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UNLOCKING SUSTAINABLE DISCLOSURE: THE GENDER DIVERSITY EFFECT ON CORPORATE GOVERNANCE, HUMAN CAPITAL, AND SSCM

Nur Zharifah Che Adenan[1*]
Roshima Said [2]
Corina Joseph[3]

[1,2] Faculty of Accountancy, Universiti Teknologi MARA Cawangan Kedah, Kampus Sungai Petani, 08400 Merbok, Kedah, Malaysia (E-mail:zharifah@uitm.edu.my, roshima712@uitm.edu.my)
[3] Faculty of Accountancy, Universiti Teknologi MARA Cawangan Sarawak, Kampus Kota Samarahan, 94300 Kota Samarahan, Sarawak, Malaysia. (E-mail: corina@uitm.edu.my)
*Corresponding author: Nur Zharifah Che Adenan zharifah@uitm.edu.my

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Abstract: *The aim of this study is to look into the effects of board gender diversity on the relationships among Corporate Governance Mechanisms, Human Capital, and Sustainable Supply Chain Management (SSCM) disclosure after the MCCG 2017 was implemented. The study extracted information from Bursa Malaysia's annual reports from 2018 to 2020. The top 100 public listed companies (based on market capitalization) constituted as samples. The study employed the SSCM checklist to construct the disclosure index, which encompassed twelve (12) themes and used an unweighted disclosure index of SSCM that considered 60 discretionary items. The Statistical Package STATA 17 was applied in the current study to synthesize and test all the hypotheses. The study's findings showed that board size, audit committee independence, directors' remuneration, and board meeting frequency all had positive relationships with SSCM disclosure. The study's findings revealed that board gender diversity moderated the relationships among board size, directors' remuneration, board meeting frequency, and SSCM disclosure. The findings of the study suggests that when aiming to promote SSCM performance, which is required to achieve SDG 12, government regulators should emphasize the impact of effective governance features and sustainability-related initiatives.*

Keywords: *Board Gender Diversity, Sustainable Supply Chain Management, Corporate Governance, Human Capital, Disclosure*

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Introduction

Going green and being more environmentally responsible are undeniably the ways of the future, and they align with the Sustainable Development Goals (SDGs) set by the United Nations. SDG 12 aims to ensure the long-term viability of consumption and production patterns, which is one of the SDG policy initiatives. Sustainable Supply Chain Management (hereafter abbreviated as SSCM) has been identified as one of the keys to a company's long-term success. The need to incorporate a wide range of social and environmental issues into their operations, and the issue of SSCM have changed how companies will operate (Mani, et al., 2017).

Nowadays, supply chain management activities are becoming more transparent (Bateman & Bonanni, 2019). According to Anggraini, et al. (2020), sustainable supply chain reports are needed as a form of corporate responsibility to stakeholders that incorporate economic, social, and environmental effects on businesses' everyday operations. Companies which make this report available are more likely to offer more data to the public with the intention of enhancing their public trust, and to convince investors that their investments are free of environmental and social hazards.

Corporate governance is believed to promote a company's reputation and economic value, and it is one method of gaining and preserving investors' confidence. Recent research by Istianingsih (2020) supported the significance of corporate governance in supply chain management but did not undertake a thorough examination of the connection between these two factors. To safeguard against market deficiencies and supply chain uncertainty, companies should take caution in designing and implementing appropriate supply chain management governance frameworks. These governance frameworks provide supply chain environmental flexibility, allowing the company to adapt quickly whilst retaining effective supply chain management.

Human capital characteristics may also have a significant influence on the degree to which businesses disclose their SSCM practices. Previous studies have found links between environmental concerns and demographic characteristics, such as gender, age, education, income, and academic specialties (Kollmuss & Agyeman, 2010). By using the resource-based view as a theoretical standpoint, Huo, et al. (2016) looked at the effect of human capital characteristics on supply chain integration (SCI) and competitive performance. According to the study's findings, organizational engagement is strongly related to the three aspects of SCI (supplier, customer integration, and internal), which show the importance of people's attitudes and motivations.

The significance of board diversity to the firm's performance is one of the highlights of the new Malaysian Code on Corporate Governance (MCCG) 2017 and 2021. According to the MCCG (2017), companies must publicly report their policies for nominating more women to the board, as well as set goals and initiatives to reach those targets. At least 30% of the seats on the board of directors in large companies should be held by women (NST, 2017). Benjamin, et al. (2020) investigated the relationships among board gender diversity, board independence, and sustainable supply chain responsibility (SSCR) and found that, having more female and independent directors on boards has a positive effect on SSCR. Based on previous research, it appears that few past studies incorporate both corporate governance (CG) and human capital (HC) characteristics towards SSCM disclosure, as well as examine the moderating effect of board diversity on the relationships. This is one of the first papers to provide empirical data on the impact of board diversity on the links among CG, HC characteristics, and SSCM disclosure.

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Therefore, the purpose of this study has been to investigate the effects of board gender diversity on the relationships among corporate governance mechanisms, human capital characteristics, and sustainable supply chain management (SSCM) disclosure after the implementation of the MCCG 2017.

Literature Review

Corporate Governance Mechanisms and SSCM Disclosure

Board Size and SSCM Disclosure

One of the most fundamental parts of corporate governance is the board of directors, which is responsible for ensuring that the corporation's business is appropriately handled through agents. Previous research has suggested that board size affects communication and teamwork issues, and the ability to monitor the organization (Yermack, 1996; Eisenberg, et al., 1998; and Raheja, 2005). The size of the board and the level of disclosure, according to Allegrini and Greco (2013), are correlated. A larger board size is positively related to SSCM disclosure (Yunus, et al., 2016). Therefore, this study has proposed the following hypothesis:

H1: There is a negative relationship between board size and the extent of SSCM disclosure.

Board Independence and SSCM Disclosure

Board independence can minimize agency problems by being more unbiased, independent, and able to influence board decisions (Kosnik, 1987), and thus, result in increased efficiency. Independent directors should ensure that financial information is accurate and that financial controls and risk management processes are robust and defensible. The independent directors must take all appropriate steps to prevent and disclose any potential conflicts of interest. Furthermore, board independence is strongly linked to SSCM responsibility (Yunus, et al., 2016; Kouaib, et al., 2020). The hypothesis has, therefore, been proposed as follows:

H2: There is a positive relationship between board independence and the extent of SSCM disclosure.

Audit Committee and SSCM Disclosure

The audit committee's role is to provide a mechanism for reviewing the company's financial data generating processes and internal controls, therefore, its presence is critical in ensuring high-quality financial reporting. The MCCG (2007) strengthened the audit committee's roles and functions by requiring audit committees to be entirely composed of non-executive board members. All committee members are capable of reviewing and understanding financial reports to do their duties effectively. Many independent board members on an audit board may relegate agency costs and extend internal controls, resulting in better disclosure quality (Forker, 1992). As a result, it has been hypothesize that:

H3: There is a positive relationship between the independence of the audit committee and the extent of SSCM disclosure

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Foreign Ownership and SSCM Disclosure

The ownership structure of a company could have a major effect on its environmental policy, particularly when it comes to sustainable supply chain management (Aray, et al. 2020; Gold, et al., 2017). Foreign firms with unique assets such as new technology, well-established management systems, and international experience will likely outperform local firms. International companies could outperform domestic firms under environmental pressure, according to a study by Kim, et al. (2016). Rustam, et al. (2019) investigated the possible effects of foreign ownership on the corporate sustainability transparency of leading non-financial firms. Accordingly, the next hypothesis has been proposed:

H4: There is a positive relationship between the extent of shares held by foreign shareholders (foreign ownership) and the degree of SSCM disclosure.

Directors' Remuneration and SSCM Disclosure

When the interests of the manager and the shareholders are not aligned (Jensen & Meckling, 1976), agency costs arise, and managers will misappropriate resources for their own benefit. Director remuneration is viewed as an incentive for the contributions of the board of directors; as a result, it would empower directors to fulfil their duties and put more effort into the best interests of the shareholders. Aslam, et al. (2019) explored the correlation between remuneration and the board of directors' performance in Pakistan. The amount and composition of remuneration should be adequate to attract and retain the directors to successfully manage the company. Talha, et al. (2009) investigated the connection between social responsibility disclosure and board of directors' remuneration and revealed that there is a relationship between social responsibility-related information disclosure and remuneration. Accordingly, the next hypothesis has been suggested:

H5: There is a positive relationship between the directors' remuneration and the degree of SSCM disclosure.

Risk Management Committee and SSCM Disclosure

The formation of a risk management committee will help improve industry health and strength, and help businesses in fulfilling their objectives, securing organizational reputations, and improving financial reporting quality (Ng & Chong, 2012). Al-Hadi, et al. (2015) explored whether the presence of a separate risk committee and the characteristics of that committee are linked to market risk disclosures. The study found that market risk disclosures were much higher for companies with a separate risk committee. The study recommended that the existence and qualifications of the risk committee can be leveraged to improve the level of disclosure. Hence, the following hypothesis has been proposed:

H6: There is a positive relationship between the existence of a separate risk committee and the extent of SSCM disclosure.

Board Meeting Frequency and SSCM Disclosure

The board meetings' frequency in which the directors meet to discuss the corporation's performance and address any serious issues can be used to assess the board's commitment and involvement (Ali, et al., 2019). Due to the increased frequency of meetings, managers are more likely to share additional information (Brick & Chidambaran, 2010). Board meeting frequency is an important corporate governance tool since it enables directors to monitor and regulate corporate operations and financial performance. When the frequency of meetings is increased,

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it puts additional pressure on managers to offer more information (Hanh, et al., 2018). Hence, the current study has proposed the following hypothesis:

H7: There is a positive relationship between board meeting frequency and the extent of SSCM disclosure.

Human Capital Characteristics and SSCM Disclosure

Internal management understanding, industry pressure, customer pressure, and government participation are all contributing variables in a sustainable supply chain (Wu, et al., 2018). The way organizations handle environmental and social compliance is one method to build sustainability policies across the supply chain. This is how the supply chain can be more closely tied to a company's sustainability strategy. Furthermore, the age of a director is believed to have an effect on the company's direction, especially when it comes to choices that must be taken at each level of the supply chain management (Nkem and Ursula, 2017; Diana, 2018). As per Johl, et al. (2015), a larger proportion of directors with financial/ accounting experience on the board of directors is linked to increased return on assets. Said, et al. (2013) investigated whether there are any links among environmental disclosure and board, firm, and human capital characteristics. The findings of the study revealed, relationships among an independent non-executive chairman's presence, the chairperson's age, CEO with legal knowledge, the industry category, and the amount of environmental exposure. Therefore, the following hypotheses have been developed:

H8: There is a positive relationship between the education level of directors and the extent of SSCM disclosure.

H9a: There is a positive relationship between the knowledge background of the directors (Accounting) and the extent of SSCM disclosure.

H9b: There is a positive relationship between the knowledge background of the directors (Law) and the extent of SSCM disclosure.

H10: There is a positive relationship between directors' age and the extent of SSCM disclosure.

The Moderating Effect of Board Diversity on the Relationships among CG, HC and SSCM

The effects of board diversity on a company's reporting, performance, and long-term sustainability have been extensively discussed. The "moderator concept", according to Lubinski and Humphreys (1990), is a concept borne out of an ability to increase theoretical and criterion-related validity. The current study included diversity on the board as a moderating variable because the revised MCCG 2017 requires companies to publicly disclose their plans for nominating more females to the board of directors, as well as define goals and actions to achieve such goals. The literature on sustainability management highlights the importance of gender diversity and the distinct contributions female directors may bring to a company's success (Ruel, et al., 2020; Diana, 2018).

Many researchers have looked into the direct relationship between board diversity and corporate disclosure, but the results have been inconclusive (Al-Qahtani & Elgharbawy, 2020; Bravo, 2018; Hoang, Abeysekera, & Ma, 2018; Katmon, et al., 2019; and Khan & Khan, 2019).

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Existing literature on gender diversity and its organisational consequences is significantly polarised. Al-Qahtani and Elgharbawy (2020) discovered that gender-diverse boards markedly improve the quality of sustainability reporting, indicating that female directors are crucial in fostering accountability and openness. Conversely, Katmon et al. (2019) indicated that board diversity, encompassing gender, exerts only a minimal or negligible influence on corporate social responsibility disclosure, suggesting that diversity may function more as symbolic compliance rather than as a meaningful catalyst for governance enhancements.

This study directly approaches these unsolved conflicts by investigating gender diversity in the realms of corporate governance disclosure, human capital development, and sustainable supply chain management techniques. By synthesizing these three interconnected elements, the report advances beyond previous research that often separates governance outcomes from overarching organizational sustainability initiatives. Moreover, the research considers institutional and industry-specific variables, recognizing that the impact of gender diversity is contingent on context rather than uniformly beneficial. This study elucidates whether gender diversity is a true catalyst for sustainable disclosure and practice or only a symbolic mechanism, thereby reconciling the contradictory results in the literature.

Despite increasing academic focus on gender diversity, previous studies yield inconsistent findings about its impact on corporate governance, human capital, and sustainable supply chain management. Research in corporate governance indicates that gender-diverse boards improve oversight, increase transparency, and diminish the risk of governance scandals; however, other studies show minimal or adverse effects, especially in firms within heavily regulated industries, smaller enterprises, or those with significant leverage (Wang et al., 2024). Likewise, concerning human capital, there is a lack of consensus on whether increased female participation results in enhanced employee-related outcomes, including decreased turnover and improved training opportunities.

Unresolved disputes are also apparent in the realm of sustainable supply chain management (SSCM) and overall organisational effectiveness. Emerging studies indicate that female representation on boards may promote responsible sourcing practices and enhance attention to supplier sustainability standards; however, other research underscores the absence of definitive causal relationships, with effects being more evident in disclosure than in tangible supply chain outcomes (Yang et al., 2024; Ruel et al., 2024). The overall correlation between gender diversity and organizational performance is ambiguous: certain studies contend that gender-balanced boards improve both long-term financial and non-financial outcomes, whereas others identify no significant relationship or even negative impacts in specific institutional and industry contexts (Birken & Cigna, 2019; Gallego-Álvarez et al., 2010). The conflicting findings highlight the intricate nature of gender diversity's influence on governance, human capital, and supply chain sectors, indicating that its impact is significantly contingent upon organizational, institutional, and cultural variables.

There seems to be scarcity in the current literature of empirical studies that explore the moderating role of board diversity on the relationships amongst CG, HC, and SSCM disclosure. The majority of previous research looked into the role of board diversity in moderating the relationship between corporate governance features and business performance (Al-Matari & Al-Swidi, 2014; Chin, et al., 2019; Nyatichi, 2017; Orazalin & Baydauletov, 2020; and Zaid, et al., 2020).

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Female directors, according to Pucheta-Martínez, et al. (2018), may increase linkages among all stakeholders at all levels of the organization, influencing corporate initiatives and, as a result, boosting business performance. The study suggested that female directors should be selected for inclusion on boards because of the benefits that heterogeneous boards may offer, such as promoting innovation, boosting the quality of the decision-making process, and integrating different perspectives. Moreover, Issa and Fang (2019) postulated that the number of female directors and the amount of CSR disclosure has a statistically significant relationship. As a result, although SSCM disclosure was not disclosed, it was included in this study because it is linked to the information disclosure level. The following hypotheses have been created based on the above discussion:

H11a: Board gender diversity moderates the relationship between board size and the extent of SSCM disclosure.

H11b: Board gender diversity moderates the relationship between board independence and the extent of SSCM disclosure.

H11c: Board gender diversity moderates the relationship between audit committee independence and the extent of SSCM disclosure.

H11d: Board gender diversity moderates the relationship between foreign ownership and the extent of SSCM disclosure.

H11e: Board gender diversity moderates the relationship between directors' remuneration and the extent of SSCM disclosure.

H11f: Board gender diversity moderates the relationship between the existence of separate risk committees and the extent of SSCM disclosure.

H11g: Board gender diversity moderates the relationship between board meeting frequency and the extent of SSCM disclosure.

H11h: Board gender diversity moderates the relationship between the education level of directors and the extent of SSCM disclosure.

H11i: Board gender diversity moderates the relationship between the directors' knowledge background (Accounting) and the extent of SSCM disclosure.

H11j: Board gender diversity moderates the relationship between the knowledge background of the directors (Law) and the extent of SSCM disclosure.

H11k: Board gender diversity moderates the relationship between directors' age and the extent of SSCM disclosure.

Underpinning Theories and Framework

According to the agency theory, when owners (principals) and managers (agents) are separated, managers of businesses are more likely to take actions that do not optimise shareholder wealth (Jensen & Meckling, 1976). Fayezi, O'loughlin, and Zutshi (2012) investigated how the agency theory can help in achieving a deeper understanding of supply chain (SC) behaviour and

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relationships. Understanding and mitigating abnormal behaviour in the supply chain is a vital challenge for managers. This need is met by the agency theory, which provides a valuable method for dealing with transaction cost dilemmas through contractual and non-contractual solutions. The review concluded that the agency theory can be used to guide contractual reactions to outcome/ behaviour complexity of agents (or principals) within SC relationships. Supplier-management and buyer-supplier partnerships are examples of agency relationships in supply chain management (Ketchen & Giunipero, 2004). These two agency relationships provide more information advantages to the managers or agents, as well as the business itself. Managers of the corporation may indeed take advantage of information asymmetry to behave in ways that are detrimental to shareholders and other stakeholders. As a result, additional disclosure is needed to minimize the agency issues between the two agency relationships. Corporate governance mechanisms may help to minimize anticipated costs and their negative effect on firm value to ease agency issues among companies and other stakeholders.

Research Method

In this study, the top 100 public listed firms in Bursa Malaysia were selected as samples and the data from the annual reports of those companies from 2018 to 2020 were extracted. The data analysis involved was the inclusion or exclusion content analysis of sustainable supply chain management framework information. Content analysis has been used in disclosure studies for several years (Abbott & Monsen, 1979;Guthrie & Mathews, 1985; Haniffa & Cooke, 2005) and it is still crucial in assessing the extent of SSCM disclosure.

Evaluating the top 100 companies by market capitalization offers a representative perspective for observing broader trends in corporate governance, human capital, and sustainable supply chain practices. These companies frequently serve as sector leaders with considerable visibility, facing more regulatory and stakeholder scrutiny, and are more inclined to implement or disclose sophisticated sustainability and governance measures. Their scale and market power establish standards for corporate conduct, with habits frequently disseminating to smaller companies within supply chains and across many industries. Consequently, although they may not encompass every detail of the business landscape, these firms operate as essential indicators of growing trends in disclosure, diversity, and sustainable management practices on both global and regional scales.

However, dependence solely on large-cap companies presents significant issues related to omitted variable bias, especially with industry-specific risks and unobserved firm heterogeneity that could obscure the correlation between gender diversity and organizational results. To address these difficulties, the study utilizes fixed-effects models that account for time-invariant firm-level factors, therefore isolating the within-firm variance resulting from changes in board gender diversity. Furthermore, industry fixed effects are included to address sector variations such as regulatory rigour, supply chain intricacy, or cultural conventions that may otherwise distort results. This empirical technique enhances causal inference by tackling unobserved variability, ensuring that the results represent systematic links between gender diversity and sustainable disclosure, rather than misleading correlations influenced by firm size, industry, or market conditions.

The annual report disclosures were assessed since the annual report provides the most publicly visible information, which could be used as credible data in the study. A pilot test was undertaken to identify any elements that were not related to the scope of the study by examining the annual reports and sustainability reports of the corporations.

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The Measurement of the Dependent Variable (SSCM disclosure)

Based on several processes, this study created a checklist for SSCM disclosure. The Global Reporting Initiative (GRIv4) and National Annual Corporate Report Awards (NACRA 2018) were used to identify the SSCM fundamental components. It also included the removal/addition process, which involved comparing basic SSCM items to actual SSCM disclosures obtained in the annual reports and sustainability reports. The validation of items by experienced scholars and industry practitioners was a critical step in developing the final version of the SSCM checklist. The SSCM checklist was used to construct the disclosure index, which consisted of twelve (12) themes, namely:(1)Product responsibilities; (2) Product and Service Labeling; (3)Marketing and Public Relations; (4) Customer Privacy; (5) Compliance; (6) Society – the assessment of supplier for effects on society; (7) Human Rights – the assessment of supplier human rights; (8) Labour Practices and Decent Work – the assessment of supplier for labour practices; (9) Environment - environmental assessment of suppliers; (10) Procurement; (11) Policies; (12) Involvement of Stakeholders' Engagement.

The study employed an unweighted disclosure index that considered 60 discretionary items. In terms of CG characteristics, Barako, Hancock, and Izan (2006) showed no significant difference between the results of studies that utilized weighted or unweighted disclosure. The extent of SSCM information disclosure was assessed using the unweighted disclosure index technique, with an item scoring "1" if it was disclosed and "0" if it was not.

The Measurement of the Independent, Moderating, and Control Variables

The measurement of the independent, moderating, and control variables is shown in Table 1 below.

Table 1: Variables' Measurement

Independent Variable	Measurement
Board size	Number of directors on the board
Board Independence	Total number of non-executive directors on the board of directors
Independence of Audit Committee	Number of independent directors to the total number of directors in the audit committee
Foreign Ownership	The proportion of foreign shareholding from the total number of shares issued
Directors' Remuneration	Total remuneration of the directors
Risk Management Committee	Binary "1" companies have a risk management committee and "0" otherwise
Board Meeting Frequency	Number of times the board meeting is held in a financial year
Knowledge background	Number of directors with accounting/law background divided by the total number of directors on the board
Level of education	The highest education received by Directors and Top Management Teams: 0 = Below diploma 1 = Diploma 2 = Degree 3 = Professional and/or post degrees
Directors' age	Age of directors

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Moderating Variable	Measurement
Board's Diversity (Gender diversity)	Number of female directors divided by total number of directors on the board
Control Variables	Measurement
Profitability	Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM)
Total Assets (TA)	Total Assets

Statistical Technique

The Statistical Package STATA 17 was applied in the current study for data synthesis and hypothesis testing. Descriptive statistics, correlation, and Ordinary Least Squares (OLS) multiple regression analysis were performed using STATA 17. In this study, three models were developed to assist in measuring the associations among CG mechanisms, HC characteristics, board diversity, and SSCM:

Model 1 was created to aid in the measurement of the independent variables, control variables, and dependent variable's direct relationships.

$$SSCMDit = \beta 0it + \beta 1BSit + \beta 2BINDit + \beta 3ACINDit + \beta 4FOit + \beta 5DRit + \beta 6RMCit + \beta 7BMEETit + \beta 8LOEACCit + \beta 9BLOELAWit + \beta 10BPJEit + \beta 11DAit + \beta 12NPMit + \beta 13ROAit + \beta 14ROEit + \beta 15TAit + \bar{e}it$$

Model 2 has been designed to determine the direct relations among the dependent variable, independent variables, control variables, and moderating variable.

$$SSCMDit = \beta 0it + \beta 1BSit + \beta 2BINDit + \beta 3ACINDit + \beta 4FOit + \beta 5DRit + \beta 6RMCit + \beta 7BMEETit + \beta 8LOEACCit + \beta 9BLOELAWit + \beta 10BPJEit + \beta 11DAit + \beta 12BDit + \beta 13NPMit + \beta 14ROAit + \beta 15ROEit + \beta 16TAit + \bar{e}it$$

Model 3 has been created to detect the direct links among the separate variables, dependent variable, control variables, interaction variables, and moderating variable.

$$SSCMDit = \beta 0it + \beta 1BSit + \beta 2BINDit + \beta 3ACINDit + \beta 4FOit + \beta 5DRit + \beta 6RMCit + \beta 7BMEETit + \beta 8LOEACCit + \beta 9BLOELAWit + \beta 10BPJEit + \beta 11DAit + \beta 13BSXBDit + \beta 14BINDXBDit + \beta 15ACINDXBDit + \beta 16FOXBDit + \beta 17DRXBDit + \beta 18RMCXBDit + \beta 19BMEETXBDit + \beta 20LOEACCXBDit + \beta 21LOELAWXBDit + \beta 22PJEXBDit + \beta 23DAXBDit + \beta 24NPMit + \beta 25ROAit + \beta 26ROEit + \beta 27TAit + \bar{e}it$$

Where:

SSCMDit	=	Sustainable Supply Chain Management Disclosure
β0it	=	Intercept
B1BSit	=	Board Size
B2BINDit	=	Board Independence
B3ACINDit	=	Audit Committee Independence
B4FOit	=	Foreign Ownership
B5DRit	=	Director's Remuneration
B6RMCit	=	Risk Management Committee
B7BMEETit	=	Board Meeting
B8LOEACCit	=	Level of Education Accounting
B9LOELAWit	=	Level of Education Law
B10PJEit	=	Prior Job Education
B11DAit	=	Director's Age
B12BDit	=	Board Diversity

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B13BSXBDit	=	Interacting term between Board Size and Board Diversity
B14BINDXBDit	=	Interacting term between Board Independence and Board Diversity
B15ACINDXBDit	=	Interacting term between Audit Committee and Board Diversity
B16FOXBDit	=	Interacting term between Foreign Ownership and Board Diversity
B17DRXBDit	=	Interacting term between Director Remuneration and Board Diversity
B18RMCXBDit	=	Interacting term between Risk Management Committee and Board Diversity
B19BMEETXBDit	=	Interacting term between Board Meeting and Board Diversity
B20LOEACCXBDit	=	Interacting term between Level of Education Accounting and Board Diversity
B21LOELAWXBDit	=	Interacting term between Level of Education Law and Board Diversity
B22PJEXBDit	=	Interacting term between Prior Job Education and Board Diversity
B23DAXBDit	=	Interacting term between Director's Age and Board Diversity
B24NPMit	=	Net Profit Margin
B25ROAit	=	Return on Assets
B26ROEit	=	Return on Equity
B27TAit	=	Total Assets
Ēit	=	Error term
It	=	Subscript for Panel Data

Findings

Correlational Analysis

A correlational analysis was conducted to find any auto-relationships between SSCM disclosure and each mechanism of CG, HC characteristics, and corporate characteristics (net profit margin, return on assets, return on equity, and total assets). Table 2 shows the extent to which each of the variables in this study had a correlation.

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Table 2: Pearson Correlation of SSCM Disclosure to CG Mechanisms, HC, Board Diversity and Corporate Characteristics

	SSCM	BS	BIND	AIND	FO	DR	RMC	BMEET	LOE	PJEACC	PJELAW	DA	BD	NPM	ROA	ROE	TA
SSCM	1																
BS	0.231***	1															
BIND	0.212***	-0.145**	1														
AIND	0.408***	-0.124**	0.351***	1													
FO	0.198***	0.069	0.193***	0.288***	1												
DR	0.529***	0.305***	0.242***	0.267***	0.172***	1											
RMC	0.028	-0.028	-0.096*	0.023	-0.007	-0.102*	1										
BMEET	0.068	-0.051	0.000	0.111	0.044	0.058	0.070	1									
LOE	-0.041	0.001	-0.045	0.072	-0.006	-0.004	-0.019	-0.072	1								
PJEACC	0.068	-0.305***	0.343***	0.287***	0.174***	0.014	-0.155***	-0.001	0.032	1							
PJELAW	0.065	0.057	0.063	0.065	0.009	0.124**	-0.039	0.054	0.050	-0.027	1						
DA	-0.065	-0.011	-0.038	-0.045	-0.063	-0.065	0.066	-0.043	0.205***	0.001	0.007	1					
BD	-0.166***	-0.683***	0.087	0.020	-0.117**	-0.201***	0.035	0.064	0.041	0.191***	-0.047	0.008	1				
NPM	-0.020	-0.020	0.138**	0.008	0.066	0.008	0.048	0.004	0.081	0.083	0.011	-0.026	-0.028	1			
ROA	-0.053	-0.028	-0.000	-0.069	0.022	0.029	0.073	0.071	-0.046	-0.082	-0.207***	0.062	-0.052	0.069	1		
ROE	0.049	0.162***	0.209***	0.044	0.091	0.048	0.152***	0.060	-0.009	-0.019	-0.085	0.049	0.048	0.184***	0.425***	1	
TA	0.561***	0.208***	0.243****	0.367***	0.157***	0.570***	0.081	0.131**	-0.046	0.113	0.091	-0.046	-0.150***	-0.057	-0.025	0.039	1

*p≤0.10, **p≤0.05, ***p≤0.01

SSCM Sustainable Supply Chain Management Disclosure, BS Board Size, BIND Board Independence, ACIND Audit Committee Independence, FO Foreign Ownership, DR Director Remuneration, RMC Risk Management Committee, BMEET Board Meeting, LOE Level of Education, PJEACC Prior Job Experience (Accounting), PJELAW Prior Job Experience (Law), DA Director's Age, BD Board Diversity, NPM Net Profit Margin (Profitability), ROA Return on Assets (Profitability), ROE Return on Equity (Profitability), TA Total Assets (Company Size).

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The results from Table 2 revealed significant positive relationships at $p<0.001$ between SSCM disclosure and board size, board independence, audit committee independence, foreign ownership, and directors' remuneration. There was a negative relationship between SSCM disclosure and board diversity at a $p<0.01$ significance level with $r=-0.166$. This result designates that SSCM disclosure and board diversity were working in a conflicting way. Since there was a connection between the two variables, the subsequent analysis was performed.

Furthermore, the correlation coefficients between SSCM disclosure and risk management committee, board meeting, and knowledge background were positive but not significant. Whereas, the correlation coefficient for the level of education was shown to be negative and not significant with SSCM disclosure. In addition, the value of correlation was at less than 0.10 and can be said to be weak. Since the correlation values were not equal to zero, the subsequent analysis was conducted to confirm the findings.

The analysis also suggests that the independent variables had no multi-linearity problems, as they did not exceed 0.80. According to Gujarati (2004), multi-collinearity is likely to exist when the correlation factor is 0.80 and higher. Whilst Hair, et al. (2010) suggested that 0.90 is an indicator of the multi-linearity. The result of a VIF which showed a mean of 1.31 also confirmed this. To sum up, there was no problem with the Pearson's correlation coefficient and VIF findings.

Regression Analysis

The first step in examining the relationship between SSCM disclosure and the independent variables of each CG mechanism and HC characteristic was achieved by performing a Multiple Regression analysis via Ordinary Least Squares (OLS) longitudinal panel regression or pooled regression. Following that, the random consequence generalized least squares regression was utilized to examine the research hypotheses further and to ensure that the main Ordinary Least Squares (OLS) regression analysis outcomes were reliable. The Pagan Lagrange multiplier (LM) and Breusch test were utilized to differentiate between the simple Ordinary Least Squares (OLS) and the random effect Generalized Least Squares (GLS) regression analyses. The random effect GLS regression was found to be appropriate based on the significance of the results.

Therefore, by means of the fixed effect approximation method to prove the consistency of the random effect GLS regression results, more testing of the research hypotheses was required. The Hausman test was performed to evaluate which of the fixed effect and random effect models was preferable, and the test showed that the fixed effect approximation method was the best model.

The results of the ordinary least squares regression, random effect model, and fixed-effect model are presented in Table 3.

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Table 3: Fixed Effects Regression Results, Random Effects GLS Regression, and OLS Longitudinal Panel Regression

	Model 1	Model 2	Model 3
Variables	**Pooled regression**	**Random effect**	**Fixed effect**
Board Size	0.003**	0.003**	0.006***
	(2.20)	(2.20)	(2.89)
Board Independence	0.004	0.004	0.021
	(0.22)	(0.22)	(0.69)
Audit Committee Independence	0.058***	0.058***	0.059***
	(4.43)	(4.43)	(3.65)
Foreign Ownership	0.000	0.000	-0.001
	(0.70)	(0.70)	(-0.92)
Director's Remuneration	0.001***	0.001***	0.000***
	(4.51)	(4.51)	(2.91)
Risk Management Committee	0.004	0.004	0.004
	(0.69)	(0.69)	(0.60)
Board Meeting Frequency	-0.001	-0.001	0.003
	(-0.18)	(-0.18)	(0.53)
Level of Education	-0.003	-0.003	-0.001
	(-0.86)	(-0.86)	(-0.32)
Prior Job Experience (Accounting)	-0.001	-0.001	0.008
	(-0.12)	(-0.12)	(0.41)
Prior Job Experience (Law)	-0.012	-0.012	-0.013
	(-0.48)	(-0.48)	(-0.42)
Director's Age	-0.000	-0.000	0.001
	(-0.26)	(-0.26)	(1.27)
Net Profit Margin	-0.000	-0.000	0.000
	(-0.32)	(-0.32)	(0.19)
Return on Assets	-0.003	-0.003	-0.002
	(-0.84)	(-0.84)	(-0.48)
Return on Equity	0.000	0.000	0.001
	(0.09)	(0.09)	(0.78)
Total Assets	0.001***	0.001***	0.001***
	(4.89)	(4.89)	(5.44)
Constants	0.278***	0.278***	0.135
	(7.23)	(7.23)	(1.64)
R-square	0.437	0.437	0.392
Prob>F / Prob>chi2	0.000	0.000	0.000
Observation	300	300	300
Breusch and Pagan Lagrangian Multiplier Test	0.076*		
Hausman Test		0.016**	

*p≤0.10, **p≤0.05, ***p≤0.01

The three models above were put to the test in order to determine which one was the best. To choose between a simple Ordinary Least Squares regression and a random effect generalized least squares regression, the Breusch Lagrange multiplier (LM) and Pagan tests were utilized. Because the Ordinary Least Squares (OLS) longitudinal panel regression was not suitable (p≤0.10 in both tables), the regression model had to be projected using random effect generalized least squares regression.

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Additional research hypothesis tests utilizing the fixed effect approximation method were needed to verify the consistency of the random effect generalized least squares regression results. This was due to, as explained by Baltagi (2005), the random effect model being ineffective when the sample was not drawn at random from a huge population, but instead from the top 100 public listed firms in Malaysia (by market capitalization) from 2018 to 2020. This is constant with countless scholars' works which were also grounded on the market capitalization of the population's sample (Ramli & Ramli, 2015; Rosli, et al., 2017; and Sadou, et al., 2017). As a result, Wooldridge (2010) suggested using the Hausman test to determine which model is best, random effects or fixed effects. The result shows that the chi-square was significant ($\chi2=28.93$, $p<0.05$). As a consequence, it appeared that the fixed effect approximation method was the most suitable for the current study.

Further heteroskedasticity and autocorrelation tests were carried out. The probability values ($P<0.01$) indicated the existence of autocorrelation and heteroskedasticity issues, according to the outcomes of the altered Wald test and Wooldridge test. According to Kelejian and Prucha (2010) and Patriota, et al. (2011), applying the rule of hypothesis testing with a possibility value of less than either 1 % or 5 % or 10 % could indicate the occurrence of a heteroskedasticity problem.

Therefore, the robust standard error was used to correct the autocorrelation and heteroskedasticity issues. The results of the regression analysis using the robust standard error, namely the correlated panel corrected standard errors (PCSEs), are shown in Table 4.

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Table 4: Regression of Linear, Correlated Panel Corrected Standard Errors

Variables	Model 1	Model 2	Model 3	Model 4
Control Variables				
Net Profit Margin	0.000	0.000	0.000	0.000
Return on Assets	-0.004	-0.003	-0.002	-0.003*
Return on Equity	0.001	0.000	0.000	0.001
Total Assets	0.001***	0.001**	0.001**	0.001**
Independent Variables				
Board Size		0.003	0.004	0.008*
Board Independence		0.004	0.005	-0.007
Audit committee Independence		0.058***	0.058***	0.078***
Foreign Ownership		0.000	0.000	0.000
Director's Remuneration		0.001***	0.001***	0.000***
Risk Management Committee		0.004	0.004	0.004
Board Meeting Frequency		-0.001	-0.001	0.021**
Level of Education		-0.003	-0.003	0.002
Prior Job Experience (Accounting)		-0.001	-0.001	0.013
Prior Job Experience (Law)		-0.012	-0.011	-0.023
Director's Age		-0.000	-0.000	-0.001
Moderating Variables				
Board Diversity			0.005	0.300
Interaction terms				
Board Size* Board Diversity				-0.017**
Board Independence*Board Diversity				0.002
Audit committee Independence* Board Diversity				-0.043
Foreign Ownership* Board Diversity				-0.000
Director's Remuneration*Board Diversity				0.001**
Risk Management Committee* Board Diversity				-0.002
Board Meeting Frequency* Board Diversity				-0.063**
Level of Education* Board Diversity				-0.014
Prior Job Experience (Accounting)* Board Diversity				-0.048
Prior Job Experience (Law)* Board Diversity				0.026
Director's Age* Board Diversity				0.002
Constants	0.341***	0.278***	0.273***	0.181
Prob>Chi2	0.000	0.001	0.001	0.000
R square	0.319	0.437	0.438	0.453
Max lag (N)	300	300	300	300

***p < 0.01, ** p < 0.05, * p < 0.10

Dependent variable: SSCM disclosure

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Model 1 in Table 4 depicts the regression analysis with four control variables; three representing the companies' profitability, specifically net profit margin, return on assets, and return on equity; and one representing the companies' size, that is total assets. The R-square for Model 1 was 0.319.

The independent variables, as well as the control variables, were included in Model 2. Following the statistical control by the four control variables, the model revealed direct relationships between the dependent variable and the independent variables. Table 4 showed that with R square = 0.437, the model was significantly enhanced. This implies that the additional variance of 11.8 per cent in the SSCM disclosure was explained by the seven corporate governance mechanisms and four human capital characteristics.

Table 4 shows that board diversity was included as a moderating variable in Model 3 and the four control factors and the independent variables in the regression analysis model. This model was performed to determine whether or not the moderating variable operated as a predictor of the dependent variable. In other words, board diversity was introduced into the equation to investigate its impact as an independent predictor. In Model 3, by including the moderating variable in collaboration with the other variables, the R-square improved by only 0.1 per cent. The regression analysis outcome displays that the R square was 0.438 only. In addition, the result showed that board diversity, which was the moderating variable, was non-significant in this study as an independent variable (ß = 0.005, $p>0.05$).

In Model 4, all of the control variables, independent variables, the moderating variable, and the interaction terms were entered to determine the significance of the interaction terms. By integrating the interaction terms in Model 4, the R square climbed to 45.3 per cent. The significant independent factors in this model, which were favourably associated with the SSCM disclosure, were audit committee independence (ß = +0.078, $p < 0.01$) and directors' remuneration (ß = +0.000, $p < 0.01$). Moreover, board meeting frequency was positively related (ß = +0.021, $p < 0.05$) to SSCM disclosure. Board size was also positively related (ß = +0.008, $p < 0.10$) to SSCM disclosure. The results show that the higher the emphasis on the audit committee independence, directors' remuneration, board meeting frequency, and board size, the higher the SSCM disclosure became. Whilst, other independent variables, namely, board independence, foreign ownership, risk management committee, level of education, knowledge background, and directors' age did not significantly relate to SSCM disclosure. Therefore, hypotheses H1, H3, H5, and H7 were supported, but hypotheses H2, H4, H6, H8, H9a, H9b, and H10 were not supported.

The results of Model 4 in Table 4 indicated that based on the interaction terms, board's gender diversity only significantly moderated three independent variables, namely board size, directors' remuneration, and board meeting frequency.

Model 4 in Table 4 showed that board diversity negatively and significantly moderated the relationship between board size and the extent of SSCM disclosure. The results were statistically significant (ß= -0.017, $p<0.05$). The outcome showed that, the lesser the board gender diversity in the board, the higher the SSCM disclosure became. Thus, H11a was supported. Moreover, the result showed that board's gender diversity positively and significantly moderated the relationship between the remuneration of the directors and the degree of SSCM disclosure. The results were statistically significant (ß= +0.001, $p<0.05$). The outcome showed that the larger the directors' remuneration, the larger the extent of SSCM

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disclosure became, with the presence of higher board gender diversity. Thus, H11e was supported. Lastly, the result showed that board's gender diversity negatively and significantly moderated the relationship between board meeting frequency and the extent of SSCM disclosure (ß= -0.063, $p<0.05$). The result supported H11g and it indicated that the higher the frequency of board meetings, the higher the extent of SSCM disclosure became, with the presence of lower board's gender diversity.

Board's gender diversity did not significantly moderate the relationships between other independent variables (specifically, board independence, audit committee independence, foreign ownership, and risk management committee) and SSCM disclosure. Furthermore, board's gender diversity did not moderate the relationships between level of education, knowledge background, and director's age with SSCM disclosure. Therefore, the hypotheses H11a, H11e, and H11g were supported, but hypotheses H11b, H11c, H11d, H11f, H11h, H11i, H11j, and H11k were not supported.

Discussion and Conclusion

The SSCM requirement leads to the formulation of a company's environmental, social, and economic objectives. Thus, companies have to undertake the required efforts to address it. Supply chain management activities are becoming more apparent these days and stakeholders are pressuring companies to provide more information about their supply chains, and the reputational cost of failing to do so can be significant. Therefore, this study has examined the effects of CG mechanisms and HC characteristics in the context of SSCM disclosure, using the agency theory and upper echelon theory as the framework. The current study is one of the first to look into how gender diversity affects the relationships among CG, HC, and SSCM disclosure. The results of the study revealed that board size, audit committee independence, directors' remuneration, and board meeting frequency had positive relationships with SSCM disclosure.

According to MCCG (2012), every public listed company should be governed by an effective board of directors that can both lead and control the company. It is critical to have the right board of directors in place to ensure good governance. The size of the board of directors may have a significant effect on corporate transparency. A previous research work has suggested that board size has an effect on communication and coordination issues, as well as the board's ability to govern management and avoid poor decision-making's cost (Raheja, 2005). The study's finding is consistent with those of Yunus, et al. (2016), who revealed that larger board size was linked to SSCM disclosure. A large number of board members can have an effect on the organization's degree of information disclosure because they bring extensive experience, expertise, and skills to the boardroom (Abeysekera, 2010; Handajani, et al. 2014; and Samaha, et al., 2015).

The previous study has identified a relationship between audit committee characteristics and information disclosure, demonstrating that audit committees can aid in the improvement of corporate governance practices. According to the findings of the current study, audit committee independence has an effect on SSCM disclosure among public listed companies. The findings of the study are consistent with that of Appuhami and Tashakor (2017). The presence of audit committees with the appropriate qualities can serve as a market signal for the quality of a company's internal monitoring and CSR disclosure. Supply chain performance has long been seen as a critical component of a competitive strategy for increasing organizational productivity and profits (Imran, et al., 2019; Singh & Kaur, 2014). The audit committee's existence is

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crucial in implementing and monitoring corporate governance processes. Therefore, it is proposed that the supply chain companies increase their effectiveness in audit practices. Bujno and Parsons (2021) emphasized the audit committee's expanding functions as a result of the pandemic crisis and encouraged the audit committee to ensure that any newly identified strategic risks are discussed with the entire board of directors. Due to economic volatility and a transformed operational environment, the ongoing COVID-19 outbreak has resulted in significant changes such as in financial risks and other risks. Financial reporting, ethics, and compliance are some of the highest priority concerns for audit committee monitoring incorporation.

The principal-agent theory is commonly used in economics to justify a favourable association between executive compensation and corporate performance. According to the findings of this study, board remuneration is positively related with the level of SSCM disclosure. By looking at the 'two sides of the argument,' it can be stated that if the board's remuneration is used responsibly, without going overboard or engaging in deceptive practices, it can reinforce executive-owner relationships and increase shareholder value. On the other hand, if this CG instrument is misused or fails, it can lead to management entrenchment and systemic risk (Yablon & Hill, 2002). Individuals may be motivated to improve their competence and performance quality through this economic reward (Sardjana, et al., 2019). The current study's findings show that directors' remuneration acts as an incentive for them to increase SSCM disclosure levels. Therefore, the amount and nature of the remuneration should be able to encourage and sustain the directors' required skills to run the company successfully (Talha, et al., 2009).

The current study's findings also reveal that frequent board meetings result in a higher level of SSCM disclosure. This finding is in line with Percy, et al. (2008). Similarly, Allegrini and Greco (2013) found that frequent board meetings had a positive effect on disclosure practices amongst non-financial Italian listed companies. Frequent board meetings would encourage knowledge sharing and provide opportunities for communication and participation in sustainable supply chain operations. A regular board meeting is crucial to a firm's overall efficacy since the board of directors consists of the critical group of people in deciding the firm's performance. The agency theory states that having more board meetings improves the board's abilities to manage, assist, criticize, and foster a regimented atmosphere (Eluyela, et al., 2018).

In addition, this current study's findings reveal that the gender diversity of the board moderated the relationships among board size, directors' remuneration, board meeting frequency, and SSCM disclosure. The term "glass ceiling" refers to a hidden barrier to achievement in a field that disproportionately affects women and minorities. Therefore, the contribution of board diversity to the firm's success is one of the hallmarks of MCCG (2017). Gender diversity is emphasized in the literature on sustainable management, and so are the specific contributions female directors can make to a company's performance (Ruel, et al., 2020; Diana, 2018).

The findings of this study imply that the higher the percentage of women on the board, the stronger the relationships among board size, board remuneration, frequency of board meetings, and SSCM disclosure. The findings of this study have several important implications. The findings suggest that, to increase SSCM disclosure, board members should pursue effective governance mechanisms, such as having the optimum board size, regular meetings, a strong audit committee, and a uniform set of director remuneration. According to the findings, investors who are concerned about sustainability issues should encourage businesses to promote

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effective CG policies and processes to improve sustainable supply chain management performance. When aiming to promote SSCM performance, which is required to achieve SDG 12, government regulators should emphasize the importance of effective governance features and sustainability-related initiatives. The findings may also aid legislators and regulators in enacting legislation to promote women to participate in corporate boards to build sustainable supply chain management for all stakeholders and the public.

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