ESG Score and Carbon Emission: Empirical Evidence in Malaysian Listed Companies

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ABSTRACT

This study investigates how board effectiveness moderates the association between carbon emission and Environmental, Social, and Governance (ESG) scores of Malaysian listed corporations. Using data collected on 1051 Malaysian listed firms belonging to the year 2023, this study investigates the effect of ESG score on reducing the promotion of carbon emissions. The findings evidenced a negative relation of ESG scores against carbon emission, whereby the effect of board effectiveness was stronger in the companies. Such findings signify that firms which take sustainability seriously, especially through effective board effectiveness, have a great advantage in the reduction of carbon emission. Companies are encouraged to proactively and strategically reduce their carbon footprint, as part of a broader, comprehensive sustainability strategy, both to meet rising stakeholder expectations but also then to obtain high reductions of emissions for longer-term financial returns and competitive advantage.

Keywords: ESG Score, Carbon Emission, Board Effectiveness

INTRODUCTION

Generally, in recent decades, the reasonable decision would have been for current business enterprises to dump their waste into nearby lakes and rivers and, shortly thereafter, sell their new products considerably less than their competitors. Most times, such practices save time, money, and the company from hassles with government regulation. But in the deteriorated state of environmental pollution that mankind is facing now, sustainability is becoming increasingly important for all corporate players around the globe. Some cornerstones of their core frame were, practically, putting off releasing emissions that lead to global warming. Scope 1 and Scope 2 are a term for direct emissions (hereafter referred to as S1 and S2, respectively), which are controlled by the organization directly. Scope 3 has no such direct control.

There has been increasing pressure over the past few years on organizations worldwide to address hard and fast matters of environmental, social, and governance (ESG). Carbon emissions pose specific hazards against climate change and long-term environmental sustainability along this continuum of issues (Luo & Tang, 2023). Coupled with global pressure to lessen their carbon footprint, businesses are seeing growing urgency to integrate more sustainable practices into their operational workings, and they are increasingly given serious consideration within the prospective shift toward a responsibility-supporting corporate perspective. Companies that do not develop a sustainability agenda set themselves up for damage to their reputations or financial hits or jeopardize their competitiveness in a market that increasingly places a high value on green initiatives (Treepongkaruna et al., 2024).

The companies that proactively make energy sustainability are likely to direct their attention to the creation of value and long-term survivability. The ESG ratings have been considered by Guardian Management & Finances (2021) and Peako Sustainability (2021) in determining the performance levels of the three principal

grant categories: the environment, society, and governance scorecard. Today, listings like MSCI, Sustainalytics, and other bodies based on data from various public resources and proprietary research must be assumed as pivotal to the evaluation of how companies manage the risks and opportunities linked to sustainability. Wherever possible, the investors' and stakeholders' decision-making depend on this information.

According to Kimbrough et al. (2024), ESG metrics ratings are becoming widely used to assess the ethical impact and sustainability of corporations. Interest in the linkage between ESG scores and carbon emissions has intensified in the wake of mounting fears of climate change and environmental destruction. This literature review outlines the research done to date regarding the nexus between carbon emissions and ESG variables, and it goes on to review the implications of ESG performances with consideration to policymakers and investors in terms of corporate carbon footprints on companies. Carbon emissions are a major driver of climate change, and companies are being increasingly held accountable for the environmental impacts of their operations. Research indicates that companies with lower carbon emissions tend to receive higher ESG scores. For example, in a study by Baratta et al. (2023), a positive correlation was found between good ESG performance and lower carbon intensity, suggesting that environmentally responsible companies commonly adopt practices that reduce emissions. Many works examined the impact of ESG ratings upon the corporate actions concerning carbon emissions. Hence, according to Drempetic et al. (2020), companies with high ESG scores are encouraged to adopt green technologies and to cut emissions. However, firms with low ESG scores may also face reputational risks for falling below the bar, causing them to adopt more sustainable practices. This feedback establishes a connection between increased ESG ratings and lower emissions.

The escalating urgency to address climate change has led to heightened scrutiny of corporate practices related to environmental sustainability, particularly with respect to carbon emissions. Although the significance of ESG (Environmental, Social and Governance) scores as metrics for assessing a company's sustainability performance has grown, a notable gap persists in comprehending how these scores directly affect corporate carbon emissions. Some research indicates a correlation between elevated ESG scores and diminished carbon footprints (Baratta et al., 2023); however, the inconsistencies in ESG rating methodologies may obscure this relationship and complicate efforts to hold companies accountable for their environmental impact (Clementino & Perkins, 2021). Additionally, the widespread occurrence of greenwashing where companies amplify their ESG commitments while failing to implement meaningful changes, raises questions about the reliability of ESG scores as a mechanism for fostering authentic reductions in carbon emissions (Treepongkaruna et al., 2024).

This issue is especially pressing because the rising expectations from investors and regulators compel corporations to exhibit accountability in their environmental practices (Oyewo, 2023). As companies navigate the complexities of sustainability reporting and stakeholder demands, however, comprehending the true implications of ESG scores on carbon emissions becomes essential for cultivating a corporate environment that truly prioritizes climate action. Although challenges abound, this understanding is crucial for long-term success.

This research is rooted in stakeholder theory (Steurer, 2006), which posits that companies must address the needs and interests of all stakeholders. Stakeholder theory emphasizes that by responding to the varied expectations of stakeholders, firms can enhance their long-term financial performance. However, this approach may present challenges, because balancing these needs is not always straightforward. Although some may argue that prioritizing stakeholders can be detrimental to profits, the evidence suggests otherwise: firms that engage with their stakeholders effectively often see significant benefits. As environmental concerns become increasingly significant to stakeholders, especially regarding sustainability, it is essential to understand how carbon emissions play a role within the ESG framework (Lee & Isa, 2023). Addressing carbon emissions is vital for environmental performance and aligns with broader stakeholder demands, positioning companies for success in sustainable development goals. Therefore, this research seeks to address the following questions: Does ESG scores able to curb the carbon emission for Malaysian listed companies?

The subsequent portions of this work are structured as follows: The second component comprises research hypotheses and a theoretical review. The research design is detailed in the third part. The fourth section examines the regression findings and robustness tests. The fifth section contains further elaboration on the findings. The sixth section provides insights and conclusions.

LITERATURE REVIEW AND THEORETICAL ANALYSIS

Contemporary sustainability reporting often appears to live in isolation. Companies regard it as an annual obligation, merely a duty to be marked off the compliance checklist. However, the issue lies in the fact that the report is insular, and by the time it is completed, it is already obsolete. Some may contend that sustainability necessitates a distinct reporting framework to prioritise decarbonisation initiatives. However, the truth is that financial performance has historically been the principal criterion for assessing the success of any firm. Disregarding this truth and conducting sustainability reporting independently is unhelpful. It jeopardises the environmental agenda entirely. Without the integration of sustainability data with financial data, it would perpetually be regarded as a peripheral consideration rather than a fundamental influence on business success.

Numerous companies assess emissions in isolation, detached from financial data. The rationale for maintaining sustainability as a distinct initiative may appear reasonable due to enhanced concentration and simpler communication; yet it neglects a vital truth: CEOs and decision-makers base their actions on financial considerations. If emissions and finances are not synchronised under a unified source of truth, emissions data is relegated to an afterthought. It no longer influences decision-making; it only remains unused, accumulating dust. When sustainability teams promote investments in decarbonisation initiatives, executives encounter a disjointed business case that impedes and frequently obstructs development.

ESG Score and Carbon Emission

Sustainability reporting must occur more frequently than annually. Financial reporting operates differently, and carbon data should not follow that model. Failing to consistently monitor emissions and incorporate such data into financial reporting results in the loss of valuable information that may facilitate meaningful decarbonization efforts. Amidst a worsening global crisis, mitigating carbon emissions has transitioned from a moral obligation to a business need. A corporation needs to meet strict environmental regulations while adding to the demand for environmentally conscious consumers to develop strong carbon reduction strategies. Reducing carbon footprint connects businesses with national and international sustainability goals, creating operational efficiencies, reducing costs and improving brand value. This paper discusses reducing a corporate carbon footprint, fulfilling environmental responsibility and a good business practice. A more energy efficient operation lowers costs, while embracing renewable energy can serve as a hedge against the uncertainty of fossil fuel markets. In addition, sustainability frontrunners are also more appealing to investors, customers and high potential.

When deciding to invest, there is an increasing focus on ESG performance. Those that make the leap begin actively reducing carbon which are perceived as lower-risk, more capable of weathering the storm of a carbon-constrained world. Likewise, consumers tend to appreciate brands that share their values, and the need to meet carbon-neutral targets is an effective method of appealing to eco-conscious customers.

Recent academic literature has focused on the divergence of ESG scores from carbon emissions, disparaging this discrepancy as an indicator of corporate sustainability efforts missing the mark on climate change. Studies have shown a strong correlation between above average ESG ratings and lower carbon emissions, suggesting that companies with strong environmental practices are more likely to be adopting actual solutions in a manner sufficient to reduce their carbon footprints. According to research by Lee & Isa (2023), better ESG performance correlated with lower carbon intensity scores, indicating positive sustainability engagement among firms.

In contrast, poor ESG rated firms are subject to increased scrutiny and reputational risks which can pressure them to adopt greener practices (Baratta et al., 2023). Nonetheless, differences in ESG rating methodologies lead to skepticism that these scores accurately and reliably capture real-world environmental harm (Kimbrough et al., 2024). The relationship is further complicated by the occurrence of greenwashing, where firms may boast high ESG scores while failing to achieve substantive reductions in carbon emissions (Treepongkaruna et al., 2024). While there is some justification for global carbon weighting to be lower when the ESG score is high, myriad factors complicate assessments and corporate accountability, and this area of study should be explored until its full potential is realized across the globe. From the arguments above, we can conclude that:

Hypothesis 1: ESG score can promote reduce the carbon emission

The moderating Effect of Board effectiveness

According to a PwC poll, more than two-thirds of corporate boards have an insufficient understanding of the ESG risks facing their organizations. Less than one quarter of boards have an enterprise-wide knowledge of carbon disclosures and even fewer understand their businesses' climate risk or strategy. While ESG concerns are often on the board agenda, the majority of directors admit to having a low understanding of key sustainability issues. However, there is a growing inertia in ESG-related reporting preparedness, and strong support for tying executive pay to non-financial targets.

Investigating ESG scores, board of directors' characteristics, and carbon emissions based on the Draft Report of an Environmental Sustainability Research Initiative Research indicates that boards with greater diversity and independence better prioritize sustainability and deploy more successful carbon reduction plans. Higher presence of independent directors on the board correlates with better ESG performance (Velte, 2016), owing to the diversity of perspectives and the heightened accountability that independent board members often lead to. Additionally, Aliani (2023) noted that companies with board diversity are more likely to practice proactive environmental approaches, hence reduce carbon emissions. This is because of the varying experiences and backgrounds board members bring to the table and the innovative solutions driven by these unique perspectives on environmental challenges. On the other hand, organizations with fewer diverse boards may not have the requisite oversight and commitment to sustainability, which can translate into lower ESG scores and higher carbon risk emissions. Moreover, robust governance features of the board, including sustainability committees, are linked to higher ESG performance and quality of carbon management strategies (Baratta et al. 2023). In summary, a balanced and heterogeneous board of directors can make a key turning point regarding corporate ESG performance and the way to create less carbon.

But the make-up of a board of directors is its size and diversity, for example, how it can significantly moderate and how strongly ESG scores translate into carbon emissions that a company can reduce, reflected in sustainability outcomes. Referring to Klein (1998) in terms of what the existing literature says that the larger boards bring more knowledge and expertise, but coordination problems arise as size goes above so many members. However, smaller boards may be more effective in that they can implement sustainability measures more quickly resulting in improved ESG scores and lower carbon emissions (Jensen, 2005).

The moderating effect of board diversity is especially important in this regard. More broadly, and supported by a growing body of empirical evidence, boards with a wider diversity of gender, ethnicity, and professional backgrounds tend to devote greater attention to environmental issues and to adopt more creative strategies to respond (Ferreira, 2010). A board made up of more diverse individuals could stimulate investment in sustainability discussions, resulting in a greater drive to reduce carbon emissions and improve ESG performance (Baratta et al., 2023)

Independent directors can also facilitate accountability and oversight, which could motivate firms to steward the environment. According to Velte (2016), independent members on boards are able to promote sustainability, thus strengthening the positive relationship between high ESG scores and low carbon

emissions. In conclusion, this relationship between board effectiveness and ESG performance and how board effectiveness can be influenced through size and diversity has big implications for how governance shapes the reality of a firm corporate environmental strategies and in the end really get their act right together to achieve meaningful reductions of carbon emissions. Hence, it deduced the second hypothesis.

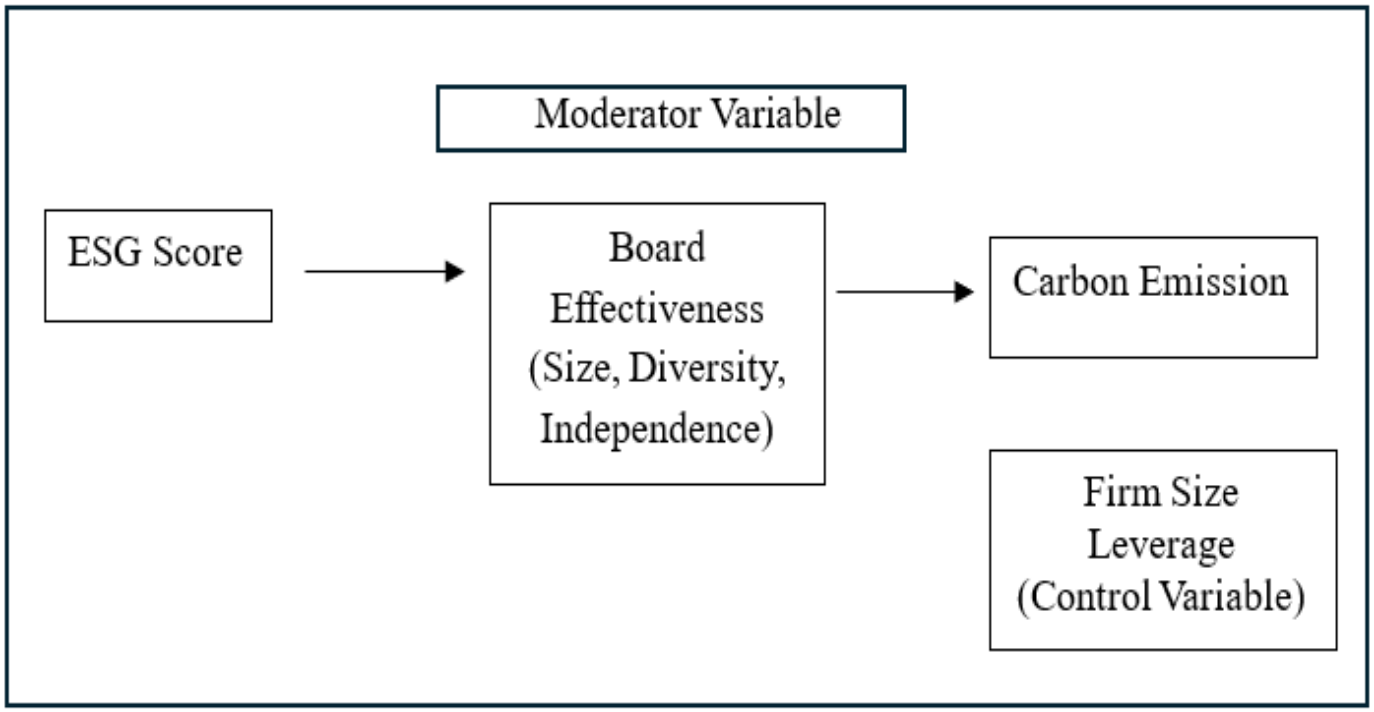
Hypothesis 2: The board effectiveness has a moderating effect on the relationship between ESG score and carbon emission

Stakeholder Theory

The theory of Stakeholder, as stated first by Freeman & Phillips (2002), holds the view that maximization of shareholders` value is not the only objective that will determine a company's performance but achievement of harmony among all stakeholders will also. The stakeholders include shareholders, employees, customers, suppliers, communities, governments, and their organizations. The theory argues that organizations which take into account the needs and expectations of many different groups of stakeholders have better chances for sustainable development and long-term profitability (Mahajan et al 2023). By adopting a holistic approach to stakeholders, companies are in a position to face complex social, environmental, and governance issues more effectively.

This study points out the relevance of the stakeholder theory, stressing that companies have to account for issues like carbon emissions in their ESG reporting. Since all the stakeholders are focusing on sustainability, firms have to adopt appropriate environmental practices to maintain authenticity and economic profitability. This study builds on the stakeholder theory by demonstrating the effect of ESG scores on financial performance, which is a measure of how particles meet the stakeholder's expectations. Furthermore, it investigates whether variations in carbon emissions in the atmosphere affect this relationship, reinforcing the trend whereby meeting stakeholder expectations in terms of environmental performance becomes critical in achieving long term financial performance. Earlier studies have utilized the stakeholder theory to investigate the relationship between ESG and financial performance. Mardini (2022) found that companies that pay attention to stakeholder activities, including environment, social and governance, are more likely to be financially profitable than those that do not because of better risk and reputation management.

Figure 1: Conceptual Framework



RESEARCH METHODOLOGY

Sample selection

The data on ESG score, carbon emission and board effectiveness are from Refinitiv Eikon database. Outliers are excluded at the 1% and 99% levels. The final sample is 1051 listed companies in Malaysia (KLSE) for the year of 2023.

Model specification

This study seeks to analyse the influence of ESG scores on business carbon emissions. In accordance with methodologies employed in analogous research (Lee et al., 2022; Li and Wen, 2023), we established the subsequent fundamental regression model:

$$CARBONi,t = \alpha i + \beta_1 ESGSCOREi,t + \beta_2 SIZE\ i,t + \beta_3 LEVERAGEi,t + \varepsilon i,t \quad (1)$$

Where CARBONi,t denotes the carbon emission. ESGSCOREi,t refers to the overall company score based on self reported information in the environmental, social and governance pillar (Refinitiv Eikon database). SIZEi,t refers to the firm size which calculated from the log transformation of total assets and LEVERAGEi,t is refer to the total debt over total assets. While εi is the error term.

To test H2, this study employs a moderation effect of board effectiveness. The model to test H2 is as follows:

$$CARBONi,t = \alpha i + \beta_1 ESGSCOREi,t + \beta_2 ESGSCOREi,t \times BODEFei,t + \beta_3 SIZEi,t + \beta_4 LEVERAGEi,t + \varepsilon i,t \quad (2)$$

Where ESGSCOREi,t denotes the overall company score based on self reported information in the environmental, social and governance pillar (Refinitiv Eikon database), ESGSCOREi,t x BODEFi,t refers to the interaction term of ESG score and Board effectiveness. The remaining elements are the same as in equation (1).

Variable Selection

The dependent variable is the total of CO2 equivalent emission to revenue in USD. Currently, a limited number of corporations are willingly revealing carbon emission statistics. Certain scholars have opted to get carbon emission data from business reports; however, this approach yields a restricted sample size, predominantly comprising heavily polluting firms. This methodology possesses many constraints. This work references recent research (Jiang & Tang, 2023) and estimates company carbon emissions utilising industry-level carbon emissions data. Corporate carbon emissions intensity is quantified as the ratio of corporate carbon emissions to primary revenue.

Explanatory variable: Environmental, Social, and Governance (ESG) score. In light of the focus on aligning the economy with environmental considerations, several leading rating agencies, including Bloomberg and Wind, provide assessments of corporate ESG performance.

Moderating variable: To calculate the composite measure of board effectiveness, each non-binary variable was transformed into a binary format by assigning a value of one to variables that were greater than or equal to the median of all samples, and zero otherwise. Thus, the composite score for the board ranged from zero to three, with higher scores indicating greater board effectiveness. This approach has been used in previous studies by DeFond et al. (2005).

Referring to previous studies, this study incorporates several two variables, namely firm size (SIZE) and leverage. As shown in Table 1, the variables are defined in more detail.

Table 1: Variable Measurement

Variables	Symbol	Measurement
Carbon Emission	CARBON	Total CO2 Equivalent Emissions to Revenues USD in million (Refinitiv Eikon database)
ESG Score	ESGSCORE	Overall company score based on self-reported information in the environmental, social and governance pillar (Refinitiv Eikon database)
Board Effectiveness	BODEF	Each non-binary variable was transformed into a binary format by assigning a value of one to variables that were greater than or equal to the median of all samples, and zero otherwise
Firm size	SIZE	The log of total assets
Leverage	LEVERAGE	Total debt to total assets

Calculating the Board Committee Effectiveness Score

Table 2: Board Effectiveness Score

Board Size	Board size was coded “1” if the number of the board on the higher than the sample median, and “0” if otherwise.
Board Independence	Board independence was coded “1” if the percentage of independent non-executive directors was higher than the sample median, and “0” if otherwise
Board Diversity	Board diversity was coded “1” if the number of women during sitting in board was higher than the sample median, and “0” if otherwise

ANALYSIS AND RESULTS

Results in Table 3 provides the descriptive statistics for the key variables in the study. The mean for carbon emission per unit is 426.51 tons per million dollars of revenue, with a standard deviation of 1730.85 tons per million dollars of revenue, indicating a moderate variation across companies. The average ESG score is 50.491, with a standard deviation of 16.908, showing some variation in the companies' sustainability practices. The range (min and max values) show significant variability across all variables, especially in terms of carbon emissions and size.

Table 3: Descriptive Analysis

Variable	Mean	Standard Deviation	Minimum	Maximum
CARBON	426.581	1730.846	0.0347	21436.247
ESG SCORE	50.497	16.908	11.205	90.277
BODEF	1.46	0.855	0	3
SIZE	10.975	1.320	7.717	12.011
LEVERAGE	0.144	0.255	-0.00001	2.254

A correlation coefficient of -0.042 signifies a notable negative relationship between ESG SCORE and carbon emissions, as illustrated in Table 4. BODEF (-0.036) and SIZE (-0.046) exhibit a negative correlation with carbon emissions. This suggests that organizations with robust sustainability reporting substantially decrease their carbon emissions, as reflected in their ESG scores. This may be attributed to stronger environmental

restrictions prompting corporations to prioritize environmental protection and implement steps to reduce carbon emissions in order to comply with governmental requirements and evade economic fines. Conversely, LEVERAGE (0.022) demonstrates a positive association with carbon emissions.

Table 4: Correlation Analyses

Variable	Carbon	ESG Score	BODEF	Size	Leverage
CARBON	1	-0.042**	-0.036*	-0.046**	0.022
ESG SCORE		1	-0.403**	-0.018	0.131**
BODEF			1	-0.038*	0.067**
SIZE				1	-0.665**
LEVERAGE					1

The outcomes of H1 testing in this study are presented in Table 5. The ESG SCORE coefficient is negative and statistically significant at the 1% level (Coeff. = -3.025, p-value = 0.002), indicating that higher ESG SCORES are substantially correlated with decreased carbon emissions. This outcome aligns with expectations, since companies that prioritise environmental and social responsibilities are likely to implement more initiatives to diminish their carbon footprint to satisfy the demands of diverse stakeholders. Consequently, hypothesis 1 is corroborated. The control variable SIZE exerts a negative and statistically significant influence on firm performance (Coeff. -2.747, p-value 0.006), also significant at the 1% level, indicating that larger companies, on average, possess greater financial resources to invest in technology aimed at reducing carbon emissions. LEVERAGE demonstrates a negative and negligible correlation with carbon emissions (Coefficient -0.313, p-value 0.755). The R-squared value of 0.333 indicates that the independent and control variables in the model account for approximately 33.3% of the variance in carbon emissions.

Table 5: Regression Analysis of Carbon Emission and ESG Score

Variable	Coefficient	p-value
Constant	4.899	0.000
ESG SCORE	-3.025	0.002
SIZE	-2.747	0.006
LEVERAGE	-0.313	0.755
R-square	0.333	
Statistic	7.020	
N	1051	

Additionally, Table 6 displays the outcomes of the H2 test. The interaction term ESG score x BODEF exhibits a negative and statistically significant coefficient at the 1% level (Coeff. = -2.094, p-value = 0.036), suggesting that an increase in carbon emissions diminishes the positive correlation between ESG score and board effectiveness. This indicates that for firms with elevated carbon emissions, the positive influence of ESG practices and board efficacy diminishes, corroborating the premise that board efficacy moderates the impact of carbon emissions. In other terms, board effectiveness exacerbates the adverse effects of ESG on carbon emissions. Thus, this corroborates hypothesis 2. In summary, our findings indicate that ESG scores exert a significant beneficial influence on the reduction of company carbon emissions, an effect that is amplified by the board's efficacy (size, diversity, and independence). This offers essential knowledge for companies: board effectiveness can function as a monitoring mechanism and furnish strategy while striving for sustainability and carbon reduction objectives.

Table 6: Regression Analysis of Moderating Role of Board Effectiveness

Variable	Coefficient	p-value
Constant	9.624	0.000
ESG SCORE	-2.858	0.004
ESG SCORE*BODEF	-2.094	0.036
SIZE	-5.547	0.000
LEVERAGE	-0.651	0.515
R-square	0.165	
Statistic	22.173	
N	1051	

DISCUSSION

ESG Score and Carbon Emission

The first hypothesis asserts that higher ESG scores lead to reduce carbon emission tons per million dollars of revenue for the Malaysian listed companies. The regression analysis results support this hypothesis, as indicated by the first model's negative and statistically significant coefficient for ESG scores. The finding implies that the ESG score enhances the oversight function of stakeholders, necessitating corporations to implement carbon reduction measures. When a company produces excessive carbon or fails to act in reduction, a low ESG rating promptly conveys a negative signal to the market. This transparency may lead investors, consumers, and other stakeholders to reevaluate their associations with the company and could garner public scrutiny and criticism (Treepongkaruna et al., 2024; Baratta et al., 2023).

Companies with higher ESG scores support this finding and often benefit from improved reputations, reduced operational risks, and increased investor confidence, all of which contribute to curb the carbon emission. Additionally, ESG-focused companies are better positioned to attract socially conscious investors, strengthening their competitive advantage and long-term profitability (Luo, 2024).

However, these results differ from Treepongkaruna et al. (2024) who found that ESG scores does not reduce the carbon emission. The results demonstrate that enterprises with high ESG ratings or environmental ratings do not exhibit reduced carbon emissions. These corporations seem disincentivised to enhance their environmental efforts, having already received favourable exposure for their eco-friendly practices. Another line of inquiry reveals an inconsequential or adverse correlation between ESG and carbon emissions, hence endorsing legitimacy theory, as well as the 'cheap talk' or 'greenwashing' hypotheses. The studies encompass (Raghunandan & Rajgopal ,2022; Qian & Liu, 2024).

This study's findings support stakeholder theory, suggesting that companies that balance the interests of all stakeholders are more likely to attain sustained success over the long term (Mahajan et al., 2023). By enhancing ESG standards, organizations address stakeholder concerns, which helps reduce risks and strengthen their brand image. Meeting stakeholder expectations can improve financial performance, as there is a growing demand for organizations to adopt sustainable and responsible business practices.

ESG Score, Board Effectiveness and Carbon Emission

The second hypothesis is supported, as the influence of ESG scores on reducing carbon emission is more substantial with board effectiveness in the companies. The interaction between board effectiveness and ESG scores is pivotal for driving corporate sustainability and reducing carbon emissions. Effective boards that

prioritize ESG considerations can significantly influence a company's environmental performance. Future research should address existing gaps, particularly through sector-specific and longitudinal studies, to deepen the understanding of this important relationship and support the development of effective governance practices that foster sustainability.

Analysis of firms like Unilever and Danone demonstrates that companies with effective governance structures and high ESG scores have successfully implemented strategies that significantly reduce carbon footprints (Hodge, 2021). In addition, a study by Velte (2016) employing regression analysis found a positive correlation between board effectiveness, ESG performance, and carbon emissions reduction across multiple sectors, indicating that firms with strong governance are more likely to invest in sustainable practices.

The results of this study can also be understood through the lens of stakeholder theory. In the case of low-carbon emission companies, these firms address critical environmental concerns, a growing priority for many stakeholders. Active participation forms the board in reducing emissions and implementing strong ESG practices, these companies can enhance their reputations, reduce risk, and foster stronger relationships with their stakeholders (Baratta et al., 2023). Therefore, the results support that companies aligning with stakeholder expectations, particularly around environmental responsibility, are more likely to experience enhanced financial performance. The findings of this study encourage companies to take proactive steps in reducing their carbon footprint as part of a broader sustainability strategy, not only to meet stakeholder expectations but also to ensure long-term financial success.

CONCLUSION

The findings of this study indicate that ESG scores able to reduce the carbon emission, and the influence of ESG scores on carbon emission is stronger with the board effectiveness (size, diversity and independence) within the companies. This suggests that companies prioritizing sustainability meet the growing demands of environmentally conscious stakeholders and achieve enhanced operational efficiencies and long-term profitability. Firms that effectively manage their carbon emissions will likely experience reduced regulatory risks and lower costs, further amplifying the benefits of strong ESG practices.

In line with stakeholder theory, these results demonstrate that companies that address the concerns of diverse stakeholders, including shareholders, employees, customers, suppliers, communities, government, and associations, by adopting sustainable and responsible business practices tend to perform better financially. By reducing carbon emissions and improving ESG scores, companies align with stakeholder expectations, fostering trust, minimizing risks, and enhancing their profitability over the long term. The findings of this study have several practical implications for both businesses and policymakers. For companies, the results highlight the importance of integrating ESG initiatives into their core strategies, mainly focusing on reducing carbon emissions. Firms that proactively manage their environmental impact will likely experience better financial performance and improve their competitive positioning in the marketplace. Investors can also use ESG scores as a critical metric to assess a company's long-term viability and sustainability. For policymakers, these results reinforce the need to create supportive regulatory frameworks encouraging businesses to adopt sustainable practices, especially in carbon-intensive industries.

Moreover, a limitation of this study is its failure to consider industry-specific differences in ESG practices and carbon emission. Various sectors may encounter challenges and opportunities related to implementing ESG initiatives, which could influence the results. Furthermore, future research could extend the geographical scope of this analysis to encompass companies from additional regions like any other ASEAN countries. It would also be beneficial for future studies to explore the long-term effects of ESG initiatives, providing deeper insights into how these practices affect carbon emission sectors over time, particularly considering the changing global regulatory environment.

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