

Boards of Directors and High-Tech Sectors Affect ESG Disclosure Quality: An Empirical Analysis of Global Firms

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Abstract

Our days are characterized by two intertwined phenomena, digital technologies and sustainability concerns, which have significantly changed our lives. The growing attention of stakeholders on sustainability has resulted in a greater demand for transparency about environmental, social, and governance (ESG) issues, but, although the significance of ESG disclosure is widely acknowledged by businesses, the extent of ESG disclosure varies considerably between firms.

This study, using agency theory as the theoretical basis, aims to examine the effect of various characteristics of boards of directors, such as gender diversity, independence, size, average age, frequency of meetings, tenure, and membership in high-tech industries, on the level of ESG disclosure. The empirical analysis is conducted using an OLS regression model on a cross-sectional sample of 863 firms.

The findings show that board characteristics such as gender diversity, independence, and size, as well as membership in the high-tech sector, positively impact the level of ESG disclosure. Surprisingly, board members' average age positively influences ESG disclosure level, whereas board tenure has a negative influence. This study offers substantial implications for policymakers, regulators, and organizations committed to promoting sustainability and social responsibility.

Keywords: Agency theory, board of directors, digital technologies, ESG disclosure, high-tech industry, sustainability

1. Introduction

Our days are marked by the interconnection of two significant phenomena, digital technologies and sustainability concerns, which have profoundly transformed the way we live.

The increase in public awareness of social, environmental, and ethical issues, combined with the concern for the impact of climate change, depletion of natural resources, inadequate working conditions, pandemic and postpandemic scenarios, and numerous corporate scandals, has led to a rise in sustainability concerns (Money and Schepers, 2007; Reverte, 2009; García-Sánchez et al., 2020; Raimo et al., 2020; García-Sánchez et al., 2021; Esposito, 2023; Vitolla et al., 2023). Moreover, two significant factors highlight the expanding emphasis on socio-environmental issues, on the one hand, the United Nations' most recent emissions report emphasises the urgent need to reduce carbon footprints and adopt sustainable consumption and production methods (UN, 2022) and, on the other hand, numerous media reports emphasise the rising consumer demand for environmentally friendly products and business practises (Berrone et al., 2013; Huang et al., 2023). As a result, socially responsible organizations that align their operations with societal values have gained greater attention (Chapple and Moon, 2005; Aerts and Cormier, 2009), with sustainability investments widely regarded as a means of creating value and ensuring long-term survival (Aureli et al., 2020).

Firms are now encouraged to adopt sustainable practices that have a lower impact on the environment and society and effectively communicate these efforts through disclosure policies (Vitolla et al., 2020a; Eliwa et al., 2021; Manes-Rossi et al., 2021; Raimo et al., 2021a; Nicolò et al., 2022; Raimo et al., 2022; Wasiuzzaman et al., 2022), in this perspective, governments are mandating that large businesses evaluate and disclose their impact on society and the environment (Haji et al., 2022) and companies are responding by increasing stakeholder

engagement and communication (Herremans et al., 2016; Ruiz et al., 2021). European Union's most recent Corporate Social Responsibility Directive (CSRD) underscores the increasing focus on sustainability, acknowledging its social and economic significance, and striving to enhance the dissemination of related information. Consequently, environmental, social, and governance (ESG) disclosure has become a crucial aspect of corporate reporting for both scholars and practitioners (Baldini et al., 2018).

Furthermore, in addition to the increasing focus on sustainability, the spread of digital technologies such as big data analytics, artificial intelligence, cloud computing, robots, and the Internet of Things, has caused significant transformation to the global economy and society (Berman and Bell, 2011; Linz et al., 2017; Porter and Heppelmann, 2015; Verhoef et al., 2021). However, it is important to emphasize how sustainability concerns and digital technologies are interconnected, in fact, information and communication technologies (ICTs) have a significant impact on the environment with their bandwidth usage accounting for over 0.8 gigatons and their energy consumption accounting for 4% of global energy in 2021, with a rising trend to 10% by 2025. To address this issue, the industry is shifting toward using renewable energy technologies and energy-efficient practices (Mohanty and Moreira, 2014), nevertheless, Hilty (2011) warns that under current economic conditions, the use of ICTs may not lead to dematerialization and could have negative environmental consequences. Moreover, the strong connection between sustainability and digital technologies is highlighted by several scholars who emphasise how the ICT industry has the potential to have a significant indirect impact on global sustainability (Marrone and Raimo, 2021), including energy consumption, data privacy and security, and governance and transparency (Berawi, 2020). ICT companies should consider societal factors such as workplace conditions, diversity, employee engagement, a sense of belonging, heightened vigilance towards human rights violations by ICT service providers, and accidental disclosure of consumers' personal information, with a focus on addressing harmful stereotypes and fostering digital confidence among women (Grishunin et al., 2022).

This close relationship between digital technologies and sustainability is also reflected in the significance of ESG issues for these companies, in fact, as noted by Sutherland (2016) ICT firms that meet the highest ESG standards outperform their less environmentally conscious competitors and by engaging in such reporting, high-tech firms can demonstrate their commitment to sustainability, effectively manage non-financial risks, attract investors, and strengthen their competitiveness and reputation.

In the aforementioned context, defined by the interdependence of two critical phenomena, corporate governance assumes a pivotal role. Primarily, it serves to ensure that organisations adhere to ESG disclosure mandates, thereby establishing a framework for decision-making and promoting accountability. This, in turn, assists businesses in recognising and managing ESG-related risks and opportunities, as well as defining explicit ESG objectives and performance metrics. Secondly, effective governance is of the utmost importance for companies operating in the ICT industry, as it has a significant impact on their overall performance (Rittenhouse et al., 2011). In this sense, the topic of ESG disclosure and the role of governance in determining the levels of such disclosure is therefore of the utmost relevance and importance, not only for society but also for academia. Despite the large number of articles that have investigated the relationship between board characteristics and ESG disclosure levels, no consensus has been reached, indicating that this is still a matter of debate. In addition, ESG disclosure is a highly relevant topic for high-tech companies, but surprisingly few studies have examined the effect of sector membership on ESG reporting levels. Thus, the goal of this study is to examine the level of ESG disclosure of 863 worldwide firms from the S&P 1200 global index, taking into account several governance variables such as board gender diversity (BGD), board independence (BDI), board size (BDS), board average age (BAG), board meeting frequency (BFQ), and board tenure (BDT) and lastly, membership in a high-tech industry (HTI).

The following sections of this paper are structured as follows. Section 2 offers a review of the existing literature, whereas section 3 introduces the theoretical framework and outlines the research hypotheses. Section 4 provides a comprehensive explanation of the methodology utilized, while section 5 presents and discusses the results obtained. The conclusion is presented in section 6.

2. Literature Review

According to Suileek and Alshurafat (2022), the determinants of ESG disclosures are multifaceted, dynamic, and divergent, in this sense, despite numerous research endeavours dedicated to examining corporate ESG disclosures, a consensus regarding the underlying factors that influence these disclosures has yet to be reached (Terzani and Turzo, 2021). Following the purpose of this study, the literature analysis conducted in this section will focus on the impact of board characteristics on levels of disclosure by first analyzing the primary literature on environmental disclosure issues, then on sustainability and corporate social responsibility (CSR) disclosure,

and finally on ESG disclosure.

Several studies have examined the link between board characteristics and environmental disclosure, arriving at results that are not always unanimous. Halme and Huse (1997) examined 140 European companies operating in Spain, Finland, and Sweden and found no correlation between board size and environmental disclosure; the same results were obtained by Sartawi et al. (2014) and Fernandes et al. (2018). In contrast to the aforementioned authors, other authors (e.g., Akbas, 2016; Trireksani and Djajadikerta, 2016; Raimo et al., 2021a) have identified the existence of a significant and positive relationship between the size of the board and the extent of environmental disclosure. In relation to other characteristics of the board, the findings also exhibit inconsistency. Specifically, Kathy Rao et al. (2012) conducted a study on the disclosure levels of 96 Australian listed companies. Their findings indicated a significant and positive association between board characteristics, including size, gender diversity, independence, and disclosure levels while Raimo et al. (2021a), examining the disclosure of 129 global companies implemented through integrated reports, found a non-significant relationship between board independence and environmental disclosure levels and confirmed the positive impact of gender diversity. The gender diversity findings of Raimo et al. (2021a) are consistent with those of Rupley et al. (2012), who examined a panel data sample of 127 companies and discovered a positive impact of gender diversity. In contrast, Akbas (2016) found no correlation between gender diversity on the board of directors and the level of environmental disclosure among 62 publicly traded companies in 2011. This result was confirmed by Fernandes et al. (2018), who analysed 152 Brazilian listed companies and found that gender diversity in the board of directors does not affect environmental disclosure, whereas the age and independence of board members have positive effects. With a panel analysis of 82 companies listed on the SBF120, Khaireddine et al. (2020) not only confirmed the positive impact of board size, independence, and gender diversity but also discovered a positive correlation between board activities and the level of environmental disclosure. This result was also confirmed by Giannarakis et al. (2020), who analyzed 278 S&P 500 component companies. Even in terms of board activities, the results were not unanimous, in fact, Ofoegbu et al. (2018) analysed 303 companies operating in Nigeria and South Africa and found no significant correlation between board activities and the level of environmental disclosure. Lastly, in terms of environmental disclosure, both Sai et al. (2014) in a study involving 120 annual reports of Malaysian listed companies, as well as by Sartawi et al. (2014) in their analysis of 103 annual reports of Jordanian listed firms have found a positive impact of board age on the amount of information disclosed.

Many researchers have examined the influence of governance characteristics in a more comprehensive framework than the aforementioned environmental context, specifically focusing on sustainability disclosure and CSR disclosure provided by companies. In terms of sustainability disclosure, Michelon and Parbonetti (2012) analysed 57 companies belonging to the Dow Jones Sustainability Index and the Dow Jones Global Index and found no significant correlation between sustainability disclosure and board independence. This result was contradicted by Mahmood et al. (2018), who analysed 100 listed Pakistani companies and found that independence levels and board size have a positive and significant influence on sustainability disclosure. Shamil et al. (2014) confirmed the positive impact of board size, but their analysis of the disclosure of 148 Sri Lankan listed companies revealed that gender diversity negatively affects disclosure levels. In contrast, Ong and Djajadikerta (2020), after analysing 131 Australian publicly traded companies, discovered that gender diversity, independence, and multiple directorships have a positive and substantial impact on sustainability disclosure. Also in terms of sustainability disclosure, both Hu and Loh (2018), who analysed 462 Singaporean listed companies, and Shwairef et al. (2021), who analysed 204 Asian companies, found a positive impact of board size, member independence and activities on disclosure levels.

In terms of CSR disclosure, Barako and Brown (2008) demonstrated that the independence and gender diversity of board members have a positive effect on the CSR disclosure levels of 40 Kenyan banks. The analysis conducted by Kilic et al. (2015) on 26 Turkish banks confirmed these findings, but they found no significant impact of board size. In contrast, Khan (2010) found, through a panel analysis of private listed Bangladeshi commercial banks, that gender diversity has no significant impact on CSR disclosure levels, while member independence has a positive impact. Said et al. (2009) analysed 150 Malaysian listed companies and discovered that board size has no negative effect on CSR disclosure, whereas Veronica Siregar and Bachtaar (2010) analysed 87 Indonesian listed companies and discovered that board size positively affects disclosure levels. Also, Pucheta-Martnez and Gallego-Ivarez (2019), in a cross-national analysis of 13 178 companies operating in 39 countries, discovered a positive effect of board size and gender diversity on CSR disclosure levels, but a negative effect of independence levels. In addition to confirming a portion of the aforementioned findings in terms of board characteristics, both Ju Ahmad et al. (2017) and Fuente et al. (2017) found a positive effect of meeting frequency on CSR disclosure levels.

Regarding ESG disclosure, Faisal (2018) examined a sample of 73 Indonesian listed companies and found that board size negatively impacts ESG disclosure. In contrast, Giannarakis (2014) analyzed a larger sample of 366 Fortune 500 companies and found a significant positive relationship between board size and ESG disclosure. Similarly, Khoiriawati and Nuswantara (2021) found a positive relationship between board size, independence, gender diversity, and level of ESG disclosure in Asian companies. Lavin and Montecinos-Pearce (2021), confirmed that both board independence and gender diversity have a positive influence on ESG disclosure. Additionally, Cucari et al. (2018) found a positive effect of board independence on ESG disclosure, while average board age had no significant effect on ESG disclosure in Italian companies. Husted and de Sousa-Filho (2019) pointed out that board size and board independence positively influence ESG disclosure, while board gender diversity has a negative impact. Conversely, Wasiuzzaman and Wan Mohammad (2020) found a positive impact of gender diversity on ESG disclosure in a sample of 78 Malaysian companies. Regarding gender diversity, Giannarakis et al. (2014) examined 100 companies in the S&P 500 index between 2010 and 2015 and found no significant effect on ESG disclosure levels. Giannarakis et al. (2020) indicated that a lower average age of directors has a negative effect on sustainability disclosure, while higher levels of independence improve environmental disclosure. Moreover, Al-Amosh and Khatib (2022) found that foreign and state ownership are crucial factors in determining the level of disclosure and the role of independence and, as noted by McBrayer (2018), governance factors are decisive determinants of the quality and consistency of ESG disclosure. Lastly, Rella and L'Abate (2022) analysed a sample of 335 US companies from the S&P 500 Index and discovered that certain governance characteristics, such as board size, independence, and diversity, positively impact ESG disclosure levels; however, board size has a negative effect.

Reviewing the primary literature on the effect of governance on disclosure practises, it is evident that the results are not unanimous. This is due to the frequently national and rather small sample sizes, which have frequently hampered the generalizability of the results. Moreover, the analysis reveals that despite its significance, the relationship between membership in the high-tech sector and ESG disclosure has not been thoroughly investigated. Consequently, this study aims to investigate, on the one hand, the impact of governance dimensions from an all-encompassing and global perspective and, on the other, high-tech sector membership as a determinant of such disclosure, thereby contributing to a greater understanding of the role of board and high-tech sector membership in ESG disclosure.

3. Theoretical Background and Hypothesis Development

This study, in line with the previous contributions on how board characteristics and industry affiliation influence information disclosure (Barako et al., 2006; Donnelly and Mulcahy, 2008; Al-Shammari and Al-Sultan, 2010; FriasAceituno et al., 2013; Raimo et al., 2020; Vitolla et al., 2020a; 2020c) is based on agency theory as outlined by Jensen and Meckling (1976). According to several scholars (e.g. Firth, 1980; Chow and Wong-Boren, 1987; Hossain et al., 1995), agency theory is a valuable framework to explain the motivation for voluntary disclosure of information by managers. According to this theory, managers act on behalf of shareholders (Ross, 1973; Jensen and Meckling, 1976; Fox, 1984; Eisenhardt, 1989; Raimo et al., 2020) and the resulting separation of management and ownership leads to the emergence of agency costs within the company, which can be classified in monitoring costs, bonding costs and residual loss (Jensen and Meckling, 1976). Monitoring costs are those incurred by the principal to prevent harmful actions by the agent; bonding costs are those incurred to prevent the agent from acting against the principal's interests; and residual loss expenses result from the agent's sub-optimization of the welfare-maximizing objective, the sum of these three types of costs, according to Jensen and Meckling (1976) are the agency costs. In the context of firms, these costs arise primarily from the presence of information asymmetry between shareholders and managers (Barako et al., 2006), in fact, managers who deal directly with the business activity, have an important informational advantage while shareholders face significant moral dilemmas as they cannot evaluate managers' choices (Barako et al., 2006). In this situation of information asymmetry, management can easily act contrary to shareholders' interests (Donnelly and Mulcahy, 2008); indeed, management seeks to maximise the current value of the company, upon which its compensation and reputation depend, while shareholders are interested in the company's long-term value and the resulting situation is detrimental to the economic capital valuation of the company (Healy and Palepu, 2001). Theoretically, a formal contract could mitigate the agency problem because formal contracts tend to align the interests of shareholders and managers (Healy and Palepu, 2001; Barako et al., 2006), however, companies frequently find it challenging to implement this solution due to the incomplete nature of contracts. Disclosure is thus an additional possible solution for reducing information asymmetry by aligning the interests of shareholders and managers and thereby reducing agency costs (Healy and Palepu, 2001; Watson et al., 2002; Bozzolan, 2006).

In this sense, an adequate level of control is necessary for disclosure to fulfil its purpose of reducing information

asymmetry. The first control mechanism is represented by the board of directors, which is required to oversee the work of management in terms of disclosure (Donnelly and Mulcay, 2008). The main function for which the shareholders rely on the board of directors is monitoring, which is an endogenous mechanism aimed at reducing agency costs; consequently, the board of directors plays a controlling and supervisory role, analysing and evaluating the work of top management to ensure maximisation of shareholder profits (Jensen and Meckling, 1976; Fama and Jensen, 1983; Donnelly and Mulcay, 2008). Furthermore, it also represents a defence against inefficiency in corporate management (Schellenger and Wood, 1991). Based on this theoretical framework, it is possible to conclude that the board of directors' oversight serves as a mechanism to improve the level of disclosure quality, thereby mitigating information asymmetry and associated agency problems. However, in order to effectively fulfil their monitoring responsibilities, the board of directors must possess certain qualities, which are outlined below.

Several studies indicate that boards can benefit from diversity in various ways, including informational and social diversity (Jehn, 1995). According to academic research, diversity in decision-making is highly valued (Post et al., 2011), and gender diversity is the subject of extensive academic debate (Frias-Aceituno et al., 2013; Alfiero et al., 2017). Several studies have pointed out that women on boards bring valuable experience, skills, education, values and commitment to create a favourable working environment (Feingold, 1994; Huse and Solberg, 2008; Hofstede et al., 2010) and increased dissemination of information (Hichri, 2022). Furthermore, research indicates that women are better communicators and are more likely to be transparent and share more information than men (Barako and Brown, 2008; Bear et al., 2010; Dey, 2020) and that female directors are more ethical and moral than their male counterparts, and that their presence is positively correlated with CSR (Bernardi et al., 2006; Bear et al., 2010). Moreover, gender diversity can decrease the likelihood of groupthink within an organization, in fact, cognitive biases can form and negatively impact the quality of disclosure when decisions are made by a homogeneous group. Based on this, it can be hypothesized that:

H1 The level of ESG disclosure is positively influenced by board gender diversity.

The practice of disclosure also benefits from the independence of the board of directors. According to research conducted by Donnelly and Mulcay (2008), it was observed that the presence of non-executive directors has a positive impact on disclosure practices, in fact, according to López and Rodrigues (2007), non-executive directors strive to safeguard their reputation through the promotion of transparency. According to Dey (2020), a higher percentage of independent directors indicates greater transparency through increased disclosure, in this sense, Omran et al. (2021) argued that a higher number of independent directors can reduce agency costs, promote disclosure and encourage companies to disclose more information. According to the agency theory, the positive influence of the degree of independence would derive from the fact that a significant number of autonomous members allow for supervision of management conduct, resulting in reduced information asymmetries (Vitolla et al., 2020a). Various researchers have emphasised the importance of non-executive directors in strengthening supervisory functions (Dunn and Sainty, 2009), fostering the company's interaction with its surroundings (Garegnani et al., 2015) and responding to stakeholder expectations (Johnson and Greening, 1999; Michelon and Parbonetti, 2012; Torchia and Calabrò, 2015) such as the disclosure of CSR (Biswas et al., 2018) and ESG issues (Cucari et al., 2018). The independence of members within an organisation is essential for promoting ESG disclosure, as it provides several key advantages to ensure that businesses respect and effectively communicate their commitment to sustainability and social responsibility. First and foremost, the presence of independent members on a board of directors significantly contributes to introducing an external and unbiased perspective within the organisation by fostering transparency. This is crucial, as independent members are less likely to be influenced by internal conflicts of interest or corporate pressures that could discourage the complete and truthful disclosure of ESG-related information. In addition, their impartiality makes them less likely to conceal or minimise problems, resulting in more reliable communication. Lastly, independence is advantageous in terms of expertise and specialised knowledge, in fact, numerous independent members bring extensive experience in sustainability and governance, which is essential for the development of effective ESG strategies, the precise interpretation of relevant data, and the disclosure of these data. Based on this, it can be hypothesized that:

H2 The level of ESG disclosure is positively influenced by board independence.

According to Vitolla et al. (2020b), a larger board of directors could present a greater degree of diversity in terms of experience, perspective, gender and education. These findings are corroborated by Hichri (2022) and Songini et al., (2022) according to which a larger number of board members and thus greater heterogeneity in terms of knowledge and experience improves the board's ability to monitor management's actions, increasing the transparency of non-financial information and leading to greater efficiency. This notion is supported by empirical

evidence, as indicated by Hidalgo et al. (2011), which suggests that a larger board facilitates access to a wider range of expertise. Furthermore, Domínguez and Gamez (2014) and García Sánchez et al. (2011) argue that a broader board also promotes a greater diversity of experience, expertise, and opinions. This diversity can improve the efficiency and effectiveness of organizational operations, as Gandía (2008) argues. Furthermore, Adams and Flynn (2005) and De Villiers et al. (2018) argue that a broader board can lead to improved disclosure policies and increased transparency. In addition, Fiori et al. (2016) argued that larger boards, in terms of number of members, are more likely to adhere to non-financial reporting initiatives. Consequently, Iredele (2019) also pointed out that the number of members is one of the determining factors in achieving a higher quality of financial information. Thus, a board with more members will have a wider range of skills, perspectives, and experiences and this diversity can be advantageous for addressing a broader spectrum of ESG issues and increasing communication about them. In addition, a larger board will be more capable of exercising more stringent oversight over the company's activities, adherence to ESG policies, and related communication. In addition, a larger board can increase the company's ESG practices' transparency and accountability. Lastly, a larger board may exert internal pressure to ensure that the company adheres to stringent ESG reporting requirements. Diverse perspectives within the board can lead to more in-depth discussions regarding the significance of ESG disclosure and the need to adhere to higher standards. Based on this, it can be hypothesized that:

H3 The level of ESG disclosure is positively influenced by board size.

Previous experience and more knowledge gained over the years allow for a higher level of information transparency (Dahya et al., 1996). The extent of experience about board age has been examined by Anderson et al., (2004) and Giannarakis (2014). However, it remains uncertain whether council age or education level is a better indicator of council experience. According to Hafsi and Turgut (2013), there is a negative relationship between the age of board members and CSR performance. However, conflicting results were reported by Bantel and Jackson (1989) and Bilimoria and Piderit (1994), who found a positive association between board member age and CSR performance. According to the study conducted by Post et al. (2011), a negative relationship was observed between the average age of the board and the level of ESG disclosure. According to agency theory, younger directors tend to provide a greater amount of information to substantiate the arguments presented and thus exert a greater influence on management. This can be explained by considering that younger directors are less risk-averse (Redondo and Bilbao, 2018); consequently, increased reporting activity allows them to disseminate their perspectives and validate their decisions, thus reducing agency costs in fact, according to Katmon et al., (2019), younger directors are generally associated with greater risk-taking and disclosure activity. Furthermore, a board with a high average age may lack generational diversity, whereas age diversity may result in broader perspectives and greater consideration of ESG concerns. In addition, the age of board members may influence their knowledge and comprehension of ESG issues, with younger members possibly being more knowledgeable and sensitive to these issues, resulting in a greater emphasis on ESG disclosure. Lastly, the average age of the board may reflect the company's culture and approach to issues, with younger boards possibly focusing more on innovation and the adoption of sustainable business practices, which are frequently associated with ESG disclosure. Based on this, it can be hypothesized that:

H4 The level of ESG disclosure is negatively influenced by the board average age.

The studies conducted by Lipton and Lorsch (1992) and Frias-Aceituno et al. (2013) have demonstrated that board meetings have a positive impact on board activity and disclosure, similarly, Xie et al. (2003) have put forth the argument that an increase in board meetings enhances corporate control and oversight. Additionally, Kanagaretnam et al. (2007) have provided evidence to support the notion that board meetings contribute to a reduction in information asymmetry. The study conducted by Banghøj and Plenborg (2008) revealed a positive association between the frequency of board meetings and the extent of information disclosure, and, Brick and Chidambaran (2010) propose that managers could potentially derive advantages from an increased number of annual board meetings. Therefore, more meetings encourage constant monitoring, foster a greater sense of accountability, necessitate more reporting, stimulate discussion and feedback, and contribute to a climate of transparency and trust between the board and management by reducing agency costs. Thus, frequent meetings between management and the board of directors can increase the company's openness and transparency, promoting the discussion and disclosure of ESG-related information, as management and board members will be more cognizant of the importance of these issues to stakeholders. In addition, regular meetings provide the opportunity for stakeholders to gain a deeper understanding of the ESG effects on company operations, thereby encouraging the company to collect and disclose more comprehensive and informative information regarding its ESG initiatives. In addition, frequent meetings provide the opportunity to better align corporate strategies with

ESG objectives, which can result in increased disclosure as the company gains a better understanding of how ESG issues are incorporated into its overall strategy. Moreover, regular meetings enable the company to continuously monitor its ESG performance, promoting the continuous disclosure of ESG data and results to demonstrate its commitment and growth. Lastly, businesses are becoming increasingly cognizant that ESG issues can pose substantial risks. Frequent meetings enable the proactive discussion and management of these risks, which may involve the dissemination of ESG risk management information. Based on this, it can be hypothesized that:

H5 The level of ESG disclosure is positively influenced by board meeting frequency.

There exists a divergence of opinions within the literature regarding the potential impact of board tenure on disclosure levels. Vafeas (2003) posits that a board with a longer tenure enhances the comprehension of the company and its adaptability to changes in the business environment, conversely, Berberich and Niu (2011) discovered that inadequate management oversight yields adverse outcomes for governance. According to Byrd et al. (2010), the establishment of enduring relationships between boards and executives may lead to an escalation of agency problems and a reduction in the board's ability to effectively supervise executives. The presence of long tenure among board members has been found to be indicative of experience, ability, and competence, as suggested by Bebchuk et al. (2005). This, in turn, can lead to a heightened level of critical analysis within the board (Bebchuk et al., 2005) and foster greater interaction and exchange of information among directors (Rutherford and Buchholtz, 2007). Typically, long-tenured managers have a deeper understanding of the organisation, its culture, and its operations, and this knowledge can facilitate the identification and evaluation of ESG issues pertinent to the company and the promotion of quality disclosure. Moreover, stable leadership can improve the continuity of ESG initiative management, which frequently requires time to develop and produce results, and executives with longer tenure may be more likely to engage in long-term initiatives, such as disclosure, whose costs are immediate but returns are long-term. In addition, executives with a longer tenure within a company may feel more personally responsible for its long-term success and be more motivated to ensure that the company effectively manages ESG issues to protect its reputation and value by investing in effective disclosure practices. Eventually, executives can contribute to the development of an ESG-focused corporate culture in which the significance of ESG issues is incorporated into routine business decisions. This culture can facilitate improved ESG reporting. Based on this, it can be hypothesized that:

H6 The level of ESG disclosure is positively influenced by board tenure.

The influence of sector affiliation on corporate disclosure practices is a notable factor, as shown by research conducted by Bozzolan et al. (2003) whose study revealed discrepancies in intellectual capital disclosure across sectors within Italian financial statements. According to Deegan and Gordon (1996), Holder-Webb et al. (2009), and Van Overfelt (2010), there is a variation in disclosure practices among industries due to the differing expectations of stakeholders. According to Hall (2010), it is commonly observed that research and development (R&D) expenditures constitute a significant portion, often exceeding 50%, of a company's investment in technology. R&D-intensive companies possess distinct intangible assets, which are not easily quantifiable or physical in nature and the intangibility of these assets gives rise to higher agency costs. As a result of the dynamic nature of the business landscape, organizations frequently exhibit hesitancy in divulging details pertaining to their research and development initiatives in order to mitigate the risk of knowledge spillovers. Several scholars, including Carpenter and Petersen (2002), Brown and Petersen (2009), and Belloc et al. (2016), have highlighted the connection between industries in the high-tech sector that allocate substantial resources to R&D and the presence of significant agency problems and their associated expenses. Moreover, media, investors, and the general public pay more attention to high-tech companies, which can increase pressure for greater transparency and disclosure of ESG data. It is essential to emphasise that the high-tech industry is highly innovative and competitive. Companies strive continually to enhance their image and reputation in order to attract capital, talent, and customers. Increased ESG disclosure can aid in demonstrating a commitment to ethics and sustainability, thereby enhancing a company's competitive position. Based on this, it can be hypothesized that:

H7 The level of ESG disclosure is positively influenced by board high-tech industry membership.

4. Methodology

4.1 Sample

An initial sample of 1221 international firms belonging to the S&P 1200 global index was obtained from Bloomberg to investigate the impact of governance variables and high-tech industry membership on ESG disclosure quality. Two primary reasons motivated the selection of this sample. Primarily, because it includes all

firms that meet Standard & Poor's eligibility criteria, this methodology eliminates any potential bias in the sample. Secondly, the provided sample has a consistent distribution across diverse geographic regions and encompasses all sectors, allowing for the possibility of conducting sub-analyses that take both geographical location and industry into account. Due to the lack of data on dependent and independent variables, the final sample consists of 863 international companies.

4.2 Dependent Variable

In line with previous research on ESG disclosure (e.g. Giannarakis et al., 2014; Fatemi et al., 2018; Raimo et al., 2021a; Wong et al., 2021; Huang et al., 2022; Chung et al., 2023), Bloomberg's ESG Disclosure Index (ESGD) is used as a proxy for the amount of ESG information disclosed by the sampled firms. This index evaluates and quantifies the ESG disclosure levels of companies using a proprietary scoring method. It examines ESG-related information presented in relevant documents and focuses on significant ESG issues including labour standards, climate change, human rights, and corporate governance. Higher scores indicate more comprehensive ESG disclosure. The score is normalized according to industry standards and weighted to emphasize publicly available information. Investors and stakeholders typically use this index to evaluate the ESG performance and risks of a company. Data for this variable pertain to 2022.

4.3 Independent Variables

To test the seven hypotheses, seven distinct independent variables have been added to our model. These are:

- The gender diversity of the board (BGD) is a measure of the percentage of women on the board (e.g. Frias-Aceituno et al., 2013; Liao et al., 2015; Alfiero et al., 2017);
- The independence of the board (BDI) is calculated as the percentage of independent board members (e.g. Frias-Aceituno et al., 2013; Vitolla et al., 2020b);
- The size of the board (BDS) is determined by the number of members present on the board (e.g. Frias-Aceituno et al., 2013; Vitolla et al. 2020a);
- The age of the board (BAG) corresponds to the average age of directors on the board (e.g. Bueno et al., 2018; Martikainen et al., 2018; Nour et al., 2020);
- The frequency of the meetings of the board (BFQ) corresponds to the number of annual meetings of the board of directors (e.g. Frias-Aceituno et al., 2013; Vitolla et al., 2020a);
- The tenure of the board (BAT) is the tenure of directors on the board (e.g. Kim et al., 2014);
- The high-tech industry membership (HTI), is measured through a dummy variable with a value of 1 if the company operates in high-tech sectors and 0 otherwise. According to Bozzolan et al. (2003) as high-tech sectors, we refer to biotechnology, entrainment, Internet, IT distribution, high-tech manufacturing, software, system integration and telecommunication, web services, and we include healthcare.

4.4 Control Variables

Based on previous studies on the effect of the board on the quality of sustainability disclosure, this study includes two control variables to enhance the accuracy and reliability of the regression model. The selection of these variables is determined by their impact on disclosure quality, which has been amply demonstrated in previous research. Specifically, we control for firm size (FSIZE) measured by the natural logarithm of total assets, (e.g. Frias-Aceituno et al., 2013; Vitolla et al., 2019; Vitolla et al., 2020; Raimo et al., 2021b; Esposito et al., 2023), and we control for financial leverage (LEV) measured as the ratio between total assets and equity (e.g. Andrikopoulos et al., 2014; Esposito et al., 2023).

4.4 Model

To assess the impact of the independent variables on ESG disclosure quality, we used a regression model with a cross-sectional design. We chose this approach over a panel analysis because there is limited variation in both the dependent and independent variables over time (Bavagnoli et al., 2018). The analysis is represented by the following equation:

$$ESGD = \beta_0 + \beta_1 BGD + \beta_2 BDI + \beta_3 BDS + \beta_4 BAG + \beta_5 BFQ + \beta_6 BAT + \beta_7 HTI + \beta_8 FSIZE + \beta_9 LEV + \epsilon$$

5. Results

5.1 Descriptive Statistics, VIFs and Correlation Analysis

Table 1 displays the results of the descriptive analysis of the variables. The dependent variable, ESG disclosure index (ESGD), exhibits a moderate level of disclosure, with an average value of 56.62. The ESGD score ranges

from 21.33 to 85.70, indicating a significant variation in the amount of information disclosed among the sampled firms. The independent variables provide insightful considerations. The sampled firms demonstrate a modest degree of gender diversity in their boards (BGD), with an average of 3.61% of women, a maximum of 11%, and a troubling minimum of 0%. In terms of board independence (BDI), the results are opposed, with an average value of 76.66%, a minimum of 11.11%, and a maximum of 100%. On average, the sampled firms have a board size (BDS) of 11 members, with a range of variation from a minimum of 5 to a maximum of 24 members. The average age of board members (BAG) is 61.46 years, with the youngest board averaging 40.88 years and the oldest 77.93 years. The frequency meeting of the board (BFQ) is approximately 10 meetings per year, with a minimum of 2 and a maximum of 48 meetings, and the average board tenure (BAT) is 7.23 years, with a minimum of 1.14 years and a maximum of 22.94 years. Lastly, 30% of the companies in the final sample belong to the high-tech sector (HTI).

Table 1. Descriptive statistics

Variables	Obs.	Mean	Std. dev.	Min.	Max
ESGD	863	56.62	10.68	21.33	85.70
BGD	863	3.61	1.62	0	11
BDI	863	76.66	18.77	11.11	100
BDS	863	11.19	2.72	5	24
BAG	863	61.46	4.18	40.88	77.93
BFQ	863	9.70	4.94	2	48
BAT	863	7.23	3.10	1.14	22.94
HTI	863	0.30	0.45	-	-
FSIZE	863	10.90	1.99	7.33	20.31
LEV	863	6.43	27.63	1.02	709.5

Note. ESGD=ESG Disclosure Index; BGD=Board Gender Diversity; BDI=Board Independence; BDS=Board Size; BAG=Board Age; BFQ=Board Meetings Frequency; BAT=Board Average Tenure; HTI=High-Tech Industry Membership; FSIZE=Firm Size; LEV=Financial Leverage.

Pearson's correlation analysis was used to understand the relationship between governance dimensions, ESG disclosure level, and control variables. The results are presented in Table 2. There was no evidence of significant multicollinearity, with the highest correlation coefficient of 0.6651 between BGD and BDS. In fact, according to Farrar and Glauber (1967), problematic levels of multicollinearity occur when the correlation coefficient reaches ± 0.8 or ± 0.9 . A variance inflation factor (VIF) analysis was also conducted to assess the potential multicollinearity between the explanatory variables, and the results are shown in Table 2. The VIFs range from 1.01 to 2.14, with an average value of 1.43. According to Myers (1990), if any VIFs are less than 10, multicollinearity is not a significant concern in the regression model. Therefore, based on both analyses conducted, we can reasonably rule out potential multicollinearity problems.

Table 2. VIFs and Pearson's correlation coefficients

Variables	VIF	ESGD	BGD	BDI	BDS	BAG	BFQ	BAT	HTI	FSIZE	LEV
ESGD		1									
BGD	2.03	0.1999***	1								
BDI	1.26	0.0906***	-0.0828**	1							
BDS	2.14	0.1886***	0.6651***	-0.2063***	1						
BAG	1.37	-0.0101	-0.1352***	0.2753***	0.0110	1					
BFQ	1.22	0.0721**	0.0411	-0.1315***	0.0067	-0.0996***	1				
BAT	1.44	-0.2876***	-0.1740***	0.0057	-0.0327	0.3829***	-0.2994***	1			
HTI	1.01	0.2354***	-0.0289	0.0626*	-0.0427	-0.0123	0.0131	-0.0606*	1		
FSIZE	1.39	0.1416***	0.0254	-0.2514***	0.2341***	0.0111	0.3412***	-0.2483***	-0.0198	1	
LEV	1.01	-0.0500	0.0088	-0.0309	0.0107	0.0201	0.0018	0.0380	-0.0680**	0.0222	1

Note. ESGD=ESG Disclosure Index; BGD=Board Gender Diversity; BDI=Board Independence; BDS=Board Size; BAG=Board Age; BFQ=Board Meetings Frequency; BAT=Board Average Tenure; HTI=High-Tech Industry Membership; FSIZE=Firm Size; LEV=Financial Leverage; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level.

5.2 Multivariate Analysis Results and Discussion

The seven hypotheses were tested using a multiple linear regression model. The results of these analyses are summarized in Table 3. This table shows the results of the regression coefficients for all independent variables using ESG disclosure index (ESGD) as the dependent variable.

Table 3. OLS regression model results

Variables	Coefficient	Standard Error	p-value	Sign.
Cons	35.488	4.985	0.000	***
BGD	0.549	0.291	0.060	*
BDI	0.062	0.019	0.002	***
BDS	0.531	0.177	0.003	***
BAG	0.156	0.082	0.060	*
BFQ	-0.044	0.073	0.544	
BAT	-0.919	0.127	0.000	***
HTI	5.145	0.728	0.000	***
FSIZE	0.408	0.195	0.037	**
LEV	-0.012	0.012	0.286	

Note. n=863; Adj R²=18.19; ***Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level; ESGD=ESG Disclosure Index; BGD=Board Gender Diversity; BDI=Board Independence; BDS=Board Size; BAG=Board Age; BFQ=Board Meetings Frequency; BAT=Board Average Tenure; HTI=High-Tech Industry Membership; FSIZE=Firm Size; LEV=Financial Leverage; SIGN=Significance.

The adjusted R-squared score of 0.1819 means that the model can account for 18.19% of the variability of the dependent variable.

The results support hypothesis 1 (H1). The findings indicate a significant positive association between board diversity (BGD) and ESG disclosure index (ESGD), with a statistical significance level of $p = 0.060$. This suggests that companies with a greater representation of women on their boards of directors are more inclined to share information related to ESG factors. The observed phenomenon could potentially be attributed to the inclination of women to place a higher emphasis on social responsibility and ethical decision-making, alongside their heightened dedication and engagement in board-related endeavours (Liao et al., 2015). Furthermore, the inclusion of women in corporate boards has been linked to a favourable organizational climate and greater inclusiveness (Hofstede et al., 2010). Lastly, gender diversity can reduce the likelihood of groupthink occurring within an organisation, in fact, when decisions are made by a homogeneous group, cognitive biases may negatively impact the level of disclosure. These factors may serve as additional incentives for companies to enhance their transparency in reporting on ESG matters. The present study adds to the extant body of evidence regarding the favourable relationship between board diversity and sustainability disclosure (García-Sánchez et al., 2014; Verbeeten et al., 2016; Hussain et al., 2018).

The results support hypothesis 2 (H2). The findings indicate a strong positive association between board independence (BDI) and ESG disclosure index (ESGD), with a statistically significant link at a significance level of $p = 0.002$. This suggests that companies with a greater proportion of independent members on their board of directors are more inclined to share information related to ESG factors. The involvement of non-executive members is of utmost importance in overseeing the operations of a firm and meeting the expectations of stakeholders, as well as protecting the rights and interests of minority shareholders (Birindelli et al., 2018; Elmagrhi et al., 2019; Chintrakarn et al., 2020). In addition, the presence of independent board members contributes significantly to introducing an external and objective perspective within an organisation by fostering transparency, in fact, due to their objectivity, they are less likely to conceal or minimise problems, resulting in more reliable communication. Lastly, numerous independent members bring extensive expertise in sustainability and governance, which is crucial for the creation of effective ESG strategies, the precise interpretation of relevant data, and the disclosure of these data. The findings presented in this study extend prior research that has examined the favorable influence of board independence on the disclosure of ESG information (Oliveira et al., 2011; De Villiers and Hsiao, 2018; Chijoke-Mgbame et al., 2020).

The results support hypothesis 3 (H3). The findings indicate a statistically significant positive relationship between board size (BDS) and ESG disclosure index (ESGD) at $p = 0.002$. This suggests that companies with a

larger board of directors are more inclined to share information related to ESG factors. Boards of larger size possess a broader spectrum of abilities and experiences, hence potentially enhancing their capacity for problem-solving and decision-making in a more efficacious manner (Vitolla et al., 2020a; Vitolla et al., 2020b). Such competencies, in a multifaceted context such as ESG disclosure, make it possible to effectively monitor the entire process of gathering and disseminating information relating to all aspects of company management, thus fostering a better quality of disclosure. A larger board is also capable of exercising stricter oversight over the company's activities, ESG policy compliance, and related communication. Moreover, a larger board may also exert internal pressure to ensure compliance with stringent ESG reporting requirements. Lastly, diverse perspectives within the board can lead to more in-depth discussions regarding the significance of ESG disclosure and the necessity of adhering to higher standards. Our findings contribute to the existing literature on the importance of transparency in corporate reporting (Godos-Diez, 2018; Lagasio and Cucari, 2019; Velte, 2022) and highlight the role of board size in facilitating ESG disclosure.

The results do not support Hypothesis 4 (H4). Although the relationship between board average age (BAG) and ESG disclosure is significant it is positive and shows that, among the sampled firms, those characterized by older boards are more likely to disclose ESG information. It is worth noting that boards with a higher average age may be more attuned to ESG issues due to their exposure to the evolution of society's stance on sustainability and corporate social responsibility. These older board members may also be able to provide a long-term strategic vision for the company, including the significance of addressing ESG concerns to ensure the company's sustainability, safeguard its reputation, and attract investors. In this regard, senior advisors may disclose more ESG information in order to attract capital due to their desire to attract investors and their strong focus on economic-financial aspects.

The results do not support Hypothesis 5 (H5). The impact of board meeting frequency (BFQ) on ESG disclosure is not statistically significant. This dimension seems not to be related to ESG disclosure levels.

The results do not support Hypothesis 6 (H6). Although the relationship between board average tenure (BAT) and ESG disclosure index (ESGD) is significant it is negative and shows that, among the sampled firms, those characterized by board in charge for longer are less likely to disclose ESG information. Long-serving board members may be influenced by personal relationships or vested interests, leading to a lack of transparency in sharing information and reluctance to disclose information that may reveal organizational problems. Moreover, boards with long-serving members may become less adaptable and more resistant to change, as well as lacking new ideas and creative solutions. In addition, board members with a lengthy term could have consolidated relationships with stakeholders that could influence ESG-related decision-making and disclosure. In conclusion, it is noted that, over time, board members may become less connected with shareholders and their ESG concerns, reducing the incentive to improve disclosure in this area and heightening the levels of informational asymmetry.

The results support hypothesis 7 (H7). The findings indicate a statistically significant positive relationship between high-tech industry membership (HTI) and ESG disclosure index (ESGD) at $p = 0.000$ and a very strong impact of 5.145. This suggests that firms with a higher level of technologies are more likely to disclose ESG information. Companies in the high-tech industry have better access to data due to advanced technologies such as data analytics and artificial intelligence, allowing them to collect, analyze, and present ESG information more efficiently. Additionally, they face greater investor pressure and increased awareness of ESG risks and opportunities. These results align with previous studies by Hsu and Chang (2011), who noted that organizations operating in industries characterized by a high degree of knowledge-based activities, such as the high-tech sector, tend to disclose intangible assets more frequently. This disclosure behaviour can be attributed to the significant impact of intangible assets on shareholder value. In addition, it has been posited by Biscotti and D'Amico (2016) that agency theory proposes that firms possessing greater amounts of intangible assets are more likely to enhance their disclosure practices in order to mitigate information asymmetry with external stakeholders.

Lastly, the findings of the study indicate that, out of the two control variables examined (SIZE and LEV), only company size exhibits a statistically significant positive influence on the ESG Disclosure index (ESGD).

6. Conclusions

Through the testing of seven hypotheses firmly rooted in the theoretical framework of agency theory, the aim of this study is to examine, on the one hand, the impact of certain governance characteristics, such as board gender diversity, board independence, board size, average board age, board meeting frequency, and board tenure, and, on the other hand, the impact of high-tech sector membership on the level of ESG disclosure of companies.

The empirical analysis, conducted using a cross-sectional OLS regression model on an international sample of 863 companies operating in a variety of industries, revealed that board characteristics such as gender diversity,

independence, size, and average age have a positive impact on ESG disclosure levels, whereas tenure has a negative impact on ESG disclosure levels and meeting frequency has no impact. The same analysis revealed that high-tech sector membership has a positive impact on the ESG disclosure levels of the sampled companies.

This study has significant theoretical and practical implications. This study contributes to the academic literature on corporate ESG disclosure by presenting a holistic and comprehensive view of governance characteristics and their effects. This study also contributes to the generalizability of findings regarding the impact of governance dimensions on sustainability disclosure, particularly ESG disclosure, by analysing a sample of global companies. In addition, the academic contribution of this study consists of the analysis of the impact of membership in high-tech sectors on ESG disclosure levels, which is rarely examined in the literature, and the extension of the application of agency theory, which is related to the contributions described above. On the other hand, this study has significant practical and professional implications. Companies that provide complete and transparent ESG disclosure are more attractive to investors because they demonstrate a commitment to sustainability and responsible management, and ESG disclosure enables companies to identify and mitigate ESG risks that could impact their operations and reputation. Facilitated access to capital and proactive management of ESG risks can aid in lowering financing costs, boosting investor confidence, and avoiding significant costs associated with unforeseen events or crises. In light of this, corporate practitioners and executives should consider redesigning their boards to promote ethical behaviour and improve the level of ESG disclosure; larger boards with higher levels of gender diversity and independence can contribute specifically to improving the ethical behaviour and level of ESG disclosure of companies. Moreover, as the European Union's most recent Corporate Social Responsibility Directive (CSRD) approaches, these findings take on an even greater significance, as they provide policymakers, regulators, and business leaders with valuable insights into increasing disclosure levels.

Although this study offers important theoretical and practical results and implications, it is necessary to recognise its limitations. Firstly, the employed methodology is based on a cross-sectional design which, despite being extensively discussed and justified in the section on the model, may affect the results of the analysis by preventing the capture of even minor changes over time. Second, some of the board characteristics examined here may be subject to limitations. For instance, with references to diversity, understood here to be gender diversity, additional characteristics such as education, nationality, and ethnicity could be examined. Finally, high-tech technologies were only operationalized in terms of industry membership, which may not capture their impact on disclosure practises in its entirety.

The limitations mentioned above do not, in our opinion, detract from the overall quality of the paper, but rather provide several insights for future research. Future research could examine this phenomenon longitudinally over a number of years, allowing for a more in-depth understanding of the relationships between board characteristics, high-tech technologies, and ESG disclosure levels. In addition, future research could investigate the influence of previously unexplored governance dimensions, such as additional forms of diversity and activity. Lastly, future research could investigate the influence of governance and non-governance factors, such as company size, industry, and ownership structure, as well as the influence of various technologies on disclosure levels.

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