Based on previous literature, certain control variables were taken into consideration in this research. It included the firm's age calculated by the number of years since the firm got established [55], the firm's size which is measured by natural algorithm of total assets [15, 16, 55, 59] and profitability by using ROA measured by dividing the net income by total assets [15, 16, 55, 59].

Results

Descriptive analysis

From table 2, it is noticed that the company with the highest compliance to IRQ was Domty (93%), while the lowest was Egypt Poultry (11%) for manufacturing sector. For non-manufacturing sector, Orascom Development had the highest compliance (90%), while El Obour Real estate was the lowest (9%). These findings are based on table in appendix. For all these companies the audit size ranged from 3 to 4 members. Number of audit committee meetings was alternating in number for companies as Egypt for poultry ranging from 0 to 8 meetings per year. On the other hand, Orascom and Domty had a consistent number of four meetings every year.

Regarding the IRQ, it was noticed that it was divided into 7 dimensions as mentioned in appendix 1. Those dimensions were Organizational Review, Opportunities and Risks, Strategy and Resource Allocation, Business Model, Governance, Performance, and Future outlook. Regarding organizational review, both manufacturing and non-manufacturing companies with high IRQ and low IRQ had a profile, but all companies with low IRQ had not any mission statements, vision, values, fundamental growth, stakeholders' inclusivity, supply chain outbound, and market overview.

For opportunities, risk, strategy, resource allocation, and future outlook, all firms with low IRQ completely disregarded those dimensions, while those with high IRQ took them all seriously. Regarding the business model, the intellectual capital only existed in manufacturing companies with high IRQ, while non-manufacturing companies did not report having high intellectual capital. On the other hand, all companies had financial capital. The performance of the companies varied between two sectors manufacturing and non-manufacturing in terms of different subdimensions. Almost all companies reported neither efficiency index nor their talent management.

Only the highest companies in terms of IRQ in manufacturing field reported the employee evaluation. The low IRQ companies in non-manufacturing field are the ones who did not report who will be accountable. In terms of governance, remuneration policy was only reported by high IRQ non-manufacturing companies. Only high IRQ companies had key activities of board, nomination committee, audit committee, and internal control.

Correlation analysis

The Pearson correlation coefficients presented in Table 3 reveal several noteworthy associations between integrated reporting quality (IRQ) and the independent variables under examination.

Firstly, the analysis indicates a moderate positive correlation between IRQ and firm size ($r=0.436, p<0.01$), suggesting that larger firms exhibit superior integrated reporting practices, perhaps due to greater resources and capabilities. This aligns with prior academic literature highlighting firm size as a determinant of voluntary disclosure and reporting quality [4] (Ntim et al. 2021).

Secondly, a weak positive correlation is evident between IRQ and audit committee size ($r=0.123, p<0.05$), implying that companies with larger audit committees demonstrate somewhat higher IRQ. This may be attributable to greater collective oversight and monitoring abilities within bigger audit committees, as highlighted by agency theory [60].

Thirdly, a significant weak positive association emerges between IRQ and audit committee independence ($r=0.185, p<0.01$), indicating that higher independence levels correspond with marginally improved integrated reporting quality. This resonates with the notion that independent directors enhance objectivity in oversight duties, including reporting quality assessments [61].

On the contrary, IRQ exhibits statistically insignificant correlations with return on assets, firm age, audit

Table 2 Descriptive statistics for variables in phenomenon *Source:* Calculations based on sample of 54 companies using Stata 14

Variable	Manufacturing firms				Non-manufacturing firms			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
IRQ	0.497674	0.274042	0.116279	0.930233	0.506131	0.285032	0.093023	0.906977
ROA	0.037241	0.142144	-1.31605	0.294516	0.807512	8.19002	-0.16107	85.92254
Firm Size	3.643035	0.924444	1.974604	5.66166	3.691196	0.860532	1.581153	5.211436
Firm Age	35.5	15.08675	16	84	38.36364	33.53561	3	168
Female gender on board	0.8	0.860013	0	3	1.036364	1.483408	0	7
Audit committee size	3.125	0.97613	0	6	3.172727	1.573048	0	8
Audit committee financial expertise	0.5625	0.497636	0	1	0.527273	0.501541	0	1
Audit committee independence	2.93125	0.939168	0	6	2.981818	1.573763	0	7
Audit committee meetings	5.65625	4.31036	0	23	4.327273	3.427116	0	16

Table 3 Pearson correlation coefficients for associations between variables *Source:* Calculations based on sample of 54 companies using Stata 14

	IRQ	ROA	Firm size	Firm age	Female gender at BOD	AC size	AC FE	AC Indep	AC meeting
IRQ	1								
ROA	−.048	1							
Firm size	0.436**	−0.012	1						
Firm Age	0.115	−0.010	−0.006	1					
Female gender BOD	0.029	0.269**	−0.071	−0.031	1				
AC size	0.123*	−0.007	−0.038	−0.078	0.195**	1			
AC FE	−0.049	0.056	−0.084	−0.072	−0.030	0.165*	1		
AC Indep	0.185**	0.003	−0.019	−0.017	0.147*	0.004	0.034	1	
AC meeting	0.040	−0.013	−0.037	−0.039	−0.014	0.043	0.089	0.052	1

Sig: ** < 0.01, * < 0.05, "" > 0.05

committee financial expertise, and committee meetings. This implies that these factors may not directly determine integrated reporting quality within the examined Egyptian firms, contrary to certain prior studies [34].

In summary, the correlation analysis provides initial evidence that larger firm size and enhanced audit committee size and independence may contribute positively to integrated reporting quality, while other attributes appear insignificant. Further regression analysis is warranted to isolate the predictive effects of these variables on IRQ.

Pooled effect model

1st full model building

After checking stationarity and finding that no lags need to be considered, panel data analysis can be executed. The results of Lagrange multiplier test resulted in using

pooled effect model since the data did not have a panel effect.

The pooled effect model results presented in Table 4 offer valuable insights into the determinants of integrated reporting quality (IRQ) within the manufacturing and non-manufacturing sectors. For manufacturing firms, firm size, firm age, audit committee independence, and audit committee meetings exhibit statistically significant positive coefficients ($p < 0.05$). The positive association between firm size and IRQ aligns with agency theory, whereby larger firms face greater external pressures for transparency and thus improve reporting [60]. Similarly, older firms may have more established governance processes benefiting IRQ. The results suggest audit committee independence and frequent meetings also contribute to enhanced IRQ, consistent with arguments that independence and diligence in monitoring improves oversight quality [61].

Table 4 Coefficients of pooled effect model for companies based on data collected from (2018–2022) *Source:* Calculations based on sample of 54 companies using Stata 14

IRQ	Manufacturing companies		Non-manufacturing companies	
	Coefficient	Standard error	Coefficient	Standard error
ROA	0.11468	0.148051	−0.00259	0.002314
Size	0.071132**	0.02316	0.239714**	0.021691
Firm age	0.004861**	0.001494	−0.00027	0.000544
Female gender on board	0.089611**	0.024686	0.04177**	0.013227
Audit committee size	−0.03779	0.037878	−0.00799	0.035363
Audit committee financial expertise	−0.04944	0.045179	0.053404**	0.006405
Audit committee independence	0.078665*	0.03943	0.034947	0.034601
Audit committee meetings	0.01251**	0.004957	0.0124**	0.005998
_cons	0.040563	0.142165	−0.47226**	0.087305

Sig values: ** < 0.01, * < 0.05, "" > 0.05

Table 5 Coefficients of pooled effect model with moderator for companies based on data collected from (2018–2022) *Source:* Calculations based on sample of 54 companies using Stata 14

IRQ	Manufacturing companies		Non-manufacturing companies	
	Coefficient	Standard error	Coefficient	Standard error
Audit committee size*BGD	-0.01993	0.041103	0.019015	0.03218
Audit committee financial expertise*BGD	-0.05997	0.049728	-0.06289	0.041101
Audit committee independence*BGD	-0.0117	0.043353	-0.02661	0.036128
Audit committee meetings*BGD	-0.02149**	0.005997	0.015205*	0.00833
ROA	0.124335	0.141834	-0.002	0.002498
Size	0.06047**	0.022706	0.251653**	0.022124
Firm Age	0.003554*	0.001481	-0.00044	0.00054
Female gender on board	0.249425**	0.08286	0.09044*	0.059442
Audit committee size	0.007736	0.065256	-0.00393	0.045825
Audit committee financial expertise	-0.04744	0.060756	0.11315*	0.050557
Audit committee independence	0.074071	0.064855	0.032428	0.046132
Audit committee meetings	-0.00385	0.005527	-0.01778	0.011108
_cons	-0.04614	0.146879	-0.50454**	0.0918

Sig values: ** < 0.01, * < 0.05, "" > 0.05

Conversely, ROA, audit committee size and financial expertise show no significant relationship with IRQ in manufacturing firms. This implies these factors may not directly impact IRQ, contrary to some prior evidence [34]. The insignificant results could reflect industry-specific conditions within Egyptian manufacturing firms.

For non-manufacturing firms, firm size, audit committee financial expertise, and meetings exhibit significant positive coefficients, while other variables are insignificant. This points to larger firm size, financial proficiency, and active monitoring by audit committees associating with better IRQ. The divergence from manufacturing firms highlights sectoral differences in IRQ determinants.

2nd model with moderator building

The moderated regression analysis in table 5 reveals several salient findings regarding the impact of board gender diversity (BGD) on the relationship between audit committee attributes and integrated reporting quality (IRQ) across sectors.

In manufacturing firms, the positive significant interaction term between BGD and audit committee meetings suggests that gender diversity amplifies the positive link between frequent audit committee meetings and IRQ. A potential explanation is that diversity brings a wider range of perspectives that enrich committee discussions and oversight [62]. Hence, gender diversity coupled with active monitoring through regular meetings is associated with enhanced IRQ.

However, BGD does not significantly moderate the associations between IRQ and other audit committee attributes like size, expertise, and independence in

manufacturing firms. This points to gender diversity specifically benefiting the "meeting-IRQ" relationship, rather than broadly affecting all audit committee dynamics.

Within non-manufacturing firms, BGD positively and significantly moderates the connection between audit committee financial expertise and IRQ. This implies gender diversity improves the impact of having financially proficient directors on the committee. Prior research argues diversity may mitigate "groupthink" and thereby allow specialized expertise to be more fully utilized [63]. This effect seems most relevant for expertise in non-manufacturing contexts. On the other hand, as with manufacturing firms, BGD does not significantly affect the other audit committee links with IRQ in non-manufacturing firms.

In summary, board gender diversity appears to possess nuanced, conditional effects on audit committee functioning and IRQ across industries. The evidence aligns with contingency theory arguments that organizational factors like diversity must be considered in context to understand governance dynamics [64]. While no broad or uniform impacts emerged, the results highlight fertile areas for future research into diversity's role in enhancing audit committee effectiveness across sectors.

Table 6 offers insights into the measurements on the models constructed. It presents coefficient of determination (R^2) and the adjusted R^2 which are explanatory measurements for IRQ model quality. These metrics are measures of the models' explanatory power and the extent to which the independent variables capture the variation in IRQ.

Initially in the manufacturing sector, full model accounted for 20.56% of variations in IRQ shaped by R^2 . This implies that around twenty percent of variation in IRQ could be ascribed to the effects of variables like ROA, firm size and age, gender diversity, and audit committee attributes. Contrary, adding moderators to the model increased the explanatory power tremendously, where the R^2 went up to 29%. Such adjustment stresses the moderating roles of other variables in the context of manufacturing by means of which predictors are associated with IRQ.

On the contrary, in the non-manufacturing sector, the full model displayed a more considerable explanatory power with an R^2 of 60%, implying that a large part of the variation in IRQ is explained by the independent variables included in the model such as gender diversity, ROA, firm size, firm age, and audit committee attributes. After introducing moderators, the model's explanatory power increased a little, R^2 rising to 63%. This rise is only marginal in comparison with the manufacturing, but reveals the strength of the model to reflect the IRQ variations within the non-manufacturing.

Robust test

The robustness test is a requirement to prove that the results obtained are valid to be further inferred. To test robustness of the results, a 2-stage least square (2SLS) regression model will be employed. To use it an instrumental variable should be utilized. The one used was the Firm age as an instrument variable, while the instrumented variable was the firm size.

As per the findings of the manufacturing sector in table 7, a statistically significant link is shown when the significance value is less than 0.05. This implies that Firm Size, Audit committee independence, and Audit committee meetings have a significant impact on IRQ. The study revealed that the gender diversity of the Board of Directors (BOD) has a significant impact on IRQ with a confidence level of 95%. All the other variables in the study exhibit a p -value greater than 0.05, indicating a lack of significance. Therefore, the variables of Return on Assets (ROA), direct Audit committee size, and Audit committee financial knowledge do not exhibit a significant

impact on IRQ. The results came consistent with the results of the pooled effect model. This shows that the results were valid.

Concerning the non-manufacturing industry, a significance value less than 0.05 indicates a significant association, indicating that Firm size, Audit committee meetings, and Audit committee financial expertise have a significant impact on IRQ. The IRQ was significantly affected by gender diversity with a confidence level of 95%. The remainder have significance values greater than 0.1. Consequently, ROA, Audit committee size, and Audit committee independence have no significant effect on IRQ. The results came consistent with the results of the pooled effect model. This shows that the results were valid (Table 7).

Based on the findings shown in Table 8 of the manufacturing sector, a significant association is indicated by a significance value below 0.1. Specifically, the variables of Firm size, audit committee meetings, and Female gender at the board of directors' level were found to have significant effects on IRQ. Gender diversity was found to be a significant predictor as well as a significant moderator in the association between audit committee meetings and IRQ. The firm size on the other hand was found to have a significant negative impact on IRQ. All the remaining variables have significance values greater than 0.1. Therefore, the variables of Return on Assets (ROA), Audit Committee Size, Audit Committee Financial Expertise, and Audit Committee Independence do not demonstrate a significant effect on IRQ. The moderator shows that gender diversity and number of females in board directors have an impact on the association between the meetings and the IRQ.

Based on the findings of the non-manufacturing sector, a significant association was seen with a significance value below 0.1. This indicates that the variables of Firm size, Gender diversity, Audit committee meetings, and financial expertise have a significant effect on IRQ. All the remaining variables have a significance level greater than 0.1. Therefore, the variables of Return on Assets (ROA), the size, audit committee independence and size, do not demonstrate a significant effect on IRQ. The presence of the moderator variable, namely the female gender, exerts

Table 6 Model evaluation metrics *Source:* Calculations based on sample of 54 companies using Stata 14

	Sector	R	R ²	Adjusted R ²	Std. error of the estimate
Full model	Manufacturing	0.453	0.2056	0.1635	0.002047
	Non-manufacturing	0.779	0.6078	0.5767	0.003059
Full model with moderator	Manufacturing	0.543	0.2957	0.2382	0.003335
	Non-manufacturing	0.798	0.6372	0.5923	0.054536

Table 7 Robust test without moderator for companies based on data collected from (2018–2022)

IRQ	Manufacturing companies		Non-manufacturing companies	
	Coefficient	Standard error	Coefficient	Standard error
ROA	0.003486	0.151818	−0.00247	0.002155
Firm size	0.06063**	0.02607	−0.0399**	0.021227
Female gender on board	0.10744***	0.03477	0.0458***	0.014828
Audit committee size	−0.06053	0.043274	−0.0086	0.039989
Audit committee financial expertise	−0.00243	0.048171	0.0752**	0.036622
Audit committee independence	0.06826**	0.02390	0.034482	0.038374
Audit committee meetings	0.00920**	0.00576	0.0175**	0.005819
_cons	0.263993	0.142929	−0.47058**	0.085657

Sig values: *** < 0.01, ** < 0.05, * < 0.1, "" > 0.1

Table 8 Robust test with moderator for companies based on data collected from (2018–2022)

IRQ	Manufacturing companies		Non-manufacturing companies	
	Coefficient	Standard error	Coefficient	Standard error
Audit committee size*BGD	−0.01645	0.077005	0.062203	0.038236
Audit committee financial expertise*BGD	−0.09843	0.061351	−0.08193	0.062112
Audit committee independence*BGD	−0.06281	0.056896	−0.06909	0.04127
Audit committee meetings*BGD	−0.011443*	0.007121	0.015205*	0.00833
ROA	0.033183	0.139357	−0.00109	0.002182
Firm size	−0.047545*	0.025868	0.01380*	0.009164
Female gender at board of direct	0.570657*	0.325904	0.11322***	0.016431
Audit committee size	0.015212	0.136033	−0.05615	0.053844
Audit committee financial expertise	−0.05533	0.066484	0.09900*	0.06335
Audit committee independence	0.133402	0.075768	0.078691	0.054682
Audit committee meetings	−0.0317***	0.006077	−0.02957*	0.012433
_cons	−0.10188	0.359449	−0.50044***	0.104595

Sig values: *** < 0.01, ** < 0.05, * < 0.1, "" > 0.1

significant impact on Audit committee meetings. This suggests that there exists a moderate association between Audit committee meetings and IRQ, as evidenced by the significance of the link with a p-value of less than 0.1, while Female gender has insignificant impact on Audit committee size and independence association with IRQ as its value is above than 0.1. Thus, Female gender does not moderate association between of them.

The findings of the coefficient of determination are presented in Table 9. The findings of the study revealed that the manufacturing sector was shown in its entirety. The model constructed using variables such as return on assets (ROA), firm size and age, gender diversity, and audit committee attributes accounts for 68.00% of the observed variation in integrated reporting quality. Following the inclusion of moderators, the model exhibited enhanced performance, resulting in an increased ability to elucidate 71% of the variance seen in the integrated

reporting quality. In the non-manufacturing sector, a significant proportion of the variance in integrated reporting quality, namely 65.13%, may be attributed to a robustness test model. This model incorporates many factors such as gender diversity, return on assets (ROA), business size, firm age, and attributes of the audit committee. Following the introduction of moderators, the model exhibited an enhanced capacity to elucidate 69.55% of the variance observed in integrated reporting quality. Most importantly the robust test showed that the same results would be concluded; thus, the results are valid and accurate.

Results and discussion

The research model aims to explore the association between audit committee attributes and integrated reporting quality, while also investigating the moderating role of board gender diversity in this association. The

Table 9 Model evaluation metrics of 2SLS model *Source:* Calculations based on sample of 54 companies using Stata 14

	Sector	R	R ²	Adjusted R ²	Std. error of the estimate
Without moderator	Manufacturing	0.824	0.6800	0.6714	0.002235
	Non-manufacturing	0.807	0.6513	0.6419	0.004108
With moderator	Manufacturing	0.842	0.7100	0.6976	0.012340
	Non-manufacturing	0.833	0.6955	0.6825	0.055670

paper will discuss the hypotheses and their implications based on the results presented in the tables.

First, the manufacturing sector was investigated. According to the first hypothesis H1 the research model suggests that audit committee attributes, including independence, financial expertise, meetings frequency, and size, have a positive association with integrated reporting quality. However, the results indicate that only certain attributes have a significant effect on integrated reporting quality, while others do not.

The subhypothesis of H1.1 posits that audit committee independence has a positive association with integrated reporting quality. The results support this hypothesis, as the analysis shows a significant weak positive association between audit committee independence and integrated reporting quality. Nicola et al. [55] had consistent results with this hypothesis as it found for its 125 firms sampled from a total of 527 NGOs and profit-based firms that independence of audit committee leads to a higher level for transparency and disclosure.

The subhypothesis H1.2 suggests a positive association between audit committee financial expertise and integrated reporting quality. However, the results indicate an insignificant association between these two variables. This was validated by robustness of model that there is no enough evidence that the financial expertise of audit committee had significant impact on IRQ. This may be due to having no enough sample and high variation in financial expertise in manufacturing sector that could not be captured by the sampled companies. Appuhami and Tashakor [8] agree with the results of the study as they indicated that financial expertise does not affect the integrated reporting quality. Another study that was previously mentioned by Nicola et al. [55] did not find enough evidence for the influence of financial expertise on integrated reporting quality.

Moreover, the subhypothesis H1.3 proposes that a higher frequency of audit committee meetings positively impacts integrated reporting quality. The results support the association between audit committee meetings and the integrated reporting quality. The higher number of meetings gave higher chance for inspection

of frauds. This was consistent with most of the literature previously reviewed in chapter two [15].

In addition, the subhypothesis H1.4 suggests that a larger audit committee size positively influences integrated reporting quality. The results had no significant evidence that the audit committee size had an impact on IRQ. Erin and Adegboye [22] support the results of our study as they stated previously in literature that large audit committee can result in different opinions and cause problems.

Afterward, H1.5 was investigating the gender diversity as a moderator in the association between audit committee and IRQ. The results show that gender diversity moderates the association between audit committee meetings frequency and integrated reporting quality, but it does not moderate the associations with other audit committee attributes.

Concerning the H2 it was same as H1 but applied to the group of non-manufacturing sector. Also, a few attributes were found to have a significant impact on IRQ, while others did not show any influence on the target variable.

Starting with subhypothesis H2.1, it presented the association of the audit committee independence with the IRQ. There was no enough evidence in this study that the non-manufacturing sector industry exhibits IRQ correlated to the audit committee independence. It may be reflected by the small sample of non-manufacturing sector in the study.

H2.2 suggested the positive association of financial expertise with the IRQ. This was proved by this study for the non-manufacturing sector. This explains how higher financial expertise will lead to higher and more transparent disclosure.

H2.3 investigated the frequency of meetings and how it would impact the IRQ. It was found to be positively significant in case of non-manufacturing sectors. This can be thoroughly explained by the previously reviewed literature. Altawalbeh [7] had supported that hypothesis within the study on Jordan's 72 listed firms covered the time period 2013–2016.

H2.4 lastly was the hypothesis responsible for the audit committee size and its influence on the IRQ. It was found

to be insignificant in terms of non-manufacturing sector. The results may contradict much studies. However, it is noticed that these studies did not take the sector into consideration.

H2.5 investigated the moderating effect of gender diversity on the association between audit committee and IRQ. The results showed that gender diversity moderated the association between audit committee meetings and the IRQ. However, for the rest of the attributes, their association with IRQ was not moderated by gender diversity.

Although our research uncovers some variables that influence IRQ substantially, we do not ignore those that do not hold it to be statistically significant. Due to the non-significant results seen in certain variables, the search for plausible reasons behind their lack of effect on IRQ becomes inevitable.

In case of variables like return on assets (ROA), audit committee size, audit committee financial expertise, and audit committee independence—their non-significant relationships with IRQ could be due to several reasons. In the beginning, we should admit the shortcomings of our data, like the number of samples is limited, there is an element of data quality problem, and possible measurement error. Such conditions could be a reason why none of the significant results was shown to be due to the variables with smaller effects or complex impact on IRQ.

Also, other explanations for the non-significant outcomes deserve attention. For example, the non-significant relationship between ROA and IRQ can imply that the financial performance metrics do not capture the whole picture of integrated reporting practices. The same goes for the insignificant relationships of audit committee attributes as well which may reflect on the multi-dimensional aspect of corporate governance and its interaction with integrated reporting. Moreover, our study practice-specific which concentrates on manufacturing and non-manufacturing sectors, influences of some variables. Industry-based dynamics, regulatory settings, and organizational features may moderate relationships between variables and IRQ, thus contributing to non-significant findings in our analysis.

Our study brings forth useful findings on the drivers of integrated reporting quality, but the non-significant results indicate that more research is needed. Further investigations using other methodologies, with inclusion of more variables, or longitudinal designs could be used to improve the understanding of the determinants of IRQ. Also, qualitative researches, stakeholder views, and case studies might be utilized as the additional complementary information concerning the integrated reporting practices complexities.

In both manufacturing and non-manufacturing sectors, gender diversity was found to moderate the connection between audit committee meetings and IRQ. This implies that the existence of gender-diverse boards moderates the role of audit committee meetings in predicting IRQ outcomes. One possible explanation for this moderation effect can be that gender-diverse boards enable an inclusive decision-making environment which in turn makes for better communication and collaboration within the audit committee leading to amplified effects of meetings on IRQ. Besides, various views on gender-diverse boards can contribute to more comprehensive discussions during meetings which could promote the identification and disclosure of appropriate information in integrated reports.

Nevertheless, the relevance gender diversity was not observed as a moderator between audit committee size, financial expertise, independence, and IRQ in both sectors. Such could be due to multiple factors not limited to composition of the audit committee and organizational culture geared toward gender diversity. It is likely that other contextual factors in the organization, for example, leadership support to diversity initiatives or the existence of gender biases may attenuate the potential moderating effects of gender diversity on these relationships. Additionally, the particular pathways that mediate gender diversity roles as moderator necessitate extended study as the current results present only the base layer that might be teased up in further studies.

Notably, the gender diversity serves as a moderator and drives attention to diversity and inclusion in corporate governance. Through comprehending the board-gender inclusion's impact on audit functions on corporate governance, organizations can see diversity as a strategic asset in integrating reporting into governance practices.

The study provides valuable insights into the impact of audit committee attributes on integrated reporting quality and the role of gender diversity as a moderating factor. The findings can be useful for companies, regulators, and stakeholders in enhancing integrated reporting practices and governance. It is crystal clear how no references were mentioned in the results of the non-manufacturing sector as it was previously stated in the paper that little to no studies were conducted regarding the impact of audit committee attributes on integrated reporting quality in the non-manufacturing sector. A few papers were only found on the impact of both variables in the manufacturing sector only. However, further research and consideration of additional factors may be necessary to gain a more comprehensive understanding of the topic.

Conclusion, limitations, and suggestions for future research

This study examined the effects of attributes of an audit committee on integrated reporting quality, using gender diversity on the board as a moderating variable. The purpose of the study was to investigate the associations among the attributes of audit committees including size, independence, experience, and frequency of meetings and effectiveness of integrated reporting. The study examined whether the gender diversity of the board affects this association. The goal of the novel idea of integrated reporting is to give stakeholders a thorough grasp of a business's performance by combining financial and non-financial data into a single report.

Audit committees, on the other hand, are responsible for overseeing the financial reporting process and ensuring its accuracy and reliability. The research used secondary data obtained from financial statements and corporate governance reports of 54 firms listed in the Egyptian stock exchange market from the period 2018–2022. The research excluded non-financial firms due to their special nature. There may be some similarities and differences between the results of the current study and those of the earlier studies discussed in the literature review. Previous studies have highlighted the importance of audit committee independence, financial expertise, and size in ensuring effective financial reporting and governance [65]. Moreover, research has explored the association between board gender diversity and firm performance, including financial performance and corporate social responsibility.

Independent and sizable audit committees have continuously been named as crucial elements of good company governance in several studies [19, 55]. Along with financial expertise and frequency of audit meetings, they formed the audit committee attributes that was investigated by the rest of the literature on its impact on disclosure. Most of the literature studied the association between the two variables; however, there was a total disregard for how this may differ in different sectors of industries. Therefore, this study was the gateway for future research to consider the type of industry and the first milestone to compare the association between

attributes of audit committee and IRQ in manufacturing and non-manufacturing sectors.

The current study aimed to build on this existing body of research by investigating the association between audit committee attributes and IRQ, while also exploring the moderating role of board gender diversity in this association. The findings revealed some interesting results and added to the understanding of these associations.

The IRQ of manufacturing sector companies was significantly impacted by the independence of the audit committee and the frequency of their meetings. The gender diversity in the board of directors also had a significant impact on the IRQ and also moderated successfully the association between audit meetings and the IRQ. However, it could not find a significant association between financial expertise and IRQ. This came in contrast with previous research as Dwekat et al. [19] and Fayad et al. [23]. The current conclusion that genders diversity modifies the correlation between audit committee meetings and IRQ is consistent with previous research showing a beneficial association between gender diversity and business performance [35, 66].

For the non-manufacturing sector, the IRQ was influenced by the audit committee financial experience and frequency of their meetings. Still as the manufacturing sector, the gender diversity in board of directors also had significant influence on the IRQ. It significantly moderated the association between audit meetings frequency and the IRQ. The independence and size of audit committee on the other hand had no significant influence on IRQ. This contradicted much literature that was previously reviewed. However, this may be explained due to the concentration on the non-manufacturing sectors.

Conversely, the association between the frequency of audit committee meetings and IRQ is moderated by board gender diversity. This implies that the effectiveness of audit committee meetings in raising the integrated reporting quality may be impacted by the participation of female board members. Nonetheless, there was not a noticeable moderating influence of board gender diversity on the associations between IRQ and other audit committee attributes.

The final model was found to be:

$$\begin{aligned} \text{Manufacturing : IRQ}_{it} = & -0.04614 + 0.124335 \text{ ROA} + 0.06047 \text{ Firm Size} + 0.003554 \text{ Firm Age} \\ & + 0.249425 \text{ Gender Diversity} + 0.007736 \text{ AC size} - 0.04744 \text{ AC FE} \\ & + 0.00074071 \text{ AC Indep} - 0.00385 \text{ AC Meeting} - 0.01993 \text{ BGD} * \text{ AC size} \\ & - 0.05997 \text{ BGD} * \text{ AC FE} - 0.0117 \text{ BGD} * \text{ AC Indep} - 0.02149 \text{ BGD} * \text{ AC Meetings} \end{aligned}$$

$$\begin{aligned}
 \text{Non – Manufacturing : } IRQ_{it} = & -0.50454 - 0.002 ROA + 0.251653 \text{ Firm Size} - 0.00044 \text{ Firm Age} \\
 & + 0.02044 \text{ Gender Diversity} - 0.00393 \text{ AC size} + 0.11315 \text{ AC FE} \\
 & + 0.032428 \text{ AC Indep} - 0.01778 \text{ AC Meetings} + 0.019015 \text{ BGD} * \text{ AC size} \\
 & - 0.06289 \text{ BGD} * \text{ AC FE} - 0.02661 \text{ BGD} * \text{ AC Indep} + 0.015205 \text{ BGD} * \text{ AC Meetings}
 \end{aligned}$$

By offering an extensive understanding of the association between integrated reporting quality and audit committee attributes as well as how board gender diversity may moderate this association, the current study adds to the body of literature. It emphasizes the value of specific attributes, such as audit committee meetings, in raising the integrated reporting quality and the part gender diversity plays on the board in pertaining to the efficacy of audit committee meetings are at raising the integrated reporting quality.

These findings have practical implications for companies, regulators, and stakeholders in enhancing corporate governance practices and integrated reporting. They emphasize the significance of having independent and appropriately sized audit committees and suggest that gender-diverse boards can positively impact integrated reporting quality. However, it is essential to recognize that further research is necessary to explore additional factors and to ensure a comprehensive understanding of the complex dynamics between corporate governance attributes and integrated reporting quality.

There are a number of recommendations that can be addressed to the manufacturing and non-manufacturing sectors to ensure high IRQ. All companies from any sector should especially consider the Opportunities and Risks, Strategy and Resource Allocation and Future Outlook. Manufacturing companies should recognize the importance of announcing their financial indicators and intellectual capital, while non-manufacturing sector needs to report their remuneration policy to achieve high IRQ.

This study makes several valuable contributions to the academic literature on audit committees, gender diversity, and integrated reporting quality. However, there are some recommendations that can be provided for future research. Integrated reporting quality was assessed using a disclosure index. More qualitative analysis of report content could reveal subtleties not captured in the disclosure scoring. Also, only gender diversity was examined as a moderating variable. Future studies could explore how other forms of diversity like age or professional background moderate the association between both variables. In addition, other governance mechanisms like board independence, CEO duality, and internal audit function could be investigated as moderators or control variables. Additional audit committee attributes like tenure,

engagement with auditors, and adoption of emerging technologies could be considered. Future researchers should explore other classifications of firms to provide a more comprehensive understanding of the research topic. On the contrary, the research was limited to companies in a single country. These results may not be generalizable to private companies or firms in other regions. Moreover, other potential audit committee attributes were not taken into consideration due to the limited literature on the association between integrated reporting quality and other important audit committee attributes. This research did not investigate other classifications of firms. It only compared manufacturing and non-manufacturing sectors.

Appendix 1 Integrated reporting quality measurement

Organizational overview (7 items)

- Mission and vision statement
- Profile
- General explanations about organization culture, ethics, or values
- Fundamental growth trends
- Stakeholder inclusiveness
- Supply chain outbound
- Market overview

Opportunities and risks (6 items)

- Business drivers
- Regulatory settlements
- Long-term contracts
- Principal risks
- Opportunities
- Mitigating actions

Strategy and resource allocation (6 items)

- Reliability
- Materiality
- Strategy and values
- Strategic purpose
- Business expansion in emerging markets
- Sustainability in the supply chain (inbound)

Business model (6 items)

- Financial capital
 - Manufactured capital
 - Human capital
-

Brand/customer capital
 Natural/social capital
 Intellectual capital
Governance (6 items)
 Key activities of board
 List of BOD
 Nomination committee
 Remuneration policy
 Audit committee
 Internal control
Performance (6 items)
 Non-financial indicators
 Financial indicators
 Employees evaluation score
 Who is accountable
 Efficiency index performance
 Talent management and career development
Future outlook (6 items)
 Future economic environment
 Strategies of developing business
 Opportunities from the development of general conditions
 Economic performance opportunities
 Revenue and earnings future trends
 Innovations for a sustainable future

Abbreviations

IRQ	Integrated reporting quality
ROA	Return on assets
BGD	Board gender diversity
AC	Audit committee
FE	Financial expertise
BOD	Board of directors
CSR	Corporate social responsibility
IR	Integrated reporting
OLS	Ordinary least squares
FDI	Foreign direct investment
EGX	Egyptian exchange
EGX100	Top 100 companies listed on Egyptian exchange
NGOs	Non-governmental organizations
2SLS	Two-stage least square

Acknowledgements

Not applicable

Author contributions

LA performed the theoretical framework and literature review of the research and was a major contributor in writing the manuscript and data collection; MS analysed 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.

Funding

Not applicable: No funding resources for this paper; it is the authors' original work and all the comments and views are related to the authors not to the institution working in it.

Availability of data and materials

The data used for this research were sourced from the S&P/EGX ESG Index requested from the Egyptian information dissemination (EGID) for EGX trading market, investing.com (<https://www.investing.com/>), and the sample companies' annual reports and websites.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Received: 28 December 2023 Accepted: 12 May 2024

Published online: 24 July 2024

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Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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