REVIEW ARTICLE

A Meta-Analytic Review of Board Characteristics and Carbon Emission Disclosure: The Moderating Effect of Contextual Factors

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Abstract

Board characteristics play a pivotal role in Board characteristics are crucial for enhancing transparency and accountability in firms' reporting processes, fostering stakeholder trust, and promoting sustainable business practices. This paper synthesises 66 empirical studies on the link between board characteristics and carbon emission disclosures using meta-analyses with random effect models. The results show significant correlations between board independence, size, gender diversity, the presence of an environmental committee, and carbon disclosure, with CEO duality showing no significant relationship. Notably, environmental committees and gender diversity are most strongly associated with carbon disclosures. The study also reveals that geographical context significantly impacts outcomes, with no significant relationships found in the United States and Canada. This research contributes to the discussion on board attributes that enhance carbon emission disclosures, highlighting the need for innovative approaches.

KEYWORDS
Board gender diversity, Board independence, Board size, Carbon emission disclosure, CEO duality, Environmental committee, Meta-analysis.

1 | INTRODUCTION

The revelation of carbon emissions by corporations is essential for a multitude of stakeholders, particularly in the fight against climate change and the promotion of sustainability. Entities that disclose their carbon emissions provide invaluable data to investors, regulators, consumers, and the broader community. This information enables stakeholders to evaluate the ecological repercussions of a firm's operations, make enlightened decisions pertaining to investments or purchases, and ensure that organisations are held accountable for their carbon footprint. Furthermore, the act of disclosing carbon emissions can assist organizations in pinpointing areas requiring enhancement, establishing targets for emissions reduction, and illustrating their dedication to environmental stewardship.

Carbon emissions disclosure constitutes a fundamental aspect of corporate transparency and sustainability initiatives that can yield profound implications for businesses and society at large (Qosasi et al., 2022). Within corporate governance, both executive and non-executive boards are important players in handling agency costs that come with carbon disclosure. Their obligations encompass supervising the scope and quality of disclosures, in addition to monitoring and obstructing any misleading environmental claims. By adeptly executing their responsibilities, the board can augment transparency and accountability in carbon reporting, thereby cultivating trust among stakeholders and fostering sustainable business practices (Alfi, Mohamad, and Hussainey, 2024).

Numerous empirical investigations have analyzed the influence of various board characteristics, including board composition, gender representation, board autonomy, CEO duality, and the establishment of an environmental committee, on the transparency of carbon emissions reporting. These analyses have yielded a spectrum of contradictory results. Scholars such as Gonenc and Krasnikova (2022), Hollindale et al. (2019) have documented evidence of a positive relationship between gender representation and both the enhanced quality and increased volume of disclosures. Conversely, alternative studies have reported inconsistent findings, with some even revealing ambiguous correlations. This phenomenon is evident in the research conducted by Bui, Houqe, and Zaman (2020), Mardini and Lahyani (2023), Rupley, Brown, and Marshall (2012). The variations in results may stem from the application of

disparate theoretical frameworks and methodological strategies. Consequently, it is imperative for both scholars and practitioners to exercise caution when interpreting the diverse outcomes.

Notwithstanding the considerable efforts undertaken by the discipline of management research to grasp the fundamental nature of the relationship between board characteristics and corporate carbon emission transparency, the subject remains complex. An additional element contributing to the clarification of this intricacy is CEO duality and its association with carbon transparency. A variety of empirical investigations into this relationship yield inconsistent results; for instance, while Hossain et al. (2017) report a positive effect of CEO duality on carbon transparency, other studies, such as those conducted by Charumathi and Rahman (2019) or Bui et al. (2020), identify either a detrimental or negligible correlation between board characteristics and carbon transparency. Consequently, despite these academic undertakings, the essential inquiry persists concerning which specific board traits exert a favorable influence on carbon transparency outcomes and which exhibit an insignificant or adverse impact. The empirical evidence presents a heterogeneous landscape and provides minimal clarity for reaching a consensus, thereby hindering the progression of theoretical development in this area.

The existing disjunction identified within the current body of literature serves as the principal impetus for the initiation of our research project. The objective of this investigation is to address this deficiency by systematically consolidating the pre-existing literature concerning board attributes and carbon emission disclosures. Our inquiry is grounded in two fundamental aims: firstly, to identify significant correlates of the previously explored connection between diverse board characteristics and carbon emission disclosures, and secondly, to elucidate the factors contributing to inconsistencies in earlier research findings through a quantitative synthesis of conflicting results. This endeavor is crucial due to the potential prevalence of various moderators that may influence the outcomes of preceding studies.

The research endeavors to investigate the importance of CEO duality, board diversity, independence, size, and the establishment of environmental committees concerning the disclosure of carbon emissions. Through the execution of a meta-analysis, the research aims to enhance comprehension and validate the credibility of earlier empirical findings. This methodology incorporates synthesized data to provide a more holistic viewpoint on the topic under consideration.

Utilizing meta-analyses that encompass 66 individual studies and employing random effects models, the findings highlight a significant association between all board attributes and carbon disclosure, with the exception of CEO duality, which reveals a non-significant connection. The existence of an environmental committee and gender diversity within the board emerge as the most strongly related elements to carbon emission disclosure. Furthermore, our subgroup analyses indicate that the research or contextual framework is pivotal in elucidating the disparate outcomes. Investigations concerning disclosure emphasize the heightened importance of board size in Europe and the UK, whereas the influence of an environmental committee on carbon disclosure is notably stronger in Asia. Curiously, negligible correlations between all examined board characteristics and disclosure were noted in the United States and Canada.

This investigation offers numerous significant contributions to the academic discourse surrounding corporate governance and sustainability. Primarily, this study, to the best of our knowledge, is the most thorough meta-analysis carried out to this point concerning the link between board features and carbon emission transparency. Although preceding reviews—such as those by Alfi et al. (2024)—have delivered insightful findings, their analytical scope has been constrained by a limited focus on specific board attributes and a predominant emphasis on developed economies. In contrast, our study expands the analytical framework by incorporating less-examined governance dimensions, such as the existence of environmental committees and CEO duality, and assesses their significance concerning greenhouse gas disclosure practices. Second, this study improves generalizability by integrating data from a wide range of geographical contexts, including Asia, Africa, Europe, the UK, Canada, and the United States. In doing so, it accommodates institutional and cultural diversity, thereby offering a more globally representative understanding of the ways in which board structures impact carbon transparency. Third, this study contributes to theoretical discourse by elucidating the dynamic relationship between structural board characteristics and external institutional pressures, thereby providing a more cohesive framework for future theoretical advancements in the realm of ESG-related governance research.

The subsequent sections of this manuscript are structured as follows: it initiates with a rigorous exploration of theoretical paradigms, succeeded by a comprehensive elucidation of the methodology that delineates the strategies for data acquisition and the utilized meta-analytic techniques. Thereafter, an in-depth examination of the findings is articulated, ultimately leading to the concluding remarks.

2 | THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

2.1 | Theoretical background

The ramifications of board attributes on the disclosure of carbon emissions have been thoroughly scrutinized within academic discourse through a multitude of theoretical lenses. While agency theory, stakeholder theory, legitimacy theory, upper echelons theory, and institutional theory have conventionally been utilized to investigate the correlation between board governance and carbon disclosure (Barg et al. 2023; Hossain and Farooque 2019; Kalu, Buang, and Aliagha 2016; Tauringana and Chithambo 2015), alternative theoretical frameworks have also been considered by certain scholars. For instance, Prado-Lorenzo and Garcia-Sanchez (2010) conducted an analysis of resource-oriented viewpoints, particularly focusing on stewardship theory. Experts have employed this theoretical structure to investigate the ramifications of

CEO duality, board size, independence, gender diversity, and the inclusion of environmental committees on programs aimed at lowering carbon emissions. Notwithstanding the variety of theoretical paradigms employed, a prevailing consensus within the literature indicates that proficient and robust boards are predisposed to improve a firm's practices regarding carbon emissions disclosure.

The scholarly examination of the impact of corporate board attributes on corporate emission disclosure predominantly relies on the theoretical framework of agency theory. The agency perspective within corporate governance underscores the bifurcation between ownership and control, thereby intensifying the necessity for governance mechanisms. The justification for the association between governance and emission disclosure arises from the principals (shareholders) striving to effectively oversee the decisions and behaviors of agents (managers) (Hussain et al. 2023; Jensen and Meckling 1976; Kim et al. 2019). Those who back agency theory believe that principals and agents often have conflicting interests, leading managers to possibly put their personal rewards ahead of the organization's enduring targets. Within the context of greenhouse gas disclosure, the relevance of agency theory is accentuated as a pivotal framework, positing that disclosure mechanisms are employed to align the interests of managers and shareholders by alleviating managerial self-interest and diminishing agency costs, thereby fostering transparency and accountability within corporate governance (Khaireddine et al. 2020; Liao, Luo, and Tang 2015; Mitchell 2019).

The stakeholder theory presents a divergent viewpoint in contrast to the agency model by contending that corporations, in addition to their shareholders, hold obligations towards a more extensive range of stakeholders, including employees, governmental bodies, consumers, and other entities that possess the capacity to influence and be influenced by the organization (Peters and Romi, 2014). Challenges may arise if the corporation fails to provide accurate carbon-related data to various stakeholders, as this deficiency can significantly affect the organisation. Consequently, disclosures function as a vital channel for firms to engage in dialogue with stakeholders, particularly investors, who rely on such information to assess potential risks and make informed decisions. It is imperative for managers to disseminate pertinent information, such as statistics concerning carbon emissions, in order to address the specific needs of pivotal stakeholders like institutional investors, whose influence can profoundly impact the organization's valuation (Jaggi et al., 2018).

Legitimacy theory, which is fundamentally grounded in the principles of political economy, posits that organizations utilize their annual reports as instruments to substantiate their actions and decisions in accordance with societal expectations and values (Cosma, Principale, and Venturelli, 2022). This theoretical structure outlines the critical role of organizations in reflecting societal values and norms to ensure their legitimacy and trustworthiness in stakeholder viewpoints. By demonstrating their activities and operations in a fashion deemed socially responsible and appropriate, firms can enhance their reputation and cultivate trust among their stakeholders (Ieng, Chatterjee, and Brown, 2013). The authenticity of the organization is anticipated to be subject to rigorous examination. In terms of carbon output, firms typically declare that their actions do not negatively affect the natural world or the community, a proposition that could be misleading. To address this issue of credibility, it is recommended that board members disclose the organization's carbon footprint to the public and demonstrate an earnest commitment to its reduction (Chithambo and Tauringana 2017).

The essence of institutional theory hinges on the pressures imposed by institutions, which necessitate that organizations align with prescribed norms, regulations, and standards. This compels firms to implement specific organisational frameworks, operational methodologies, and policies to demonstrate credibility and authenticity to external stakeholders (Grauel and Gotthardt 2016). In accordance with the theory, environmental influences are predominantly derived from societal considerations rather than from concerns pertaining to efficiency or effectiveness, steering organizations towards practices and disclosure frameworks that are congruent with institutional expectations. As a result, this congruence fosters sustainable development and enhances the transparency of carbon emissions reporting (Goud 2022). Scholars argue that the impact of both formal and informal institutional pressures on board characteristics and the relationship with carbon emission disclosures is not uniform, thus potentially influencing these dynamics across varying contexts (Lewis, Walls, and Dowell 2014; Majid et al. 2023).

The theoretical framework referred to as the Upper Echelon Theory posits that the actions and decisions undertaken by organizations, including the voluntary dissemination of environmental or carbon-related information, are profoundly influenced by the characteristics and backgrounds of board executives. This theoretical perspective underscores the notion that the values, cognitive frameworks, and prior experiences of board members are instrumental in determining a company's strategies and responses to external pressures and demands. Moreover, the theory accentuates the considerable impact that top executives on the board have on the overall trajectory and conduct of an organization (Lewis et al., 2014). With respect to the decision-making process concerning the disclosure of carbon emissions, the presence of a diverse array of perspectives and expertise within a board is recognized as a critical element. A pertinent example of this is the establishment of an environmental committee, where the independence of the board is expected to introduce varied experiences and specialized knowledge that ultimately enhance the quality of decisions related to disclosure (Ben-Amar and McIlkenny 2015; Darus and Rahman 2015; Moalla, Salhi, and Jarboui 2020; Shwairef et al. 2021). These theoretical constructs collectively inform five hypotheses regarding the correlation between board characteristics and carbon disclosure.

2.2 | Hypothesis development

2.2.1 | Board independence and Carbon Emission disclosure

"Board Independence" denotes the proportion of non-executive directors constituting the board, underscoring the board's capacity to execute independent decision-making distinct from the executive management. The determination of this indicator entails the division of the number of non-executive directors by the aggregate number of board members (Khaireddine et al. 2020). Stakeholder-agency theory underscores the importance of non-executive directors preserving their independence from executive directors. The autonomy of the board is vital in ensuring proficient oversight, which inhibits insiders from unilaterally promoting their own interests. This oversight mechanism serves to mitigate conflicts of interest and fulfill the informational needs of stakeholders, particularly in the context of carbon emission disclosures (Darus, Zuki, and Yusoff 2020; Jaggi et al. 2018; Khaireddine et al. 2020). The characteristics and experiences of non-executive directors are posited to enhance the quality of disclosures, as posited by the Upper Echelon Theory (Lewis et al., 2014). Legitimacy theory posits that the involvement of external and non-executive directors bolsters the credibility of firms by facilitating communication and disclosure of information pertaining to carbon emissions (Hossain and Farooque 2019).

Various outcomes are discerned through empirical methodologies. The research conducted by Chakraborty and Dey (2023), Hossain et al. (2017), Rupley et al. (2012), Wahyuningrum et al. (2024) demonstrates a strong and favourable correlation between the presence of independent directors and an increase in voluntary carbon or climate disclosure. This assertion is further substantiated by the research conducted by Darlis, Kurnia, and Alamsyah (2020). In contrast to previous investigations, Darus and Rahman (2015) identified that an independent board did not exert a statistically significant influence on the extent of environmental disclosure among the Malaysian firms they analyzed. Consequently, the hypothesis posits that the independence of the board ought to be correlated with carbon emission disclosures:

***H1*.There is a positive relationship between board independence and carbon emission disclosure.**

2.2.2 | CEO duality and Carbon Emission disclosure

The phenomenon of "CEO duality" is appraised by assessing the scenario in which a single individual holds both the positions of Chief Executive Officer and chairperson of the board, which implies a centralization of power that could potentially impact the transparency and accountability of the organization (Darus et al. 2020). The inquiry into agency theory and stakeholder perspectives necessitates a thorough exploration of CEO duality, indicating that the concentration of decision-making authority within one individual (simultaneously serving as CEO and chairman) could hinder the board's independence in fulfilling its oversight responsibilities, thus influencing the propensity to disclose information pertinent to carbon emissions. This arises from the possible constraints imposed by CEO duality on the flow of information that could negatively affect the organization's public image (Gerged 2021).

Previous investigations have yielded empirical evidence regarding the correlation, or lack thereof, between CEO duality and the transparency of carbon emissions reporting. Charumathi and Rahman (2019) identified a negative association between the role of the CEO and the information disclosed concerning greenhouse gas emissions. In a like manner, Abbas et al. (2023) in collaboration with He et al. (2019) validated these claims, connecting CEO duality with a harmful relationship regarding carbon disclosure. In a different light, ongoing analysis by Bui et al. (2020), Khaireddine et al. (2020), and Ma et al. (2019) showed no significant connections. Two rationales underpin the anticipated negative relationship between these variables, leading to the formulation of the subsequent hypothesis:

***H2*. There is a negative relationship between CEO duality and carbon emission disclosure.**

2.2.3 | Board size and Carbon Emission disclosure

The concept of "Board Size" refers to the aggregate number of directors, which includes both internal and external members, who are present on the governing body of a corporation. Boards characterized by a larger size are frequently acknowledged for their increased diversity regarding experience and expertise (Hossain et al. 2017). Extensive boards, composed of individuals hailing from diverse backgrounds and possessing specialized knowledge, exhibit a wide array of interests, often encompassing members with a propensity for engaging in activities that promote societal welfare. As a result, the capacity for reducing carbon emissions and fostering such initiatives is augmented in accordance with the principles of legitimacy and upper-echelon theories (Cosma et al. 2022; Khaireddine et al. 2020). In examining this situation through the lenses of stakeholder theory and agency theory, it is crucial to uphold an optimal number of board members to guarantee the organization's capability to effectively oversee and report information pertaining to carbon emissions (Gerged 2021; Rupley et al. 2012).

Moreover, an extensive array of divergent conclusions is extracted from the empirical findings pertinent to board size. Bui et al. (2020), Ofoegbu, Odoemelam, and Okafor (2018), Riantono and Sunarto (2022) have highlighted the positive impact of board size on carbon emission disclosure in their respective research. Conversely, Hossain et al. (2017), Prado-Lorenzo and Garcia-Sanchez (2010)have suggested, among other results, the existence of a negative correlation between board size and carbon emission disclosure. These opposing perspectives illuminate the

complex character of both theoretical and empirical inquiries within this specific domain. The ensuing hypotheses are delineated:

H3. **There is a positive relationship between board size and carbon emission disclosure.**

2.2.4 | Board gender diversity and Carbon Emission disclosure

By examining the concept of "gender diversity" within corporate boardrooms, numerous aspects related to carbon emissions can be highlighted. The evaluation of gender diversity necessitates an analysis of the representation of women on corporate boards, which functions as a metric of inclusivity and diversity concerning gender within the sphere of corporate governance. The measurement involves juxtaposing the number of women directors with the total directory count on the board, or by computing the female directors' ratio against the overall number of board directors (Barg et al. 2023).

From the perspective of stakeholders and agency theory, the inclusion of female directors is imperative for the proficient supervision of managerial behavior and the mitigation of financial malfeasance, while concurrently improving financial performance. Female members of the board possess the ability to align the interests of management with those of various stakeholders, including shareholders, thereby facilitating progress in corporate sustainability initiatives (Hussain et al. 2023). Women serving on corporate boards may offer distinctive viewpoints, ethical frameworks, and innovative insights, while also demonstrating a heightened dedication to philanthropic activities. Such contributions can yield positive outcomes regarding Corporate Social Responsibility (CSR) and may bolster the board's efficacy in devising diverse and high-caliber strategies related to carbon disclosure, as posited by upper-echelon and legitimacy theories (Alfi et al. 2024).

The empirical investigations undertaken by Hossain et al. (2017), Liao et al. (2015), along with Gonenc and Krasnikova (2022), have illustrated that a heterogeneous gender representation within corporate boards has the potential to significantly improve the quality of environmental disclosures. These findings imply that the involvement of women on boards is instrumental in enhancing the credibility of the disclosed information. Nevertheless, it is imperative to acknowledge that divergent findings have been documented in alternative studies, indicating that the presence of female directors on boards may not exhibit a statistically significant correlation with voluntary carbon disclosure (Chakraborty and Dey 2023; Darus and Rahman 2015; Lahyani 2022). In light of the foundational justifications for anticipating a relationship between these variables, we propose the subsequent hypothesis:

H4. **There is a positive relationship between board gender diversity and carbon emission disclosure.**

2.2.5 | Environmental committee and Carbon Emission disclosure

The existence of an "environmental committee" within the board is hypothesized to influence both the likelihood and transparency of disclosures pertinent to greenhouse gas emissions. This variable was evaluated through an analysis of its existence within a corporation and employed as an indicator of the firm's committed stance on ecological issues. In general, these types of assessments are categorized as two-part variables, where a score of 1 reflects the presence and a score of 0 reflects the absence (Peters and Romi 2014).

From the lens of agency and stakeholder theory, environmental committees serve a governance function focused on a narrowly delineated aim. They augment awareness and coherence in the implementation of sustainable practices, formulate policies, and supervise a corporation's endeavors to mitigate carbon emissions, thus addressing information asymmetry and exhibiting a proactive stance towards stakeholder management (Hussain et al. 2023; Liao et al. 2015; Peters and Romi 2014). These committees consist of individuals possessing expertise in environmental matters and are tasked with influencing the corporation's policies and initiatives concerning greenhouse gas emissions. As a result, they contribute to the disclosure of supplementary carbon-related information, which subsequently reduces the legitimacy gap and aligns with the upper-echelon theory (Chakraborty and Dey 2023; Tingbani et al. 2020).

Research carried out by Liao et al. (2015), along with that of Ofoegbu et al(2018) , confirmed via empirical investigation that the Environmental Committee showed a statistically significant positive relationship with environmental disclosure. They contended that individuals occupying directorial roles are instrumental within the environmental committee by disseminating information pertinent to greenhouse gas emissions. Peters and Romi (2014) yielded analogous findings, positing that board independence markedly enhances carbon disclosure. In contrast, Chakraborty and Dey (2023), along with Elsayih, Tang, and Lan (2018), disclosed that the presence of an environmental committee does not exert a significant influence on carbon disclosure. Therefore, in consideration of the importance of the relationship between environmental committees and carbon emission disclosure, a hypothesis is proposed:

H5. **There is a positive relationship between the environmental committee and carbon emission disclosure.**

3 | METHODOLOGY

Meta-analysis represents a sophisticated statistical methodology that amalgamates and scrutinizes quantitative data derived from multiple empirical research studies (Schmidt and Hunter 2015). This analytical framework places considerable emphasis on pre-existing theoretical assumptions pertinent to the subject matter under investigation. It is imperative to accurately define the phenomenon under scrutiny within

the meta-analytical framework. Our examination specifically delves into how various independent factors, including different aspects of corporate governance like board size, independence of the board, gender diversity, dual roles of the CEO, and the presence of environmental committees, affect a specific dependent factor which is the disclosure of carbon emissions. This methodological approach advocates for the implementation of rigorous criteria for the selection of samples, with the objective of determining the inclusion or exclusion of research studies in our overall analysis.

3.1 | Data collection and Sample

The initiation of the research process necessitates the formulation of explicit criteria for both inclusion and exclusion to alleviate the potential ramifications of publication bias. Relevant empirical studies that contain data pertinent to the research objectives are employed as illustrative cases for the meta-analysis. Consequently, the research sample incorporates a variety of independent variables, including board size, gender diversity, CEO duality, levels of independence, and the establishment of an environmental committee. The dependent variable identified in this investigation is the disclosure of carbon emissions. The selected study samples are mandated to perform regression analyses to explore the interrelationships among these variables. Furthermore, the articles must present correlation coefficients pertinent to the meta-analysis data and should encompass both developed and developing markets. The selection process includes all works that have been disseminated in peer-reviewed journals and are authored in English. The stipulation of peer-reviewed journals as a criterion guarantees that the empirical studies contained within each article incorporated into the sample are credible, thereby augmenting the significance of our meta-analysis..

The methodological approach follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). PRISMA represents a rigorously established normative framework employed to enhance the efficacy of systematic literature reviews. It is anticipated that adherence to this particular protocol will furnish authors with the requisite and pertinent information necessary for the evaluation of the quality and rigor of the review (Takkouche and Norman 2011). The PRISMA framework delineates a methodical three-phase process that encompasses the activities of searching or identification, screening, and synthesis. In the next step, these approaches are enacted across numerous scholarly databases and research platforms, including ProQuest Central, EBSCOhost EJS, Scopus, SpringerLink, and Wiley Online Library. These specific platforms are highly regarded for their appropriateness in conducting meta-analyses, attributed to their comprehensive scope and reliability (PRISMA-P Group et al. 2015).

In the preliminary stage of the study, a thorough assessment was executed to emphasize distinct phrases. The key documents were discerned after a comprehensive analysis of the existing literature, employing a mix of online and electronic channels, including Web of Science, Scopus, and the Google Scholar database. The search terminologies included expressions related to various board characteristics as well as the reporting of carbon emissions and their associated metrics. To facilitate a thorough literature review, a blend of singular and multiple keywords was utilized. The employed search terms encompassed notions such as ”board independence,” ”board size,” ”board gender diversity,” ”CEO duality,” ”CSR committee,” ”environmental committees,” ”board composition,” ”carbon emission disclosure,” ”greenhouse gas disclosure,” ”climate disclosure,” ”carbon transparency,” ”CSR disclosure,” ”climate change disclosure,” ”carbon report*,” ”greenhouse gas report*,” ”greenhouse gas emission report*,” or their pertinent synonyms.

In the screening stage, the search findings were diligently reviewed against established criteria to confirm the relevance and suitability of the titles and abstracts for inclusion in a meta-analysis. Simultaneously, the screening process adhered to established criteria. Furthermore, an exhaustive evaluation was conducted on the aggregation of primary studies. Following an initial search, we identified 376 primary studies that could be deemed potentially relevant. These studies encompass at least two distinct concepts: one pertaining to a characteristic of a board and the other related to the disclosure of carbon emissions. This research has been documented internationally over the preceding four decades.

This substantial corpus of research underscores the significance of the subject matter. It covers an array of research techniques, featuring theoretical exploration, extensive literature critiques, and hands-on research efforts. Nonetheless, after meticulously reviewing all abstracts and scrutinizing issues associated with corporate governance and carbon disclosure, 201 non-empirical and duplicate studies were eliminated. Consequently, a total of 175 suitable empirical studies remained for analysis after the refinement of the dataset. In the subsequent stage, 119 studies were excluded due to methodological and analytical inadequacies, such as the lack of a Pearson bivariate correlation matrix. We incorporated a total of 10 pertinent studies into our inquiry utilizing the ancestry approach. The execution of this approach involved a thorough examination of the references contained within the selected publications and critiques (Hussain et al. 2023).

With respect to the methodology of sample selection, we draw upon the established scholarly discourse concerning the interplay between corporate governance and the dissemination of carbon emissions, which is categorized as a form of non-financial reporting (Alfi et al. 2024). In our examination, we integrate research that explores the association between various dimensions of board characteristics and employs a metric of voluntary disclosure (including carbon emission disclosure, ESG disclosure, climate change disclosure, and environmental disclosure) as the dependent variable within their proposed analytical framework. According to Lagasio and Cucari (2019), non-financial reporting encompasses data regarding the natural environment, energy consumption, human capital, product offerings, community involvement, and all facets of corporate social responsibility disclosures. Therefore, our selection criteria for samples are meticulously crafted to include all dimensions pertinent to non-financial reporting, as advocated by both academic scholars and policymakers.

In conclusion, the results of the search underwent a stringent evaluation process to ascertain the reliability of the chosen studies. With the application of the PRISMA framework (refer to Figure 1), we ended up with 66 empirical investigations included in the meta-analysis.

Figure 1 AROUND HERE

3.2 | Descriptive Analysis of the Sample Studies

This meta-analysis integrates a total of 66 empirical investigations from diverse geographical settings, exploring the relationship between board characteristics and disclosures pertaining to carbon emissions. The descriptive analysis offers a comprehensive overview of the distribution of studies categorized by publication year, geographic region, and country, while clarifying the progression of scholarly research on board governance and carbon disclosure, highlighting notable trends and regional shortcomings within the existing literature.

3.2.1 | Distribution of Studies by Publication Year

The yearly distribution of scholarly investigations reveals an escalating interest in the relationship between board characteristics and carbon disclosure, particularly in the contemporary era. Figure 1 depicts a notable escalation in the annual output of research, especially following 2015, which corresponds with a global increase in awareness regarding climate change and a heightened regulatory focus on modifications in corporate governance. Noteworthy years distinguished by a substantial concentration of studies encompass 2023.

Figure 2 AROUND HERE

This ascendant trajectory signifies the increasing significance of environmental accountability and the function of corporate governance in advancing carbon transparency.

3.2.2 | Geographic and Country-Level Distribution

Figure 3 elucidates the spatial distribution of scholarly investigations, indicating a notable predominance of research activities in Asia (43.9%), succeeded by the United Kingdom, Europe (24.2%), and international contributions approximating (12%). The distribution underscores considerable research output originating from industrialized regions, while contributions from emerging markets, particularly within the African continent, remain inadequately represented. This observation accentuates a pronounced deficiency in the existing literature, thereby underscoring the imperative for further exploration in nascent domains.

Figure 3 AROUND HERE

At the national level, while the Asian nations yield the highest volume of scholarly investigations, the United Kingdom and Europe demonstrate the significance of research activities in economically advanced regions. Nonetheless, the inadequate representation from African nations signifies a considerable deficiency within the existing body of literature.

Figure 4 AROUND HERE

3.2.3 | Sample Size Distribution

At the national level, whereas Asian countries produce the greatest quantity of academic research, the United Kingdom and Europe exemplify the importance of research endeavors in economically developed areas. However, the insufficient participation from African countries indicates a substantial shortcoming within the current corpus of literature.

3.2.4 | Descriptive Statistics of Board Characteristics

The attributes of the board of directors that have been scrutinized encompass board independence, the phenomenon of CEO duality, board size, gender diversity, and the existence of environmental committees. Table 1 delineates a comprehensive overview of the descriptive statistics pertinent to these variables.

Table 1 AROUND HERE

This analytical examination elucidates a wide spectrum concerning the composition and governance methodologies of the boards scrutinized, especially regarding gender diversity and the establishment of environmental committees, which are observed to be more prevalent in Europe and Asia in comparison to North America.

3.3 | Data Extraction, Meta-analytic Strategy, and Procedures

Following the initial screening and evaluation of eligibility, we proceeded with the extraction of data to assemble essential quantitative and contextual information from each study that met the inclusion criteria. The variables extracted encompassed author identities, year of publication, geographical focus, sources of data, governance indicators, measures of carbon disclosure, sample size, and duration of the study. This process of standardization was imperative for facilitating robust and comparable meta-analyses across a variety of empirical contexts.

To rectify the contradictions observed in the existing body of work, we implemented a meta-analytic process that consolidates effect sizes across diverse studies. The metric for effect size that was utilized was Pearson's correlation coefficient ($\bar{r}$), which is frequently employed in meta-analytic research (Field, 2005; Velte, 2019; Hussain et al., 2023). In instances where the original studies reported standardized regression coefficients (β) in lieu of correlations, these values were converted into $\bar{r}$ to facilitate aggregation.

Two transformation methods were applied depending on the magnitude of β. For β values within the range of $[-0.5, +0.5]$, we followed Peterson and Brown (2005):

$$\bar{r} = 0.99\beta + 0.04\lambda + 0.02\eta \quad (1)$$

where $\lambda = 1$ if $\beta > 0$, and 0 otherwise; $\eta = 1$ if the average intercorrelation among predictors exceeds 0.17, and 0 otherwise. For β values outside this interval, we applied a transformation using the reported *t*-statistic and degrees of freedom (*df*) (Schmidt and Hunter, 2015):

$$\bar{r} = \sqrt{\frac{t^2}{t^2 + df}} \quad (2)$$

After standardizing the $\bar{r}$ values, we applied Fisher's Z transformation to stabilize variance:

$$Z = \frac{1}{2}\log\left(\frac{1+\bar{r}}{1-\bar{r}}\right) \quad (3)$$

Each Z-score was weighted by the inverse of its sampling variance ($w = n - 3$), where *n* is the sample size. The weighted average Fisher Z was then computed as:

$$M = \frac{\sum_{i=1}^{k} w_i Z_i}{\sum_{i=1}^{k} w_i} \quad (4)$$

The consolidated Z value (*M*) was thereafter subjected to a back-transformation in order to yield a correlation coefficient, thereby enhancing interpretability.

To determine if there is any variability present across the studies, we employed Cochran's Q statistic, along with Higgins and Thompson's I^2, the H^2 statistic, and the variance estimator for heterogeneity τ^2. The Q-test evaluates whether the variance observed exceeds what could be attributed to random chance. The I^2 statistic determines the ratio of total variability that is due to heterogeneity as opposed to sampling error, while τ^2 estimates the variance component observable between the studies.

In order to identify and correct for potential publication bias, we implemented selection models (Schmidt and Hunter, 2015; Bartoš et al., 2022). These models consider the non-random probability of publication contingent on the significance of results, employing weighted likelihood estimation to alleviate bias in the overall effect size.

Ultimately, forest plots were constructed to visually convey the effect sizes and confidence intervals across the studies included in the analysis. Studies characterized by broader intervals or substantial deviations from the mean signify heterogeneity, thereby underscoring the necessity for a random-effects model.

4 | RESULTS

4.1 | Effect Size Analysis

This segment elucidates the outcomes derived from the meta-analytic synthesis, with a particular emphasis on the correlation among five distinct board characteristics and the disclosure of carbon emissions. We delve into the significance of board independence, board size, the presence of gender diversity, CEO duality, and the setup of an environmental committee. A cumulative total of 66 studies were incorporated, categorized by predictor variable, and evaluated through the application of random-effects models to effectively capture the variability inherent across diverse contexts and sample configurations.

Our preliminary examination scrutinized the distribution of scholarly articles contributing to each governance variable. The meta-analyses encompass 38 studies addressing board independence, 30 concerning board size, 36 focusing on gender diversity, 17 related to CEO duality, and 18 pertaining to environmental committees. This comprehensive scope of analysis bolsters the generalizability of our conclusions. Figure-based forest plots along with Tables 2 and 3 encapsulate the effect sizes and corresponding confidence intervals. Generally, the findings substantiate a positive correlation between board governance mechanisms and carbon disclosure, with the significant exception noted in the case of CEO duality. Board independence demonstrates a moderate positive influence on carbon disclosure, reflected in an average effect size of $\bar{r}$ = 0.144 (95% CI = [0.0970, 0.1924], $Z = 5.743$, $p < 0.05$). Although the majority of studies corroborate this outcome, a subset reported insignificant results, suggesting heterogeneity that may be attributed to contextual or methodological variances.

The role of gender diversity has been marked as a vital element in predicting disclosure. In an extensive review encompassing 36 studies, the mean effect size was calculated to be $\bar{r}$ = 0.200 (95% CI = [0.1410, 0.2635], $Z = 6.408$, $p < 0.05$). Notwithstanding the general alignment of findings, a limited number of studies (e.g., Ashraf and Nazir, 2023; Daromes and Monica, 2019; Kiliand Kuzey, 2019) reported non-significant outcomes, thereby underscoring the possible impact of institutional or firm-level moderating variables. Additionally, board size exhibited a positive correlation with disclosure, with an average effect size of $\bar{r}$ = 0.179 (95% CI = [0.1248, 0.2378], $Z = 6.290$, $p < 0.05$). This indicates that larger boards may enhance oversight capabilities and incorporate a wider array of perspectives in sustainability reporting. Nevertheless, certain studies (e.g., Cosma et al., 2022; Gerged, 2021; He et al., 2019) revealed overlapping confidence intervals that included zero, suggesting variability in this relationship across different contexts.

In contrast, the phenomenon of CEO duality did not demonstrate a statistically significant correlation with carbon disclosure. The average effect size was minimal at $r = 0.008$ (95% CI = [-0.068, 0.0833], $Z = 0.197$, $p > 0.10$). The majority of investigations within this category yielded inconclusive outcomes, with only a select few (e.g., Gerged, 2021; Khaireddine et al., 2020) indicating a significant inverse relationship. These divergent findings imply that the influence of CEO duality may be contingent upon contextual factors or shaped by firm-specific governance frameworks. The establishment of an environmental committee emerged as the most substantial positive predictor of disclosure among all examined variables. The meta-analysis encompassing 18 studies indicated an average effect size of $r = 0.262$ (95% CI = [0.1678, 0.3678], $Z = 5.250$, $p < 0.05$). This underscores the importance of specialized sustainability governance frameworks in promoting carbon transparency. While many studies affirm this discovery, a handful (e.g., Baalouch et al., 2019; Bui et al., 2020; Rupley et al., 2012) presented findings that were not statistically significant.

Table 2 about here

Table 3 about here

Figures 5 through 9 present forest plots that delineate the dispersion of effect sizes and confidence intervals across various studies pertaining to each governance characteristic. These visual representations affirm the coherence of the majority of findings while simultaneously depicting variability in both the precision and magnitude of effects. Importantly, studies characterized by expansive confidence intervals or effect sizes proximate to zero exhibit variability that necessitates further moderator analysis.

Figure 5 about here

Figure 6 about here

Figure 7 about here

Figure 8 about here

Figure 9 about here

4.2 | Subgroup Analysis

To further elucidate the considerable heterogeneity identified within the primary meta-analytic findings, we undertook subgroup analyses predicated on the geographic locale of the research studies. The stratification according to national groupings provides a nuanced understanding of how institutional and regional determinants may influence the nexus between board characteristics and carbon emission disclosure. Table 2 delineates the variability observed across studies for each governance variable. The presence of significant Q-statistics alongside I^2 values surpassing 75% implies substantial heterogeneity, thereby validating the necessity for subgroup analyses. It is noteworthy that no evidence of publication bias was detected in any model ($p > 0.05$), signifying a representative distribution of results across the studies examined.

Table 4 about here

Following Shelby and Vaske (2008), countries were grouped into five regions: Africa, Asia, International (multi-country studies), UK/Europe, and US/Canada. This regional classification enables analysis of institutional differences such as legal systems, cultural norms, political environments, and levels of sustainability regulation, all of which may influence corporate carbon reporting (Kreuzer and Priberny, 2022; Muttakin et al., 2022).

Table 5 about here

The majority of studies originate from Asia, the UK, and Europe, reflecting their active roles in ESG discourse. In contrast, few studies were found for Africa and North America. Interestingly, US and Canadian studies consistently revealed non-significant associations between board characteristics and carbon disclosure. This may be a function of limited sample size or potentially distinct institutional contexts requiring further exploration. Across all regions, Europe and the UK showed relatively strong associations for board size ($\bar{r} = 0.32$) and gender diversity ($\bar{r} = 0.19$). By comparison, Asian studies reported slightly lower correlations for these same traits ($\bar{r} = 0.15$ and 0.16, respectively) (see Tables 5, 6). However, Asia exhibited higher effect sizes for board independence and environmental committee presence than UK/Europe (see Tables 4, 8). In the international subgroup, the presence of environmental committees was particularly impactful, with a correlation of $\bar{r} = 0.55$—the strongest regional association in the analysis. In contrast, CEO duality had no significant effect in any regional category, reinforcing its overall null finding.

Table 6 about here

Table 7 about here

These analytical outcomes reinforce Hypotheses H1, H2, H3, and H5, consequently affirming the presence of statistically meaningful associations between board independence, gender diversity, board size, and the existence of environmental committees regarding carbon disclosure (average $\bar{r}$ = 0.14, 0.20, 0.17, and 0.26, respectively; all $p < 0.05$). Conversely, the examination related to H4 (CEO duality) did not indicate a statistically significant correlation ($\bar{r} = 0.008, p > 0.10$), thereby implying a constrained governance influence within this domain.

Table 8 about here

While these findings support prior theoretical and empirical work suggesting that diverse and well-structured boards enhance transparency, they must be interpreted with caution due to persistent heterogeneity. Figures and forest plots in earlier sections illustrate how individual study variability contributes to these patterns. In conclusion, subgroup analysis reveals that institutional and geographic factors play a meaningful role in shaping the strength of governance-disclosure relationships. Further research is warranted to unpack these contextual dynamics and explore why some regions, particularly North America, yield systematically weaker results despite strong sustainability discourse.

5 | CONCLUSIONS

In the recent past, a significant surge in academic inquiry has emerged, focusing on examining the link between board attributes and the transparency surrounding carbon emissions. Notwithstanding this expanding corpus of literature, a discourse persists concerning the intrinsic nature of this association and the contextual variables that may shape it. This research endeavor aims to conduct a comprehensive examination of the prevailing empirical studies that assess the nexus between board attributes and the disclosure of greenhouse gas emissions. Additionally, the investigation seeks to analyze the unique characteristics of these scholarly pursuits that might elucidate the variances in their findings. After analyzing the outcomes of a systematic review, the researchers deduced a conclusion drawn from 66 empirical-quantitative investigations focusing on the association between board traits (like gender diversity, CEO duality, board size, independence, and the role of environmental committees) and the reporting practices of carbon emissions.

The empirical findings provided robust support for four hypotheses, wherein all four mean effect sizes related to gender diversity, board size, independence, and environmental committee demonstrated statistical significance. Consequently, our results are consistent with the foundational tenets of widely accepted theoretical frameworks, including agency, stakeholder, and legitimacy theories. As a result, it indicates that the variables that have been statistically validated could have a direct positive effect on the transparency of carbon emissions reporting. However, hypothesis H4 concerning the CEO was found to lack statistical significance, even when considering various geographical contexts.

We undertook subgroup analyses and engaged in a qualitative assessment of the contextual frameworks within the primary studies. The results we acquired substantiate the conclusions articulated by Córdova, Zorio-Grima, and Merello (2018), Grauel and Gotthardt (2016), Muttakin et al. (2022), demonstrating the profound impact of geographical contexts on the relationship between board characteristics and the transparency of carbon emissions disclosure. This is congruent with institutional theory, which asserts that the legal frameworks, societal norms, values, and cultural beliefs unique to each nation play a pivotal role in influencing both economic and social conduct.

We augment the prevailing corpus of knowledge by contributing to the established theories and literature across various dimensions. Our meta-analysis, specifically, elucidates the strengths and orientations of the relationships between board structural attributes and disclosures related to Greenhouse Gas, utilizing a statistical synthesis of empirical studies that have thus far encountered difficulties in validation. Prior investigations have predominantly depended on quantitative methodologies, particularly scrutinizing a constrained array of board characteristics such as board size, independence, and gender diversity. Only 22 scholarly articles have been incorporated into these analyses, which have singularly concentrated on developed markets (Alfi et al. 2024).

In order to enhance and modernize these evaluations, our investigation expands the spectrum of resources and conducts a thorough assessment encompassing 66 distinct studies. The meticulous analysis reveals a considerable degree of fragmentation in earlier results concerning board characteristics and their association with the disclosure of carbon emissions. This necessitates a comprehensive inquiry into the moderating effects of various methodological variables. An analytical approach was employed to evaluate the influence of geographical or country-specific variables and carbon emission outcomes on the investigated correlation, with particular emphasis on the boundary conditions. Concerning practical and policy implications, the findings suggest that decision-makers and regulatory bodies should consider the composition of corporate board attributes when devising strategies to improve environmental initiatives and transparency in climate-related disclosures. Moreover, executives and organizations may need to address the distinct impacts of different board attributes on climate-related disclosures in order to meet stakeholder expectations and comply with regulatory requirements.

The study presents constraints, whereas corporate governance encompasses both internal and external mechanisms for guiding, overseeing, and regulating firms. The internal mechanisms consist of board composition, executive remuneration, and ownership structure. Subsequent research endeavours may amalgamate various internal facets of corporate governance and their impacts on the disclosure of carbon emissions. Due to the limited sample size, only a select few facets of board attributes have been scrutinized in relation to carbon emission disclosure. In scenarios involving extensive datasets incorporating various aspects of internal governance, the outcomes of effect size examination and subgroup assessment could potentially yield diverse discoveries and ramifications, alongside a comparative international investigation.

Given the inferences derived from this meta-analysis, subsequent research endeavors ought to investigate alternative pathways for further scrutiny. Future investigations may delve into the influence of pivotal board characteristics, particularly the presence of an environmental committee, as moderating variables affecting carbon disclosure and transparency. Furthermore, evaluating the ramifications of varying climate-related policies and regulations, such as the United Kingdom's pledge to eradicate greenhouse gas emissions by 2050 alongside the more conservative stance of the United States, on investors' strategies and corporate greenhouse gas emissions could yield beneficial insights. Finally, broadening the analysis to encompass the implications of diverse board attributes on additional dimensions of corporate social responsibility and sustainability, beyond mere carbon disclosure, would offer a more comprehensive perspective on the advantages of board diversity.

Exploring these scholarly domains will augment our comprehension of the intricate nuances of green disclosure, thereby facilitating advancements in governance and climate change initiatives.

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List of Tables

TABLE 1 Descriptive Statistics of Board Characteristics

Statistic	Board Independence	Board Size	Gender Diversity	Env. Committee Presence	CEO Duality
Count	38	30	36	18	17
Mean	0.1423	0.1767	0.1941	0.2530	-0.0011
Std Dev	0.1386	0.1434	0.1750	0.2013	0.1627
Min	-0.1	-0.0747	-0.23	-0.036	-0.298
25%	0.0593	0.0855	0.0860	0.0653	-0.073
50% (Median)	0.1130	0.1377	0.2200	0.2315	-0.0267
75%	0.2300	0.2938	0.2940	0.4600	0.0570
Max	0.5470	0.4517	0.5666	0.5510	0.4120

TABLE 2 Summary of Analysis of Correlates of Carbon Disclosure and Heterogeneity Statistics, created using R 4.4.0

Variables	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
B.IND	38	30,589	0.144	5.743**	0.0001	0.0970	0.1924
B.Gen	36	50,909	0.200	6.408**	0.0001	0.1410	0.2635
B.SIZE	30	41,186	0.179	6.290**	0.0001	0.1248	0.2378
CEO.DUAL	17	27,110	0.008	0.197	0.8437	-0.068	0.0833
Env.Com	18	9,077	0.262	5.250**	0.0001	0.1678	0.3678

TABLE 3 Heterogeneity Statistics and Publication Bias,created using R 4.4.0

Variables	Q-stats	I^2	τ^2	H^2	Egger's Test
B.IND	279.4881***	92.20%	0.0187	12.82	0.3272
B.Gen	675.2082***	97.22%	0.0319	37.04	0.4850
B.SIZE	784.9334***	95.86%	0.0211	24.15	0.4651
CEO.DUAL	178.0054***	96.56%	0.0230	29.07	0.1199
Env.Com	267.1668***	95.46%	0.0434	22.05	0.2764

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Variables are indicated as follows: Q represents Cochran's Q test; I^2 represents Higgins and Thompson's I^2 test; H^2 represents the H^2 statistic; τ^2 represents the heterogeneity variance τ^2 test. The variable B.IND denotes board independence, B.Gen represents the presence of women on the board, B.SIZE reflects the size of the board, CEO.DUAL represents the presence of CEO duality, and Env.Com represents the presence of an environmental committee on the board.

TABLE 4 Sub-group Analysis of Board Independence,created using R 4.4.0

Region	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
Africa	2	890	0.372	4.214	0.0001	0.2092	0.5731
Asia	21	22,912	0.133	4.395	0.0001	0.0744	0.1943
Australia	1	203	0.352	2.617	0.0089	0.0923	0.6431
International	2	384	0.201	1.986	0.0470	0.0027	0.4056
The UK/Europe	10	5,077	0.104	2.487	0.0129	0.0221	0.1866
The US/Canada	2	1,123	0.037	0.410	0.6818	-0.1419	0.2170
Overall Statistics							
Q-stats = 54.227, I^2 = 90.07%, H^2 = 10.7, τ^2 = 0.0147							

TABLE 5 Sub-group Analysis of Gender Diversity,created using R 4.4.0

Region	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
Africa	2	1,717	0.296	2.262	0.0240	0.0408	0.5705
Asia	12	5,130	0.164	2.827	0.0050	0.0506	0.2794
Australia	1	203	0.368	1.925	0.0540	-0.0070	0.7792
International	7	32,577	0.239	3.335	0.0010	0.1005	0.3868
The UK/Europe	10	5,948	0.186	3.074	0.0020	0.0682	0.3080
The US/Canada	4	5,334	0.172	1.811	0.0700	-0.0142	0.3615
Overall Statistics							
Q-stats = 40.68, I^2 = 97.0%, H^2 = 34, τ^2 = 0.01877							

TABLE 6 Sub-group Analysis of Board Size,created using R 4.4.0

Region	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
Africa	2	890	0.191	2.134	0.0328	0.0159	0.3716
Asia	15	21,432	0.150	4.361	0.0001	0.0833	0.2193
Australia	NA	NA	NA	NA	NA	NA	NA
International	4	1,699	0.100	1.464	0.1432	-0.0340	0.2348
UK/Europe	7	3,411	0.322	6.699	0.0001	0.2358	0.4309
US/Canada	2	13,754	0.0143	0.163	0.8705	-0.1572	0.1857
Overall Statistics: Q-stats = 70.6, I^2 = 90.0%, H^2 = 10.41, τ^2 = 0.0140							

TABLE 7 Sub-group Analysis of CEO Duality, created using R 4.4.0

Region	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
Africa	1	587	0.159	1.042	0.297	-0.1415	0.4627
Asia	10	22,548	-0.044	-0.881	0.378	-0.1411	0.0536
Australia	NA	NA	NA	NA	NA	NA	NA
International	2	1,458	-0.048	-0.435	0.663	-0.2634	0.1677
UK/Europe	3	2,156	0.153	1.737	0.082	-0.0198	0.3273
US/Canada	1	361	0.019997	0.127	0.899	-0.2889	0.3289
Overall Statistics: Q-stats = 5.08, I^2 = 96.60%, H^2 = 29.7, τ^2 = 0.0220							

TABLE 8 Sub-group Analysis of the Presence of an Environmental, created using R 4.4.0l Committee

Region	K	Sample	$\bar{r}$	Z-value	P. Value	CI.lb	CI.ub
Africa	2	1,433	0.418	3.596	0.0003	0.2027	0.6882
Asia	4	751	0.329	3.675	0.0002	0.1594	0.5235
Australia	3	948	0.347	3.472	0.0005	0.1576	0.5663
International	1	101	0.551	3.146	0.0017	0.2337	1.006
UK/Europe	4	2,245	0.110	1.259	0.2080	-0.0613	0.2816
US/Canada	4	3,599	0.132123	1.534	0.1249	-0.0369	0.3027
Overall Statistics: Q-stats = 52.3, I^2 = 93.1%, H^2 = 14.5, τ^2 = 0.0286							

List of Figures

FIGURE 1 Flow diagram of the study selection process. (Source: Author)

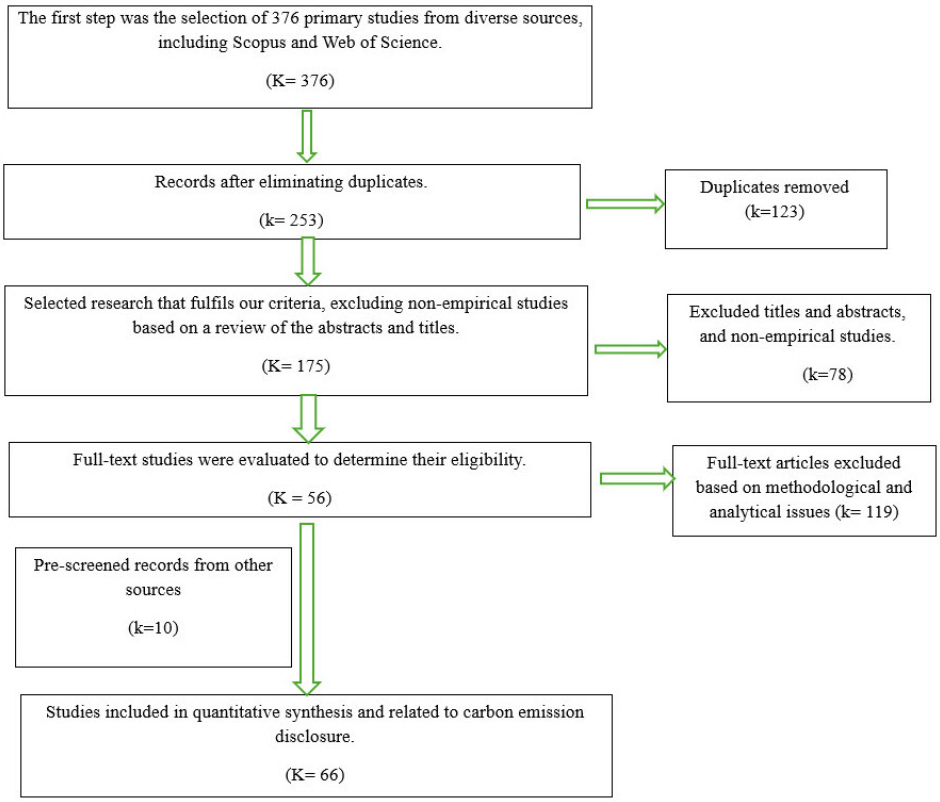

FIGURE 2 Publication by Year

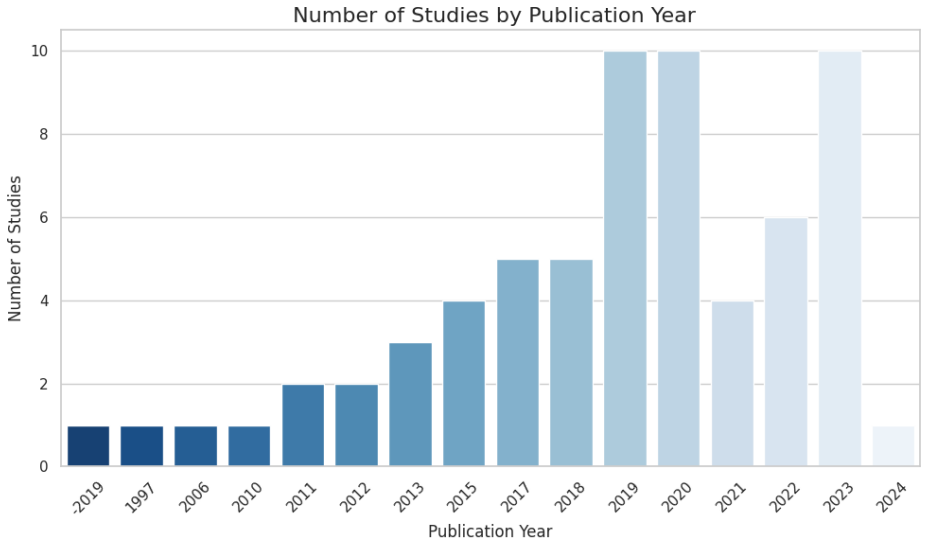

FIGURE 3 Geographical Distribution

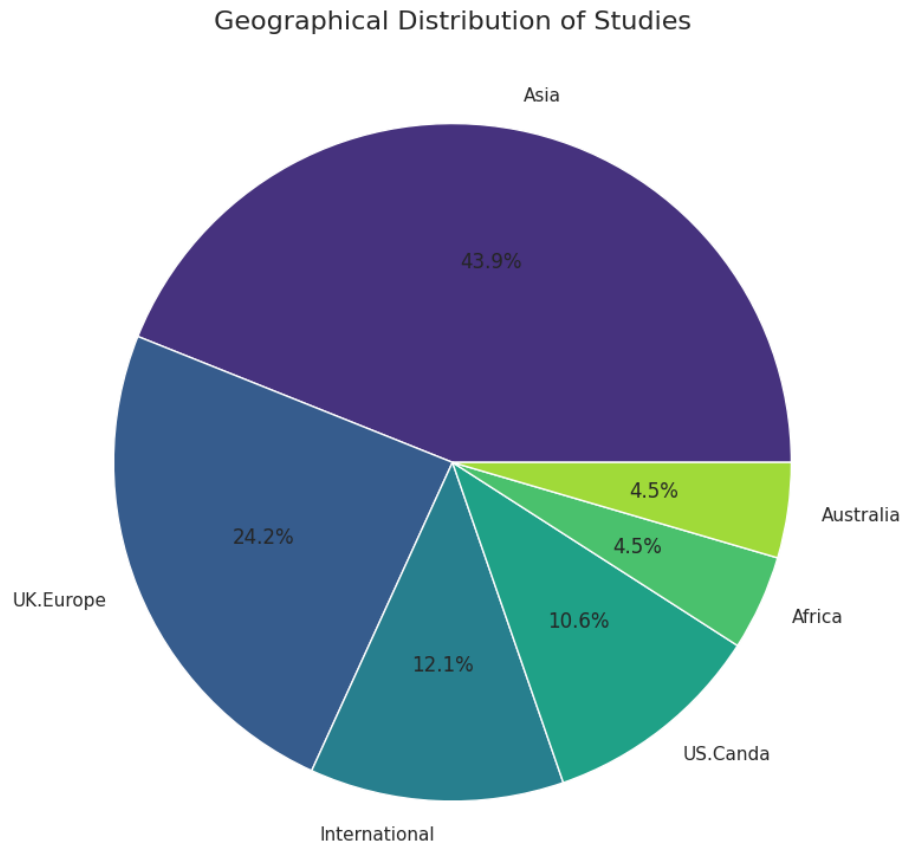

FIGURE 4 Geographical Region by Studies

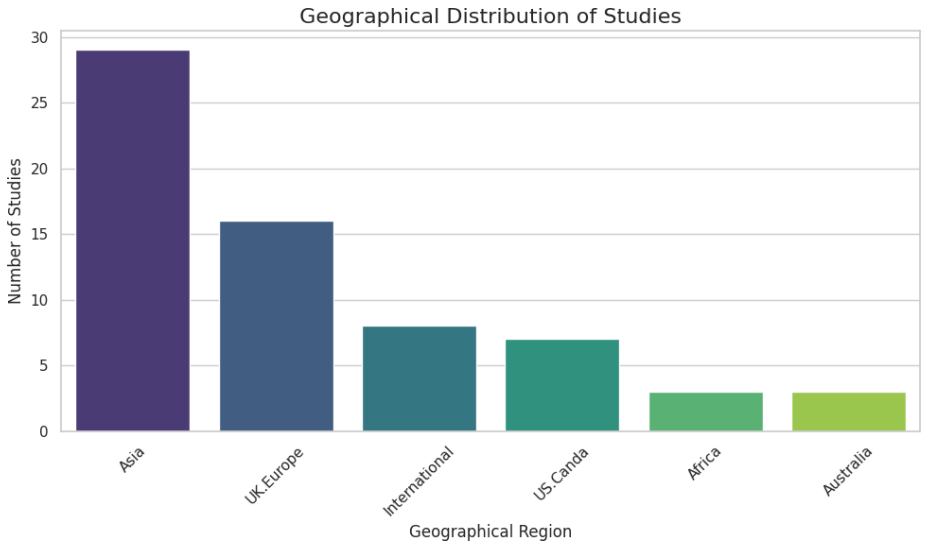

FIGURE 5 The forest plot of board independence. created using R 4.4.0

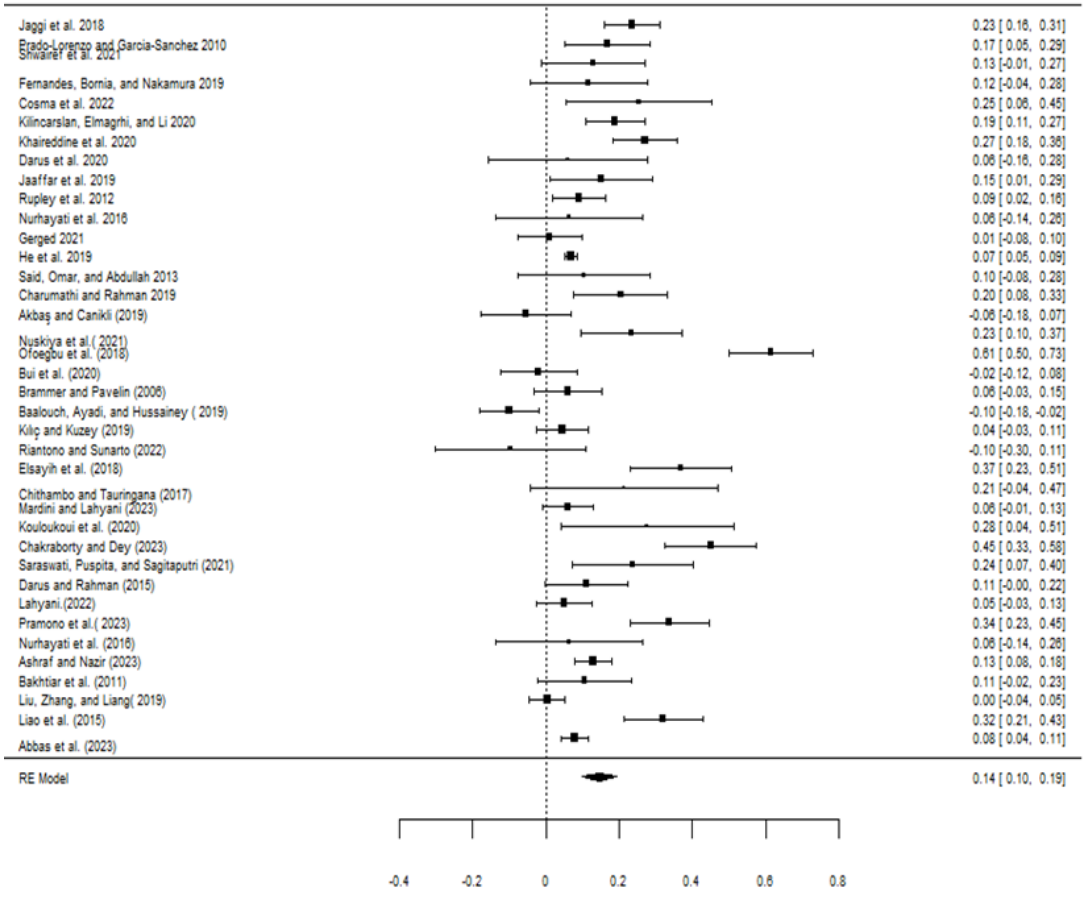

FIGURE 6 The forest plot of Gender diversity, created using R 4.4.0

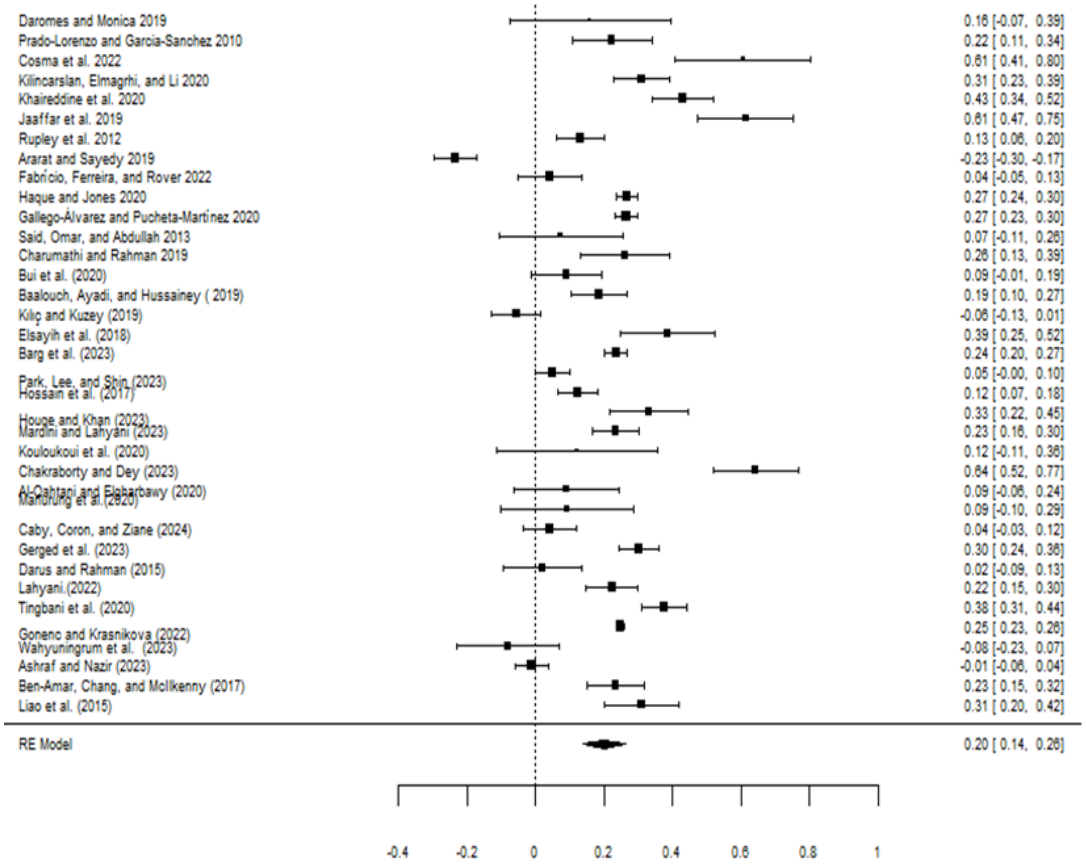

FIGURE 7 The forest plot of Board Size. created using R 4.4.0

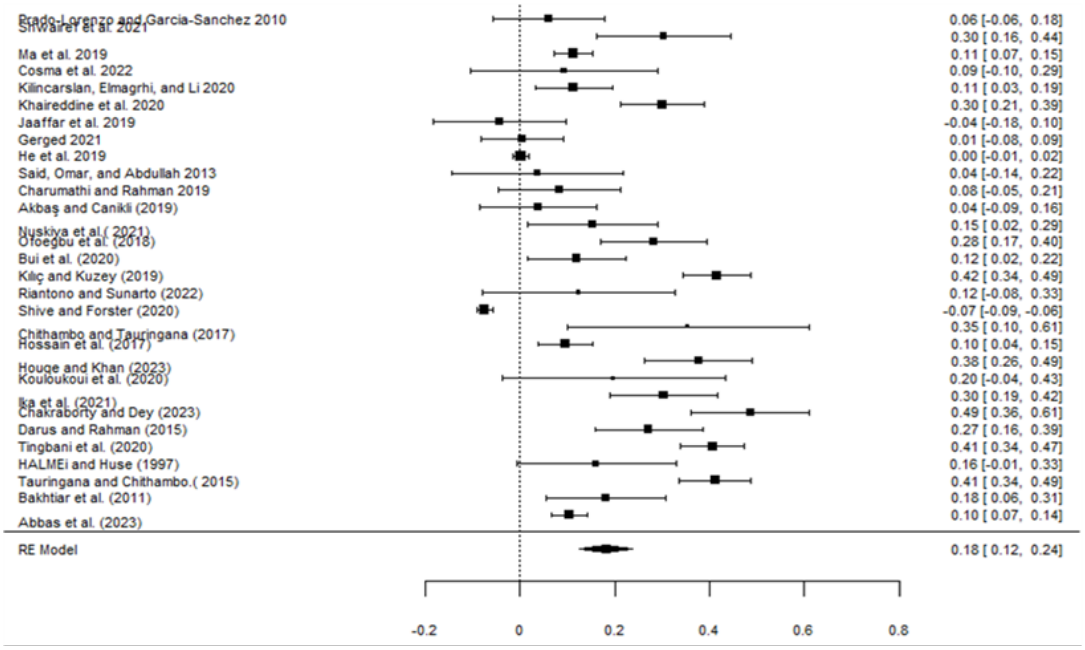

FIGURE 8 The forest plot of CEO Duality. created using R 4.4.0

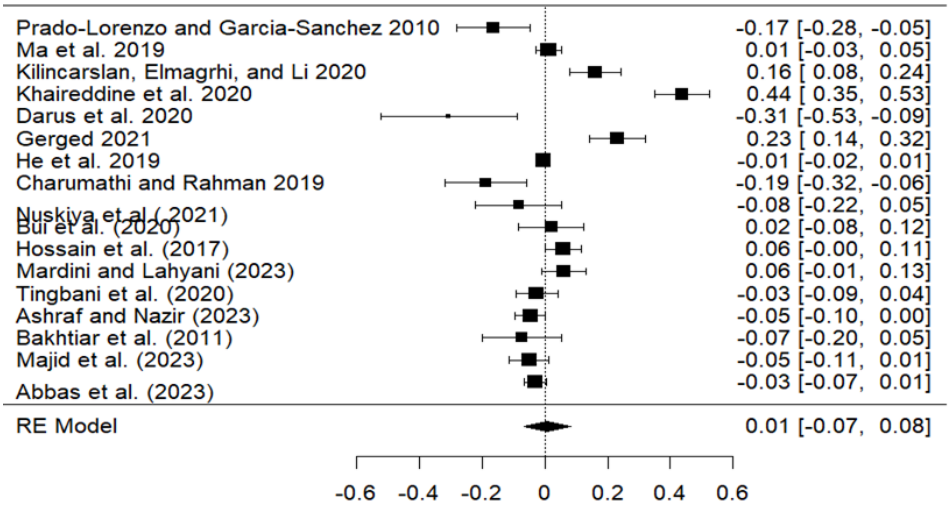

FIGURE 9 The forest plot of the presence of an environmental committee. created using R 4.4.0