Research Articles

Disclosure of Greenhouse Gas Reduction Information and Its Impact on the Firm Value of Thai Listed Companies

Thanai Sriersan[1], Thanadom Rasrirattana[2]* and Ukrit Panna[3]

[1] Accounting Program, Faculty of Business Administration and Information, Technology Rajamangala University Khonkaen Campus, Khonkaen, 40000

[2] Accounting Program, Faculty of Business Administration and Information, Technology Rajamangala University Khonkaen Campus, Khonkaen, 40000

[3] Business Innovation Management Program, Faculty of Business Administration and Information, Technology Rajamangala University Khonkaen Campus, Khonkaen, 40000

* Corresponding author: E-mail address: thanadom.ra@rmuti.ac.th

(Received: March 10, 2025; Revised: June 25, 2025; Accepted: July 7, 2025)

https://doi.org/10.55164/pactj.v38i4.279415

Abstract

This study examines the disclosure of greenhouse gas (GHG) reduction information and its impact on the firm value of Thai listed companies. This research focuses on promoting global environmental sustainability, particularly in economically developing regions. The researchers collected data from 113 on the Thai listed companies. The data were obtained specifically from companies that disclosed information on GHG emission reduction in the SETSMART database during the 2023 fiscal year. The data collection focused on disclosures related to GHG reduction, ESG score rankings, and corporate GHG reduction management plans, all of which may impact firm value, as measured by Tobin's Q. The researchers employed multiple regression analysis. The study found that a high level of GHG disclosure positively influences ESG scores, which, in turn, enhances firm value. This research is beneficial for listed companies as it demonstrates that responsibility in reducing GHG emissions for environmental preservation can contribute to increased firm value. Additionally, the implementation of a GHG management plan helps support the disclosure of such information, contributing to the company's sustainability.

Keywords: Greenhouse Gas Reduction Disclosure, Firm Value, Thai Listed Companies

Introduction

The escalating concern regarding climate change and its related hazards has led to increased attention on Greenhouse Gas (GHG) emissions and their mitigation across diverse global enterprises [1]. As nations and organizations commit to reducing their carbon footprints, the focus on how these efforts impact business performance has intensified. In Thailand, where the economy is significantly driven by industrial and corporate sectors, the role of listed companies in contributing to GHG reduction is critical [2].

According to data from 2022, global carbon dioxide emissions reached 38.5 gigatons ($GtCO_2$), and when all GHG are included, total emissions amounted to 53.8 gigatons of CO_2 equivalent ($GtCO_2e$). The primary GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) [3].The relationship between environmental responsibility and firm value has become a pivotal area of study, particularly in the context of emerging markets like Thailand [4]. Given the urgency of environmental challenges, firms that prioritize sustainability may also benefit from government incentives and support, further solidifying their competitive advantage [5].

The significance of this issue stems from the simultaneous demands confronting Thai listed companies: the obligation to comply with international environmental norms and the imperative to maintain or enhance firm value [6]. As global regulations tighten and consumer expectations shift, firms are compelled to adopt greener practices. However, the economic implications of such transitions are complex [7]. Some studies indicate that GHG reduction may lead to cost savings, improved brand recognition, and long-term financial benefits, while others caution against potential increases in operational costs and competitive drawbacks, particularly in the short term [8].

Review of the existing literature reveals mixed findings. Several studies have documented positive correlations between environmental sustainability and firm value, particularly in developed economies where regulatory frameworks and market incentives are well established [9]. However, research focusing on developing countries, including Thailand, is relatively sparse [10]. The unique economic, regulatory, and market dynamics in Thailand necessitate a closer examination of how GHG reduction efforts specifically affect firm value in this context [11].

The objective of this research is to examine the impact of GHG reduction efforts on firm value, using various financial and sustainability indicators. Data were collected exclusively from companies listed on the Thai listed companies that publicly disclose GHG reduction information, with the dataset focusing on 2023 performance. The researchers earnestly anticipate that this study will serve as a significant contribution to the prioritization of

environmental stewardship and enhance corporate value, thereby fostering confidence in adherence to GHG reduction policies, particularly among listed companies in Thailand.

Objectives

1. To study the impact of GHG reduction disclosure on the ESG rating of Thai listed companies

2. To examine the impact of GHG reduction disclosure on the firm value of Thai listed companies

3. To investigate the impact of ESG rating on firm value of Thai listed companies

4. To analyze the impact of corporate GHG management plans on the GHG reduction disclosure of Thai listed companies

5.To assess the impact of GHG emissions verification on the GHG reduction disclosure of Thai listed companies

Literature Review

This section of the literature review presents the theoretical perspectives related to sustainability theory, GHG reduction in Thailand, ESG scores, firm value, verification of GHG emissions, and corporate GHG management plans.

1. Sustainability Theory

The sustainability theory proposed by the World Commission on Environment and Development (1987) underscores the necessity of harmonizing economic, environmental, and social dimensions to achieve long-term corporate prosperity and societal well-being within this framework [12]. GHG reduction is a critical aspect of a firm's environmental responsibility and is integral to achieving sustainability. Thai listed companies that incorporate sustainability into their business strategies are likely to experience several benefits, such as cost savings from energy efficiency, reduced regulatory risks, and enhanced brand reputation [13].

2. Greenhouse Gas Reduction Disclosure

GHG reduction disclosure in Thailand has become an increasingly significant environmental issue, driven by rapid industrialization, energy production, and urbanization. Several studies have explored strategies for GHG reduction, focusing on energy efficiency, renewable energy adoption, and policy-driven initiatives aligned with international commitments such as the Paris Agreement [14]. The country has pledged to reduce GHG emissions by 20–25% by 2030 under its Nationally Determined Contributions (NDCs). Research conducted by the Thailand Greenhouse Gas Management Organization (TGO) has examined policy frameworks to achieve this objective, identifying essential strategies such as carbon pricing,

emissions trading systems, and the expansion of renewable energy sources, particularly solar and wind power [15]. Evidence indicates that Thailand's energy sector is the predominant source of GHG emissions, with disclosure practices reflecting this trend. Governmental programs such as the Alternative Energy Development Plan (AEDP) have been instrumental in addressing these emissions. Agriculture also plays a notable role in GHG output, particularly methane emissions from rice cultivation. Scholars have recommended sustainable farming practices, including precision agriculture, to help mitigate these impacts [16]. Numerous studies highlight the significant influence of Thailand's policies on the development and implementation of GHG reduction measures. The Climate Change Master Plan (2015–2050) sets out a strategic framework emphasizing long-term planning and alignment with international sustainability goals [17]. Energy efficiency and renewable energy remain central components of Thailand's initiatives. While the country's efforts to curb GHG emissions have gained momentum, substantial challenges persist. Addressing these gaps will be essential for Thai listed companies to meet their GHG reduction targets and align with global climate commitments.

3. ESG Rating

The SET aggregates ratings derived from the assessment of the ESG performance of publicly listed companies. This tool allows investors to evaluate the ESG performance of individual companies. Additionally, the SET has created the SET and ESG Index, which is consistent with the objectives of prominent Raters and Index Providers worldwide who evaluate and select exceptional ESG stocks, as well as develop ESG indices to serve as information for investors' decision-making. This index reflects the movement of stock prices of listed companies that have been evaluated by the SET ESG Ratings, with sizes and liquidity that adhere to the specified criteria [18].

Incorporating sustainability into corporate plans is essential for organizations aiming to enhance their Environmental, Social, and Governance (ESG) scores. GHG reduction is acknowledged as a crucial environmental indicator among the elements influencing ESG. The decrease of GHG corresponds with international climate initiatives, enabling enterprises to alleviate climate concerns and appeal to investors that emphasize sustainability. Clarkson et al. [19] found that GHG reduction impacts ESG scores differently across industries. In the energy and industrial sectors, which are significant sources of emissions, GHG reduction initiatives tend to have a more pronounced impact on ESG performance compared to lower-emission sectors such as finance. Friede et al. [20] found that businesses frequently implement GHG reduction techniques frequently see improvements in their firm value over the long term, especially in markets where investors place a high value on ESG considerations. These sustainability efforts tend to result in higher ESG scores, which in turn boost investor

confidence and enhance company valuation. This study hypothesizes that:

H1: Positive Relationship between GHG Reduction Disclosure and ESG rating of Thai listed Companies

4. Firm Value

Tobin's Q has become a widely used metric for assessing firm value, particularly in corporate finance, economics, and strategic management research. This ratio, which compares a firm's market value to the replacement cost of its assets, serves as a proxy for evaluating corporate performance, investor attractiveness, and overall market efficiency [21]. A multitude of studies have examined its correlation with business performance, corporate governance, environmental policies, and innovation, each providing diverse viewpoints and insights into how Tobin's Q encapsulates value [22]. Numerous seminal studies have explored the relationship between corporate values and Tobin's Q.

The revelation of GHG mitigation techniques has emerged as a pivotal concern in environmental sustainability and corporate finance. Researchers are increasingly examining the correlation between corporate environmental disclosures, especially regarding GHG reduction, and market performance, as indicated by Tobin's Q, a recognized metric for firm value that offers insights into market perceptions of a firm's GHG reduction efficacy relative to its underlying assets. Empirical analysis reveals that enterprises providing comprehensive GHG emission reduction strategies typically have a higher Tobin's Q than those with minimal or no disclosures. Their findings indicate that transparency in environmental measures can enhance investor confidence, resulting in an increased market valuation [19]. Matsumura et al. [23] found that illustrated how companies revealing comprehensive GHG emission reduction programs generally exhibit a higher Tobin's Q in comparison to those with minimal or no disclosures. Their findings indicate that transparency in environmental measures can enhance investor confidence, resulting in an increased market valuation. Qiu et al. [9] found that the correlation between organizations' environmental performance, namely their GHG reduction initiatives, and their financial outcomes. Their research indicated that companies with strong sustainability activities generally attain greater company values, mainly due to enhanced risk management, reputation, and resource efficiency. Tobin's Q has shown sensitivity to high-quality GHG disclosures, especially in industries with significant environmental exposure. This study hypothesizes that:

H2: Positive Relationship between GHG Reduction Disclosure and Firm Value of Thai listed Companies

ESG ratings have garnered heightened attention in recent years as investors, regulators, and stakeholders include non-financial elements into their decision-making processes [24].

Numerous academic research has concentrated on the affirmative correlation between ESG performance and firm value, investigating if the incorporation of ESG variables might enhance long-term business success and shareholder value [25]. A multitude of studies offer actual data corroborating the favorable correlation between ESG scores and firm value. Eccles et al. [26] found that companies exhibiting robust ESG rating performance generally surpass their peers with deficient ESG records in terms of stock price and operational efficiency. Fatemi et al. [27] found that companies with robust ESG policies exhibit superior financial success, improved risk management, and an elevated reputation. They contend that ESG performance mitigates financial risks and enhances investor trust and investigations into business financial performance throughout several areas. Whelan et al. [28] found that the beneficial impacts of ESG score are particularly significant in industries like technology and consumer goods, where stakeholder participation and environmental issues are critical. This study hypothesizes that:

H3: Positive Relationship between ESG rating and Firm Value of Thai listed Companies

5. Corporate Greenhouse Gas Management Plan

The corporate GHG management plan denotes a thorough strategy that organizations implement to track, regulate, and diminish their emissions. These plans typically include measures aimed at improving energy efficiency, transitioning to renewable energy sources, adopting cleaner production methods, and participating in carbon offset programs [29]. For Thai companies, particularly those listed on the SET, GHG management has become a key consideration not only for achieving environmental sustainability but also for maintaining competitive advantage, complying with increasing regulatory requirements, and meeting investor expectations [30]. In recent years, numerous Thai enterprises have initiated the implementation of GHG management methods in response to governmental rules and worldwide market exigencies. The TGO has played a pivotal role in facilitating support and certification for corporate emissions reduction initiatives. The implementation of GHG management strategies is inconsistent across industries, with larger corporations and those in energy-intensive sectors seeing more advancement than smaller businesses or those in low-emission sectors [14].

The relationship between corporate GHG management plans and GHG reduction disclosure reveals that companies that actively manage their emissions are more likely to disclose their reduction strategies and performance. Phongphitak & Laohavichien [31] found a positive association between the quality of GHG management plans and the extent of GHG disclosure among publicly listed companies in Thailand. Their findings indicate that companies with extensive GHG reduction initiatives are more likely to disclose their emissions transparently,

motivated by the necessity to comply with legal mandates and market expectations. Wongrattanachai & Narapinit [32] found that Thai companies are under mounting pressure from regulators and investors to reveal their GHG reduction initiatives. The SET has implemented sustainability reporting requirements to promote corporate transparency on environmental impact. Narapinit & Kittichai [33] found that GHG disclosure improves firm reputation by demonstrating strong environmental stewardship to shareholders and the public. This study hypothesizes that

H4: Positive Relationship between Corporate GHG Management Plan and GHG Reduction of Thai listed Companies

6. Verification of Greenhouse Gas Emissions

The verification of GHG emissions has become essential for Thai listed companies as Thailand progresses towards its obligations under the Paris Agreement and its national carbon reduction objectives, the verification of GHG emissions by publicly listed corporations has become increasingly significant. Entities like the TGO are crucial in advancing and enabling verification processes, as well as in the formulation of certification programs and carbon credit initiatives [14]. Nonetheless, obstacles persist regarding the extensive implementation of GHG verification. Smaller publicly traded corporations may encounter difficulties with the expenses and intricacies of verification procedures. Moreover, discrepancies in GHG reporting standards might hinder verification processes, resulting in inconsistent openness and accountability across various industries. Notwithstanding these hurdles, the increasing significance of environmental sustainability in business operations has established GHG emission verification as a crucial element in fostering corporate responsibility and furthering Thailand's sustainability strategy [32].

There is a relationship between GHG emission verification and GHG reduction disclosure. Phongphitak & Laohavichien [31] found that verified emissions data enhances stakeholder trust by ensuring accuracy, which in turn promotes more transparent GHG reduction reporting. The TGO supports this by offering certification and verification programs to encourage third-party audits for Thai listed companies. Narapinit & Kittichai [33] found that verified emissions data enhances investor confidence, as investors tend to trust companies with independently validated GHG reduction reports. This trust often contributes to higher firm value among firms that excel in sustainability reporting. Supachalasai & De Silva [34] found that Thai companies with validated GHG emissions often provide more detailed and verifiable reduction reports, effectively communicating their efforts to monitor and reduce emissions, enhancing their reputation and attracting environmentally conscious investors. This study hypothesizes that

H5: Positive Relationship between Verification of GHG Emissions and GHG Reduction of Thai listed Companies

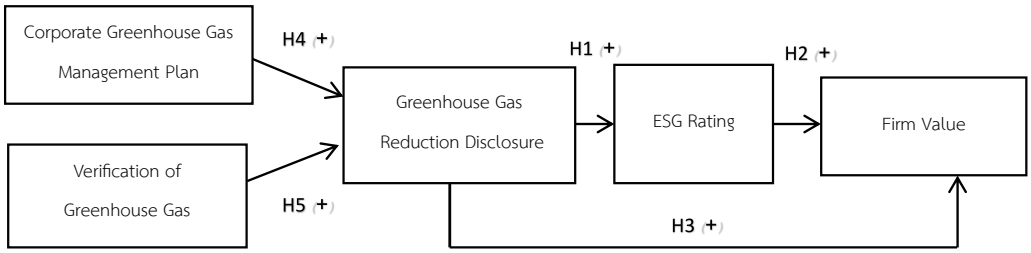

Figure 1 Research Framework

Methodology

This section outlines the research methodology, including the sample selection, data collection process, variables used in the study, and the estimation model employed to analyze the relationships under investigation.

1. Sample

The sample for this study was selected in accordance with the conceptual framework designed to evaluate GHG reduction disclosure among Thai listed companies. The researcher focused on firms that publicly disclose GHG reduction data sourced from the SETSMART database for the year 2023. A total of 113 companies across seven sectors were included in the sample, excluding the financial and provident fund group due to the distinct nature of their operations compared to other industries.

2. Data Collection and Variables

All variables used in the data collection process were obtained from secondary sources, including corporate annual reports for the 2023 reporting year and the SET Security Market Analysis and Reporting Tool (SETSMART) database. Further details are provided in Table 1.

The independent variable pertains to the total reduced GHG metric, measured in kilograms of carbon dioxide equivalent (GHGR). The mediating variable is the ESG rating (ESG) obtained from the Stock Exchange of Thailand. The dependent variable, firm value (FV), is measured using Tobin's Q. The antecedent variables include companies with a corporate GHG management plan (MGP) and those with verification of GHG emissions (VER). The control variables are firm size (FS), firm age (FA), leverage (Lev), and audit type (AT).

Table 1 Variable Measurement

Variables	Notation	Measurement
GHG reduction disclosed	GHGR	The natural logarithm reduced GHG (KG)
ESG rating	ESG	ESG rating score form stock exchange of Thailand
Firm value	FV	Tobin's Q ratio
Corporate GHG management plan	MGP	as 1= companies have GHG management plan as 0 = companies do not have GHG management plan
Verification of GHG emissions	VER	as 1= companies have verification of GHG emissions as 0 = companies do not have verification of GHG emissions
Firm size	FS	The natural logarithm of total asset
Firm age	FA	Age of the company
Leverage	LEV	Total debt to total asset ratio
Audit type	AT	as 1= Big 4 audit type, as 0 = otherwise auditor type

Based on the characteristics of the variables, the antecedent variables include the corporate GHG management plan (MGP) and verification of GHG emissions (VER), while the control variable is defined as the audit type (AT). The researchers chose to employ these variables as dummy variables to test the hypothesis, as using dummy variables allows data to be coded with values of 0 (indicating absence) and 1 (indicating presence). This approach makes the statistical model more flexible and capable of processing data that cannot be represented by continuous quantitative variables, as supported by the findings of Hossain [35].

3. Model and Methodology of Estimation

To assess the validity of the five hypotheses outlined earlier and examine the relationships among GHG reduction disclosure (GHGR), ESG rating (ESG), firm value (FV), the presence of a GHG management plan (MGP), and GHG emission verification (VER), the following ordinary least squares (OLS) regression model was developed using cross-sectional data:

$$ESG = \alpha 1 + \beta 1 GHGR + \beta 2\ FS + \beta 3 FA + \beta 4 Lev + \beta 5 AT + \varepsilon \text{ (Model A: First Hypothesis)}$$

$$FV = \alpha 2 + \beta 6 GHGR + \beta 7\ FS + \beta 8 FA + \beta 9 Lev + \beta 10 AT + \varepsilon \text{ (Model B: Second Hypothesis)}$$

$$FV = \alpha 3 + \beta 11 ESG + \beta 12\ FS + \beta 13 FA + \beta 14 Lev + \beta 15 AT + \varepsilon \text{ (Model C: Third Hypothesis)}$$

$$GHGR = \alpha 4 + \beta 16 MGP + \beta 17 FS + \beta 18 FA + \beta 19 Lev + \beta 20 AT + \varepsilon \text{ (Model D: Fourth Hypothesis)}$$

$$GHGR = \alpha 5 + \beta 21 VER + \beta 22\ FS + \beta 23 FA + \beta 24 Lev + \beta 25 AT + \varepsilon \text{ (Model E: Fifth Hypothesis)}$$

Results

This section presents an overview of the research findings, including descriptive statistics, the Pearson correlation matrix, and the results of the OLS regression analysis.

1. Descriptive Statistics

Table 2 presents a descriptive analysis of all variables utilized in this study, employing mean, standard deviation, frequency, and percentage. For example, the average logarithm of reduced GHG emissions is 4.3353 (SD = 1.6387), the average ESG score is 2.407 (SD = 1.4978), and the average firm value, measured by Tobin's Q ratio, is 1.4164 (SD = 0.9591). Firm size, measured as the logarithm of total assets, has a mean value of 19.47 (SD = 11.369), while leverage, defined as the ratio of total debt to total asset, has an average of 0.4333 (SD = 0.1938). The dummy variable for the GHG management plan indicates that 54 companies (47.78%) have implemented such a plan, while 59 companies (52.22%) have not. Verification of GHG emissions indicates that 61 enterprises possess verification (53.98 percent), while 52 companies lack verification (46.02 percent). In terms of audit firm type, 84 companies (74.34%) are audited by Big 4 firms, while 29 companies (25.66%) are audited by non-Big 4 firms.

Table 2 Descriptive Statistics

Pannel A : Descriptive Statistics : Log_GHGR, ESG, FV, Log_FS, FA						
Variables	**N**	**Mean**	**SD**	**Median**	**Max**	**Min**
Log_GHGR	113	4.3353	1.6387	4.2242	7.6203	0.1367
ESG	113	2.407	1.4978	2	5	1
FV	113	1.4164	0.9591	1.0485	5.6620	-1.0317
Log_FS	113	4.0434	0.7309	3.9047	5.9556	2.4424
FA	113	19.47	11.369	18	46	4
Lev	113	0.4331	0.1938	0.4467	0.8759	0.0023

Pannel B : Dummy Variable : MGP,VER,AT		
Variables	**N**	**Percent**
Variable: MGP		
GHG management plan	54	47.78
Not GHG management plan	59	52.22
Total	113	100
Variable: VER		
Verification of GHG emissions	61	53.98

Table 2 Descriptive Statistics (continued)

Pannel B : Dummy Variable : MGP,VER,AT		
Variables	**N**	**Percent**
Not verification of GHG emissions	52	46.02
Total	113	100
Variable: AT		
Big 4 audit type	84	74.34
Otherwise audit type	29	25.26
Total	113	100

2. Pearson Correlation Matrix

Prior to executing a multiple regression analysis, the assumption on the absence of multicollinearity among the variables included in the analysis was initially assessed. Table 3 presents the correlation matrix used to assess multicollinearity among the nine variables included in the study: independence variable, mediator variable, dependence variable, antecedence variable and control variable.

The correlation between any two variables should not exceed 0.700 to avoid multicollinearity concerns. In this study, no multicollinearity issues were detected, as the highest Pearson correlation coefficient was 0.535, well below the threshold. Thus, it can be concluded that no serious multicollinearity issues were present among the variables, in accordance with the findings of Hair et al. [36]. The Pearson correlation matrix revealed that GHG reduction disclosure (Log_GHGR) is significantly associated with firm value (FV) and the GHG management plan (MGP), supporting Hypotheses H2 and H4. Additionally, ESG rating was found to be correlated with firm value (FV), consistent with Hypothesis H3. These findings align with the results of the multiple regression analysis presented in Table 4.

Prior to the execution of the multiple regression analysis, an examination of the normal distribution of the data was conducted, revealing that certain variables conformed to a normal distribution while others did not, as evidenced by the slight discrepancies between the mean and median values is provided in Table 2. Consequently, the researcher undertook a modification of the data employing the logarithmic transformation, in accordance with the principles established by Kong et al.,[37]. This study therefore used the Robust Standard Errors technique to alleviate the non-normal distribution of the data by dealing with the Heteroskedasticity problem in the model used to test the hypothesis to make the study results reliable before testing the hypothesis according to the concept of Francis et al.,[38].

Table 3. Pearson Correlation Matrix

Variable	Log_GHGR	ESG	FV	MGP	VER	Log_FS	FA	LEV	AT
Log_GHGR	1								
ESG	0.174	1							
FV	0.194*	0.204*	1						
MGP	0.285*	0.380*	0.071	1					
VER	0.190	0.466**	0.064	0.315**	1				
Log_FS	0.268**	0.535**	0.004	0.412**	0.397**	1			
FA	0.042	0.115*	-0.147	-0.015	0.230*	0.369**	1		
LEV	0.172	0.093	-0.159	0.084	0.005	0.392**	0.022	1	
AT	0.057	0.201*	0.026	0.197*	0.027	0.347**	-0.017	0.055	1

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level

3. OLS Regression Result

Table 4 delineates the findings of the OLS regression analysis of GHG reduction disclosure (GHGR), which signifies a substantial correlation with firm value (FV), thereby corroborating hypothesis H2 (β=0.124, α = 5% level). Secondly, ESG rating (ESG) demonstrates a noteworthy association with firm value (FV), thereby endorsing hypothesis H3 (β=0.149, α = 5% level). Lastly, the corporate GHG reduction management plan (MGP) indicates a significant relationship with GHG reduction disclosure (GHGR), thus supporting hypothesis H4 (β=0.712, α = 5% level).

Conversely, the GHG reduction disclosure (GHGR) does not exhibit a significant correlation with ESG rating (ESG), as the results do not substantiate hypothesis H1 (β=0.034). Furthermore, the verification of GHG emissions (VER) does not show a statistically significant correlation with GHG reduction disclosure (GHGR), as the results do not support Hypothesis H5 (β = 0.388).Furthermore, Table 4 shows that the models explain approximately 2.181 to 9.890 percent of the variance in the data (F-Test). The adjusted R^2 values range from approximately 0.050 to 0.284. Although these values indicate that the models explain only a moderate proportion of the variance, this is not considered a limitation for hypothesis testing. The regression results remain meaningful, as the coefficients are statistically significant in explaining the variation in the dependent variable based on the independent variables. Therefore, this is not considered a limitation in model development for hypothesis testing, as supported by the findings of Moksony & Heged [39]. Additionally, the Variance Inflation

Factor (VIF) values for all variables used in this study were below the commonly accepted threshold of 10, indicating no serious multicollinearity issues. This aligns with the guidelines proposed by Hair et al. [36]. The highest VIF value was observed in Hypothesis H3, at 2.261.

Table 4. Result Multiple Regression

Relation	Hypothesis	Coefficient (β)	Std. Error	T-Value (sig)	F-vale	Adjust R^2	Maximum VIF	Results
Log_GHGR→ESG	H1	0.034	0.076	0.444	9.890	0.284	1.736	Not Supported
Log_GHGR→FV	H2	0.124	0.056	2.225*	2.569	0.065	1.736	Supported
ESG→FV	H3	0.149	0.071	2.099*	2.452	0.061	2.261	Supported
MGP→ Log_GHGR	H4	0.712	0.334	2.130*	2.881	0.077	2.006	Supported
VER→ Log_GHGR	H5	0.388	0.338	1.149	2.181	0.050	1.961	Not Supported

*Significant at the 0.05 level

Discussion and Conclusion

1. Discussion

The OLS regression results presented in Table 4 indicate that the initial hypothesis (H1) was not supported, as GHG reduction disclosure was found to be statistically insignificant in its effect on ESG rating. This finding aligns with existing studies suggesting that ESG ratings may, at times, underemphasize environmental factors such as carbon emissions, placing greater emphasis on broader sustainability frameworks or corporate governance structures. The empirical data indicates that this aligns with the research outcomes reported by Arian & Sands [40], Wen et al. [41], and Barros et al. [42]. Furthermore, the second hypothesis (H2) was found to be statistically significant at the 0.05 level, indicating that GHG reduction disclosure has a positive influence on firm value. This finding aligns with the increasing body of evidence indicating a correlation between environmental responsibility and improved financial performance. Companies that adopt transparent sustainability strategies, particularly with regard to GHG emission reductions, tend to be perceived more favorably by investors and stakeholders, which may contribute to an increase in firm value. The empirical data suggests that this finding is consistent with the research outcomes of Qiu et al. [9], Matsumura et al. [23], and Zhang et al. [43]. Moreover, the third hypothesis (H3) was found to be statistically significant at the 0.05 level, demonstrating a positive relationship between ESG ratings and firm value. This supports the notion that higher ESG ratings are associated with increased firm value, highlighting the growing importance of sustainability in shaping corporate strategy and

investment decisions. This favorable correlation indicates that companies with superior ESG performance are perceived more positively by investors, who acknowledge the long-term value and diminished risks linked to sustainable practices. The empirical data indicates alignment with the research outcomes of Friede et al. [20], Eccles et al. [26], Fatemi et al. [27], and Whelan et al. [28]. Additionally, the fourth hypothesis (H4) was found to be statistically significant at the 0.05 level, indicating a positive relationship between the implementation of a corporate GHG management plan and both the quality and extent of GHG reduction disclosure. The findings indicate that organizations with organized GHG management strategies are more inclined to participate in public reporting, thereby advancing the overarching objectives of environmental accountability and corporate sustainability. The empirical data indicate that this finding is consistent with the research outcomes of Phongphitak & Laohavichien [31], Narapinit & Kittichai [33], and Supachalasai & De Silva [34]. Finally, the last hypothesis (H5), which posited a relationship between GHG emission verification and GHG reduction disclosure, was not found to be statistically significant. The results indicate that GHG emission verification does not have as strong an effect on GHG disclosure practices as hypothesized. This discrepancy may arise from sectoral disparities, discrepancies in regulatory frameworks, or divergent stakeholder expectations across industries. The empirical data support this observation, aligning with the findings of Chaichaloempreecha et al. [44] and Huboyo et al. [45].

2. Conclusion and Suggestion

This study examines the impact of GHG reduction disclosure on the firm value of Thai listed companies. The results demonstrate a positive correlation between GHG reduction disclosures and corporate value. Firms that openly disclose their GHG reduction initiatives are generally assigned better market valuations, indicating that investors are progressively emphasizing environmental sustainability in their investment decisions. The findings of the study align with the principles of sustainability theory, which posit that environmental accountability is a critical component in achieving long-term sustainable outcomes. Implementing energy efficiency measures emerges as a beneficial strategy for cost reduction, thereby enhancing the likelihood of business success in generating firm value for the enterprise.

The research findings indicate that GHG reduction disclosure has a positive effect on firm value. A higher ESG score contributes to increased firm value by reflecting strong environmental, social, and governance practices. Furthermore, corporate GHG management plans, supported by board-level commitment, play a key role in enhancing GHG reduction disclosure among Thai listed companies. This highlights the importance of organizational leadership exemplifying effective management principles, particularly in promoting environmental and

social responsibility. Correspondingly, sustainability theory suggests that such initiatives demonstrate to investors, customers, and regulators that the firm is proactive in addressing environmental concerns and aligned with global sustainability trends.

There are several limitations in this study that should be addressed. First, the research focuses exclusively on Thai listed companies, which may limit the generalizability of the findings to other geographic regions or regulatory environments. Second, the study focuses solely on GHG reduction as a dimension of sustainability and does not account for how other environmental or social factors might also influence firm value. These constraints should be considered when interpreting the results.

Future studies could extend the current analysis by including firms from a broader range of emerging economies, thereby allowing for cross-country comparisons and a deeper understanding of regional differences in GHG disclosure practices. Moreover, subsequent research might investigate the cumulative impact of comprehensive ESG disclosures on corporate value, rather than concentrating exclusively on GHG reduction disclosure. Longitudinal studies examining the long-term financial benefits of environmental transparency would provide valuable insights into how sustainability reporting influences corporate performance over time.

References

[1] Axelsson, H., Harvey, S., Asblad, A., & Berntsson, T. (2003). Potential for greenhouse gas reduction in industry through increased heat recovery and/or integration of combined heat and power. *Applied Thermal Engineering, 23*(1), 65–87.

[2] Nakapreecha, N. (2012). *Carbon emissions management of the petrochemical industries in Thailand.* [Unpublished Doctoral Dissertation, Durham University].

[3] Tantisilpanon, N. (2024). *Energy transition and zero greenhouse gas emissions by 2050 part 1.* https://www.chula.ac.th/news/200103. (In Thai)

[4] Mitra, A., & Gaur, S. S. (2020). Does environmental concern drive Asian firms' governance? *Journal of Asia Business Studies, 14*(4), 481–503.

[5] Rappa, A. L. (2016). Sustainability and the law: Thailand sufficiency economy in perspective. *Ecoforum Journal, 5*(1), 35–40.

[6] Thongplew, N., Spaargaren, G., & van Koppen, C. K. (2017). Companies in search of the green consumer: Sustainable consumption and production strategies of companies and intermediary organizations in Thailand. *NJAS-Wageningen Journal of Life Sciences, 83*, 12–21.

[7] Rohac, D. (2012). Economie transitions: Learning from Central Europe. *Policy Review, (175)*, 69–73.

[8] Purba, W., Yandri, E., Setyobudi, R. H., Susanto, H., Wahono, S. K., & Sirega, Faturahman, D. (2021). Potentials of gas emission reduction (GHG) by the glass sheet industry through energy conservation. In *E3S Web of Conferences, 226*, 1–12.

[9] Qiu, Y., Shaukat, A., & Tharyan, R. (2016). Environmental and social disclosures: Link with corporate financial performance. *The British Accounting Review, 48*(1), 102–116.

[10] Intarakumnerd, P. (2015). Seven unproductive habits of Thailand's ineffective technology and innovation policies: Lessons for other developing countries. *Institutions and Economies*, 80–95.

[11] Misila, P., Winyuchakrit, P., Chunark, P., & Limmeechokchai, B. (2017). GHG mitigation potentials of Thailand's energy policies to achieve INDC target. *Energy Procedia, 138*, 913–918.

[12] Chitlaoarporn, C., Thirasirikul, J., & Suksermsongchai, S. (2021). Sustainable development and the world economic change. *Thai Research and Management Journal, 2*(3), 77–93.

[13] Lerskullawat, P., & Prukumpai, S. (2018). Sustainable development and firm performance: Evidence from Thailand. *WMS Journal of Management, 7*(Special), 1–11. (In Thai)

[14] Thepkhun, P., Limmeechokchai, B., Fujimori, S., Masui, T., & Shrestha, R. M. (2013). Thailand's low-carbon scenario 2050: The AIM/CGE analyses of CO2 mitigation measures. *Energy Policy, 62*, 561–572.

[15] Kusumadewi, T. V., Winyuchakrit, P., Misila, P., & Limmeechokchai, B. (2017). GHG mitigation in power sector: Analyzes of renewable energy potential for Thailand's NDC roadmap in 2030. *Energy Procedia, 138*, 69–74.

[16] Thongplew, N., Pooyphay, S., & Sriburee, J. (2020). Assessing and analysing the socio-ethical impacts of plate waste: A case of university canteens in Thailand. *International Journal of Sustainable Society, 12*(4), 309–325.

[17] Rajbhandari, S., Limmeechokchai, B., & Masui, T. (2019). The impact of different GHG reduction scenarios on the economy and social welfare of Thailand using a computable general equilibrium (CGE) model. *Energy, Sustainability and Society, 9*, 1–21.

[18] The Stock Exchange of Thailand (SET). (2023). SET ESG Data Showcase: Carbon emission of Thai listed companies. *SET ESG Data Showcase: Carbon emission in Stock Exchange of Thailand*. (In Thai)

[19] Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy, 30*(2), 122–144.

[20] Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2,000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), 210–233.

[21] Kim, J. Y., Kwak, J., & Lee, K. (2015). Estimating Tobin's Q for listed firms in Korea (1980–2005): Comparing alternative approaches and an experiment with investment functions. *Seoul Journal of Economics, 28*(1), 1–30.

[22] Luong, H. M. (2018). *Is there a case for an augmented Tobin's Q model of R&D investment? Investigating the role of market structure, knowledge spillovers and corporate governance quality.* [Doctoral Dissertation, University of Greenwich].

[23] Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-value effects of carbon emissions and carbon disclosures. *The Accounting Review, 89*(2), 695–724.

[24] Leung, T. C. H., & You, C. S. X. (2023). Environmental, social, and governance (ESG) in the business industry. In *Environmental, social and governance and sustainable development in healthcare* (pp. 11–32). Springer Nature Singapore.

[25] Junius, D., Adisurjo, A., Rijanto, Y. A., & Adelina, Y. E. (2020). The impact of ESG performance to firm performance and market value. *Journal Aplikasi Akuntansi, 5*(1), 21–41.

[26] Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science, 60*(11), 2835–2857.

[27] Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal, 38*, 45–64.

[28] Whelan, T., Atz, U., Van Holt, T., & Clark, C. (2021). *ESG and financial performance: Uncovering the relationship by aggregating evidence from 2015–2020* (Research Report). NYU Stern Center for Sustainable Business and Rockefeller Asset Management.

[29] Mazhar, M. (2023). Understanding greenhouse gas management: Scopes and boundaries for carbon foot printing. In *The handbook of carbon management* (pp. 265–287).

[30] Koukouzas, N., Tyrologou, P., & Koutsovitis, P. (2020). Special issue: Climate change, carbon capture, storage and CO_2 mineralisation technologies. *Applied Sciences, 10*(21), 1-3.

[31] Phongphitak, P., & Laohavichien, K. (2021). The impact of GHG verification on corporate sustainability reporting: Evidence from Thai listed companies. *Journal of Environmental Management,* 112-123.

[32] Wongsapai, W., & Daroon, S. (2021). Estimation of greenhouse gas mitigation potential from carbon intensity and energy data analysis from Thai industrial sector. *Energy Reports, 7,* 930–936.

[33] Narapinit, T., & Kittichai, T. (2019). Investor confidence and GHG disclosure in Thai listed companies. *Journal of Corporate Governance and Sustainability, 13*(2), 112–128.

[34] Supachalasai, S., & De Silva, P. (2020). Corporate greenhouse gas emission verification in Thailand: Impacts on GHG reduction disclosure. *Sustainability, 12*(8), 365.

[35] Hossain, M. (2006). The use of dummy variables in econometric analysis. *Journal of Economic Analysis, 1*(2), 123–134.

[36] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Pearson Education Limited.

[37] Kong, L., Akbar, M., & Poulova, P. (2023). The role of environment, social, and governance performance in shaping corporate current and future value: The case of global tech leaders. *Sustainability, 15*(17), 1-4.

[38] Francis, B., Hasan, I., & Li, L. (2016). Abnormal real operations, real earnings management, and subsequent crashes in stock prices. *Review of Quantitative Finance and Accounting, 46,* 217–260.

[39] Moksony, F., & Heged, R. (1990). Small is beautiful: The use and interpretation of R^2 in social research. *Szociológiai Szemle, Special issue,* 130–138.

[40] Arian, A., & Sands, J. S. (2024). Corporate climate risk disclosure: Assessing materiality and stakeholder expectations for sustainable value creation. *Sustainability Accounting, Management and Policy Journal, 15*(2), 457–481.

[41] Wen, H., Ho, K. C., Gao, J., & Yu, L. (2022). The fundamental effects of ESG disclosure quality in boosting the growth of ESG investing. *Journal of International Financial Markets, Institutions and Money, 81,* 101655-101678.

[42] Barros, V., Matos, P. V., Sarmento, J. M., & Vieira, P. R. (2023). High-tech firms: Dividend policy in a context of sustainability and technological change. *Technological Forecasting and Social Change, 190,* 1-13.

[43] Zhang, Z., Chen, L., & Liu, X. (2020). Do carbon disclosure initiatives improve firm value? Evidence from Chinese listed companies. *Sustainability, 12*(9), 3841-3858.

[44] Chaichaloempreecha, A., Chunark, P., Hanaoka, T., & Limmeechokchai, B. (2022). Thailand's mid-century greenhouse gas emission pathways to achieve the 2 degrees Celsius target. *Energy, Sustainability and Society, 12*(1), 1-22.

[45] Huboyo, H. S., Wibowo, H., & Sari, W. R. (2018). Green house gases (GHG's) emission reduction measures and verification challenge at transport sector. *MATEC Web of Conferences, 159,* 01027, 1-6.