GREEN INITIATIVES AND CARBON EMISSION IN MALAYSIA

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Abstract: This research study examines the relationship between green initiatives and carbon emissions in Malaysia, focusing on the years 2010 to 2021. This study aims to investigate green initiatives, environmental investment, policies on carbon emission, size, and return on assets (ROA) that influence carbon emissions in Malaysia. The analysis reveals a weak negative correlation between ROA and total assets (TA), signifying that larger total assets are associated with decreased carbon emissions. However, these results are significant as they indicate potential relationships between environmental regulations, policy on carbon emissions, company profitability, and total assets. This research contributes significantly to the ongoing discourse surrounding green initiatives and their impact on carbon emissions in Malaysia. The results emphasise the importance of sustainable practices and call for a more profound understanding of how environmental investments translate into emissions reductions. Furthermore, the study underscores the need for more effective policy measures and incentives to encourage businesses to adopt green initiatives as part of their environmental stewardship efforts. Ultimately, this research paves the way for further exploration and policy considerations in pursuing a greener and more sustainable future for Malaysia.

Keywords: Green initiatives, carbon emissions, sustainable practice, Malaysia.

Introduction

As the country strives to become a high-income economy by 2020, rising energy demand has pressured the government to choose less expensive energy sources when renewable energy sources are expensive. To date, progress in analysing the current situation and identifying effective emission reduction strategies in the power sector has been slow (Babatunde *et al.*, 2017). The current government policy aims to increase resource diversity and energy security while failing to articulate adequate emission reduction targets and measures for the sector. This study aims to characterise current issues related to carbon dioxide (CO_2) emission reduction strategies in the power sector, identify promising mitigation measures based on the experiences of other countries, and identify limitations and emerging policy issues.

In addition, the country's focus on renewable energy and green taxation reflects its commitment to environmental sustainability and economic growth. It is crucial to continue evaluating and refining these initiatives to balance environmental protection and economic development. Among other criteria, the establishment of energy efficiency has become crucial, thereby encouraging the knowledge and abilities of professionals to learn the green concept, practice sustainable construction, and strategise cost-effective methodologies.

According to MacAskill *et al.* (2021), green initiatives encourage the sustainable growth of human society, which calls for the manufacturing sector to incorporate environmental protection and ecological health into its operations, support the modernisation of both traditional and green industries, consider potential environmental returns and risks when providing financial services, and create corporate green financial instruments and individual green consumer goods.

This study focuses on implementing green initiatives that affect environmental performance by lowering pollutant emissions, waste, energy consumption, toxic inputs, noise, smell/odour emissions, and the risk of serious accidents. The effect of green initiative adoption on environmental performance in this study is consistent with the findings on supply chain management in Chinese manufacturing enterprises (Zhu *et al*., 2013).

Energy is crucial to growing economic activity, yet human activity is responsible for climate change and the damaging effects of CO_2 emissions. The use of liquid fuels (CO_2L), industry (IND), economic growth (GDP), and trade openness all contribute to CO_2 emissions (TR). The study demonstrates that as urbanisation rates continue to rise, the growth of green initiatives can hasten the transformation of traditional energy use, thereby advancing the Chinese government's objective of "achieving carbon peak by 2030 and carbon neutrality by 2060".

Most CO_2 emissions are caused by humans, burning fossil fuels, and deforestation. Additionally, two major threats, pollution and climate change have been brought on by the rise in human-caused greenhouse gas (GHG) emissions (Bello *et al*., 2018). Since the agricultural industrial revolution, there has been a sharp increase in CO_2 emissions through deforestation and forest degradation, which is one of the primary causes of global climate change (Begum *et al*., 2020).

Global warming is becoming increasingly ingrained in the fabric of national conversation in numerous nations. The government, the corporate world, and the media all participate in the green movement. If global carbon emissions are not reduced, the Earth's surface temperature will rise, and the water evaporation rates will increase. Malaysia is ranked 30th in the world for countries with the highest levels of carbon emissions, despite ongoing attempts by the Malaysian government to reduce emissions. In addition, companies have begun to undertake green initiatives. Global warming has rapidly accelerated owing to continual CO_2 emissions. According to all accounts, global warming is one of the most significant concerns, which makes it impossible to ignore. The leading cause of the hazard posed by global warming, which includes other environmental problems such as floods and rising sea levels is the increased rate of carbon emissions (He *et al*., 2021; Shair *et al*., 2021). Accelerating the transformation of energy use is essential in the face of global climate change.

Tolliver *et al*. (2020) stated that to achieve sustainable development based on the Paris Agreement, funds from carbon-dense investments must be transferred to sustainable green investments. The government also prioritises lowering GHG and CO_2 emissions to combat global warming (Mahat *et al*., 2019). To address these issues, the government must revitalise the financial system innovation and consider environmental protection and economic growth (Guild, 2020). Green practices by companies can reduce their carbon emissions. This study highlights the impact of green initiatives on reducing carbon emissions.

This study contributes to the cost of doing business after implementing green transformation, which is lower than the cost they pay for business transformation. Cost-benefit analysis shows that big polluters have incentives to implement green transformation to maximise benefits. Hence, implementing green projects after transformation encourages the growth of the green finance system. It adds value to society's green economic development (He *et al*., 2019). Green finance can more sustainably manage natural resources. According to many studies, green initiatives can improve environmental quality while reducing carbon emissions (Ren *et al*., 2020). Thus, this study could add some knowledge on green initiatives and carbon emission reduction, specifically in Publicly Listed Companies (PLCs) in Malaysia. Our findings support and highlight the relevance of regional green finance initiatives in furthering development goals in manufacturing.

Literature Review

The green initiative is one way in which the two financial and environmental investment linkages are transformed. Green funding is put into practice by focusing on ecologically friendly projects and implementing measures to increase carbon emissions. Assistance from government and financial institutions is necessary to produce green initiatives. Governments and financial institutions must ensure sustainable operational regulation. Government and financial organisations that evaluate the sustainability of green initiatives and businesses that use funding are required to implement it in a way that maximises profits and protects the environment. Government and financial institutions must also guarantee appropriate funding through the development of green investment products and models for green financial instruments.

Green initiatives in Malaysia have focused on sustainable practices that protect and preserve the environment. This study examined various green initiatives implemented in Malaysia to address environmental concerns. By promoting sustainable development and minimising the impact of human activities on nature, Malaysia aims to create a greener and more sustainable future for its people and planet.

According to Loganathan Shahbaz and Taha (2014), green initiatives and carbon emissions in Malaysia have become a significant focus in recent years. The country has made progress in implementing various green initiatives to minimise environmental degradation due to carbon emissions. Renewable energy development is a strategic initiative to reduce carbon emissions in the power generation sector. The Malaysian government actively promoted the adoption of green taxation to further reduce carbon emissions and promote economic growth.

The "green capital" has increased its support for green initiatives and sped up the transition to a more environmentally friendly energy structure and contemporary development (Irfan *et al*., 2021). By changing the unemployment rate, green initiatives indirectly impact carbon emissions. Some conventional polluting businesses will undoubtedly need structural upgrades because of China's shift to sustainability (Zhu *et al*., 2014; Ren *et al*., 2022).

The green initiatives adopted include green supply chain management, which consists of waste management, green packaging, evaluating vendors' green performance, reducing carbon emissions in the delivery of goods, and developing eco-friendly products (Zhu *et al*., 2013). In addition, natural resource policy is an important policy tool that affects activities in the manufacturing industry (Li & Zhang, 2021).

The relationship between Malaysian economic development, energy consumption, industry, international commerce, and carbon emissions was investigated using an integrative framework approach. Although environmental quality degradation worsens the environment and GHG emissions primarily cause global warming, the environment has overcome the problems facing developing countries. The building sector is tasked with lowering its energy consumption and carbon footprint in compliance with the Paris Agreement because it generates approximately 40% of global annual GHG emissions.

As a member of the global economic network, Malaysia must respond to the worldwide trend of environmental preservation to gain access to global markets. Consequently, regulations were introduced in 2007 to require all PLCs in Malaysia to produce a Corporate Social Responsibility (CSR) report that includes social and environmental reporting (Zainal *et al*., 2013). These reflect the Malaysian government's concern about green initiatives and the expectation of a solid environmental commitment from Malaysian organisations. Waste management, recycling, energy savings, environmental or health and safety measures, process redesign for environmental or health

and safety, green supply chain, paperless business, and tree planting may be among the green initiatives adopted by organisations. The Malaysian government has been seriously emphasising environmental preservation through various initiatives. For example, the Malaysia Development Plan and Vision 2020 targets the country to become a developed nation and focuses on environmental sustainability (Mahyudin & Rao, 2003).

According to the research, upgrades, economic growth, and carbon emissions of industrial systems are all inextricably linked over the long run. Industrial systems produce outcomes that are beneficial to economic progress. Environmental performance measures were adopted: Reduced pollution emissions, water usage, energy consumption, toxic inputs, paper usage, noise, odour emissions, and the risk of severe accidents (Jalaludin *et al*., 2010; Zeng *et al*., 2021).

Solar energy has been a major focus of various solar projects and installations nationwide. The Net Energy Metering (NEM) program allows solar panel owners to sell excess energy back to the grid. In addition, Malaysia has existing hydropower projects and there may be ongoing investments in optimising and expanding its hydropower capacity. Thus, the hypotheses of this study are as follows:

Hypothesis 1: There is an association between environmental investment and carbon emissions in Malaysia.

Hypothesis 2: There is an association between policy on carbon emissions and carbon emissions in Malaysia.

Research Method

Conceptual Framework

This study examined the impact of green initiatives and carbon emissions in Malaysia. The independent test variables in this study are green initiatives (i.e., environmental investment and policy on carbon emissions). Meanwhile, the dependent test variable is carbon emissions. Size and return on assets (ROA) were used as control variable (Figure 1).
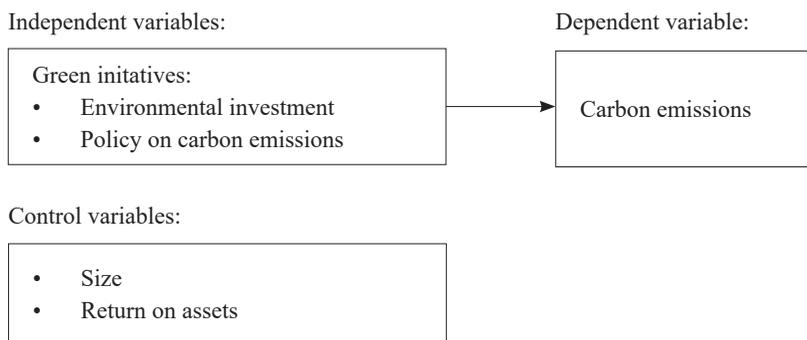
Independent variables:

Green initatives:
- Environmental investment
- Policy on carbon emissions

Dependent variable:

Carbon emissions

Control variables:
- Size
- Return on assets

Figure 1: Conceptual path diagram

Data Collection

Data collection is the process of obtaining information from various sources to handle an issue and analyse the outcomes. Secondary data were also used in this study to support the findings. However, secondary data included information previously published in the literature. In this study, we obtained data from secondary sources. Such information may be documented as public material or internal and external to the company and accessible via the Internet (Sekaran, 2003). This study focused on green initiatives and carbon emissions. With "peak carbon" and "carbon neutral" goals in mind, green initiatives are increasingly important methods for lowering regional energy intensity. Green initiatives can advance and reduce

carbon emissions in Malaysia. Environmentally friendly businesses such as high-tech and green technology enterprises can receive exogenous financial capital aid using green initiatives at the micro level. Green initiatives also give investors more options and instruments for making investments in ecologically friendly projects as the sector of green initiatives expands. Additionally, it promotes more energy and environmentally friendly practices in the area.

This research selected data from 2010 until 2021 with the observation of 12,660 and total companies of 1,055, excluding financial institutions and other missing data. Table 1 summarises the measurement of all the variables used in this study.

Secondary Data

Secondary data are dispensable for most organisational studies. This refers to the information gathered by someone other than the researcher conducting the current study. Such data can be internal and external to the organisation and can be accessed through the Internet or through the perusal of recorded or published information. There are several sources of secondary data, including books and periodicals, government publications on economic indicators, census data, statistical abstracts, databases, media, annual reports of companies, and other archival records (Sekaran, 2003).

Research Model

Research design is a conceptual blueprint for a thesis that creates an action plan, that lays out the steps for data collection, measurement, and analysis (Sekaran & Bougie, 2016). Malhotra and Birks (2017) distinguished three types of research design: Exploratory, descriptive, and causal. The paper aims to investigate how creative thinking and green initiatives reduce carbon emissions in Malaysia. To assess their success in reducing carbon emissions, this study incorporated economic and population growth into the model.

$$CO_2t = \alpha 0 + \beta 1 Git + \beta 3 SZt + ROA + et$$

where:

CO_2t = Carbon emission

t   = Time period

GI   = Green Initiatives

SZ   = Size

ROA = Return on assets

Table 1: Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Carbon emission	333	3,104,958	1.30e + 07	578	1.98e + 08
Environmental investment	539	0.1966605	0.3978427	0	1
Policy on carbon emission	627	0.6842105	0.4652006	0	1
ROA	783	0.0311442	0.0885464	-0.4538838	0.6474283
TA	796	4.09e + 09	1.67e + 10	2,715,478	1.50e + 11

Descriptive Analysis

Table 1 summarises the statistical data for various observations (Obs.). Each row represents different sets of data with their respective mean, standard deviation (Std. Dev.), minimum (min.), and maximum (max.) values. For carbon emissions of 333 observations, the mean is 3,104,958, with a standard deviation of 13,000,000, a minimum value of 578, and a

maximum value of 198,000,000. Environmental investment has 539 observations with a mean value of 0.1966605 and a standard deviation of 0.3978427. The minimum value is zero, while the maximum value is one. Consequently, for policy on carbon emission with 627 observations, the mean is 0.6842105, and the standard deviation is 0.4652006. Again, the minimum value is zero, while the maximum value is one. ROA consists of 783 observations having a small positive mean value (0.0311442) and a small standard deviation (0.0885464). However, large negative (-0.4538838) and positive (0.6474283) extremes for minimum and maximum values, respectively. The last total assets (TA) has an extremely high mean value (4.09e + 09) for its 796 observations. It also has an enormous standard deviation (1.67e + 10), large minimum (2,715,478), and even larger maximum value (1.50e + 11). This table shows that the data is presented in a tabular format with different sets of data and their respective measures of central tendency and variability.

Pairwise correlation is a descriptive statistic that measures the linear relationship between two variables. It tells us how strongly and in what direction the two variables are related. For example, if we want to know how height and weight correlate, we can calculate the pairwise correlation coefficient between two variables. To interpret pairwise correlation coefficients, we need to consider both the magnitude and the sign of the coefficient. The magnitude indicates the strength of the relationship, while the sign indicates the direction of the relationship. A positive sign means that the variables increase or decrease together, while a negative sign means that the variables move in opposite directions. The closer the coefficient is to 1 or -1, the stronger the relationship is. The closer the coefficient is to 0, the weaker the relationship is.

The pairwise correlation table (Table 2) presents the correlations between the five variables: CO_2_EMISSION, ENVIR_EX_INV, POLICY_EMISSIONS, ROA, and TA.

Table 2: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)
(1) CO_2_EMISSION	1.000				
(2) ENVIR_EX_INV	0.111*	1.000			
(3) POLICY_EMISSION	0.046	0.219***	1.000		
(4) ROA	-0.017	-0.029	-0.066*	1.000	
(5) TA	-0.037	-0.096**	-0.070*	-0.056	1.000

Table 2 presents the pairwise correlation for all the variables used in this study. For the correlation between the dependent and independent variables, correlations were only shown between CO_2_EMISSION and ENVIR_EX_INV. ENVIR_EX_INV was shown to be correlated with POLICY_EMISSION and TA, while POLICY_EMISSION was correlated with ROA and TA. The pairwise correlations also showed a correlation between ROA and TA. Despite the few correlations between the independent variables, there was no concern about multicollinearity, as all the correlations were less than 0.6.

Panel data regression analysis is a statistical technique that combines cross-sectional and longitudinal data to study the effects of some independent variables on a dependent variable. Cross-sectional data are observations of different units (such as individuals, firms, countries, etc.) at a given time. Panel data regression analysis (Table 3) allows us to control for the unobserved heterogeneity of the units, capture the dynamic relationships among the variables, and exploit the variation within and between the units.

Table 3: Panel data regression analysis

Variables	1 (RE)
ENVIR_EX_INV	0.001
POLICY_EMISSION	0.703
ROA	0.000
TA	0.251
_cons	0.000

Variables descriptions: ENVIR_EX_INV = Environmental investment, coefficient: Positive, interpretation: Increased environmental expenditures positively affect carbon emission. The coefficient is statistically significant; POLICY_EMISSION = Policy emission, coefficient: Positive (with higher standard error), interpretation: Policy interventions related to emissions have a positive impact, but further investigation is needed. The statistical significance is uncertain due to the wide confidence interval. TA = Total assets, coefficient: Negative, interpretation: Larger total assets are associated with a decrease in the dependent variable. Significance is not statistically significant. Based on Table 3, the p-values indicate that only ENVIR_EX_INV is statistically significant at the 95% confidence level. Policymakers should consider this when formulating environmental policies.

Results and Discussion

This research adds significantly to the current academic literature by investigating green initiatives, environmental investment, policies on carbon emission, and carbon emission in Malaysia. The findings show a substantial inverse correlation between the adoption of green initiatives, consistent with previous studies by Meirun *et al.* (2021) and Obobisa *et al.* (2022). Malaysia has taken significant steps towards reducing CO_2 emissions by adopting green technologies. Carbon emission has a perfect positive correlation with itself, which is expected since it is the same variable. Environmental investment and policy on carbon emissions have the strongest correlation with a coefficient of 0.219, which is statistically

significant at the 0.01 level. ROA and TA have a weak negative correlation with a coefficient of -0.056, statistically significant at the 0.1 level. These results are significant as they indicate potential relationships between environmental regulations, policy on carbon emissions, company profitability, and total assets.

The environmental investment is positively accepted with the dependent variable (CO_2 emissions) and is statistically significant, thus, supporting Hypothesis 1. In contrast, policy effects measured by the variable policy emission do not show a statistically significant association with CO_2 emissions, so, Hypothesis 2 is not accepted.

The study on green technology, exports, and carbon emissions in Malaysia found that the country observed both decreases and increases in carbon emissions, emphasising the need for intensified efforts to address current and future emissions. Additionally, a study on the carbon reduction efforts from the port sector in Malaysia indicated an overall growth in carbon emissions, suggesting the need for more effective policies and actions to achieve significant reductions in carbon emissions.

Furthermore, both environmental investment and policy on carbon emissions harm in Malaysia are found to be positively connected to carbon emissions. Shahbaz *et al.* (2021), Hasanov *et al.* (2018), and Leitao and Lorente (2020) discovered comparable findings in their investigations and panel analyses of the Chinese market. However, Bekhet and Othman's findings for Malaysia, which show an inverted N-shaped curve in the growth-carbon nexus, counter these conclusions. These findings are valuable for policymakers,

researchers, and stakeholders in developing strategies to promote sustainable development in Malaysia.

Limitations of the Study

The study's data is limited to green initiatives and carbon emissions in that certain data are missing because certain companies have not presented adequate data for certain years. This limitation can affect the generalisation of the findings. In addition, this study could not be evaluated over a long period of time since the data were limited to two years only and certain data became unbalanced. When the data are unbalanced, certain analyses of industry companies cannot be run such as the unit root test and others that require strongly balanced data. The data for this study was collected over a 12 years accounting period from 2010 until 2021. The limitation can affect the generalisation of the findings.

Conclusions and Recommendation of the Study

Future studies can use a bigger sample size with more years of observation to determine whether these results can be generalised. Furthermore, future studies can also investigate the nature of carbon emissions. For example, Source-specific Emissions Analysis: Detailed examination of carbon emissions by sector (e.g., transportation, industry, and agriculture) and specific activities within those sectors to identify significant contributors and target areas for reduction. Next, Impact of Climate Policies: Evaluating the effectiveness of existing climate policies and carbon pricing mechanisms in reducing emissions. This could also involve modelling potential future policies to assess their potential impacts. Correspondingly, Technological Innovations and Transitions: Examining the role of technological innovation in transitioning to low-carbon energy sources, including renewable energy, nuclear power, and the electrification of transportation. Lastly, Future Emission Scenarios: Using climate and economic models to project future emission scenarios under different assumptions. This can help understand the potential trajectories of climate change and the urgency of mitigation efforts. According to the study, Malaysia requires more advanced green technologies to monitor and enforce rules and regulations more effectively. They also face challenges such as a lack of green awareness, financial incentives, and technical resources.

Adoption of green initiatives necessitates a significant amount of effort, time, and resources, which are costly to businesses and may not yield returns in the short term. Green practices are also given less priority among Malaysian PLCs because they must weigh the associated costs and profits. Most businesses are profit-driven. Companies also participate in charitable activities such as providing free paper waste to needy people. Top management in this industry encourages and rewards employees who adopt or practice green initiatives. Normally, businesses would consider new green technology if it provided some benefits at a low cost. Going green is not a priority for some businesses. However, it might be for others because of their beliefs and awareness of CSR activities.

The role of management in green initiatives is crucial because they could influence companies to support proactive green strategies. Managers should encourage employees to participate in green practices, perhaps by rewarding them for environmental improvements in their daily activities. Managers should educate and train employees about environmental issues, goals, and consequences of their actions on organisations. Furthermore, regulatory authorities or policymakers could facilitate and encourage the effective implementation of green initiatives by providing additional incentives such as financial incentives, technical resources, governmental subsidies, tax breaks training, pilot green projects, and green awareness.

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Conflict of Interest Statement

The authors declared that they have no conflict of interest.

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