INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 13, Issue 2, (2024) E-ISSN: 2226-3624

The Relationship of Board Characteristics and Carbon Management Strategy of Listed Companies in Malaysia

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To Link this Article: http://dx.doi.org/10.6007/IJAREMS/v13-i2/21569 DOI:10.6007/IJAREMS/v13-i2/21569

Published Online: 26 May 2024

Abstract

There has been overwhelming scientific evidence that climate change presents severe risks to humanity, requiring an urgent global response to avoid its catastrophic impact. Board characteristics are critical in deciding a company's carbon management strategy since the board's makeup, competence, and dedication to sustainability have a substantial impact on the strategic decisions and policies implemented for environmental management. Diverse and competent boards are more likely to prioritise and effectively implement carbon-reduction plans and promote sustainable practices. The study's main objective was to investigate the relationship between board characteristics in terms of board size, board gender, board independence, educational level of board members and, nationality of board members, and carbon management strategy (CMS). 288 samples of publicly listed companies in Bursa Malaysia for the year 2016 had been examined. The data were collected from both annual reports and company websites. The results show that board characteristics don't impact carbon management strategy, challenging the idea that factors like gender diversity or independence directly drive sustainability efforts. Future research should look into other factors influencing CMS adoption. Companies need to expand their approach to integrating sustainability into board decisions, considering factors like stakeholder engagement and organizational incentives alongside board composition to improve commitment to initiatives like carbon management.

Keywords: Climate Change, Corporate Governance, Diversity and Boardroom

Introduction

In Malaysia, as a developing nation, addressing climate change is imperative, necessitating the implementation of carbon management strategies to mitigate carbon emissions. Despite

this urgency, there remains a notable absence of specific regulations mandating carbon disclosure reports in companies' annual reports (Bakar et al., 2019). This gap in regulatory mandates highlights the need for more accountability and transparency measures to address the escalating environmental concerns and support stakeholders in making well-informed decisions. Stakeholders have consistently called for corporate responsibility towards climate change, reflecting a growing demand for environmentally sustainable practices and transparency in business operations.

In line with the demand of stakeholders, board directors who serve as top management always claim that the action is environmentally clean. For instance, the board of directors should discuss strategies for reducing carbon emissions within a company or organization. They are responsible for the approval of methodologies used to assess "additionality" of current companies' performance and discussion about projects that may be able to reduce their carbon emissions. There is a strong reason for all companies and organizations to implement this strategy because the carbon management strategy plays a vital role in reducing emissions and turning the companies into low-carbon companies in the future (Damert et al., 2017). This is important to the board because these stakeholder groups are stressing this issue and putting pressure on the board of directors.

This study provides insights into the impact of board characteristics on carbon management strategies in Malaysian listed companies. Through analysing this relationship, investors and consumers acquire vital knowledge about the current trends in carbon management methods among Malaysian companies. This comprehension empowers individuals to make better-informed decisions, be it in terms of investment selections or consumer behaviours, thereby facilitating the advancement of environmentally sustainable practices within the corporate domain in Malaysia.

Many investors demand corporate information regarding the changing climate (Haque & Islam, 2015). An investor group hopes that the companies can disclose their carbon emissions data so that the group can determine their achievement as well as the ways or strategies for handling carbon emissions (VicSuper, 2016). When a company implements this strategy, it will strongly increase investors' confidence in the company or organization. They will believe that the company is making an effort to make a change in preventing the issue of climate change. Hence, the company will get more investment from those investors since they are practicing eco-type organizations.

For consumers, the carbon management strategies giving them ability to evaluate a company's commitment to sustainable practices. The comprehension of this concept enables consumers to make well-informed decisions, hence exhibiting a preference for businesses that prioritise environmental stewardship. In addition, by their support of these companies, customers play an active role in promoting the adoption of comparable methods, thus cultivating a culture of accountability and transparency among the corporate community. In essence, this research serves as a catalyst for promoting environmentally conscious company practices throughout Malaysia, so making a valuable contribution to the wider endeavours of environmental sustainability.

Literature Review

This section is structured into four sections: an overview of legitimacy theory and agency theory, which are crucial for understanding the empirical link between board characteristics and carbon management strategy; literature reviews on board characteristics and carbon

management strategy; a discussion of hypothesis development and a conceptual framework diagram.

Theoretical Perspectives

Legitimacy Theory

According to Suchman (1995), legitimacy was defined as the idea that the activities of the companies are applicable and fitting for the norms, values, and beliefs of society. Companies should ensure their activities are recognized by society and the public to fulfill the activities that fit society's norms, values, and beliefs (Islam & Deegan, 2010).

Legitimacy theory plays an important role in providing a solid perspective regarding the relationship between companies and social thoughts. The likelihood of the community providing strong power in recognizing these sustainable companies is high. To acknowledge and satisfy the requirements of the public, this theory emphasizes that companies should maintain their community position (Islam, 2017).

Furthermore, legitimacy theory explains the practices of companies in executing charity events and disclosing environmental information to fulfill their promises where the companies promise to execute events favored by the public. Hence, the companies will endorse their promises and accountability to keep their legitimacy in the people's eyes (Islam & Deegan, 2010).

Moreover, the companies' annual report disclosure can be considered as one of the ways to maintain legitimacy (Deegan, 2002). The larger the opportunity of adverse shifts in public predictions, the larger the necessity of trying to impact the adverse shifts through carbon management strategy. Hence, the information should be disclosed to the people by listing in the companies' annual reports. The companies should behave in line with the legitimacy theory, especially in this competing market. This will bring a positive image and reputation to the public, which will attract investors to invest in the companies and further increase profit and performance (Kamatra & Kartikaningdyah, 2015).

Agency Theory

The agency problem arises when the owners or savers who invest their money in companies need to play an active role in business management. The owners delegate their responsibilities to the managers to operate their business. The managers could lead to expropriating the owner's funds in a company for their own pockets. For example, suppose the owners or savers buy the shares of the companies. In that case, the managers can use that money from owners to acquire perquisites, pay excessive compensation, and make investments or decisions that can harm the interest of the outside investors (Jensen & Meckling, 1976).

Healy and Palepu (2001) have suggested several ways to overcome this agency problem. First, the optimal contract between the managers and investors, such as the compensation agreement and debt contract, helps to secure the interest of equity holders and debt holders. These contacts require managers to disclose relevant information. As a result, this will enable the investors to monitor the compliance of contracts to evaluate whether the managers manage the company's resources efficiently. The second mechanism is that the board of directors whom the shareholders appoint can monitor and discipline the management on behalf of outside shareholders. For example, the outside directors should ensure that the management acts accordingly to improve financial reporting quality (Cheng & Courtenay, 2006). Lastly, financial analysts and rating agencies can act as information

intermediaries to uncover misappropriation of management. This will lead to market corporate control, such as hostile takeovers and proxy contests to mitigate agency problems between the insiders and outside investors.

Voluntary disclosure, such as a carbon management strategy, can also reduce agency costs resulting from the emergence of information asymmetry between the contracting parties. Disclosure information enables shareholders to monitor managers through monitoring and bonding activities. Watson *et al* (2002) point out that those managers are incentivized to try and convince shareholders to act optimally and of the disclosure means of achieving this.

The agency costs may differ in companies that have different corporate environments, such as leverage, size, and listing status. Ball and Foster (1982) explain that highly leveraged companies tend to disclose more information to satisfy the needs of the loan holders and trustees. This will reduce the uncertainty of outside investors towards highly leveraged companies that disclose more, thus reducing the cost of capital. This is also related to the companies' size when larger companies tend to employ more leverage to use higher amounts of fixed-interest securities as a financing technique because of the tax advantages. Lastly, Ahmed and Courtis (1999) found that listing companies have a positive association with the disclosure level because listing companies reflect their responsive corporate reaction to regulatory requirements for more information.

Board Characteristics and Carbon Management Strategy

The positive relationship between board characteristics and carbon management strategy had stayed strong among most of the prior empirical studies. Most of the abroad researchers claimed that the carbon management strategy and board characteristics like board size, board gender, and the independence of the board had a positive relationship. Few researchers claimed that board size and carbon management strategy did not have any relationships.

Researchers such as Yunus et al (2016); Kılıç and Kuzey (2018) have found the existence of the positive effect of board characteristics on carbon management strategy. A study by Yunus *et al* (2016) showed that logistic regression analyses concompanyed that companies adopting a carbon management strategy are more likely to have an environmental management system (EMS), an environmental committee, a larger board size, and greater board independence. The study also finds a significant association between CMS adoption, company size, leverage, and environmental sensitivity of the company's industry.

In Turkey, Kılıç and Kuzey (2018) researched the effect of corporate governance on emission disclosures. In their study, the empirical findings suggested that entities with a higher number of independent directors on their boards were more likely to respond to the Carbon Disclosure Project. In addition, board nationality diversity and the existence of a sustainability committee had a significant positive impact on the propensity to disclose carbon emissions and the extent of those disclosures.

Kılıç and Kuzey (2018) also discovered that board size and carbon management strategy had a negative relationship. Unlike the research done by Yunus *et al.* (2016), the entities with larger boards did not bring much impact or relationship to the response of the carbon disclosure project. Besides that, the control variables of return on assets (ROA) and leverage have shown negative relationships in carbon management strategy based on the research done by (Kılıç and Kuzey, 2018).

Liesen et al (2015) revealed that, on average, only 15 percent of companies that disclose GHG emissions report them in a manner that the authors consider complete from year 2005

to 2009. Their regression analysis results suggested that external stakeholder pressure determines emissions disclosure's existence but not completeness. Findings are consistent with stakeholder theory arguments that companies respond to external stakeholder pressure to report GHG emissions, but also with legitimacy theory claims that companies can use carbon disclosure, in this case, the incomplete reporting of emissions, as a symbolic act to address legitimacy exposures.

A good overall governance structure will assist in ensuring the companies achieve the policy of optimum disclosure (Shleifer & Vishny, 1997). Taylor *et al* (2010) found that the disclosure pattern of financial risk is having a positive relationship with the strength of corporate governance structure. Nevertheless, the determinant of corporate governance structure, which is known as an important element of a company's transparency, was opposed. O'Sullivan *et al* (2008) reported that productivity showed a positive relationship between the corporate governance system and the disclosure in 2000, but no similar result was found for 2002. O'Sullivan *et al* (2008) stated that the incremental application of corporate governance methods did not positively impact the disclosures.

In investigating the degree of voluntary disclosure of Malaysia-listed companies, Ghazali and Weetman (2006) involved various types of information as additional analysis to conduct the study. The result of Ghazali and Weetman (2006) stated that company size and profitability have a positive relationship with strategized voluntary disclosures. Moreover, Ghazali and Weetman (2006) further studied that the ownership of the company was having a negative relationship with the disclosure of financial and strategic information. Lim *et al.* (2017) studied the relationship between board structures and the types of voluntary disclosure of the Australian Top 500 companies. The results of these two studies differed.

However, many empirical studies studied carbon emissions and GHG emissions; there were only a few researchers studied the adoption of carbon management strategy. Yunus *et al* (2016); Kılıç and Kuzey (2018) did similar research. Yunus *et al* (2016) studied the relationship between board characteristics and the adoption of carbon management strategy, while Kılıç and Kuzey (2018) studied the effect of corporate governance and carbon emissions disclosures. Even though their studies were similar to this one, both were conducted in Australia and Turkey, respectively. It is less convincing since there is less research in Malaysia that studies the relationship between corporate governance and carbon emissions-related variables, so it is beneficial to have this study.

Hypothesis Development

This section explains the hypothesis that the researcher attempts to validate. This research marked listed companies in Bursa Malaysia to perceive how carbon management strategy relates to board characteristics in terms of board size, board gender, board independence, educational level of board members, and nationality of board members. Manipulated variables such as company size, company age, and leverage were selected in this study to support the board's characteristics toward carbon management strategy. The researcher's hypothesis is likely to be comprehensive and beneficial globally.

Board Size

The board of directors is considered the company's top management; they are responsible for developing tenable business approaches in administering cautious use of the company's assets (Jizi *et al.*, 2014). Besides that, the approach is used to ensure that material

environmental uncertainty is well-managed, monitored, and absolutely revealed (Ben-Amar et al., 2017). The board size is essential to effective corporate governance (Dalton et al., 1999).

Yermack (1996) stated that a large board size was negatively related to performance as the companies with small-scale boards used their sources effectively. Yermack (1996) believed that companies with small board sizes show more positive values for the companies, especially from the perspective of financial. Besides that, Yermack (1996) believed that the small board would bring a powerful team, particularly the performance of the Chief Executive Officer (CEO). The statement was supported by Bonn *et al* (2004) as, they suggested that it was challenging for a large board to regulate and participate in decision-making.

However, Akhtaruddin, Hossain, Hossain, and Yao (2009) stated that more involvement of directors may strengthen board supervising efficiency and the capability to promote value-creating activities. Therefore, a larger board size may be more effectively willing to handle the controversy related to carbon emission disclosures. Adopting a carbon management strategy in a company might avoid damage to the image and reputation of the company and sustain authority. For example, Liao *et al* (2015); Yunus *et al* (2016) investigated that there was a significant and positive relationship between board size and carbon emission.

Hypothesis 1: There is a positive relationship between board size and carbon management strategy.

Board Gender

Board gender diversity is considered an essential element of corporate governance structure (Barako & Brown, 2008). Previous studies proposed a few reasons supporting the positive relationship between board gender diversity and carbon management strategy disclosures. Barako and Brown (2008) proposed that a company should recruit more female directors to diversify ideas in board meetings. Besides that, it guarantees the discussion of a broad range of perspectives in the process of making decisions and improves board communication (Bear et al., 2010). Next, companies with a diversified board will acquire wider knowledge with which to determine the best ways to handle the potential conflicts among stakeholders (Harjoto et al., 2015). Kılıç and Kuzey (2018) believed that female directors support a better appraisal of the demands of diverse stakeholders, which brings the company to perform better decisions (Bear et al., 2010).

As the percentage of female delegation on a board increases, they might influence the decision-making steps and affect the results (Elstad & Ladegard, 2012). The downfall of Enron and Worldcom brought up the interest in the ethics and morality of the executives, and it led to the investigation and research about the dissimilarity in ethical decision-making between both gender executives (Ben-Amar *et al.*, 2017). Ben-Amar *et al* (2017) stated that the company's consciousness related to environmental issues can be strengthened if the company recruits women to be the directors on the board.

The studies of Liao *et al* (2015); Hollindale *et al* (2017) investigated that there was a positive relationship between board gender diversity and GHG disclosures. Hence, there is strong evidence from previous studies to show that women on the board will be more successful and able to practice the reduction of carbon emissions (Arayssi et al., 2016). The result of the study showed that women on board are significant to the social disclosure (Arayssi *et al.*, 2016).

Hypothesis 2: The number of female board directors positively impacts carbon management strategy.

Board Independence

There was a dispute that a high percentage of independent directors would reduce and decrease the conflict of interest between the shareholders. It makes the management more effective by supervising and acknowledging (Petra, 2005; Peasnell *et al.*, 2005). Jackling and Johl (2009) studied that there was proof to exhibit that independent directors bring value to the company. Moreover, the independent directors know more about the social demands, locating themselves in a suitable position than the current non-independent directors. By that, they can protect the stakeholders' advantages and interests while not facing the same pressure as those non-independent boards of directors (Sonnenfeld, 1981).

Usually, the independent directors will be invited to the board to supervise the operation and the management of the board (Baysinger & Butler, 1985). Baysinger and Butler (1985) discovered the connection between board composition and company performance, proposing that companies with more independent directors receive more outstanding performance.

However, Koontz (1967) disagreed by mentioning that independent directors may need more understanding and familiarity with the company. Hence, it is hard for independent directors to perform well, and their performance might deteriorate because of restricted time engagement (Yammeesri & Herath, 2010).

Galbreath (2010) strongly stated that board independence is crucial in delivering climate issues since it authorizes boosting new perspectives and ideas related to substantial and social stakeholders. Hence, companies with more independent directors are more likely to raise issue and concern about the carbon management strategy. The independent directors can determine whether their responsibilities are agreeable with the stakeholders' expectations, and they are more likely to alter natural resources toward carbon management strategy in legalizing the operations in organizations (Yunus et al., 2016).

Hypothesis 3: Companies with high levels of board independence have a positive relationship with carbon management strategy.

Educational Level of Board Members

In applying the knowledge to the company's decisions, Forbes and Milliken (1999) and Rindova (1999) mentioned that board members' educational backgrounds provide them with knowledge and skills that help them perform well in decision-making. These educated directors can perform well in difficult tasks. For instance, strategies are formulated, interpreted, screened, and resolved to address the difficulties that comply with complexity and uncertainty (Milliken & Vollrath, 1991). When the directors want to monitor the companies' discussion and decisions, the board members can implement the educated knowledge to work on control Fama & Jensen (1983); Mizruchi (1983), service Dalton & Daily (1999); Lorsch (1995); Rindova (1999); Westphal (1999) and resource dependence Hillman & Dalziel (2003) functions.

The directors with higher education levels should be able to solve the company's difficulties and provide the company with decisions during the meeting. Hence, this study believes that directors with higher educational levels bring positive implications to the carbon management strategy.

Hypothesis 4: The higher educational level of board members brings a positive relationship to carbon management strategy.

Nationality of Board Members

In order to increase the capability of a company to achieve a better and more effective decision, the board members should be diversified as a diversified board brings distinct suggestions, perspectives, and advice to the board meeting (Estélyi & Nisar, 2016). Estélyi and Nisar (2016) also mentioned that shareholder variety and a company's worldwide market movement are key reasons for the board nationality diversity. Companies with diversified board members based on nationality will have a bigger audience group and be subjected to various groups of stakeholders. As these stakeholder groups will be relating the diversified board with the current global issues, the company is expected to successfully engage the carbon management strategy.

However, in Korea, foreign investors are requesting high dividend returns instead of investing the profits back into the companies (Mi et al., 2012). This situation summarized that foreign investors look for short-term performance instead of long-term investment (Yon & Park, 2006). The most common platform for the investors to manage and observe the companies is through the board membership. Foreign investors will promote foreign directors to the board, but this causes a problem in which these directors have unknown contributions to the board as well as company performance (Mi Choi *et al.*, 2012). Although earlier studies have summarized that foreign directors assist in managing and monitoring the companies, there were also studies stated that no relation in the existence of foreign directors (Agrawal & Knoeber, 1996; Yermack, 1997; Vafeas & Theodorou, 1998; Bhagat & Black, 2002; Hermalin & Weisbach, 2003).

The existence of foreign directors may not give impressive independent supervision to the companies. Mi Choi *et al.* (2012) stated that most of the proposals of foreign directors were manipulated by the shareholders, who want to express their interests at the board meetings via the proposed directors. In other words, these shareholders-controlled directors probably speak for the benefit of the shareholders, provoking the reason for independently supervising the companies (Mi Choi *et al.*, 2012).

Nevertheless, in the study of Oxelheim and Randøy (2003), they believe that if a company comprises global-based board members, it will strongly build up worldwide investors' confidence as they rely more on foreign board members. Hence, in this study, the research believes that global board membership will have a good impact on the company, especially in implementing or adopting a carbon management strategy.

Hypothesis 5: The number of foreign directors on a board has a significant positive relationship to carbon management strategy.

Conceptual Framework

Figure 1 was a diagrammatic representation of board characteristics on carbon management strategy. Board characteristics, such as board size, board independence, board gender, educational level of board members, and the nationality of board members, act as independent variables in this study. The dependent variable of this study was the carbon management strategy. Control variables such as company size, company age, and company leverage were used in this study to support the independent variables. The primary emphasis

of this study was to examine how the independent variables, which were the board characteristics, affected the carbon management strategy.

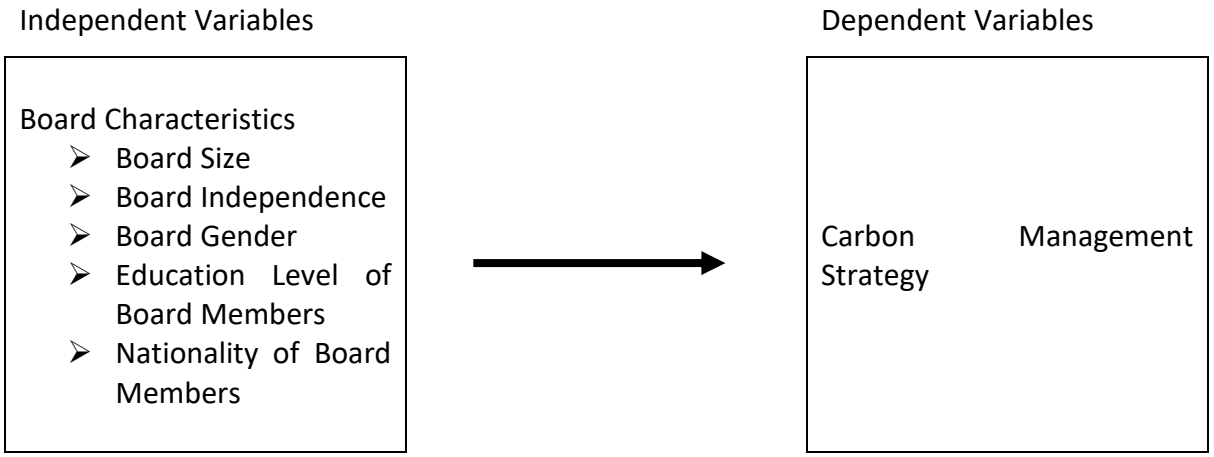

Figure 1: Relationship between board characteristics and carbon management strategy

Research Methodology

Sample Description and Data Collection

The sample of this study was selected from a set of publicly listed companies in Malaysia. The study duration was one year, which was 2016. Secondary resources were the main point of supply to conduct this research. In this research, the researcher used secondary resources to collect data on board characteristics from the companies' annual reports. Besides, the manipulated variables like company size, company age, and leverage were obtained from Data Stream by Thomson Reuters.

This study only examined one year because past research showed that the disclosure patterns of companies rarely change from year to year (Tang, 2012; Billings *et al.*, 2014). The researcher did the content analysis from the annual reports and used the samples from the companies listed in Bursa Malaysia because these companies tend to have complete annual reports. The data set consists of 372 companies and 372 company years initially. The final sample included 288 companies from different industries after eliminating 84 companies that did not have complete annual reports. The sample is considered to be representing the population if it comprises the observations of at least 30 companies from the population (Keller, 2005). The researcher was collecting data from different industries to ensure that the data collected was not biased to one side. This to ensure the data collected is fair to all industries. Hence, the data collection must be done throughout various types of industries. The table 1 below shows the sample size that allowed the researcher to collect data and the companies that needed complete reports.

Table 1
Summary of the Sample

Sector	**Various Types of Industries**
Initial Sample	372
(-) Companies that have no complete data	(84)
The sample that has complete data	288

Measurement of Dependent Variable

Carbon Management Strategy

Earlier research about carbon emissions used various ways to obtain data (Weinhofer & Hoffmann, 2010; Hrasky, 2011; Lee, 2012). The study aims to analyze whether board characteristics affect carbon management strategy. By asking the questions to the respondents, they can also provide data related to the nature of the climate change integration process and result, obligation process with the supervisors, number of projects under progress, implementation process, and others. Besides the companies' annual reports, company websites have also been inspected anxiously for the companies who need to contribute more responses to the carbon disclosure project survey.

This study adopted the prior study of Yunus *et al.*'s (2016) method to measure carbon management strategy (CMS) in Malaysia. This approach contains 6 criteria. They are:

1. *Product Innovation*
   Innovating new products that transmit less carbon or enhance the current products to be carbon-free during manufacturing (Kolk & Pinkse, 2005; Boiral, 2006; Weinhofer & Hoffmann, 2010)
2. *Innovative Technology*
   Developing the technology mechanism to enhance the greenhouse gases (GHG) inventory (Jeswani et al., 2008).
3. *Process Innovation*
   Innovating new production techniques that transmit less carbon or enhance current processes to be carbon-free (Weinhofer & Hoffmann, 2010).
4. *Energy Efficiency Initiative*
   Endorsing the project and activities with full energy, replacing the current energy sources with better fuels, and lowering the transmissions of GHGs (Lee, 2012).
5. *Emissions Trading Participation*
   Obtaining extra carbon transmission capacity by willingly joining the emission trading schemes (Jeswani *et al.*, 2008; Weinhofer & Hoffmann, 2010).
6. *Carbon Offset Initiative*
   Plowing in carbon-emission-related projects (Weinhofer & Hoffmann, 2010; Lee, 2012).

In this research, carbon management strategy is a dichotomous variable coded "1" if the company's board characteristics affect the strategy and coded "0" if it does not. The researcher will conduct a pilot study to ensure that the initial coding criteria used for this study are enough to differentiate companies that implement carbon management strategies from those that are affected by the board characteristics from those that are not (Yunus et al., 2016). Operational definitions and coding rules shall be tested on a small group of samples before proceeding to real research to ensure validity and reliability (Holsti, 1969).

From above, this research came out with an equation:

$$CMS_i = \sum \frac{X_i}{n_i}$$

Where n_i = number of items expected for *i* company, $n_i \leq 6$

X_i = 1 if the item is disclosed, whereas 0 if the item is not disclosed.

So that $0 \leq CMS_i \leq 1$

Choice of Weight

Allocating the correct weight to disclosure items is essential for evaluating the information value obtained from disclosure scores. Weighted scores are used to prioritize information items for investors and users of accounting information. However, they face criticism for being subjective and lacking consensus among analysts on the assigned weights. The variation in weights given by different analysts can be explained by the subjective character of the process, mainly when user preferences are unknown. On the other hand, some advocate for utilizing an unweighted dichotomous disclosure score, as research has demonstrated similar outcomes between weighted and unweighted approaches in capturing disclosed data (Cooke, 1989; Collett & Hrasky, 2005).

Measurement of Independent Variables

According to Zikmund *et al* (2013), the designed independent variables are expected to affect the dependent variable. The independent variables may affect the dependent variable either positively or negatively (Sekaran & Bougie, 2016).

Board Size

Board size is the total number of directors on the board (Galbreath, 2010).

Size = Total number of directors

Board Gender

The number of female directors measures board gender to the total number of directors. Gender diversity is measured by the number of female directors in the company (Jizi & Nehme, 2017).

Board Gender = Number of female directors

Board Independence

Board independence is calculated by the number of independent or non-dependent directors on the company's board (Prado-Lorenzo & García-Sánchez, 2010).

Board Independence = Number of independent directors

Educational Level of Board Members

Each board director's educational level is hand-collected or manually collected from directors' reports or through web surfing. This is calculated by the number of directors who pursue their studies above the Master's level in the company.

Educational Level = Number of directors who obtained Master level and above

Nationality of Board Members

The nationality of each of the board directors is hand-collected or manually collected from directors' reports or through web surfing. This is calculated by the number of foreign directors on the company's board.

Nationality = Number of foreign directors

Measurement of Control Variables

Company Age

This study investigated the effect of company age in terms of the current year minus the year that the companies were established (Ofuan & Izien, 2016). The measurement of company age:

Company Age = current year (2016) – Companies' established year

Company Size

Company Size was used to examine the value of companies' assets, which affects their performance. The bigger the company, the bigger the assets the companies own. Doğan (2013) suggested that company size can be measured by total assets in natural logarithm form. The measurement of company size:

Company Size = Natural Logarithm of Total Assets

Leverage

This study studied the effects of a company's leverage on carbon management strategy. A high level of leverage showed that the company relies on the deficit to support the company's activities. Leverage can be measured using the debt-to-assets ratio, as suggested by (Doğan, 2013; Fooladi and Kolaie, 2015). The measurement of company leverage:

Company leverage = Total liabilities to total assets

Regression Model

The multiple regression analysis measured the relationship between board characteristics and carbon management strategy. Board characteristics included board size, board gender, board independence, educational level, and nationality of board members. Meanwhile, control variables like company size, age, and leverage were used to test their effects on carbon management strategy. The multiple regression model allowed greater flexibility as researchers could manipulate the variables that were affecting the dependent variable explicitly.

Baseline Model

$$CMSit = \beta_0 + \beta_1 BSIZE_{it} + \beta_2 BGEN_{it} + \beta_3 BIND_{it} + \beta_4 EDU_{it} + \beta_5 NAT_{it} + \beta_6 FAGE_{it} + \beta_7 FSIZE_{it} + \beta_8 LEV_{it} + \varepsilon it$$

Where:

Dependent Variable

CMS = Carbon Management Strategy

Independent Variables

BSIZE = Board Size
BGEN = Board Gender
BIND = Board Independence
EDU = Educational Level of Board Members
NAT = Nationality of Board Members

Control Variables
FAGE = Company Age
FSIZE = Company Size
LEV = Leverage
β = Coefficient
ε = Disturbance

Findings and Discussions
Descriptive Analysis
Table 2
Descriptive Statistics of Variables

Variables	Observations	Minimum	Maximum	Mean	Standard Deviation
CMS	288	0	6	2.982	1.513
BSIZE	288	4	14	7.106	1.763
BGEN	288	0	5	0.918	1.008
BIND	288	2	7	3.365	0.944
EDU	288	0	8	1.700	1.418
NAT	288	0	10	0.612	1.118
FAGE	288	3	188	31.506	16.414
TA	288	5.879 mil	92.55 bil	2.366 bil	8.782 bil
LEV	288	0.010	3.129	0.353	0.212

The results of the descriptive statistics are presented in the table 2 above. The samples in this research included 288 companies in Malaysia, and their annual reports for the year 2016 were investigated.

With the CMS ranging between 0 to 6, it showed that the average mean of CMS was 2.982, which meant that the companies fulfilled 2 to 3 criteria as listed in the previous chapter. The BSIZE is diverse beyond the sample companies, in which the minimum was 4 and the maximum was 14. The average board size had around 7 directors with a standard deviation of 1.872. The highest number of women represented in the companies' boards was 5, with a mean of around 1. It showed that the level of women's participation in boardrooms was extremely low. For BIND, the mean of BIND was 3.427, stating that, on average, the board had around 3 to 4 independent directors, along with a standard deviation of 0.982.

With an average mean of 1.865 in the educational level variable, it stated that only around 2 directors pursued their study until Master level and above, at the time they served as board members. On average, the score of foreign board members was between 0 and 1, indicating that only less than 1 director from the board was a foreign director, which was considered low in terms of foreign board members' participation.

The company age was determined by subtracting the current year and the established year. The average company age of this study was 31.36, with a standard deviation of 18.8. The company size was calculated by using the natural logarithm of total assets. In descriptive analysis, the value of total assets was used to determine this study's mean and standard deviation. The average total asset of this study was RM2.366 billion, with a standard deviation

of RM8.782 billion. Leverage was calculated using the ratio of total liabilities to total assets. In this study, leverage consisted of an average of 39.08% and a standard deviation of 27.07%.

Pearson's Correlation Coefficient Test

Pearson's Correlation Coefficient Test will be used to examine the strength of the relationship between the variables. The perfect positive correlation between two variables is 1.0, whereas a perfect negative correlation shows -1.0. Table 3 shows the Pearson's correlation between the dependent, independent, and control variables. It indicated that the relationship of carbon management strategy (CMS) to board characteristics as measured by board size (BSIZE), board gender (BGEN), board independence (BIND), educational level of board members (EDU), nationality of board members (NAT), company age (FAGE), company size (FSIZE) and leverage (LEV). The positive and negative signs indicate the correlations among the variables shown below.

In Table 2, the results indicate that board gender (BGEN) and leverage (LEV) have a negative relationship with carbon management strategy (CMS), while board independence (BIND) shows a positive significant correlation with CMS at a 1% level of significance. Similarly, educational level (EDU) and company size (FSIZE) positively correlate with CMS. However, variables such as nationality of board members (NAT) and company age (FAGE) are not significantly related to CMS, with p-values larger than 0.10. Additionally, the number of directors under BSIZE, BIND, EDU, NAT, FAGE, and FSIZE positively correlates with CMS, suggesting that an increase in the number of directors under these variables leads to increased implementation of CMS. Control variables FAGE and FSIZE also show positive correlations with CMS, indicating that companies with more experience and larger assets are more likely to implement CMS. Conversely, negative correlations are observed between board gender (BGEN), leverage (LEV), and CMS, suggesting that higher numbers of women and foreign directors and increased total liabilities decrease the likelihood of CMS implementation. This might stem from perceptions that women may not contribute effectively to decision-making and a focus on resolving current debts rather than investing in CMS.

Table 3
Pearson's Correlation Coefficient Test

Correlation Probability	CMS	BSIZE	BGEN	BIND	EDU	NAT	FAGE	FSIZE	LEV
CMS	1.000 ------								
BSIZE	0.144** 0.014	1.000 ------							
BGEN	-0.0185 0.7550	0.336*** 0.000	1.000 ------						
BIND	0.158*** **	0.528*** **	0.131** *	1.000 ------					

	0.007	0.000	0.026						
EDU	0.181*** 0.002	0.428*** 0.000	0.0563 0.341	0.418*** 0.00	1.000 ------				
NAT	0.0227 0.701	0.247*** 0.000	0.120** 0.042	0.121** 0.040	0.293*** 0.0000	1.000 ------			
FAGE	0.092 0.121	0.078 0.187	0.081 0.174	0.117** 0.047	0.116** 0.050	0.139** 0.018	1.000 ------		
FSIZE	0.283*** 0.00	0.420*** 0.000	0.235*** 0.000	0.309*** 0.000	0.344*** 0.000	0.2191*** 0.000	0.328*** 0.000	1.000 ------	
LEV	-0.008 0.892	0.105* 0.074	0.137** 0.020	0.218*** 0.000	0.130** 0.028	-0.009 0.876	0.092 0.119	0.215*** 0.000	1.000 ------

*** Correlation is significant at the 0.01 level (1-tailed)
** Correlation is significant at the 0.05 level (1-tailed)
* Correlation is significant at the 0.10 level (1-tailed)

Regression Model

The multiple regression analysis measured the relationship between board characteristics and carbon management strategy. Meanwhile, control variables like company age, company size, and company leverage were used to test their effects on carbon management strategy. With the following baseline model, Table 4 shows the least squares test between the dependent, independent, and control variables.

Baseline Model

$$CMSit = \beta_0 + \beta_1 BSIZE_{it} + \beta_2 BGEN_{it} + \beta_3 BIND_{it} + \beta_4 EDU_{it} + \beta_5 NAT_{it} + \beta_6 FAGE_{it} + \beta_7 FSIZE_{it} + \beta_8 LEV_{it} + \varepsilon_{it}$$

Table 4

Least Squares Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.394	0.961	-1.450	0.148
BSIZE	0.003	0.055	0.062	0.951
BGEN	-0.114	0.086	-1.312	0.191
BIND	0.095	0.097	0.983	0.326
EDU	0.076	0.059	1.295	0.196
NAT	-0.069	0.064	-1.081	0.281
FAGE	0.000	0.004	0.076	0.939
FSIZE	0.516	0.126	4.092	0.000
LEV	-0.426	0.297	-1.434	0.153
R-squared	0.108	Mean dependent var		3.208
Adjusted R-squared	0.082	S.D. dependent var		1.356

S.E. of regression	1.299	Akaike info criterion	3.391
Sum squared resid	470.621	Schwarz criterion	3.506
Log-likelihood	-479.372	Hannan-Quinn criteria	3.437
F-statistic	4.215	Durbin-Watson stat	1.840
Prob (F-statistic)	0.000		

In Table 4, the Least Squares test has been done to test the proposed baseline model and the relationship between the independent, control, and dependent variables.

There was a positive but insignificant relationship between BSIZE and CMS. The p-value of 0.951, which is more than 0.1, showed that both of these variables had insignificant relationships. The hypothesis was not supported. Dalton et al. (1999) mentioned that the board size is an essential element in creating effective corporate governance as it may strengthen the board supervising efficiency and ability to create value-creating activities (Akhtatruddin et al., 2009). However, from the study of Yermack (1996) and Boon et al. (2004), they had mentioned that the companies with small-scale boards utilized their sources effectively and efficiently. Besides that, Yermack (1996) stated that the smaller board would bring a more powerful team, especially to the performance of the CEO, and it was challenging for the larger board to regulate and participate in the decision-making (Bonn et al., 2004). From the observations, 115 out of 288 companies, or equivalent to 39.93% of the observations, had 6 or fewer directors on board. The small number of directors, which caused a positive relationship between BSIZE and CMS, strongly indicated that the small-scale board has a higher chance of implementing CMS in the company.

A positive but insignificant relationship had occurred between BIND and CMS as well. The p-value of 0.326, which is more than 0.1, showed that both of these variables had insignificant relationships. The hypothesis was not supported. Although the high percentage of independent directors on the board will cause the management to be more effective under trustable independent supervision Petra (2005); Peasnell et al (2005), however Koontz (1967) disagrees with the statement as he mentioned that outside independent directors may not have adequate knowledge and information about the companies, which might lead them to the difficulty in performing well (Yammeesri & Herath, 2010). There were 248 out of 288 companies, or equivalent to 86.11% of the observations, that had 3 or more independent directors on board, which strongly resulted in the higher percentage of independent directors on boards possessing a higher chance to implement CMS.

From Table 4, the result showed a negative between BGEN and CMS. With a p-value of 0.191, which is more than 0.1, it showed that a negative insignificant relationship had occurred. The hypotheses were not supported. Compared to previous studies, most of the researchers stated that female directors would help the companies in building up a wide range of ideas, and they might determine the best solutions to handle the issues and conflicts (Barako & Brown, 2008; Harjoto et al., 2015). Through the companies under the observations, 119 out of 288 companies, or equivalent to 41.32% of the observations, did not have any woman director on board. As these companies were not considering women to own the directorship, it strongly reflected that women have no power in terms of owning the directorship in a company.

A positive but insignificant relationship had also occurred between EDU and CMS. The p-value of 0.196, which is more than 0.1, showed that both of these variables had insignificant relationships. The hypothesis was not supported. Forbes and Milliken (1999) and Rindova (1999) mentioned that the educational backgrounds of board members had equipped them

with sufficient knowledge and skills, which ensured they performed well in board decision-making. From the observations, 145 out of 288 companies, or equivalent to 50.35% of the observations, have 1 or fewer directors who pursued their studies to Master's level and above. Although these variables had a positive relationship, it was insignificant. This is due to the high percentage (50.35%) of the observations showing that the companies were electing a smaller number of higher educated directors on board.

The result also showed a negative between NAT and CMS. The p-value of 0.281, which is more than 0.1, showed that both of these variables had insignificant relationships. The hypothesis was not supported. From the previous studies, although Estélyi and Nisar (2016) also mentioned that shareholder variety and a company's worldwide market movement are key reasons for board nationality diversity, however, Yon and Park (2006) summarized that foreign investors look for short-term performance instead of long-term investment. This statement had been supported by (Mi Choi *et al.,* 2012).

Furthermore, there were also studies stated that there is no relation to the existence of foreign directors (Agrawal & Knoeber, 1996; Yermack, 1997; Vafeas & Theodorou, 1998; Bhagat & Black, 2002; Hermalin & Weisbach, 2003). Through the observations, 45 out of 288 companies, or equivalent to 15.63% of the observations, had 2 or more foreign directors on board. As the rest of the companies were not, or less considering the foreigners to own the directorship, it strongly reflected that foreign directors have no power in terms of owning the directorship in a company, or they might not gain the trust of the other directors, who assume that foreign directors may not perform well in the companies.

Regarding all control variables, only the company's size shows a noteworthy link with carbon management strategy (CMS). Based on their overall assets, larger companies are more inclined to use CMS. Financial resources and company capabilities are crucial for adopting and implementing sustainable initiatives like carbon management. Large companies may have more financial resources, technical knowledge, and organizational frameworks needed to carry out extensive CMS projects than smaller businesses. As such, the significance of company size highlights the role of scale and resources in driving sustainability efforts within organizations.

The adjusted R-squared value showed how the variables could be explained through the equation. Table 3 shows that the value of adjusted R-squared for CMS was 0.082. This indicated that the variation of CMS and control variables could explain 8.22% of the variance in CMS. In comparison, the other 91.78% of the variance can be explained through other variables not included in this proposed study equation.

With an overall p-value of 0.000, which is less than 0.1, the researcher concluded that the model is suitable for this study as it showed a significant relationship between the variables used in this study.

Conclusion

The discovery that the relationship between board characteristics and carbon management strategy (CMS) does not have a meaningful effect implies various consequences for theory and practice. Firstly, it suggests that conventional indicators of board composition, such as gender diversity, independence, and educational background, could not directly impact a company's decision to use CMS. These questions the widely held belief that specific board features automatically lead to sustainability efforts. Future studies should investigate other elements or methods that more effectively elucidate the acceptance and implementation of CMS inside companies.

Secondly, this discovery implies that corporations might have to review how they include sustainability factors in board decision-making procedures. Companies may consider implementing comprehensive strategies beyond board composition to include stakeholder engagement, corporate culture, and company incentives to enhance their dedication to sustainable initiatives, such as carbon management. The study's findings emphasize the intricate connection between board features and CMS, indicating the necessity for a more detailed comprehension of the elements influencing sustainable business practices.

This study shows that large companies are more likely to employ CMS based on total assets. Financial resources and company competencies are essential for facilitating the adoption and execution of sustainable measures such as carbon control. Large corporations have greater financial resources, technological expertise, and company structures required to execute major CMS initiatives than smaller enterprises. The importance of company size emphasizes the impact of scale and resources on promoting sustainability initiatives in organizations.

Acknowledgement

1. We thank the Faculty of Economics and Business, University Malaysia Sarawak (UNIMAS), and The Research, Innovation and Enterprise Centre (RIEC) for financially supporting this research.
2. Part of this research was a Bachelor of Business Management (Corporate Management) Unimas dissertation.

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