



Green pays off: the impact of corporate carbon strategies on corporate financial performance

Say Keat Ooi¹ · Seow Li Wong¹ · Yusuf Babatunde Adeneye²

Received: 6 May 2023 / Accepted: 2 April 2024 / Published online: 16 April 2024
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Abstract

As climate change continues to be a pressing issue affecting businesses, firms are taking proactive measures by integrating carbon considerations into their overall strategic planning for environmental sustainability. Nonetheless, the question of whether it pays to be green remains inconclusively answered. Based on an analysis of the 200 largest public listed firms by market capitalisation in Malaysia, the findings indicated that most of the firms are still reactive in managing their carbon activities; however, corporate carbon strategy does, indeed, lead to better financial performance. The findings reaffirmed that going green pays off, particularly for firms with higher levels of foreign ownership. Interestingly, an inverse relationship was observed among firms with higher levels of government shareholdings. Additionally, the firms have been categorised into six different groups based on their scope and level of corporate carbon strategies, ranging from “wait-and-see” to “all-round explorer” classifications. Taken together, these findings enrich corporate carbon and sustainability literature and offer insights into theoretical and policy implications, along with suggestions for future research.

Keywords Corporate carbon strategy · Carbon management · Climate change · Financial performance · Sustainability

Introduction

The business model of “grow now, clean up later” has been in use since the beginning of the industrial era (UN Environment, 2019). However, the question arises as to whether it is acceptable to delay environmental cleanup. This question is critical to prevent irreversible damage to the environment, society, and the economy

✉ Say Keat Ooi
oosaykeat@usm.my

¹ Graduate School of Business, Universiti Sains Malaysia, 11800 Penang, Malaysia

² Faculty of Hospitality, Tourism & Wellness, Universiti Malaysia Kelantan, 16100 Kota Bharu, Malaysia

(IPCC, 2023). The global temperature during the pre-industrial era (1720–1800) was approximately 0.55–0.80°C cooler than in 2005 (Hawkins et al., 2017). Over the past decade, eight of the warmest years on record have occurred, with 2016 being the hottest year in history (UN Environment, 2019). Although the temperature increase may appear small, it has had a tremendous impact on the world. Many experts predicted that if global temperatures exceed 2°C, the risks of climate change will be magnified (IPCC, 2018, 2023; UN Environment, 2019). Climate change has a cascading effect, disrupting ecosystems, exacerbating extreme weather conditions, causing health problems, and impairing economic growth (IPCC, 2018, 2023; Tang, 2019; UN Environment, 2019). Therefore, climate change is no longer solely an environmental issue, it has evolved into a multidimensional challenge affecting society, economic patterns, and business operations (Adeneye et al., 2021; Howard-Grenville et al., 2014; IPCC, 2023; Ooi et al., 2019; Ooi & Amran, 2018).

The impact of climate change is unequivocal, and addressing anthropogenic climate change requires transformative changes at all levels of organisations to drastically reduce greenhouse gas (GHG) emissions, the primary cause of global warming. While global initiatives such as the Kyoto Protocol in 2005 and the Paris Agreement in 2015 have been implemented to limit GHG emissions, reports by the UN Environment (2019) and the IPCC (2023) suggest that these commitments are still insufficient to slow down global warming. The Intergovernmental Panel on Climate Change (IPCC) reported that most GHG emissions result from human activities, with two-thirds of these activities originating from business processes (Dahlmann et al., 2019; Damert et al., 2017; Howard-Grenville et al., 2014; IPCC, 2018). As primary polluters and profit-making entities, business bear significant and inevitable responsibilities to reduce their GHG emissions and contribute to the goal of limiting global warming to below 1.5°C by 2050 (Besio & Pronzini, 2014; Dahlmann et al., 2019; UN Environment, 2019).

Despite the growing awareness of the importance of carbon mitigation strategies, some firms remain hesitant to incorporate these strategies into their business plans. This reluctance may be attributed to a lack of motivation and the perception that carbon management activities will have a negative impact on their financial performance (Busch & Hoffmann, 2011). Nevertheless, achieving superior financial performance is always a primary goal for businesses, and positive financial returns can serve as a motivating factor for engaging in climate change mitigation activities (Clarkson et al., 2011; Lewandowski, 2017; Ooi et al., 2018). As such, researchers have extensively studied the relationship between carbon performance and financial performance over the years (Busch et al., 2022; Busch & Friede, 2018; Busch & Hoffmann, 2011; Busch & Lewandowski, 2018; Trinks et al., 2020). While most studies demonstrate a positive connection, several studies have reported negative and mixed results (Busch et al., 2022; Delmas et al., 2015; Endrikat et al., 2014; Horváthová, 2010). Therefore, more future studies are required from different perspectives and approaches to achieve a comprehensive understanding of this relationship (Busch et al., 2022; Damert et al., 2017; Endrikat et al., 2014; Lee, 2012).

Moreover, while it is widely acknowledged that climate change has a global impact, previous literature has suggested that its effects will be more severe in under-developed and developing nations (Adeneye et al., 2021; UN Environment, 2019).

This is attributed to the heavy reliance of many of these countries on industries that are vulnerable to climate change, such as agriculture, forestry, and fisheries (Tang, 2019; UN Environment, 2019). In Malaysia, for instance, agriculture constitutes a significant portion of the country's gross domestic product (GDP), contributing 7.9% to the overall GDP (Tang, 2019). Therefore, it is imperative to prioritise the fight against global warming and climate change in developing countries like Malaysia. However, previous literature has indicated a lack of research on carbon strategy and climate change in developing nations (Manrique & Martí-Ballester, 2017).

Hence, motivated by existing gaps in the literature, this study aims to comprehensively understand the corporate carbon strategies and practices adopted by business corporations in Malaysia, a developing country. Simultaneously, it investigates the relationship between carbon strategy and financial performance. To clarify this relationship, the study also explores the effects of carbon strategy on financial performance, contingent on various firm characteristics, including government ownership, foreign ownership, climate sensitive industry, and firm size. In sum, this study makes a threefold contribution. First, it provides valuable insights into the patterns and extent of carbon performance and strategy adoption by firms operating in Malaysia. Second, it contributes to the ongoing debate on "Does it pay to be green?" by examining the relationship between carbon strategy and financial performance in the Malaysian context, using a range of carbon management activities. Third, it addresses the question of "When does it pay to be green?" by investigating the moderating effects of firm size, government ownership, foreign ownership, and climate sensitive industry on the relationship between corporate carbon strategy and financial performance.

Corporate carbon strategy

Corporate carbon strategy is a crucial aspect of sustainability in business operations. It encompasses a set of carbon management activities integrated into a firm's strategy to address climate change-related issues (Jeswani et al., 2008; Kolk & Pinkse, 2005; Lee, 2012; Weinhofer & Hoffmann, 2010). This integration makes it a core component of their operations, which subsequently translates into corporate carbon performance (Damert et al., 2017). Implementing a successful corporate carbon strategy offers numerous advantages, including cost savings, increased operational efficiency, enhanced reputation, and greater competitiveness. Therefore, corporate carbon strategy is gaining increasing importance among stakeholders, including customers, investors, and regulators (Cadez et al., 2019; Damert et al., 2017; Endrikat et al., 2014; Ooi et al., 2018; Rokhmawati et al., 2017).

There are various carbon management activities. For instance, Lee (2012) proposed a comprehensive framework consisting of six key carbon management activities, including emission reduction commitment, process and supply improvement, organisational involvement, product improvement, external relationship development, and new market and business development. On the other hand, Jeswani et al. (2008) categorized corporate strategy into two main groups: management activities and operational activities for energy efficiency and GHG reduction. Additionally,

Damert et al. (2017) presented a corporate strategy framework comprising three strategic objectives: carbon governance, carbon reduction, and carbon competitiveness. Each of these objectives is associated with corresponding activities such as risk management, carbon compensation, stakeholder engagement, carbon measurement, policy development, as well as product and process improvements. Meanwhile, Ooi and Amran (2018) outlined key aspects of carbon management, including governance, management engagement and actions, strategic analysis, GHG emissions, risk and opportunities related to climate change, as well as future outlook and external affairs.

Corporate carbon strategy inherently varies based on the specific business plan (Adu et al., 2023; Cadez et al., 2019; Lee, 2012). By assessing a firm's proactivity in various carbon management activities, it becomes possible to identify the corporate carbon strategy and assess carbon performance. Subsequently, the short-term and long-term outcomes of a firm's response to climate change can be determined (Damert et al., 2017; Delmas et al., 2015; Horváthová, 2010). This assessment may lead to the estimation of eventual economic benefits (Adeneye et al., 2021). Accordingly, firms across various sectors have been increasingly embracing green practices as part of their carbon strategies to mitigate carbon footprint. These green practices encompass waste recycling, the adoption of circular economy principles, and the development of strategies focused on energy efficiency, renewable energy, and technological innovation (Khan, Tabish, & Yu, 2023; Khan, Tabish, & Zhang, 2023; Khan, Yu, Ridwan, et al., 2023). This reflects a broader shift towards more sustainable corporate practices, which are not only environmentally beneficial but also strategically advantageous in today's business landscape.

Linking carbon strategy and financial performance

Over the past few decades, the idea that a firm could derive financial benefits from improved environmental performance has spurred extensive research in this area (Busch & Lewandowski, 2018; Endrikat et al., 2014). Hence, the question of whether "going green" yields financial rewards has become a central focus in the field of environmental management studies (Farza et al., 2021; Lewandowski, 2017). Despite the considerable volume of research dedicated to exploring this relationship, the results have yielded mixed and inconclusive findings (Busch & Hoffmann, 2011; Delmas et al., 2015; Endrikat et al., 2014; Horváthová, 2010; Iwata & Okada, 2011; Lee & Min, 2015). As a result, there has been a recent surge in interest in connecting carbon performance with financial performance to assess the sensitivity and robustness of these findings (Busch et al., 2022).

Basically, studies providing evidence for a positive relationship echo the principle put forth by Clarkson et al. (2011), asserting that environmentally friendly practices can create a win-win scenario. A longitudinal study of international firms by Trinks et al. (2020) confirmed superior financial performance in carbon-efficient businesses. In essence, these researchers contend that if carbon management activities yield favourable results in terms of cost reduction, improved reputation, heightened employee morale, and related factors, implementing such activities can enhance

corporate financial performance (Busch & Hoffmann, 2011; Farza et al., 2021; Ooi et al., 2018). For instance, Khojastehpour and Johns (2014) discovered a positive connection between corporate environmental responsibilities, corporate image, and profitability. Similarly, Lee and Min (2015) confirmed that investment in green research and development for eco-innovation is positively linked to improved corporate financial performance. Additionally, a meta-analysis conducted by Busch and Lewandowski (2018) revealed that carbon performance is positively associated with financial performance, irrespective of the type of financial metrics used.

It may appear that businesses responding to environmental concerns face additional costs and financial obligations (Adu et al., 2023; Brouwers et al., 2018; Lee & Min, 2015). As such, García-Sánchez and Prado-Lorenzo (2012) have argued that firms do not receive immediate financial rewards for improving their GHG emission performance, in fact, their short-term financial performance may be negatively affected by carbon emission reductions (Delmas et al., 2015; Iwata & Okada, 2011; Lee & Min, 2015). This inverse relationship may primarily be attributed to the fact that the benefits of improved carbon performance may not be immediately evident (Busch et al., 2022). However, while corporate carbon performance may have a negative impact on short-term financial performance, it can yield favorable results in the long run (Delmas et al., 2015).

Apart from these two contrasting findings, there exists a substantial body of research that yielded mixed results or demonstrated a *U-shaped* relationship. For instance, Ganda (2018) investigated the impact of carbon performance on financial performance in South Africa, a developing country. The study revealed a positive relationship between carbon performance and both return on equity (ROE) and return on sales (ROS), while it indicated a contrary association with return on investment (ROI) and market value added (MVA). Meanwhile, Busch et al. (2022) provided evidence of a positive link between carbon emissions and return on assets (ROA), reflecting short-term financial gain, and they also found that greater carbon emissions correlate with long-term financial performance, implying that carbon efficiency does not necessarily lead to better corporate financial performance (Brouwers et al., 2018). On the other hand, a *U-shaped* relationship was observed by Barnett and Salomon (2012), leading them to conclude that the highest financial returns are only achieved in two extreme scenarios, either through very high or very low involvement in carbon management activities.

Hence, these conflicting findings have spurred additional studies to uncover the causes of these disparities. In addition to exploring the question, “Does it pay to be green?”, scholars have also begun to question “When does it pay to be green?” (Busch & Lewandowski, 2018; Lewandowski, 2017). Drawing on the extant literature, researchers have proposed several factors that may influence the relationship between carbon performance and financial performance. These factors encompass the types of environmental performance and carbon measures used, the geographic region, the industry in which a firm operates, and ownership structures (Endrikat et al., 2014; Horváthová, 2010; Manrique & Martí-Ballester, 2017; Ooi et al., 2018), as well as firm size (Busch et al., 2022; Jeswani et al., 2008). Meta-analyses have generally indicated a weak positive relationship between carbon performance and financial performance. In response to call for moderating analysis (Farza et al.,

2021), various moderating factors that may strengthen the relationship between carbon performance and financial performance were examined to draw valuable insights.

Theoretical bases and hypotheses development

As the debate on “Does it pay to be green?” continues, it can be approached from two primary perspectives: the “negative traditionalist” and the “positive revisionist” (Farza et al., 2021). According to the negative traditionalist perspective, investment in environmental performance increases operating costs, ultimately negatively impacting financial performance (Brouwers et al., 2018; Delmas et al., 2015; Horváthová, 2010). In contrast, the “revisionist” argument posits that engagement in environmental improvements can lead to a win-win situation by enhancing operational efficiency (Clarkson et al., 2011; Endrikat et al., 2014). Therefore, this paper seeks to address this debate by examining the relationship between corporate carbon performance and financial performance within the context of a developing country, integrating three complementary theories: legitimacy theory, stakeholder theory, and the natural resource-based view (NRBV) (Damert et al., 2017; Endrikat et al., 2014; Gallego-Álvarez et al., 2015; Ganda, 2018; Lee & Min, 2015; Lewandowski, 2017; Rokhmawati et al., 2017).

As climate change risks and uncertainties become increasingly prominent concerns for business stakeholders, the expectations of businesses are evolving. This shift in expectations has led to the emergence of legitimacy gaps, which can be detrimental to non-pragmatic businesses (Damert et al., 2017; Datt et al., 2019; Ooi et al., 2018). To bridge these legitimacy gaps, businesses are now anticipated to actively engage in climate change mitigation efforts. By doing so, they can maintain their corporate legitimacy, cultivate a positive corporate reputation, secure stakeholder support, and enjoy a favourable reception from society (Damert et al., 2017; Ganda, 2018).

Stakeholder theory, closely associated with legitimacy theory, has played a significant role in shaping business responses to climate change performance and its impact on financial performance (Ooi et al., 2018). To ensure a firm’s sustainability and growth, it is imperative to address the interests of both internal and external stakeholders (Endrikat et al., 2014; Rokhmawati et al., 2017). Hence, businesses must enact effective carbon strategies to meet stakeholders’ expectations, especially as concerns about climate change intensify (Cadez et al., 2019; Damert et al., 2017; Ganda, 2018; Rokhmawati et al., 2017). Based on extant studies, effective stakeholder management can yield several advantageous outcomes, including reduced market risk, enhanced business reputation, attraction of environmentally conscious customers, improved long-term relationships with suppliers, and the acquisition of competitive advantages. These benefits ultimately contribute to an enhancement in corporate financial performance (Damert et al., 2017; Endrikat et al., 2014).

In addition to the stakeholder perspective, several researchers have leveraged the Natural Resource-Based View (NRBV) to elucidate the positive impacts of corporate responses to carbon issues on financial performance (Endrikat et al.,

2014; Gallego-Álvarez et al., 2015 ; Lee & Min, 2015). NRBV is an extension of the Resource-Based View (RBV), originally formulated by Barney (1991) to substantiate the notion that a firm's competitive advantage hinges on the possession of bundles of diverse capabilities and resources that are rare, challenging to replicate, and not easily substituted. As environmental challenges and pressures have grown more formidable for businesses, Hart (1995) proposed the integration of natural environmental factors into the existing framework, giving rise to the NRBV (Gallego-Álvarez et al., 2015; Lee & Min, 2015). According to the NRBV, firms that develop the capability to address environmental challenges can attain competitive advantages and achieve positive financial performance. These capabilities are considered scarce and expensive to imitate within organisational resources (Endrikat et al., 2014). From the NRBV perspective, by embracing eco-innovation and development, firms can attain several favourable outcomes, including enhanced production efficiency, improved reputation, heightened appeal to employees and consumers, and reduced operational costs (Endrikat et al., 2014; Lee & Min, 2015).

Hence, based on the described theories, it is sensible to propose that firms that adopt corporate carbon strategies are more likely to gain competitive advantages and eventually attain superior financial performance. This leads to the formulation of the first hypothesis:

H1: Higher extent of corporate carbon strategy is associated with higher corporate financial performance.

Past studies have suggested that firm characteristics, including size, industry, and ownership may influence the relationship between corporate carbon strategies and corporate financial performance (Amran et al., 2012; Horváthová, 2010; Jeswani et al., 2008). To extensively investigate the association between corporate carbon strategies and financial performance in the Malaysian context, this study examines these firm characteristics as moderators to address the question, “when does it pay to be green?”.

Numerous researchers have suggested that firm size is a crucial determinant in shaping an organisation's response to corporate carbon strategies (Endrikat et al., 2014). Larger firms often exhibit distinct responses when compared to their smaller counterparts (López-Pérez et al., 2017). The greater size of these firms frequently exposes them to heightened levels of stakeholder pressure and scrutiny (Datt et al., 2019). In line with stakeholder theory and legitimacy theory, larger firms are more likely to implement environmental mitigation actions as a means to sustain their competitive advantages. Previous studies have supported this by demonstrating that larger firms outperform smaller firms in terms of environmental disclosure (Brammer & Pavelin, 2008). Furthermore, viewed through the resource-based perspective, larger firms possess more extensive access to resources, enabling them to make more substantial contributions to carbon strategies (Adu et al., 2023; Clarkson et al., 2011; Weinhofer & Hoffmann, 2010), which can, in turn, translate into superior financial performance. This leads to the second hypothesis:

H2: The positive relationship between corporate carbon strategy and corporate financial performance is expected to be stronger in larger firms.

Besides firm size, the industry in which a firm operates plays a crucial role. Certain industries exert a more significant impact on the environment than others (Amran et al., 2012). Some researchers have proposed that the relationship between carbon strategies and financial performance is contingent upon the climate sensitivity industry (Naranjo Tuesta et al., 2020). This could be attributed to the fact that climate sensitive industries face stronger coercive pressures, leading firms within these industries to actively engage in environmental initiatives to maintain their legitimacy. For instance, businesses operating in highly polluting industries experience greater pressure from stakeholders, such as governmental bodies and the public, to reduce their carbon emissions (Datt et al., 2019). Such pressures can lead firms to incorporate carbon mitigation measures into their overall business strategies (Weinhofer & Hoffmann, 2010). This assumption is supported by the findings of Brammer and Pavelin (2008) and Amran et al. (2012), who observed that firms within climate sensitive industries are more inclined to adopt climate change disclosure and mitigation strategies. Therefore, the third hypothesis proposed:

H3: The positive relationship between corporate carbon strategy and corporate financial performance is expected to be stronger in firms within climate sensitive industries.

According to Amran et al. (2012), a firm's ownership structure can exert an influence on its climate mitigation initiatives. Previous studies have investigated the moderating impact of government ownership and foreign ownership on environmental performance (Amran et al., 2012; Ooi et al., 2018). It has been suggested that government-linked firms, owing to their heightened accountability to the public and extensive political connections, are more inclined to perform better in corporate carbon strategies (Amran et al., 2012; Liu et al., 2019). Similarly, there is evidence indicating that firms with foreign ownership tend to participate actively in corporate carbon strategies (Haniffa & Cooke, 2002). This is often attributed to the fact that many multinational corporations adopt and replicate the environmental practices of their parent firms (Amran et al., 2012). As such, it is reasonable to propose that both government and foreign ownership have a positive influence on the implementation of corporate carbon strategies, ultimately leading to enhanced corporate financial performance. With that, the fourth and fifth hypotheses are proposed as follows:

H4: The positive relationship between corporate carbon strategy and corporate financial performance is expected to be stronger in firms with higher government ownership.

H5: The positive relationship between corporate carbon strategy and corporate financial performance is expected to be stronger in firms with higher foreign ownership.

Based on the preceding theoretical discussion and hypotheses development, Fig. 1 illustrates the conceptual model of this study.

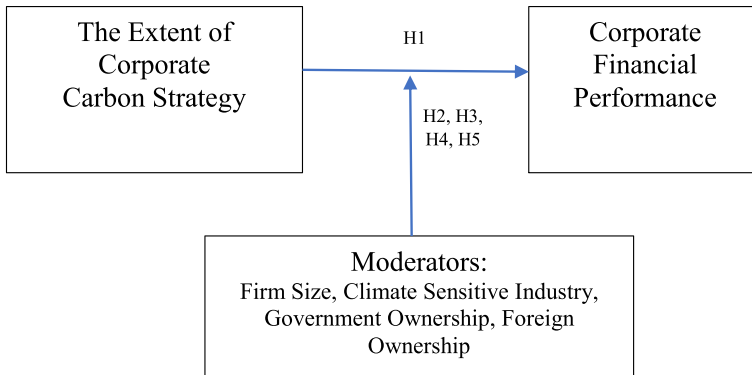


Fig. 1 Conceptual model

Research method

Samples and data collection

The aim of this study is to investigate the corporate carbon strategies adopted by Malaysian firms and their relationship with financial performance. To attain this objective, an exploratory research technique, namely content analysis, was employed to gain a deeper understanding and insights within this context. Content analysis is a scientific technique involving the systematic and objective examination of secondary data, such as texts and printed materials, to gain insights and information regarding a specific phenomenon (Krippendorff, 2019). This method is widely used in environmental management research for two main reasons. First, content analysis enables researchers to systematically and objectively assess and categorize a substantial volume of recorded content to generate valuable insights and information (Krippendorff, 2019; Lee, 2012; Ooi et al., 2018; Ooi et al., 2019). Second, it is known for its relatively non-intrusive nature and cost-effectiveness compared to other research methods (Krippendorff, 2019).

In this content analysis, a sample of 200 firms listed on the main board of Bursa Malaysia with the largest market capitalization in 2020 was identified for investigation. However, consistent with previous studies, financial service providers were excluded for two main reasons. Firstly, financial service providers are subject to different reporting requirements and regulations, which may result in fundamental differences in capital market decisions (Busch et al., 2022; Ooi et al., 2018). Secondly, businesses within the financial sector typically engage in activities associated with lower carbon emissions and tend to have lower ROAs due to different financial performance calculation, which may potentially exert adverse effects on the study's outcomes (Busch et al., 2022; Delmas et al., 2015).

In order to conduct a content analysis on these 200 firms, their corporate annual reports and sustainability reports were collected. Corporate annual reports are widely recognized as essential tools for disseminating a firm's financial and non-financial performance information, including its environmental initiatives (Ooi et al., 2019). It is

noteworthy that in 2006, Bursa Malaysia introduced a mandatory requirement for sustainable reporting in the listing criteria (Bakar et al., 2019). Subsequently, the regulatory body issued a sustainability guide to provide comprehensive instructions for business owners, emphasizing the inclusion of sustainability statements within their annual reports. One of the pivotal elements emphasized in this sustainability guide pertains to environmental practices (Adeneye et al., 2021). Therefore, the corporate annual reports serve as a reliable and valuable data source for the analysis in this study.

Organisational profile

Based on the industry classification on Bursa Malaysia, the 200 selected firms belong to 11 sectors, including consumer products and services (21.5%), industrial products and services (14%), property (14%), plantation (11.5%), construction (8%), technology (6.5%), energy (6.5%), healthcare (5%), transportation and logistics (4.5%), utilities (4.5%), and telecommunications and media (4%).

Measurements of variables

To measure the independent variable—corporate carbon strategies, a systematic assessment instrument was developed based on the six carbon management activities delineated by Lee (2012). These activities encompass emission reduction commitment, product improvement, process and supply improvement, new market and business development, organizational involvement, and external relationship involvement. Each firm's level of proactivity in these six activities was evaluated based on a five-point Likert scale, with a rating of 1 indicating a reactive/low involvement and 5 signifying a proactive/high involvement (please refer Appendix. Table 5 for the measurement scale).

One of the fundamental considerations in content analysis is its reliability (Krippendorff, 2019). To ensure the accuracy and validity of the content analysis, a multiple coder approach, as suggested by Milne and Hackston (1996), was adopted to determine the consistency among coders. Consistent with previous studies, two coders individually assessed the data to determine the inter-coder reliability (Ooi & Amran, 2018). Inter-coder reliability, which assesses the agreement among coders, is typically measured using Krippendorff's alpha, a widely accepted standard. Referring to Table 1, the Krippendorff's alpha obtained was 0.878, indicating the establishment of an acceptable level of reliability for the content analysis (Hayes & Krippendorff, 2007; Ooi & Amran, 2018).

The dependent variable, corporate financial performance, was measured using several widely used indicators, including ROA, ROE (accounting-based measures), and Tobin's *Q* (market-based indicator) (Busch & Hoffmann, 2011; Busch & Lewandowski, 2018). ROE, which quantifies the return on stockholders' equity, was defined as the

Table 1 Krippendorff's Alpha reliability estimate

	Alpha	95% confidence interval	Units	Observers	Pairs
Ordinal	0.8780	[0.8430, 0.9085]	200	2	400

ratio of net income to stockholders' equity, while ROA, which measures operational performance, was computed as the ratio of net income to total assets (Busch et al., 2022; Busch & Hoffmann, 2011; Gallego-Álvarez et al., 2015). Tobin's Q , a commonly used measure for assessing long-term financial performance, reflects a firm's reputation, investor risk, and trustworthiness (Busch et al., 2022; Busch & Hoffmann, 2011). It is calculated by dividing the market value of liabilities and assets by the total asset value (Busch et al., 2022).

In this study, several moderators were considered. Accordingly, market capitalization was used as a proxy for firm size (Busch et al., 2022); government and foreign ownership were measured by calculating the total percentages of government and foreign ownership among the top 30 shareholders in the firms (Amran et al., 2012); and lastly, climate sensitive industries were categorised based on the classification by the UNFCCC (2009). Power supply, industrial products, forestry, agriculture, transport, buildings, fossil fuels, and waste were classified as climate-sensitive industries, while all other industries were considered as less climate sensitive.

Data analysis and findings

This study employed two phases of data analysis. The first phase involved cluster analysis, while the second phase focused on relationship testing. To determine the optimal number of clusters for the analysed data, Ward's method (a hierarchical clustering procedure) was used. The K -means method (a non-hierarchical clustering procedure) was then used to assign the 200 investigated firms into the identified clusters, which is a commonly used approach in clustering analysis (Reza & Ruhi, 2015). In the second phase, for relationship testing, non-parametric partial least squares structural equation modeling (PLS-SEM) was applied to analyse the data (Hair et al., 2019; Ooi & Amran, 2018). This technique was used to examine the relationship between independent and dependent variables, as well as the potential moderating effects (Ooi et al., 2019; Yeap et al., 2022).

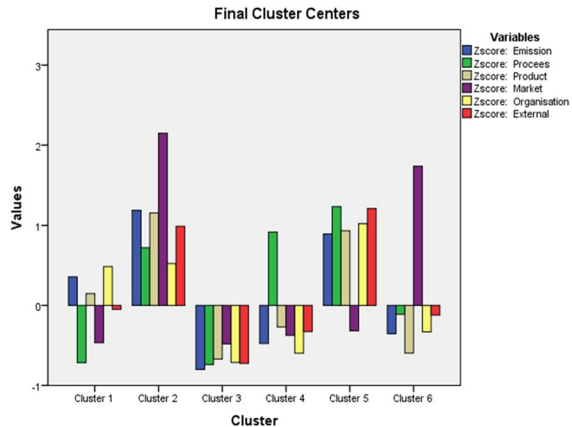
Corporate carbon strategy clusters

Based on the clustering procedures, six distinct corporate carbon strategy clusters were identified within the sample of 200 firms. Figure 2 displays the clustering results based on standardised means (Z scores). Each of these clusters exhibits its unique characteristics and demonstrates varying degrees of involvement in the assessed carbon management activities. Descriptions for each of these identified clusters are presented as follows.

(1) Cautious reducer

Moderately engaged in carbon management activities such as carbon emissions reduction, processes improvement, and organizational participation, this cluster primarily remains in the early stages of their initiatives. For example, they set general carbon emissions reduction targets and implement eco-friendly projects that involve employees within the firm. Firms in this cluster exhibit relatively lower scores in

Fig. 2 Clusters analysis
(*K*-means method)



product improvement and new market development. This cluster closely resembles the “cautious reducer” category identified by Lee (2012), the “reducer” category noted in Weinhofer and Hoffmann (2010), and the “emergent planners” category identified in Kolk and Pinkse (2005).

(2) All-round explorer

The firms within this cluster score relatively high in most carbon management activities. They actively seek opportunities for new market and business development while concurrently enhancing their carbon performance within existing business domains. These all-round explorers consistently set ambitious carbon reduction targets, devise plans for process improvements, and demonstrate a strong sense of responsibility toward environmental sustainability.

(3) Wait and see

The third cluster, labeled the “wait and see” cluster, as implied by its name, consistently scores low across all carbon management activities—a noticeable contrast to the proactive all-round explorer cluster. These firms generally display minimal engagement and limited interest in carbon management and climate change mitigation efforts. Notably, prior research has identified similar clusters, such as the “cautious planner” in Kolk and Pinkse (2005) and the “indifferent” category in Jeswani et al. (2008).

(4) Product and process enhancer

The firms within this cluster prioritize product and process improvements but achieve relatively lower scores in other carbon management activities. Their primary focus lies in the development of eco-friendly products, aiming to attract a broader customer base, while simultaneously enhancing their processes and supply chain to enhance energy efficiency.

(5) All-round enhancer

Similar to the all-round explorer cluster, the all-round enhancer cluster achieved high scores across most carbon management activities. The key difference, however, lies in the all-round enhancer cluster’s relatively low score in the realm of new market and business development. These firms tend to place a greater emphasis on enhancing carbon performance within their existing operations rather than venturing

into new markets associated with climate mitigation. A comparable cluster with this focus was also identified by Lee (2012).

(6) Emergent explorer

The final cluster identified presents a contrast to the all-round enhancer cluster. Firms within this cluster lean towards exploring new markets while allocating relatively less attention to enhancing carbon management within their current business operations. Most of these firms actively invest in environmentally friendly ventures, such as renewable energy projects.

Based on the clustering results, this study examined the patterns of corporate carbon strategies adopted by 200 Malaysian firms (refer Fig. 2). Table 2 provides an overview of the cluster analysis findings, presenting the mean scores for all carbon management activities within each identified cluster.

As depicted in Table 2, more than one-quarter of the investigated firms were in the “wait and see” cluster (28.5%). The “cautious reducer” cluster ranked second, comprising approximately 23.5% of the total sample. The “all-round explorer” and “emergent explorer” clusters each included 18 firms, constituting 9% of the total sample for each. Lastly, the “product and process enhancer” cluster encompassed 29 firms (14.5%), while the “all-round enhancer” cluster accommodated 31 firms (15.5%).

The extent of corporate carbon strategy and corporate financial performance

From the results of the PLS-SEM analysis, it is evident that a significant relationship exists between corporate carbon strategies and corporate financial performance. As shown in Table 3, the path coefficient for this relationship was 0.214 with a p -value of <0.01 , providing strong support for H1. In simpler terms, greater involvement in corporate carbon strategies is linked to improved corporate financial performance.

Moderating effects of firm characteristics

This study examines the moderating effects of four firm characteristics (firm size, government ownership, foreign ownership, and climate sensitive industry) on the relationship between corporate carbon strategies and corporate financial performance. The findings are reported in Table 4. Based on the findings, only two of the moderating effects (government ownership and foreign ownership) showed statistically significant results. The moderating effect of foreign ownership on the relationship between corporate carbon strategy and corporate financial performance was notable at 0.286 ($t = 4.025$, $p < 0.01$), indicating a positive effect on the tested relationship and supporting H5. However, the moderating effect of government ownership, though statistically significant, exhibited a negative influence ($\beta = -0.133$, $p < 0.05$) contradicting the proposed hypothesis, and thus leading to the rejection of H4.

The slope analysis depicted in Fig. 3 reinforces the findings. Referring to Fig. 3a, it becomes apparent that firms with lower government ownership outperform their counterparts with higher government ownership in terms of financial

Table 2 Cluster analysis and mean scores for all carbon management activities among the identified clusters

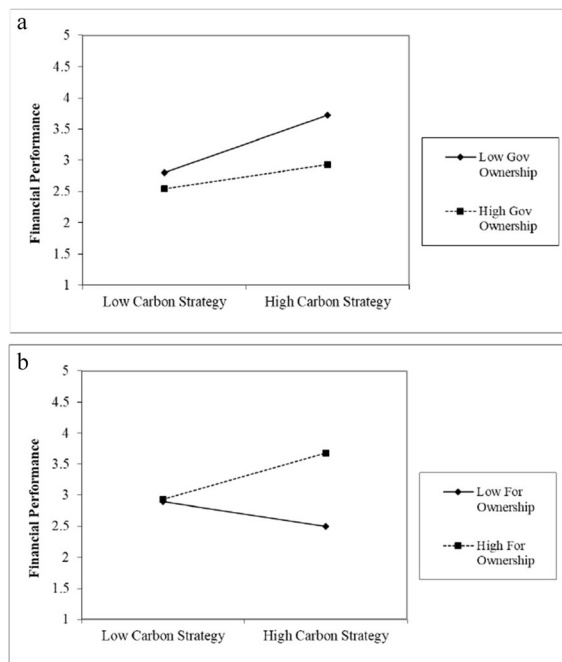
Carbon management activities	Cautious reducer	All-round explorer	Wait and see	Product and process enhancer	All-round enhancer	Emergent explorer
Emission reduction commitment	2.98	4.08	1.47	1.90	3.68	2.06
Product improvement	1.15	2.78	1.12	3.00	3.35	1.83
Process and supply improvement	3.45	4.28	2.77	3.10	4.10	2.83
New market and business development	1.09	3.56	1.07	1.17	1.23	3.17
Organisational involvement	2.57	2.61	1.40	1.52	3.10	1.78
External relationship involvement	2.28	3.83	1.26	1.86	4.16	2.17
Total firms (<i>n</i>)	47	18	57	29	31	18
(%)	23.50%	9.00%	28.50%	14.50%	15.50%	9.00%

Table 3 Direct relationship testing

Relationship	Path coefficient	Std. error	<i>t</i> -value	95% confidence interval	<i>f</i> ²
Carbon strategy -> financial performance	0.214	0.087	2.462**	[0.072, 0.332]	0.048

***p* < 0.01**Table 4** Indirect relationships testing

Moderating effects	Path coefficient	Std. error	<i>t</i> -value
Carbon strategy*government ownership -> financial performance	-0.133	0.066	2.021*
Carbon strategy*foreign ownership -> financial performance	0.286	0.071	4.025**
Carbon strategy*climate sensitive industry -> financial performance	-0.139	0.091	1.519
Carbon strategy*firm size -> financial performance	-0.011	0.089	0.126

p* < 0.05; *p* < 0.01**Fig. 3** **a** Slope analysis—government ownership as moderator. **b** Slope analysis—foreign ownership as moderator

performance. The positive relationship between corporate carbon strategy and corporate financial performance is indeed stronger in firms with lower government ownership. On the other hand, firms with higher levels of foreign ownership exhibit better financial performance when actively engaging in corporate carbon strategies. Figure 3b illustrates that the positive relationship between corporate

carbon strategy and corporate financial performance is stronger in firms with higher levels of foreign ownership.

Lastly, it is interesting to note that neither firm size nor the climate sensitive industry exhibited any moderating effects on the tested relationship. Therefore, both H2 and H3 hypotheses were rejected.

Discussion

This paper addresses climate change mitigation by assessing three key components that offer insights for future action plans. First, it analyzes the carbon strategies adopted by firms operating in Malaysia. Second, the study explores the relationship between the extent of corporate carbon strategies and financial performance based on the stakeholder theory, legitimacy theory, and NRBV. Third, the research incorporates firm characteristics, such as size, ownership, and industry of operation, as moderators to investigate their impact on the examined nexus within the Malaysian context.

Based on the findings, it is evident that despite various initiatives by the Malaysian government, such as providing fiscal incentives and tax exemptions for environmentally friendly operations (Amran et al., 2018), the adoption of carbon strategies by businesses in Malaysia remains sluggish, regardless of their respective sectors. More than a quarter of the firms fell into the “wait and see” category, while another quarter were classified as “cautious reducers.” Firms in both groups exhibit a low to moderate commitment to enhancing their carbon management practices. These results align with the findings of Ooi and Amran (2018), who also noted that engagement and reporting on climate change mitigation in the Malaysian business sector are still relatively limited.

Additionally, most of the firms showed limited activity in expanding into new markets relevant to low-carbon operations. Several possible explanations can be considered for this observed situation. Firstly, it may be attributed to the insufficient support and incentives provided by regulatory authorities (Amran et al., 2018; Seles et al., 2018). Consequently, firms may lack the interest and motivation to proactively engage in advancing their carbon management activities. Secondly, it is possible that the level of public awareness has not reached the anticipated heights.

Stakeholder theory and legitimacy theory posit that public pressure can compel businesses to establish low-carbon operations as part of their efforts in climate change mitigation. Businesses are required to align with stakeholder expectations in order to preserve their reputation, legitimacy, and competitive edge. However, if stakeholder expectations regarding environmentally sustainable operations are minimal or confined to specific sectors (Rokhmawati et al., 2017 and Seles et al., 2018), the pressure on firms diminishes, potentially leading to reduced motivation for active involvement in carbon management activities. Additionally, businesses may still perceive investments in low-carbon operations or environmental-friendly technologies as costly and potentially detrimental to their financial performance. In fact, most officers in Malaysian corporations are not aware of the opportunities and benefits that carbon management activities can bring to businesses (Begum & Pereira, 2011).

This is in accordance with neoclassical economics which holds a high regard that environmental improvements can potentially harm financial performance by reducing the availability of firm resources.

Based on the regression analysis, the extent of corporate carbon strategy is positively related with corporate financial performance. Seemingly, firms that actively engage in corporate carbon strategies tend to achieve superior financial performance. This finding aligns with the “revisionist” perspective, where proactive involvement in carbon management activities leads to a win-win situation by improving operational efficiency (e.g., reducing costs, enhancing reputation) while mitigating the environmental impacts of business (Clarkson et al., 2011). Furthermore, it is consistent with previous literature, such as the work of Lee and Min (2015) and Busch and Lewandoski (2018).

An intriguing finding in this research pertains to the moderators that were tested. Surprisingly, only foreign ownership exhibited a positive moderating effect on the relationship between carbon strategies and financial performance. This result aligns with the findings of Ooi et al. (2018), who observed that norms in investors’ home countries and their level of awareness about climate change may lead them to advocate for climate change mitigation. According to legitimacy theory and stakeholder theory, firms must ensure their legitimacy and meet stakeholder expectations to sustain their operations. Therefore, in line with these theories, foreign investors may feel pressured to uphold the firm’s image. Failure to do so could result in “punishment” from stakeholders, such as penalties from local governments, consumer product boycotts, or protests by NGOs. Consequently, financial performance may suffer, and in the worst-case scenario, the firm may no longer be welcome in the host country.

On the contrary, government ownership has been found to have a negative effect on the relationship. Though this research hypothesised that government-linked firms are under higher public pressure and scrutiny, which would compel them to excel in carbon management and eventually contribute to superior financial performance, the findings showed otherwise. The involvement of government entities did not enhance the relationship between corporate carbon strategy and corporate financial performance; instead, it negatively moderated the relationship. This may be attributed to government-linked firms, may have difficulty aligning their carbon corporate strategies (a part of CSR) with the maximization of shareholder value (Long et al., 2020), and they may place excessive focus on improving the public good rather than the economic value of the firms.

Furthermore, it is surprising to discover that firm size and climate-sensitive industry have no significant effect on the relationship between corporate carbon strategy and corporate financial performance. This result aligns with several previous studies (Endrikat et al., 2014; Ooi et al., 2018). As climate change has evolved into a significant threat for all types of firms, carbon performance actions are likely to contribute to financial returns, regardless of firm size. Similarly, for industries vulnerable to climate change, the same reasoning may apply, where improving carbon strategies is likely to lead to an enhancement in financial performance, as climate change affects all industries.

Theoretical implications

Theoretically, this study contributes significantly to the existing body of knowledge by pioneering the integration of stakeholder theory, legitimacy theory, and NRBV to elucidate the relationship between corporate carbon strategy and corporate financial performance. This integration is expected to offer a comprehensive and holistic understanding of this linkage. These three theories mutually reinforce each other, thereby providing a robust argument for explaining and demonstrating the impact of implementing a corporate carbon strategy within a firm. The significant results obtained in this study (H1) highlight the imperative role of corporate carbon strategies in driving corporate financial performance, aligning with the existing literature (Busch & Hoffmann, 2011; Farza et al., 2021; Ooi et al., 2018).

Furthermore, this research highlights that even in developing countries, such as Malaysia, active engagement in carbon management activities can yield financial benefits for firms, irrespective of their size or industry of operation. This contribution enriches the field of carbon strategy research, particularly in the context of developing nations. While previous studies have explored the link between carbon performance and financial performance, this research distinguishes itself by employing a comprehensive assessment tool for measuring carbon management activities, following the approach proposed by Lee (2012). As Horváthová (2010) highlighted, the relationship between carbon strategies and financial performance is contingent on the measurement of environmental performance. This study, by employing a different assessment tool, provides novel insights into this relationship.

Moreover, existing meta-analyses have shown that the connection between carbon performance and financial performance remains inconclusive. This research addresses some of these gaps in the literature, offering a unique perspective from the vantage point of a developing country.

Practical implications

These findings offer valuable insights for policymakers and scholars to re-evaluate existing climate change mitigation practices in Malaysia's business sectors and devise viable solutions to enhance the current state. As emphasised in the Global Environment Outlook 6, environmental data plays a pivotal role in climate change decision-making, with the aim of fostering sustainable economic growth and preserving a healthy planet (UN Environment, 2019).

Practically, the results of this research provide guidance for policymakers and business leaders in the reassessment of current climate change mitigation practices within Malaysia. Given the level of corporate carbon strategy adoption and the specific carbon management activities examined in this study, it is imperative for relevant government agencies to review existing policies and establish regulatory frameworks and incentives to promote broader adoption among firms operating in Malaysia. These initiatives are essential to fulfil Malaysia's commitment to reducing GHG emissions by 45% by 2030 (Ooi & Amran, 2018).

Drawing on the insights from this study, policymakers can pinpoint areas where Malaysian firms may still exhibit reluctance in embracing carbon strategies. For instance, the research reveals that fewer than 20% of firms actively engage in the development of new environmental sustainability markets. Consequently, authorities such as the Ministry of Environment can design more enticing incentive programmes to stimulate the growth of markets like renewable energy. Furthermore, media outlets and non-profit organisations (NGOs) play crucial roles in elevating environmental awareness. They can advocate for environmental best practices and critique economic activities that contribute to environmental issues and hazards. Such actions will exert coercive pressure on businesses and encourage increased participation in carbon management activities.

Furthermore, given the positive impact of corporate carbon strategy on corporate financial performance, the government can leverage this relationship to incentivize and support businesses in their endeavours to engage in carbon mitigation activities, thus fostering a low carbon and sustainable economy. Notably, this research demonstrates that foreign ownership has a positive moderating effect on the relationship between corporate carbon strategy and financial performance. Consequently, policymakers may explore opportunities to encourage foreign investment in Malaysia's carbon management activities. Additionally, it is essential to investigate the reasons behind government ownership's negative moderating effect on the relationship between corporate carbon strategy and financial performance.

Finally, this research contributes to dispelling common misconceptions held by business owners regarding environmental improvement operations. Active participation in environmentally friendly activities does not burden financial performance but, conversely, enhances operational efficiency, leading to superior corporate financial performance.

Conclusion

Climate change has a detrimental impact on numerous sectors, including businesses. It is widely recognised that climate change poses significant business risks that cannot be overlooked. Neglecting to address climate change-related issues can result in catastrophic consequences, such as loss of competitive advantage and increased operating costs, among other adverse effects. In response to these challenges, firms have initiated the integration of carbon strategies into their overall business strategies. Nevertheless, due to varying levels of awareness, the adoption of corporate carbon strategies and carbon management activities may vary. This paper sheds light on the current state of carbon management practices in Malaysia and explores how the extent of corporate carbon strategies affects corporate financial performance.

The positive relationship uncovered in this study highlights that engagement in carbon management activities is not in conflict with the aim of any business to generate profits; instead, it can enhance corporate financial performance. This finding is instrumental in promoting and encouraging more businesses to invest in carbon management activities. Hence, businesses should proactively adopt corporate carbon strategies, considering the substantial positive relationship between carbon strategies and financial performance. Moreover, the moderating effect analysis revealed that firms with lower government ownership and higher foreign ownership exhibit a stronger positive relationship between corporate carbon strategies and financial performance. As such, policymakers in Malaysia should explore providing increased support and incentives for firms with these ownership characteristics to promote the adoption of carbon strategies.

This research has certain limitations that merit attention in future studies. Firstly, the present study relies on content analysis, a common approach for gaining insights into specific phenomena. To enhance these insights, future research could employ empirical analysis to examine the situation from an alternative perspective. For example, conducting a survey or interview-based analysis could investigate stakeholder expectations or business owners' perceptions of corporate carbon strategy. Secondly, as noted by Horváthová (2010) and Endrikat et al. (2014), the relationship between carbon performance and financial performance is influenced by various factors, including legal systems, institutional pressures, methods of carbon performance measurement, and economic incentives. Therefore, future studies might consider incorporating these factors to explore their potential conditional impact on the relationship between corporate carbon strategy and corporate financial performance. Lastly, a longitudinal study design could be considered to compare the outcomes between these two approaches, as demonstrated in the study by Busch et al. (2022).

Appendix

Table 5 Assessment scales for carbon management activities

Carbon management activities	Levels of involvement
1 Emission reduction commitment	1. Does not mentioned on carbon emission reduction targets 2. Plan to set target 3. Has general reduction targets 4. Has clear targets on emission reduction commitment 5. Has challenging targets and clear carbon emission measures
2 Product improvement	1. Does not mention on product improvement 2. Has the intention for product improvement 3. Several eco-friendly product examples 4. Has estimated product emissions and carbon-labelling 5. Has a clear and firm product improvement policy
3 Process and supply improvement	1. Does not mention process improvement 2. Has the intention to implement process improvement 3. Several energy-efficient/process improvement examples 4. Has established carbon inventory for the production process and/or has concrete examples of process improvement 5. Has extended process improvement to the supply chain (upstream/downstream)
4 New market and business development	1. Does not mention new market/business development 2. Have plan to enter to a new market/business development 3. Has a specific plan for entering a new market/business or for technology development for a new market/business 4. Puts the new market/business development plan into practice on a limited basis 5. Puts the plans into practice completely and/or has other positive consequences
5 Organisational involvement	1. Does not mention organisational involvement 2. Shows intention for organisational involvement 3. Takes action for organisational involvement such as training taskforce 4. Changes management systems for organisational involvement (e.g., an emission management system) 5. Takes concrete and wide-ranging action for organisational involvement
6 External relationship development	1. Does not mention external relationship building 2. Shows intention to cooperate with external stakeholders (particularly governments) but does not give details 3. Has plans to participate in voluntary programs with external stakeholders (e.g., voluntary green initiatives or the national pilot project on the ETS) 4. Takes initial action with regard to voluntary climate change initiatives and/or market mechanisms (e.g., the CDP, the ETS, or the CDM) 5. Takes concrete action with respect to and/or leads voluntary climate change initiatives and/or market mechanisms (e.g., industry climate change initiatives)

Author contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Say Keat Ooi, Seow Li Wong, and Yusuf Babatunde Adeneye. The first draft of the manuscript was written by Say Keat Ooi and Seow Li Wong, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data availability The data that support the findings of this study are available from the corresponding author upon request.

Declarations

Ethics approval Not applicable. This research did not involve any human participants and/or animals. The analysis was based on content analysis of published corporate reports.

Competing interests The authors declare no competing interests.

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