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POLICY ENFORCEMENT, ENVIRONMENTAL MANAGEMENT PRACTISES AND SUSTAINABLE BUSINESS IN MALAYSIA

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ABSTRACT

Policy enforcement and environmental management practices are key drivers in promoting sustainable business, ensuring long-term growth while protecting natural resources. This study investigated the relationship between environmental management practises and the implementation of policy to support sustainable business. This study employs a panel data regression model to analyse publicly listed companies in Malaysia over the period 2011-2022. The results show that while regulatory enforcement mitigates the association, a company's environmental management practices do not significantly influence its capacity to conduct sustainable business. This suggests that companies comply with environmental laws and guidelines primarily due to regulatory pressure rather than voluntary initiative. However, when businesses adhere to mandated environmental practices, they are better positioned to implement sustainable operations. This study supports the notion that managing day-to-day operations with a balanced focus on economic, social, and environmental concerns is essential for corporate development. Such an approach may shift a firm's perspective from mere compliance toward integrating sustainability as a strategic objective, ultimately enhancing long-term economic performance. Furthermore, the study provides valuable insights into the effectiveness and limitations of existing policies, which can inform future policy formulation and contribute to the development of more robust and adaptable regulatory frameworks.

Keywords: sustainable business; policy enforcement; environmental management practises; environmental policy; sustainability.

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1. INTRODUCTION

The establishment of Sustainable Development Goals (SDGs) in 2015 alarmed all businesses to adopt the goals in their strategic direction to enhance the sustainability practises in their companies. Sustainable economic growth becomes the primary concern for various industries, as it is essential to monitor and manage resources to ensure they remain accessible to future generations. Recent studies have highlighted the need for a more comprehensive approach to defining sustainable business performance (Hadi and Baskaran, 2021), and according to Schluter et al. (2023), public funds have been allocated in recent years to support the development of various sustainable business programs. Sustainable businesses aim to generate revenue while minimising their environmental impacts and maximising their social benefits.

Despite increasing awareness of the importance of sustainability, achieving sustainable business performance remains a complex and challenging task. Research has shown that effective sustainability practises can strengthen a company's competitiveness, reduce operational costs, enhance corporate reputation (Ramírez-Orellana et al., 2023) and build consumer trust (Hanaysha and Al-Shaikh, 2022; Alsayegh et al., 2020). Furthermore, sustainability issues can directly impact corporate reputation and stakeholder trust if companies are perceived as non-compliant or merely engaging in greenwashing (Sanusi and Johl, 2022). Given these challenges, a critical question arises: To what extent do policy enforcement and environmental management practices jointly determine the sustainable business performance of companies, particularly in an emerging economy like Malaysia? Addressing this question is timely because Malaysia, as a rapidly developing country, has made sustainability a national priority by embedding green growth into its policy agenda and establishing institutions such as GreenTech Malaysia to drive green innovation and eco-industrial development (Fernando et al., 2019; De Ponte et al., 2023). Yet, despite these institutional efforts, gaps remain in how companies translate national sustainability ambitions into effective internal practices and measurable outcomes.

To explore this question, this study hypothesises that strong policy enforcement mechanisms combined with robust environmental management practices will have a significant positive impact on the sustainable business performance of companies in Malaysia. This hypothesis is motivated by the interplay of two well-established theoretical perspectives. First, the Resource-Based View (RBV) suggests that firms gain a competitive advantage when they develop unique internal resources and capabilities, such as knowledge and skills in environmental management, green process innovation, and eco-design (Shahzad et al., 2020; Chopra et al., 2021). Such capabilities enable firms to design new sustainable products and services, optimise resource use, and respond proactively to market and regulatory demands. Second, Institutional Theory posits that external institutional pressures, including laws, regulations, and policy enforcement, shape organisational behaviours and ensure compliance with broader societal expectations (Lin and Qamruzzaman, 2023). In this view, clear governance structures and robust enforcement mechanisms discourage non-compliance and greenwashing, thereby fostering a culture of accountability and responsible corporate citizenship. When combined, these two theoretical lenses highlight the synergistic effect of internal and external drivers of sustainability. Firms that develop advanced environmental management knowledge and operate within a robust governance framework are more likely to succeed in integrating sustainability into their core business models, aligning day-to-day operations with strategic sustainability objectives.

Despite growing interest in corporate sustainability, the current literature remains fragmented. Much of the existing research either focuses on the role of internal environmental management capabilities in isolation (Shahzad et al., 2020; Yadav et al., 2020) or examines the effects of policy and regulatory enforcement separately (Puluhulawa and Puluhulawa, 2021; Bose, 2021). Few empirical studies have explored how the interaction between these internal and external factors jointly shapes sustainable performance, especially within the unique policy and industrial landscape of Malaysia. This study contributes to the literature by bridging this gap and offering a more holistic understanding of sustainable business performance. By demonstrating that policy enforcement and environmental management practices are not standalone determinants but mutually reinforcing, this research provides both theoretical and practical insights for managers, policymakers, and regulators.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Establishment of Sustainable Development Goals in Global and Malaysia

Implementing a development business requires creativity and innovation in dealing with sustainable development issues. As a result, United Nations member states developed and adopted the 2030 Agenda for Sustainable Development in 2013 (Khajuria et al., 2022). In the global context, the implementation of the SDGs necessitates active collaboration across sectors, including government, business, and civil society (Khalila et al., 2024; Tulder et al., 2021). The role of multinational enterprises and public-private partnerships is increasingly recognised as pivotal in driving the SDGs forward, especially in areas such as sustainable economic growth and environmental stewardship (Tulder et al., 2021). However, critiques have emerged regarding "SDG washing," where businesses engage superficially with the goals, primarily for risk management rather than genuine commitment to sustainable practices (Alkan and Kamaşak, 2023). This underscores the necessity for robust accountability mechanisms and systematic data tracking to assess progress and ensure that actions align with the overarching goals of sustainable development (Khalila et al., 2024; Effendi et al., 2020).

In Malaysia, the pursuit of the SDGs reflects both achievements and challenges. The nation has integrated the SDGs into national development agendas, such as the 12th Malaysia Plan, which aims to achieve green economic growth through comprehensive environmental, social, and economic strategies (Ishak and Thiruchelvam, 2023; Yusoff et al., 2021). In various sectors, including transportation, policies are being developed to enhance sustainability, as seen in efforts to implement a rail-based transit system in Klang Valley (Yusoff et al., 2021). Additionally, there are focal efforts in sustainable forest management and addressing deforestation issues, highlighting Malaysia's commitment to environmental sustainability in alignment with the SDGs (Nasrullah et al., 2021).

Furthermore, Malaysia struggles to balance economic growth with environmental protection (Ariffin and Ng, 2020). Despite this challenge, Michael and Salleh (2021) argue that Malaysia has adopted and included the United Nations SDGs in its National Plan. Malaysia's New Economic Model (NEM) is a testament to its SDG commitment. It consists of three pillars- income, inclusiveness, and sustainability- that align with the SDGs' three principles: Economic, Social, and Natural Ecology (Mahdi et al., 2022). Malaysia has made significant progress in implementing the

SDGs, as highlighted in the Voluntary National Review (VNR) from 2015 to 2017 (Ismail et al., 2022). The VNR highlighted Malaysia's achievements resulting from the initial implementation of the 11th Malaysia Plan, which serves as the primary SDG document. Malaysia has also implemented numerous initiatives to ensure the successful implementation of the SDGs. As Malaysia continues to work towards the SDGs, it is essential to enhance governance frameworks that can facilitate multi-stakeholder collaborations, ensure comprehensive policy coherence, and mobilise resources efficiently (Biermann et al., 2022).

2.2. Environmental management practises and sustainable business

Sustainable business is described as achieving and maintaining economic, environmental, and social performance (Hadi and Baskaran, 2021). The requirement of theoretical capacity to act is complemented by establishing an economically viable enterprise. According to Solomon et al. (2021), agency theory shows that market freedom and social spending combine to promote entrepreneurial activity. Agency theory can explain the importance of cooperation between managers and business owners (Shukla et al., 2023), which is suitable for designing incentives and rules in line with the discussions of previous scholars discussing the relationship between society and entrepreneurs (Cowden et al., 2020). Implementing a sustainable business can be achieved by enforcing management rules and practises (Fernando et al., 2019) to ensure the continued stability of business activities. Schluter et al. (2023) and Hanaysha and Al-Shaikh (2022) stated that the relationship between business operations, the connection of business partnerships, business initiatives, and system expansion in the company are all essential factors in evaluating a sustainable business. Policy goals and initiatives, as outlined by De Ponte et al. (2023), help determine the development of the industrial sector.

The role of policy is to provide a forum for all economic and government actors to address the challenges of economic growth and population density. Ahsan et al. (2022) demonstrate how government policy has fostered long-term financial growth through effective economic policy design. The study's results illustrated how the significant positive influence of economic policy and defensive corporate strategy has contributed to the long-term financial prosperity of Chinese firms. This is supported by Mirza and Ahsan (2020), who show that economic policy significantly impacts firm performance and growth by influencing economic conditions and shaping the firm's operating environment. In addition, the role of management is critical in ensuring comprehensive business activities (Chopra et al., 2021; Yadav et al., 2020).

Additionally, Hadi and Baskaran (2021) and Bento et al. (2021) stated that management is responsible for building a sustainable company. According to Ch'ng et al. (2021) and Garcia et al. (2019), sustainable business performance can be achieved by integrating economic, social, and environmental considerations. Implementing eco-organisational management techniques, such as monitoring eco-innovation trends and frequently sharing experiences and information with employees and among departments, can significantly improve the economic performance of technology companies. Therefore, the organisations need to focus on their operations or develop new, environmentally friendly products to improve environmental performance. Third, market upheavals such as intense competition, changing customer preferences, and technological advancements amplify the positive effects of environmental business innovation on the social performance of technology firms. De Ponte et al. (2023) and Fernando et al. (2019) believe that

applying all three factors (economic, social, and environmental) can increase the long-term sustainability of firms.

To achieve sustainability, businesses must implement effective environmental policies and management systems. An environmental management system can streamline processes, improve resource efficiency, and significantly reduce environmental impacts (Sarfraz et al., 2022). Moreover, the relevance of green management techniques has been underscored by their efficacy in achieving enhanced overall business performance and maintaining competitive advantage (Sarfraz et al., 2022). These techniques encompass practices such as life cycle evaluation and sustainable value mapping, which can drive innovation in processes and products. Companies actively engaging in these green innovations are likely to achieve not only ecological benefits but also economic results by optimising operations and reducing waste (Roscoe et al., 2019). Therefore, the interplay between sustainable business practices and environmental management is essential for modern organisations striving for long-term success. Thus, the hypothesis is as follows:

H1: Environmental management practises of the firms have an association with sustainable business.

2.3. Policy enforcement, environmental management practises and sustainable business

Ensuring policy compliance is critical in promoting sustainable growth, as evidenced by the successful implementation of sustainable development globally (Taghipour et al., 2022; Patwa et al., 2021). To address significant environmental challenges, Malaysian environmental regulations should require regular assessments of companies by regulators. This form of monitoring and inspection can inform policymakers on raising environmental standards for products and services. Additionally, technological innovation plays a mediating role in the relationship between flexible environmental policy and sustainable industrial development. In addition, environmental management uses various strategies, such as promoting eco-friendly practises and introducing innovative green products and processes to achieve sustainable business practises (Wang et al., 2021). Afum et al. (2020) found that social performance mediates between green production and economic performance. Companies can benefit from investing in green production practises that promote positive, sustainable performance, operational competitiveness, and reputation. The findings provide evidence for managers to adopt green practises as part of their overall strategy to achieve economic benefits while contributing to sustainable outcomes. Adopting such practises increases companies' competitive advantage while reducing their environmental impact, underscoring the importance of investing in sustainable practises for businesses.

Effective implementation of sustainable policies and regulations is critical to promoting sustainable business practises. Regulators that monitor and evaluate businesses can influence policymakers to improve environmental standards and incentivise the development of infrastructure that promotes sustainable practises. Green policy is a government intervention to ensure a resilient regional transition to sustainability, attract green investment, and promote sustainable development. Adopting green practises can lead to positive, sustainable performance, operational competitiveness, and reputation, while using a combination of factors such as green innovation, regulation, supplier intervention, and technology can enhance sustainable performance. Integrating green practises and innovation into business operations is critical to improving

environmental and sustainable performance. Adopting these practises can help companies achieve economic benefits while contributing to sustainable outcomes. Thus, the hypothesis is as follows:

H2: Firms with a high commitment to policy enforcement strengthen the association between environmental management practises and sustainable business.

3. RESEARCH METHODOLOGY

This study examined the policy enforcement, environmental management practises, and sustainability business of publicly listed companies in Malaysia for 10 years, from 2011 to 2022. The year 2011 was chosen as a starting point as Bursa Malaysia introduced the Business Sustainability Programme in 2010 to provide clear guidance regarding managing sustainability practises. Our sample consists of 627 company-year observations after excluding financial companies and missing data. The exclusion of financial companies is because it has different regulations, which are highly regulated compared to non-financial companies (Zainul Abidin et al., 2024). All data were collected from the Refinitiv-Eikon Thomson Reuters (currently known as LSEG) database.

3.1. Model and Measurement

We employed the panel data regression model to test the first hypothesis (H1): Environmental management practises (PRACT) of the firms have an association with sustainable business (SUSTAIN). The second hypothesis (H2), firms with a high commitment to policy enforcement (ENFORCE) strengthen the association between environmental management practises (PRACT) and sustainable business (SUSTAIN). The model is constructed as follows:

$$SUSTAIN_{it} = \beta_0 + \beta 1 PRACT_{it} + \beta_2 ENFORCE_{it} + \beta_3 PRACT*ENFORCE_{it} + \beta_k CONTROLS_{it} + \varepsilon_{it} \quad (1)$$

In the above model, SUSTAIN is measured by 8 items of sustainable performance score (Table 1), which includes Total Energy to Revenues score; Green Buildings score; Water Use to Revenues score; Environmental Supply Chain Management score; Environmental Supply Chain Monitoring score; Resource use score; Emission score; and Biodiversity impact reduction score.

Regarding PRACT, it is proxied by the total score of 7 items related to Environmental management practices, including Resource Reduction Targets, Targets Water Efficiency, Targets Energy Efficiency, Environment Management Team, Environmental Materials Sourcing, Environmental control, and Targets Emission. Each indicator in both SUSTAIN and PRACT represents the normalised ESG score for each indicator, expressed as a percentage from 0 to 100. These scores are directly derived from the Refinitiv-Eikon Thomson Reuters (currently known as LSEG) database, which provides standardised, auditable data across public and private companies globally. LSEG's scoring methodology evaluates companies across 10 core ESG themes, including emissions, environmental innovation, human rights, and shareholder governance. Each score is calculated using materiality-adjusted weightings and sector-specific relevance, ensuring comparability across indicators (LSEG, 2024). A score of 100 reflects the best ESG practices, while a score of 0 denotes the least favourable outcome. For moderating variables (ENFORCE)

we are using 6 items related to policy enforcement, namely Resource Reduction Policy; Policy Water Efficiency; Policy Energy Efficiency; Policy Sustainable Packaging; Policy Environmental Supply Chain and Policy Emission which is of the policy were assigned as 1 if available or 0 if otherwise.

Table 1: List of Indicators for Environmental Management Practises, Policy Enforcement and Sustainability Business

Variable	Indicators	Measures
SUSTAIN	Total Energy to Revenues Score Green Buildings Score Water Use to Revenues Score Environmental Supply Chain Management Score Environmental Supply Chain Monitoring Score Resource Use Score Emission Score Biodiversity Impact Reduction Score	Score range from 0 to 100 as calculated by Refinitiv (currently LSEG) ESG methodology
PRACT	Resource Reduction Targets Targets Water Efficiency Targets Energy Efficiency Environment Management Team Environmental Materials Sourcing Environmental Control Targets Emission	Score range from 0 to 100 as calculated by Refinitiv (currently LSEG) ESG methodology
ENFORCE	Resource Reduction Policy Policy Water Efficiency Policy Energy Efficiency Policy Sustainable Packaging Policy Environmental Supply Chain Policy Emission	Binary score (0 if the firm don't have related policy, or 1 if have related policy)

Regarding the control variables (CONTROLS), the model includes the firm-level variables as follows: profitability proxied by return on assets (ROA), firm's size proxied by the natural log of total assets (LNSZ), financial leverage (LEVERAGE) measured by the ratio of total debt to total assets, cash flows (LNCASH), firms' industry dummy (INDUSTRY) and year observation dummy (YEAR). Detailed descriptions of all variables are presented in Table 2.

Table 2: Variables description

Variables	Description	Measurement
Dependent		
SUSTAIN	Sustainable business	8 Indicators of a sustainable performance score
Independent		
PRACT	Environmental management practises	7 Indicators of environmental management score
Moderator		
ENFORCE	Policy enforcement	Dummy variable of 6 indicators of policy enforcement
Control		
ROA	Return on assets	Total income divided by total assets
LNSZ	Firm's size	Natural log of total assets
LEVERAGE	Financial leverage	Total liability to total asset ratio
LNCASH	Cashflow	Operational cash flow
BOARD_SZ	Board size	Number of boards of director
INDUSTRY	Firm's industry	Dummy variable of the firm's industry
YEAR	Year of observation	Dummy variable of years

4. RESULTS AND DISCUSSION

The following Table 3 presents the tabulation of the industry sector based on the Bursa Malaysia sector for all firms in the sample. Firms from the Consumer Products & Services sector are the highest, with 30.30 per cent. The lowest percentage is the firms from the Technology sector, with 0.64 percent.

Table 3: Tabulation of Industry Sector base on Bursa Malaysia sector

	Freq.	Percent	Cum.
Consumer Products & Services	190	30.30	30.30
Industrial Products & Services	188	29.98	60.29
Construction	37	5.90	66.19
Energy	10	1.59	67.78
Healthcare	26	4.15	71.93
Property	36	5.74	77.67
Technology	4	0.64	78.31
Telecommunications & Media	47	7.50	85.81
Transportation & Logistics	41	6.54	92.34
Utilities	48	7.66	100.00
Total	627	100.00	

Table 4 presents the descriptive statistics of all variables. The mean (median) value for SUSTAIN is 27 (24) percent, which indicates the sustainability business score for firms in the sample was less than 50 percent. Regarding environmental management practise (PRACT), the mean(median) value is 38 (33) percent. For Policy enforcement (ENFORCE), the mean(median) value is 49(60) percent.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Q10	Q25	Q50	Q75	Q90	Std. Dev.	Min	Max	Shapiro-wilk (z)	Prob>z	Vif
SUSTAIN	627	0.27	0.01	0.09	0.24	0.42	0.57	0.20	0.00	0.822	7.23	0.00	
PRACT	627	0.38	0.17	0.17	0.33	0.50	0.67	0.22	0.17	1.00	6.75	0.00	1.68
ENFORCE	627	0.49	0.00	0.20	0.60	0.80	0.80	0.30	0.00	1.00	5.38	0.00	1.70
ROA	627	0.05	-0.22	0.01	0.02	0.06	0.14	0.12	-0.46	0.87	11.93	0.00	1.36
FIRM SIZE (Billion)	627	15.61	0.68	1.61	4.61	11.90	48.79	31.94	0.08	213.29	12.97	0.00	
LNSZ	627	22.27	20.34	21.20	22.25	23.20	24.61	1.52	18.21	26.09	4.43	0.00	2.58
LEVERAGE	627	0.29	0.03	0.08	0.24	0.36	0.54	0.46	0.01	7.17	13.52	0.00	1.12
CASH (Billion)	627	0.50	0.05	0.13	0.31	0.70	1.32	0.60	-2.00	3.59	10.50	0.00	
LNCASH	627	19.55	18.20	18.87	19.67	20.37	21.00	1.09	14.73	22.00	3.81	0.00	2.20
BOARD_SZ	627	8.54	6.000	7.00	8.00	10.00	11.00	2.38	1.00	17.00	5.08	0.00	

The following Table 5 presents the pairwise correlation for all variables. SUST_BUS has a positive correlation with PRACT and ENFORCE at 1 percent significant level ($p< 0.01$). Among control variables, only ROA and BOARD_SZ have a positive correlation with SUST_BUS at 1 percent significant level ($p <0.01$) and 10 percent significant level ($p<0.10$), respectively. PRACT is positively correlated at 1 percent significant level ($p < 0.01$) with ENFORCE, ROA and BOARD_SZ, .and negatively correlated with LNSZ at 5 percent significant level ($p<0.05$). ENFORCE has a positive correlation with ROA and BOARD_SZ at 1 percent significant level ($p < 0.01$). Regarding controlling variables, ROA has a negative correlation with LNSZ at 1 percent significant level ($p<0.01$), a negative correlation with LEVERAGE and LNCASH at 10 percent significant level ($p < 0.10$), and a positive correlation with BOARD_SZ at 1 percent significant level ($p < 0.01$). LNSZ has a negative correlation with LEVERAGE and a positive correlation with LNCASH at 1 percent significant level ($p < 0.01$). LNCASH has a positive correlation with LEVERAGE and BOARD_SZ at 5 percent significant level ($p<0.05$) and 10 percent significant level ($p < 0.10$), respectively.

Table 5: Pairwise Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) SUST_BUS	1.000							
(2) PRACT	0.668***	1.000						
(3) ENFORCE	0.759***	0.626***	1.000					
(4) ROA	0.125***	0.192***	0.173***	1.000				
(5) LNSZ	0.004	-0.095**	-0.020	-0.347***	1.000			
(6) LEVERAGE	0.006	-0.004	-0.026	-0.065*	-0.119***	1.000		
(7) LNCASH	0.057	-0.023	0.057	-0.078*	0.675***	0.096**	1.000	
(8) BOARD_SZ	0.076*	0.127***	0.139***	0.104***	-0.023	0.000	0.074*	1.000

Notes: *** p<0.01, ** p<0.05, * p<0.1.

Table 6 presents the main effect of environmental practise (PRACT) and the interaction of Policy enforcement (ENFORCE) with PRACT (ENFORCE*PRACT) toward sustainable business (SUSTAIN). First, the pooled model (OLS) in panel A shows that PRACT has no association with SUSTAIN. ENFORCE, however, has a positive association with SUSTAIN at a 1 per cent level (p<.01). The moderating effect (ENFORCE*PRACT) is shown to have a positive association with SUSTAIN. The fixed effect estimation (Panel B) also shows similar findings, where PRACT has no association with SUSTAIN, and ENFORCE*PRACT has a positive association with SUSTAIN at a 1 per cent level (p<0.1). As the Hausman test suggests that the fixed effect is more appropriate, we further apply the fixed effect model with robust standard errors, as suggested by Hoechle (2007), to handle the heteroscedasticity and autocorrelation problems (Panel C). The result of panel C is also similar to the findings from panel B.

The findings imply that a firm's environmental practices do not influence the firm's sustainable business; thus, H1 was rejected. The result implies that environmental practises do not reflect the firm's strategies to sustain their business. This shows that Malaysian firms are unable to create a sustainable business by practicing environmental management, which is contrary to the previous study. There are several reasons for such findings. For example, the firms might treat environmental practises as voluntary acts (Ismail et al., 2022), therefore, any related practises do not contribute to sustaining businesses.

In addition, sustainable business does not solely rely on a firm's environmental practises. A sustaining firm also depends on its financial factors (Ahsan et al., 2021). For instance, large firms might have more resources to be utilised in practising sustainable business (Drempetic et al., 2020). Another factor that leads to sustainable business is the governance structure (Ong and Djajadikerta, 2020). Better governance leads to better corporate decision-making, thus increasing efficiency in utilising resources toward sustainable practices.

The findings regarding H2 show that Policy enforcement can influence a firm's sustainable business; thus, H2 is accepted. This result shows that firms will have a better sustainable business when there is enforcement regarding sustainability practises in the marketplace. This is in line with

Chen et al. (2023), where policymakers play an important role in enforcing firms to ensure sustainable business, which aligns with Agency theory. This implies that through enforcement, companies are forced to comply with any guidelines and policies in environmental practices, thus leading to a sustainable business that accepts H2.

Table 6: Panel Regression

	Panel A: OLS	**Panel B: Fixed effects**	**Panel C: Fixed effect with robust standard error**
Dependent Variable: SUSTAIN	**(1)**	**(2)**	**(3)**
PRACT	-0.0104	-0.00427	-0.00427
	(0.0733)	(0.0762)	(0.0789)
ENFORCE	0.233***	0.203***	0.203***
	(0.0339)	(0.0348)	(0.0176)
ENFORCE*PRACT	0.313***	0.282***	0.282**
	(0.0953)	(0.100)	(0.115)
ROA	0.0455	-0.153*	-0.153*
	(0.0779)	(0.0821)	(0.0777)
LNSZ	0.0135	0.0440***	0.0440***
	(0.00849)	(0.0145)	(0.00538)
LEVERAGE	0.0103	0.0302**	0.0302*
	(0.0106)	(0.0133)	(0.0138)
LNCASH	0.0136*	0.00318	0.00318
	(0.00728)	(0.00759)	(0.00575)
INDUSTRY	No	No	No
YEAR	Yes	Yes	Yes
Constant	-0.643***	-0.996***	-0.996***
	(0.175)	(0.314)	(0.172)
Observations	627	627	627
R-squared	0.683	0.691	0.691
F-test		67.05***	136306.32***
Wald chi2	1502.52***		
Specification test			
Hausman Chi2		73.55***	

Notes: *** p<0.01, ** p<0.05, * p<0.1.

4.1. Model by industry sector

We replicate the robust standard error model by applying it to the industry sector as in Table 7. This analysis, based on a robust regression model, investigates the determinants of sustainability performance (SUSTAIN) across eight distinct industry sectors. The model examines the direct effects of environmental practices (PRACT) and policy enforcement (ENFORCE), as well as their interactive effect (ENFORCE*PRACT), which acts as a moderator. The findings reveal a highly heterogeneous set of relationships, emphasising the importance of a sector-specific approach to understanding sustainability dynamics.

For both the Construction and Utilities sectors, the results show a significant negative link between environmental practices (PRACT) and sustainability performance (SUSTAIN). This suggests that when there is little policy enforcement, companies in these sectors that adopt more

environmentally friendly practices actually experience lower overall sustainability performance. One possible reason for this is "greenwashing," where firms adopt practices for public image rather than for genuine, widespread change. However, a crucial finding is that the positive and significant interaction term, ENFORCE*PRACT, in both sectors (Construction $p<0.10$; Utilities $p<0.05$) changes this dynamic. This positive moderation means that a vigorous enforcement of policies counteracts the negative relationship. When enforcement is high, environmental practices become more meaningful and effective, leading to better sustainability performance.

In the Healthcare sector, a strong and significant positive relationship was found between environmental practices (PRACT) and sustainability performance (SUSTAIN) ($p<0.01$). This means that firms with more environmental practices tend to have better sustainability performance. This is likely because environmental efforts, such as using safer chemicals and reducing medical waste, align with the core mission of public health and contribute to a healthier environment and better operations. These practices often stem from strong internal motivations like ethical concerns and pressure from stakeholders. However, the interaction term, ENFORCE*PRACT, shows a highly significant negative value ($p<0.01$). This indicates that while environmental practices are beneficial, their positive effect on sustainability performance decreases as policy enforcement becomes stronger.

For the Industrial Products & Services sector, the direct effect of environmental practices (PRACT) is not statistically significant ($p>0.10$). However, the interaction term ENFORCE*PRACT is strongly positive and significant ($p<0.01$). This mirrors the pattern seen in the Utilities sector, which also shows a positive and significant moderating effect ($p<0.05$). These results suggest that in environmentally intensive industries, policy enforcement is a critical driver. It acts as a necessary catalyst, transforming environmental practices from being ineffectual to becoming a meaningful contributor to sustainability performance.

In contrast, the Consumer Products & Services, Property, Telecommunications & Media, and Transportation & Logistics sectors show different patterns. For Consumer Products & Services, neither the direct effect of PRACT nor the interaction term is statistically significant. This indicates that the relationship between environmental practices, policy enforcement, and sustainability performance in this sector is not clearly defined in this model and may be influenced by other factors. Similarly, for the remaining sectors, such as Property, Telecommunications & Media, and Transportation & Logistics, the interaction term is not significant, meaning that policy enforcement does not play a significant moderating role in the relationship between practices and performance within these industries.

The results underscore a critical insight: the relationship between environmental practices and sustainability performance is not universal but is contingent on the industry context and the strength of policy enforcement. In environmentally challenging sectors like Construction and Utilities, policy enforcement appears to be a necessary catalyst that makes environmental practices effective. In contrast, in a mission-driven sector like healthcare, environmental practices have a strong positive effect even without significant external enforcement, and excessive regulation might even impede progress.

Table 7: Regression model by industry sectors

	(1)	(2)	(3)	(5)	(6)	(8)	(9)	(10)
Dependent Variable: SUSTAIN	Consumer Products & Services	Industrial Products & Services	Contsruction	Healthcare	Property	Telecommunications & Media	Transportation & Logistics	Utilities
PRACT	0.0108	-0.297	-0.729*	1.160***	0.609	0.504	-0.860	-0.674*
	(0.126)	(0.186)	(0.397)	(0.182)	(0.377)	(0.396)	(0.632)	(0.351)
ENFORCE	0.108*	0.155***	0.0385	0.341***	0.651***	0.770***	0.219	-0.0588
	(0.0565)	(0.0333)	(0.154)	(0.0308)	(0.189)	(0.197)	(0.210)	(0.0994)
ENFORCE*PRACT	0.193	0.753***	1.063*	-0.702***	-0.832	-0.625	1.271	1.040**
	(0.116)	(0.185)	(0.493)	(0.154)	(0.520)	(0.406)	(0.936)	(0.390)
ROA	-0.00936	-0.216**	1.253	0.251**	-4.992**	-3.118	-1.177***	-5.991**
	(0.214)	(0.0809)	(0.912)	(0.103)	(1.967)	(1.952)	(0.372)	(1.947)
LNSZ	0.0864***	-0.0199	0.308**	-0.127**	-0.0501	-0.195	0.136	-0.199**
	(0.0238)	(0.0149)	(0.138)	(0.0492)	(0.244)	(0.163)	(0.0988)	(0.0848)
LEVERAGE	0.307***	-0.00264	-0.675*	-0.351**	-0.609	-0.229	0.0607	-0.0976**
	(0.0692)	(0.0131)	(0.356)	(0.114)	(0.512)	(0.204)	(0.0470)	(0.0365)
LNCASH	0.00660	0.00640	-0.0897*	0.0296*	0.0123	0.00547	-0.0175	-0.0472
	(0.00523)	(0.0125)	(0.0480)	(0.0138)	(0.0251)	(0.0807)	(0.0531)	(0.0386)
YEAR	included	included	included	included	included	included	included	included
Constant	-1.934***	0.362	-4.576	1.814**	0.947	4.325	-2.517	5.996***
	(0.487)	(0.417)	(2.863)	(0.740)	(5.252)	(3.181)	(1.863)	(1.725)
Observations	190	188	37	26	36	47	41	48
Number of groups	22	19	4	6	4	4	4	4
lag	2	2	2	2	2	2	2	2
r2_w	0.589	0.823	0.943	0.995	0.948	0.564	0.853	0.908
F	25388	1.100e+08	1.511e+06	2952	96798	788.5	36468	491.1
df_r	11	11	11	8	11	11	11	11
df_m	18	18	18	15	18	18	18	18
N_g	22	19	4	6	4	4	4	4

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2. Additional Analysis

The main result in this study (Table 6), however, might be biased due to the endogeneity problem, where firms with sustainable business were more likely to be involved in environmental practices. Thus, firms' high environmental practises might be self-selected into the sample. To overcome this issue, this paper applied two two-stage least squares (2SLS) estimation techniques, following Al-Shaer et al. (2023). The limitation of conducting 2SLS is identifying the appropriate instrument. Therefore, we follow Al-Shaer et al. (2023) by choosing the industry median board size as the instrument variable. The previous study widely uses board sizes as an instrument variable (Al-Shaer et al., 2023; Boutchkova et al. 2022). The following Table 7 presents the 2SLS model, where in the first stage, the test variable (PRACT) was regressed with the control variable and instrument variable, namely the industry median of board size (BOARD_SZ). In order to obtain unbiased estimation models, we also applied a two-step dynamic panel System-Generalised Method of Moments (GMM). The results of both 2SLS and GMM in columns (2) and (3) show similar results to those in Table 6.

Table 7: Endogeneity Test

Dependent Variable: SUSTAIN	**(1)**	**(2)**	**(3)**
VARIABLES	**FIRST PRACT**	**2SLS SUSTAIN**	**GMM SUSTAIN**
PRACT		0.0102	0.0102
		(0.0683)	(0.0657)
ENFORCE		0.287***	0.287***
		(0.0320)	(0.0307)
ENFORCE*PRACT		0.272***	0.272***
		(0.0889)	(0.0801)
ROA	0.331**	0.230***	0.230***
	(0.128)	(0.0734)	(0.0633)
LNSZ	0.0164	0.00669	0.00669
	(0.0121)	(0.00697)	(0.00721)
LEVERAGE	0.0231	0.00452	0.00452
	(0.0178)	(0.0101)	(0.00953)
LNCASH	0.0225*	0.0218***	0.0218***
	(0.0125)	(0.00713)	(0.00762)
BOARD_SZ	-0.00158		
	(0.00535)		
INDUSTRY	No	No	No
YEAR	Yes	Yes	Yes
Constant	-0.621***	-0.635***	-0.635***
	(0.219)	(0.123)	(0.129)
Observations	627	627	627
R-squared	0.447	0.767	0.767
F-test	10.20***		
Wald chi2		2064.79***	3931.45***

Notes: *** p<0.01, ** p<0.05, * p<0.1.

As our data might suffer from non-normal data distribution, as shown in the Shapiro-Wilk test (Table 4), we further employ the non-parametric approach using quantile regression analysis. The OLS model, which is normally used to test hypotheses, mainly captures the relationship at the mean value of the dataset, which could lead to bias as the model might be underestimated or overestimated. Moreover, quantile regression enables estimation of the relationship between dependent variables and independent variables at any specific quantile (Teng et al., 2021). The result of quantile regression is reported in Table 8. We test the model in 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th} quantiles (Q10, Q25, Q50, Q75, and Q90 respectively). From the result, the baseline quantile model (column 1) shows a similar result to the main model (Table 6) where PRACT has no association with SUSTAIN, ENFORCE has a positive association with SUSTAIN, and the moderating term (ENFORCE*PRACT) has a positive association with SUSTAIN. The result for Q10, Q25, and Q50 quantiles (columns 2, 3, and 4) also shows similar results to the main hypothesis. Regarding the Q75 quantile (column 5), only ENFORCE has an association with SUSTAIN. However, in Q90 (column 6), both PRACT and ENFORCE are found to have a positive association with SUSTAIN, and ENFORCE*PRACT has no association with SUSTAIN.

The result of quantile regression shows that firms at lower until median quantile (Q10-Q75) when actively involved in environmental management practise do not contribute toward sustainable business. In addition, firms in this range also might have lower resources to conduct environmental practises. By referring to Table 3, firms within Q10 until Q75 have lower profitability (ROA less than 10 percent). This shows that those firms might face unstable financial positions; therefore, conducting environmental practices is not enough to create a sustainable business. On the contrary, firms in Q90, when involved in environmental practise also contribute toward sustainable business. Firms in Q90 also have a better financial position (ROA of more than 10 percent in Table 3) and, therefore, have more resources to conduct environmental practises that can impact their sustainable business positively.

Regarding the moderating role of policy enforcement, there is a positive association between ENFORCE*PRACT toward SUSTAIN for firms in the 10^{th} quartiles (Q10) until the median quartiles (Q50). This result shows that firms at lower quantiles with less sustainable businesses need enforcement by regulators to be involved in environmental practices and contribute to their business sustainability. On the contrary, for the firms at higher quartiles (Q75 and Q90), there are no associations found regarding the interaction of ENFORCE with SUSTAIN. This can be explained as such firms already have better environmental practises and sustainable business.

Table 8: Non-Parametric Approach Using Quantile Regression

Dependent Variable: SUSTAIN	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Base	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
PRACT	-0.0286	-0.173	-0.164	-0.0286	0.0283	0.338*
	(0.0997)	(0.144)	(0.113)	(0.127)	(0.122)	(0.184)
ENFORCE	0.268***	0.133**	0.144***	0.268***	0.364***	0.440***
	(0.0467)	(0.0539)	(0.0526)	(0.0526)	(0.0484)	(0.0713)
ENFORCE*PRACT	0.337***	0.544***	0.557***	0.337**	0.172	-0.196
	(0.130)	(0.185)	(0.150)	(0.149)	(0.156)	(0.232)
ROA	0.126	0.0870	0.122	0.126*	0.141*	0.209**
	(0.107)	(0.102)	(0.0792)	(0.0667)	(0.0830)	(0.104)
LNSZ	0.00287	-0.00989	0.0134*	0.00287	0.00108	-0.00888
	(0.0102)	(0.0123)	(0.00766)	(0.0102)	(0.0142)	(0.0131)
LEVERAGE	0.00287	-0.00341	-0.00150	0.00287	-0.00127	-0.0200
	(0.0148)	(0.0126)	(0.0152)	(0.0130)	(0.0206)	(0.0244)
LNCASH	0.0207**	0.0202*	0.00760	0.0207**	0.0304***	0.0270***
	(0.0104)	(0.0118)	(0.00882)	(0.00852)	(0.0108)	(0.00933)
INDUSTRY	Included	Included	Included	Included	Included	Included
YEAR	Included	Included	Included	Included	Included	Included
Constant	-0.559***	-0.229	-0.511***	-0.559***	-0.656**	-0.391
	(0.180)	(0.157)	(0.157)	(0.205)	(0.258)	(0.322)
Observations	627	627	627	627	627	627
Pseudo R2	0.5633	0.4890	0.5442	0.5633	0.5744	0.5690

Notes: *** p<0.01, ** p<0.05, * p<0.1.

5. CONCLUSION

This study investigates the relationship between environmental management practices and sustainable business performance, along with the moderating role of environmental policy enforcement among publicly listed companies in Malaysia from 2011 to 2022. The findings reveal that environmental management practices, on their own, do not significantly contribute to business sustainability. This suggests that such practices may be implemented voluntarily and inconsistently, potentially due to concerns over increased operational costs. Additionally, sustainability is a multidimensional concept that extends beyond environmental concerns and includes financial performance, governance stability, and social responsibility. Therefore, relying solely on environmental practices may not be sufficient to achieve sustainable business outcomes.

However, the study finds that environmental policy enforcement plays a significant role in enhancing business sustainability. This outcome aligns with the principles of agency theory, which posits that in the absence of effective oversight and enforcement, firms may not act in the best interest of stakeholders. The presence of regulatory enforcement compels firms to adhere to environmental guidelines, thereby improving their sustainability performance. This finding highlights the importance of strong institutional frameworks in driving corporate behaviour towards long-term sustainability objectives. While companies that voluntarily engage in environmental management may not see direct benefits in terms of sustainability, enforcement

mechanisms create an environment where such practices become effective. Environmental management, when supported by policy enforcement, can drive innovation and operational efficiency through the adoption of green technologies. This approach can generate both environmental benefits and economic gains, contributing to a firm's overall sustainable development.

The findings of this study contribute to the broader literature on sustainability and financial theories by illustrating the conditional impact of policy enforcement on the effectiveness of environmental practices. This contributes to ongoing discussions around the integration of environmental, social, and governance factors within corporate strategy and supports the role of regulatory mechanisms in ensuring compliance and accountability. From a policy perspective, the results underscore the need for Malaysia to strengthen the enforcement of environmental regulations and enhance strategic planning in environmental management. Integrating the United Nations Sustainable Development Goals (SDGs) into national economic policies can further support sustainable business practices and foster long-term economic growth.

This study has several limitations. First, it does not consider financial and governance variables as predictors of business sustainability, which may limit the comprehensiveness of the analysis. Future studies should incorporate these factors to provide a more holistic understanding of sustainability. Second, the study excludes financial institutions, which may operate under different regulatory frameworks and environmental expectations. Exploring sector-specific differences in future research could offer more detailed insights into the role of industry context in shaping environmental and sustainability outcomes. Therefore, sustainable business performance in Malaysia is more likely to be achieved when environmental management practices are supported by vigorous policy enforcement. This study offers valuable insights for policymakers and practitioners in designing effective strategies that strike a balance between regulatory compliance and innovation, ultimately fostering long-term value creation. The findings can inform future policy development aimed at fostering a more sustainable and resilient business environment.

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