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# THE IMPACT OF SUSTAINABILITY AND CYBER SECURITY POLICIES ON FIRM PERFORMANCE: EVIDENCE FROM ASEAN LISTED COMPANIES

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## ABSTRACT

This paper explores firm performance evaluation, expanding beyond traditional return on assets to include Tobin's Q. Sustainability and cybersecurity policies are identified as crucial factors influencing corporate success. The study analyzes 206 publicly listed companies in Malaysia, Thailand, and Singapore within the ASEAN region, using data from Refinitiv Eikon and multiple regression techniques. The results reveal a significant impact of sustainability and cybersecurity policies on firm performance as measured by Tobin's Q. The findings support the theoretical frameworks of agency cost and stakeholder theories. Future research should consider broadening the study's scope to include additional datasets from other ASEAN-listed companies to enhance the understanding of the relationship between policies and firm performance.

JEL Classification: M40, M42

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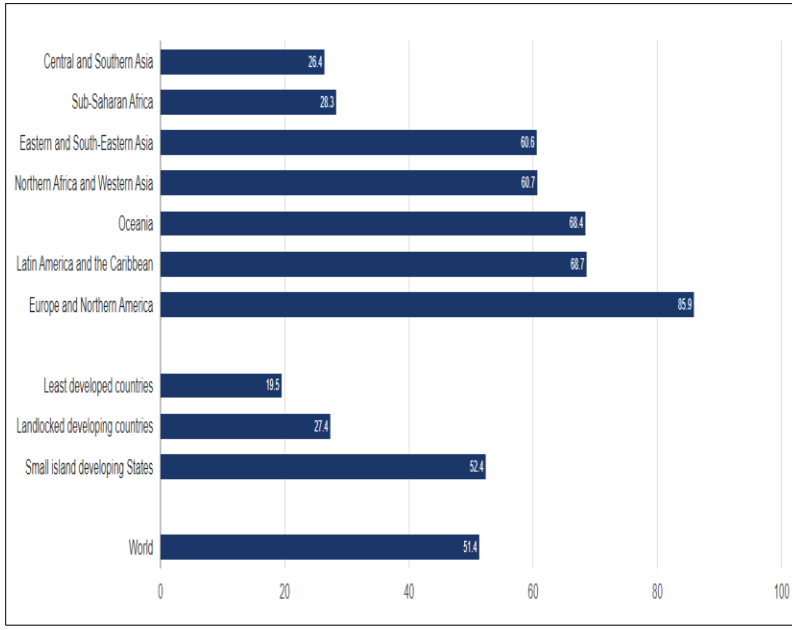
## 1. INTRODUCTION

In today's digitalized business environment, artificial intelligence (AI) tools play a crucial role in enhancing operations and corporate reputation for publicly listed companies. The use of internet and cyber technologies has significantly enriched societal knowledge (Mishra et al., 2022a). Malaysia has experienced substantial economic growth since gaining independence, transitioning from agriculture to an industrial-driven economy, notably through projects such as the Multimedia Super Corridor promoting information technology (Ahmad, 2013). Similarly, Singapore's recent amendment to the Cybersecurity Act aims at strengthening critical information infrastructure resilience (FTI, 2024). In the realm of firm performance, sustainability practices and cybersecurity policies are pivotal and kept emerging (Atkins et al., 2023). In fact, the literature emphasizes their impact on financial performance, stock market behavior, and stakeholder trust across various industries and company sizes (Hassan et al., 2020; Frizzo-Barker et al., 2020; Wang, Han, and Beynon-Davies, 2019; Cantele and Zardini, 2018), prompting further exploration. This study focuses on ASEAN-listed companies to elucidate how these factors influence financial outcomes, stock market performance, and stakeholder trust in this regional context.

The United Nations Sustainable Development Goal (SDG) 17 emphasizes global partnerships for shared objectives (SDG, 2019). The COVID-19 pandemic accelerated digitalization, raising cybersecurity concerns with increased internet usage, particularly in Europe and Northern America (Mishra et al., 2022a; Chang et al., 2020). Simultaneously, global sustainability efforts surged, prompting companies to adopt ESG policies and transparent reporting (Atkins et al., 2023; Fahad and Busru, 2021). The ESG Score introduced by Refinitiv Eikon in 2021 aids in evaluating corporate sustainability (Khunkaew, Wichianrak, and Suttipun, 2023). The growing threat of cyber-attacks necessitates robust cybersecurity measures, prompting evolving regulatory frameworks for data protection, especially in Malaysia. This study investigates cybersecurity policies among

publicly listed Malaysian companies using the Refinitiv Eikon database.

FIGURE 1
Frequency using the Internet (Source: SDG, 2019)




Challenges with ESG metrics impacting firm performance have been highlighted, particularly in IT sectors (Egorova, Grishunin, and Karminsky, 2022). Further research is needed in non-IT sectors to understand the adoption of sustainability practices and their implications for financial performance and stakeholder relations. Broader studies are required to generalize findings across countries and sectors, as shown by Wu et al. (2022) with Chinese manufacturing firms. Establishing governance for AI to align with ethical principles is crucial (Minkkinen, Niukkanen, and Mäntymäki, 2024; Brusseau, 2023). Integrating AI into ESG assessments could enhance social welfare and human capital but require standardized metrics and addressing knowledge gaps (Dwivedi et al., 2021).

Our research examines the impact of security and sustainability policies on firm performance in Malaysia, Thailand, and Singapore. Building on Wu et al. (2022) and Minkkinen et al. (2024),

we analyze sustainability metrics and cybersecurity policies using Refinitiv Eikon data. We also explore AI's role in enhancing firm performance and hypothesize that these policies significantly affect Tobin's Q. Our study aims at informing academics and policymakers about factors influencing firm performance, emphasizing cybersecurity measures based on the ASEAN Cyber Threat Assessment 2020 (ASEAN, 2023).

## 2. LITERATURE REVIEW

### 2.1 SUSTAINABILITY AND FIRM PERFORMANCE

Demand for strong ESG scores has influenced corporate strategies in the ASEAN region (Egorova et al., 2022). Pre-COVID-19, firms enhanced sustainability metrics to boost reputations (ASEAN, 2023). Low sustainability ratings deter investors and harm financial performance (Halabi and Samy, 2009; Zhicheng et al., 2016). Investors now fund improved sustainability reporting, expecting long-term gains (Shaikh, 2022; Fatemi, Glaum, and Kaiser, 2018).

This study examines the direct relationship between sustainability and firm performance, using Tobin's Q as the indicator (Bissoondoyal-Bheenick, Brooks and Do, 2023; Bose and Luo, 2014; Bharadwaj, Bharadwaj, and Konsynski, 1999). Inspired by Galbreath (2006), we find sustainability positively impacts firm performance in Malaysia, Thailand, and Singapore, informing future research on this robust link. Moreover, scientific literature and business practice agree that appropriate sustainability indicators can enhance firm value by improving performance (FTI, 2024; Shaikh, 2022). This study investigates the relationship between sustainability metrics and firm performance for companies listed in Malaysia, Thailand, and Singapore (ASEAN, 2023). Using a broad dataset from Refinitiv Eikon, including the ESG Combined Score and ESG Controversies overlay (Saini et al., 2023; Bendig et al., 2023), we provide a comprehensive understanding of how sustainability metrics impact firm performance.

### 2.2 CYBER SECURITY POLICY AND FIRM PERFORMANCE

Minkkinen et al. (2024) explore AI's impact on sustainability and ESG investment analysis, highlighting its importance for investor decisions. This study compares these insights with the ongoing

debates about AI effect on firm reputation. Our research focuses on cybersecurity policies, examining firms' willingness to invest in or neglect cybersecurity controls. We believe companies in Malaysia, Thailand, and Singapore have enhanced IT skills and adopted AI technologies (ASEAN, 2023), necessitating robust cybersecurity policies to manage knowledge asymmetries and cyber risks (Yadegaridehkordi et al., 2020).

Mishra et al. (2022a) identify AI cybersecurity threats from cloud computing, online banking, e-commerce, identity theft, privacy breaches, and the smart grid. Effective policies should manage these areas. Cybersecurity is a critical concern for academia and policymakers, impacting citizens, professionals, and company stability. In the ASEAN region, internet connectivity has advanced, increasing cyber threats to users, government agencies, businesses, and non-profits (Khan et al., 2023; Bissoondoyal-Bheenick et al., 2023)

This research aims at examining the interplay between AI, cyber security policies, and firm performance in the ASEAN region, focusing on companies listed in Malaysia, Thailand, and Singapore. By examining the proactive measures taken by these firms to enhance their IT capabilities and adopt AI technologies, we underscore the critical importance of implementing robust cyber security protocols to safeguard against cyber risks and ensure sustainable firm performance.

## 2.3 HYPOTHESIS DEVELOPMENT

This research investigates the relationship between sustainability practices and firm performance, hypothesizing that companies integrating sustainability initiatives will achieve improved financial, environmental, and social outcomes (Mishraa et al., 2022b). It also explores how well-developed cyber security policies impact financial, operational, and reputational performance compared to weaker measures.

The study evaluates the adoption of environmentally sustainable practices among companies in Malaysia, Thailand, and Singapore, and considers policy implications. It suggests governments promote sustainability among publicly listed firms. Previous literature, such as Khan et al. (2022), highlights how sustainability metrics such as ESG Scores influence stakeholder preferences and

firm performance. Despite evolving understanding, unresolved issues in ESG scores may reflect diverse stakeholder views (Boulhaga et al., 2022; Wu et al., 2022; Kang et al., 2022; Linnenluecke, 2022).

This research analyzes the composite ESG score, including total ESG Score, ESG Combined Score, and individual pillar scores, following past literature (Bendig et al., 2023; Bătae, Dragomir, and Feleagă, 2021). It includes a comparative analysis across ASEAN regions to explore regional variations in sustainability's impact on firm performance. Building on Masocha's (2018) work in South Africa, this study extends to diverse countries for a broader understanding. It examines both short-term and long-term consequences of sustainability practices (Kang et al., 2022; Masocha, 2018), hypothesizing a positive relationship with firm performance in Malaysia, Thailand, and Singapore.

H1: A positive relationship exists between sustainability and firm performance in firms with cyber policies among Malaysia, Thailand, and Singapore listed companies.

$H1_a$: A positive relationship exists between environmental pillar and firm performance in firms with cyber policies among Malaysia, Thailand, and Singapore listed companies.

$H1_b$: A positive relationship exists between social pillar and firm performance in firms with cyber policies among Malaysia, Thailand, and Singapore listed companies.

$H1_c$: A positive relationship exists between governance pillar and firm performance in firms with cyber policies among Malaysia, Thailand, and Singapore listed companies.

Previous research by Bowman and Steelman (2019) and Kang et al. (2022) has explored Information Security technology and firm performance. Building on Kang et al. (2022), who linked cyber security policies and intellectual property to market capitalization and ROI in US listed firms, we investigate this connection among companies in Malaysia, Thailand, and Singapore to challenge ASEAN's (2023) findings.

From a managerial perspective, differences in how customers and investors value a firm's InfoSec patents, copyrights, and Intellectual Property portfolios are notable. Future studies may benefit

from collecting additional data from diverse patent sources and security policy documents (Ahmad, 2013). Rapid digitalization underscores the need for AI tools to assess organizational performance, particularly in non-financial areas such as ESG, yet debate on mainstream AI use for investor protection remains limited (Brusseau, 2023; Minkkinen et al., 2024; Dwivedi et al., 2021). Our study aims at addressing these gaps.

Hovav, Gnizy, and Han (2023) explore knowledge management's strategic role, highlighting gaps in understanding recent cyber regulations' impact on knowledge management effectiveness (Hongming et al., 2020). Their findings diverge, revealing unexpected outcomes on external knowledge sharing and organizational performance, amidst industry emphasis on modern knowledge management's strategic advantages and privacy concerns. The researchers collected data from firms via an online survey through a professional panel company. Exploring secondary data sources such as the Refinitiv Eikon database could enhance understanding of these findings. Based on mixed results, companies prioritizing cyber security policies are anticipated to outperform peers across various performance dimensions. The compilation of the previous articles on this study is reported in Table 1. Based on the above explanation, we propose the following hypothesis:

H2: There is a positive relationship between cyber security policies and firm performance among Malaysia, Thailand, and Singapore listed companies.

TABLE 1
Literature Matrix Review

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Khan, I., Jia, M., Lei, X., Niu, R., Khan, J., and Tong, Z. | 2023 | Total Quality Management and Business Excellence | Corporate social responsibility and firm performance | China | firm performance | Corporate social responsibility, firm size and CEO salary | Results show that the silent donations of firms positively influence their performance. | This study advances our understanding of how and under what conditions non-SOEs make silent charitable donations and enhance their performance by highlighting the important role of these donations, thereby contributing to the literature on corporate social responsibility and silent charitable donations. |
| 2 | Bissoondoyal -Bheenick, E., Brooks, R. and Do, H. X. | 2023 | Economic Modelling | ESG and firm performance: The role of size and media channels | G20 Countries | Firm Performance (Tobin's Q) | ESG (Environmental Score, Social Score, and Governance Score)<br><br>Moderating Variables: Role of the Size and Media Channels | The firm size channel suggests that larger firms tend to invest into the ESG activities due to economies of scale to better reflect stakeholders' demands.<br><br>Meanwhile, under the media channel, firms with better media coverage can reduce information | The results deliver important implications to policy makers and firms' stakeholders, including investors and firm managers, regarding investment in ESG and portfolio management.<br><br>Investment in ESG can improve firm value through creating value for a firm's stakeholders |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | asymmetry regarding ESG investments for their stakeholders. As a result, firms can avoid various costs following the stakeholder theory view (e.g., stakeholders' punishment costs), and hence, have better performance. | in general rather than focusing on maximizing the shareholders' value alone. Moreover, engaging in ESG commitments can help firms reduce ESG-associated risks and provide better protection to investors, supporting the portfolio diversification and hedging benefits of ESG. |
| 3 | Mishraa, A., Alzoubi, Y.I., Anwar, M.J., and Gill, A.Q. | 2022 | Computers and Security | Attributes impacting cybersecurity policy development: An evidence from seven nations | USA, EU, Australia, Canada, China, India and Malaysia | Cybersecurity Policies | 14 attributes:<br>i. Telecommunication<br>ii. Network<br>iii. Cloud Computing<br>iv. E-Commerce<br>v. Online Banking<br>vi. Smart Grid<br>vii. Consumer Rights<br>viii. Cybercrime | The CS policy should be adaptable, allowing the state to enhance it as technology improves. It is advised that all nations examine the policies of other nations to get inspiration and incorporate topics relevant to their setting. This method can aid in creating a complete and successful policy. | Since cybercrime has the potential to jeopardize national security, it is critical to combat these crimes decisively. To combat cybercrime, there should be well-established policies, as well as the identification of critical CS traits so that a comprehensive policy can be devised. |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ix. National Encryption<br>x. Privacy<br>xi. Identity Theft<br>xii. Digital Signature<br>xiii. Data Security<br>xiv. Spam | Also, the growing information-sharing mechanism under the cyber protection act should promote communication between all governmental and private sectors.<br><br>In terms of digital signatures, any government must embrace this technology in order to protect digital material.<br><br>Improved technology and legislation that encourages consumers to provide their identities, increasing meetings between decision-makers and service providers; | A variety of stakeholders contribute to the development of CS policy, but the government is the driving force behind the policy's creation and modification. |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | society leaders lead to more worldwide appropriate privacy rules are all needed to combat identity theft.<br><br>Network security laws have to be improved in several nations, such as the EU, India, and Canada, where IoT security rules fail to collect private data securely. With the growing number of international data protection rules, including a policy that allows service providers to offer sufficient security for users and simply data encryption can be effective solutions. | |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | The publication of data privacy and consumer rights is a major concern, particularly in the social media space; as a result, a new strategy that protects consumer rights and privacy is an effective solution. | |
| 4 | Shaikh, I. | 2022 | Journal of Business Economics and Management | Environmental, Social, And Governance (ESG) Practice And Firm Performance: An International Evidence | Australia, Brazil, Canada, China, Europe, France, Germany, India, Indonesia, Italy, Japan, Mexico, South Africa, South Korea, Taiwan, UK, USA | Firm's Financial Performance (measured by Returns on Assets (ROA), Returns on Equity (ROE), and Tobin's-Q) | ESG compliance | The descriptive and inductive statistical analysis shows that ESG compliance is more pronounced in European companies.<br><br>Simultaneously, Asian firms are more disciplined concerning the energy sector, and the Asia-Pacific counterpart is more inclined toward technology firms. | Policy implication/ practical recommendations:<br><br>(i) Firms must ensure higher GRI compliance by introducing Industry-leading practices like independent committees |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | The study shows that Global Reporting Initiative (GRI) and non-GRI companies differ significantly in their accounting performance (ROA and ROE) and market valuations (Tobin's-Q).<br><br>The environmental dimension appears intimidating across accounting and market-based firm performance, while the social dimension contributes adversely, and governance positively affects operational efficiency. | (ii) In order to have a swift implementation of sustainability standards; firms can constitute sub-dimension committees broadly covering various aspects of Economic, Environmental, Labour, Human rights, Society and Product responsibility.<br><br>(iii) The empirical outcome shows that a firm's performance responds positively to the governance aspects; hence board diversity, |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Executive compensation, board meetings, and board independence should have enhanced the reporting. |
| 5 | Boulhaga, M, Bouri, A, Elamer, A. A. and Ibrahim, B. A. | 2022 | Corporate Social Responsibility Environmental Management. | Environmental, social and governance ratings and firm performance: The moderating role of internal control quality | France | Firm Performance | ESG<br><br>Moderating Variable: Internal control weaknesses (ICW) | The results show that both ICW and ESG ratings have a positive and significant influence on firm performance.<br><br>The results also indicate that ICW negatively and significantly moderates the relationship between ESG ratings and corporate performance. | This study offers theoretical and practical implications to drive policymakers and businesses to assure sustainable development.<br><br>This study expects that can help managers to strengthen their internal resources, such as the internal control (IC) and ESG ratings to improve a firm's performance. |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Wu, S. Li, X. Du, X., and Li, Z. | 2022 | Sustainability | The Impact of ESG Performance on Firm Value: The Moderating Role of Ownership Structure | China | | ESG Performance<br><br>Moderating Variable: Ownership Structure | The results show that:<br><br>1. ESG performance is important in improving firm value<br><br>2. Executive ownership and institutional ownership positively and significantly affect firm value, while ownership concentration and equity balance have no impact and<br><br>3. Executive ownership and institutional ownership moderate the link between ESG performance and firm value, whereas the moderating role of ownership concentration and equity balance is insignificant. | The study contributes to the existing literature on ESG and will aid corporations to enhance firm value through improving ESG performance. |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| 7 | Kang, M., Miller, A., Jang, K. and Kim, H. | 2022 | Technological Forecasting and Social Change | Firm performance and information security technology intellectual property | USA | Firm Performance | Information Security Technology Intellectual Property (InfoSec IP) | Results suggest that InfoSec IP is positively related to both return on investment and market capitalization.<br><br>Further, we find that diverse InfoSec IP portfolios strengthen the effects of a firm's InfoSec patents and copyrights on market capitalization. | Several Contributions:<br><br>1. It is one of the first studies to gauge the contributions of InfoSec IP to firm performance both empirically and objectively (e.g., InfoSec Patent and InfoSec copyrights).<br><br>2. This study extends the empirical understanding of InfoSec IP using Real Option Theory (ROT).<br><br>3. Their empirical understanding of InfoSec IP and ROT contributes to the existing knowledge related to InfoSec technology and firm performance, i.e. |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | their findings suggest that InfoSec Patent, InfoSec Copyrights, and InfoSec Patent Portfolio are positively associated with Market Capitalization and ROI.<br><br>4. This study has managerial implications. Based on their findings, customers and capital investors differently value a firm's InfoSec Patent, Copyrights, and IP Portfolio.<br><br>5. The observations of the different interaction effects between InfoSec Patent Portfolio and InfoSec IP Patent and InfoSec |

TABLE 1 *(continued)*

| No. | Authors Name | Year | Journal | Title | Country | DV | IV | Findings | Conclusion |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Copyrights provide additional theoretical and managerial implications.<br><br>6. This study makes empirical contributions by devising InfoSec Patent Portfolio using a machine learning method based on archival data (USPTO and USCO). |

# 3. METHODOLOGY

## 3.1 SAMPLE AND DATA COLLECTION

The total population of the study consisted of 246 firms from Malaysia, Singapore and Thailand listed companies. Malaysian listed companies possess a greater volume of data in comparison to their Singaporean counterparts, influenced by geographical considerations. Conversely, Thailand imposes stricter regulations, particularly regarding disclosure of cybersecurity measures. Meanwhile, to determine firm performance, we examined Tobin Q, along with sustainability metrics (indicated by ESG Score and ESG Combined Score) and cyber security policies of the selected countries, using data collected from Refinitiv Eikon database for the year 2022. We categorized the presence of sustainability and cyber security policies within the population, as detailed in Table 2. After filtering the observations by removing firms with incomplete performance data, unclear cyber security policies, and questionable information, the final sample comprised 206 companies listed in Malaysia, Singapore, and Thailand.

TABLE 2
Selected Countries with Policy Cyber Security

| | Countries | | | | | |
|---|---|---|---|---|---|---|
| | Malaysia | | Singapore | | Thailand | |
| Number of Observations | 116 | | 10 | | 80 | |
| ESG Score | 116 | | 10 | | 80 | |
| ESG Combined Score | 116 | | 10 | | 80 | |
| ESG Combined Score | Yes | No | Yes | No | Yes | No |
| Policy Cyber Security | 73 | 43 | 5 | 5 | 73 | 7 |

Furthermore, Table 3 categorizes the cyber security policy status as either No (0) or Yes (1) for firms in various sectors, including Basic Materials, Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrials, Real Estate, Technology, and Utilities, while excluding the financial sector given its stricter financial regulations. Notably, 156 firms reported having a cyber security policy, whereas 50 firms did not. All data were collected from Refinitiv Eikon database with strict filtering and observation. Next, cyber security policies were defined as security documents that outline the rules, expectations, and approaches for organizations to maintain the confidentiality, integrity, and data availability (Mishra et al., 2022b). We selected companies listed in Malaysia, Singapore, and Thailand because these countries are among Asia's fastest-growing economies and have a high rate of Internet subscribers (Statista, 2022).

The Industrials sector had the highest number of observations (63 firms), with 46 implementing cyber security policies. In contrast, the Real Estate and Technology sectors had only two firms and one firm respectively with such policies. Tobin Q,

used to measure company performance (DV), is preferred for its independence from accounting practices and earnings manipulation compared to ROA and ROE (Jubilee, Khong, and Hung, 2018). ESG variables—ESG, ENV, SOC, GOV, and ESG Combined Score —are used to describe how firms deploy resources to influence performance and reputation (Bendig et al., 2023; Bătae et al., 2021). Cyber Policy is measured by a dummy variable (0 = no policy, 1 = policy), detailed in this study. Control variables (CV) include free float ownership and number of analysts, as in prior studies (Güngör and Şeker, 2022; Di Vaio and Varriale, 2020; Jatmiko, 2017; Sila, 2010).

TABLE 3
Policy on Cyber Security

| No | Sectors | Policy Cyber Security | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| 1 | Basic Materials | 6 | 7 | 13 |
| 2 | Consumer Discretionary | 7 | 28 | 35 |
| 3 | Consumer Staples | 14 | 25 | 39 |
| 4 | Energy | 4 | 18 | 22 |
| 5 | Health Care | 1 | 12 | 13 |
| 6 | Industrials | 17 | 46 | 63 |
| 7 | Real Estate | 0 | 2 | 2 |
| 8 | Technology | 0 | 1 | 1 |
| 9 | Utilities | 1 | 17 | 18 |
| | Total | 50 | 156 | 206 |

TABLE 4
Operational Definitions and Measurement of Variables

| Item | Variables name | Acronym | Measurements | Sources | References |
|---|---|---|---|---|---|
| DV | Firm performance | TobinQ | Market Value for Company divided by Net Asset Value. | Hand-collect | Brahma et al., (2021); Bharadwaj et al., (1999); Bose and Luo (2014) |
| IV | ESG Score | ESG | Overall company score based on self-reported information in the environmental, social and corporate governance pillars. | Secondary data | Bătae et al., (2021) |

TABLE 4 *(continued)*

| Item | Variables name | Acronym | Measurements | Sources | References |
|---|---|---|---|---|---|
| | Environmental Score | ENV | Measures a company's impact on living and non-living natural systems. | Secondary data | Bătae et al., (2021) |
| | Social Score | SOC | Measures a company's capacity to generate trust and loyalty with its workforce, customers and society. | Secondary data | Bătae et al., (2021) |
| | Governance Score | GOV | Measures a company's systems and processes. | Secondary data | Bătae et al., (2021) |
| | ESG Combined Score | ESG Combined | Is an overall company score based on the reported information in the environmental, social and corporate governance pillars with an ESG Controversies overlay. | Secondary data | Bendig et al., (2023) |
| | Policy Cyber Security | Cyber Policy | one if the company has a policy on cyber security and zero otherwise. | Secondary data | Hasan et al., (2021); El Khoury, Nasrallah, and Harb, (2022) |
| CV | Free Float ownership | Free Float | Free Float as a percentage of traded shares. | Secondary data | Güngör and Şeker (2022); Di Vaio and Varriale (2020) |
| | Number of Analysts | Analysts | Number of sell-side analysts covering the security. | Secondary data | Sila (2010) |

### 3.2 ECONOMETRIC MODEL

We construct the econometric model based on firm performance incorporating sustainability and policy on cyber security, and control variables in equation (1) to (5) below. These control variables were recommended by previous researchers because they might influence firm performance. The choice of control variables comprising free float ownership (Free Float) and number of analysts (Analysts) were guided by Di Vaio and Varriale (2022), Güngör and Şeker (2022) and Sila (2010). The econometric model is as shown:

$$\text{TobinQ} = \beta_0 + \beta_1 ESG + \beta_2 Cyber\ Policy + \beta_3 Free\ Float + \beta_4 Analysts + \varepsilon_j \quad (1)$$

$$\text{TobinQ} = \beta_0 + \beta_1 ENV + \beta_2 Cyber\ Policy + \beta_3 Free\ Float + \beta_4 Analysts + \varepsilon_j \quad (2)$$

$$\text{TobinQ} = \beta_0 + \beta_1 SOC + \beta_2 Cyber\ Policy + \beta_3 Free\ Float + \beta_4 Analysts + \varepsilon_j \quad (3)$$

$$\text{TobinQ} = \beta_0 + \beta_1 GOV + \beta_2 Cyber\ Policy + \beta_3 Free\ Float + \beta_4 Analysts + \varepsilon_j \quad (4)$$

$$\text{TobinQ} = \beta_0 + \beta_1 ESG\ Combined + \beta_2 Cyber\ Policy + \beta_3 FreeFloat + \beta_4 Analysts + \varepsilon_j \quad (5)$$

Models 1 to 4 examine how sustainability pillars and cyber security policies relate to firm performance (Tobin Q) in Malaysia, Thailand, and Singapore. Model 5 explores this using ESG Combined as an independent variable (IV). We refrain from predicting the direction of these relationships due to ongoing debate. Sustainability is defined by composite ESG scores and individual scores, including ESG Combined. Panel data's heterogeneity poses econometric challenges, managed using multiple ordinary least squares regression with robust standard errors (Yao et al., 2019; Baltagi, 2008).

## 4. ANALYSIS AND RESULTS

### 4.1 DESCRIPTIVE STATISTICS

Table 5 presents descriptive statistics for the variables. Tobin Q, a measure of firm performance, ranges from 18.32 to 28.68 (M = 23.34, SD = 1.85). The Environmental (ENV) score ranges from 0 to 100, averaging 44.20 (SD = 23.67).

The mean Environmental, Social, and Governance (ESG) score is 52.18 (SD = 17.61), with most firms scoring 51.60 (SD = 17.50) on the ESG Combined score. 76% of firms have a cyber security policy (Cyber Policy = 1). Social (SOC) and Governance (GOV) scores average 56.86 and 54.61, respectively. Firms have an average of 7.71 analysts (SD = 5.62) and 40% free float ownership (SD = 0.17). All variables show skewness (-1.21 to 0.75) and kurtosis (0.94 to 0.40).

TABLE 5
Descriptive Statistics

| Variables | Minimum | Maximum | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| TobinQ | 18.32 | 28.68 | 23.34 | 1.85 | -0.02 | -0.38 |
| ESG | 12.21 | 91.10 | 52.18 | 17.61 | -0.16 | -0.70 |
| ENV | 0.00 | 96.92 | 44.20 | 23.67 | 0.07 | -0.79 |
| SOC | 8.05 | 94.97 | 56.86 | 20.42 | -0.29 | -0.72 |
| GOV | 9.94 | 95.58 | 54.61 | 20.56 | -0.11 | -0.94 |
| ESG Combined | 12.21 | 91.10 | 51.60 | 17.50 | -0.09 | -0.68 |
| Cyber Policy | 0.00 | 1.00 | 0.76 | 0.43 | -1.21 | -0.54 |
| Free Float | 0.01 | 0.97 | 0.40 | 0.17 | 0.75 | 0.40 |
| Analysts | 1.00 | 22.00 | 7.71 | 5.62 | 0.66 | -0.76 |

Note: Refinitiv Eikon dataset. SD indicates standard deviation.

The Pearson correlation coefficients are reported in Table 6. Notably, a high correlation is observed between ESG and ESG Combined scores, with a coefficient of 0.98, followed by ESG and SOC, with a coefficient of 0.903. These high correlations are expected because of the inclusion of experimental variables such as ESG, ENV, SOC, GOV, and ESG Combined scores within the same sustainability category. Therefore, the associations between experimental variables do not significantly affect the overall preliminary analysis. Furthermore, it is observed that, apart from free float, other experimental and control variables exhibit close associations with firm performance, Tobin Q at 0.001 level. This finding underscores the viability of conducting further analysis in this study.

### 4.2 HYPOTHESIS TESTING

Table 7 presents the multiple regression analysis results. Sustainability metrics (ESG, ENV, GOV, SOC) were analyzed across four models. A relationship was observed between ESG and firm performance (Tobin Q) with a p-value of 0.06. However, no significant relationship was found between cyber security policies and Tobin Q (p-value = 0.13). Additional analyses examined ENV, SOC, and GOV with Cyber Policy and Tobin Q, showing mild relationships (p-values around 0.06). Models 3 and 4 indicated a positive relationship between Cyber Policy and Tobin Q (p-values of 0.09 and 0.03, respectively). Analysis demonstrated a strong positive correlation across all models. Further analysis replaced individual sustainability metrics with ESG Combined, reflecting overall performance based on ESG Score and ESG Controversies overlay.

TABLE 6
Pearson Correlation Matrix

| No | Variables | 1/VIF | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TobinQ | 0.031 | 1.000 | | | | | | | | |
| 2 | ESG | 0.006 | 0.393** | 1.000 | | | | | | | |
| 3 | ENV | 0.040 | 0.400** | 0.881** | 1.000 | | | | | | |
| 4 | SOC | 0.033 | 0.349** | 0.903** | 0.795** | 1.000 | | | | | |
| 5 | GOV | 0.067 | 0.158* | 0.572** | 0.243** | 0.281** | 1.000 | | | | |
| 6 | ESG Combined | 0.037 | 0.367** | 0.980** | 0.864** | 0.889** | 0.550** | 1.000 | | | |
| 7 | Cyber Policy | 0.747 | 0.310** | 0.451** | 0.442** | 0.461** | 0.140* | 0.455** | 1.000 | | |
| 8 | Free Float | 0.947 | 0.070 | 0.090 | 0.090 | 0.120 | -0.010 | 0.090 | 0.040 | 1.000 | |
| 9 | Analysts | 0.639 | 0.506** | 0.518** | 0.545** | 0.488** | 0.165* | 0.480** | 0.359** | 0.1770* | 1.000 |

TABLE 7
Multiple Regression Analysis

| Items | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coeff | p-value | Coeff | p-value | Coeff | p-value | Coeff | p-value | Coeff | p-value | Coeff | p-value | Coeff | p-value |
| ESG | 0.14 | 1.92* | | | | | | | | | | | | |
| ENV | | | 0.14 | 1.86* | | | | | | | | | | |
| SOC | | | | | 0.09 | 1.23 | | | | | | | | |
| GOV | | | | | | | 0.06 | 1.05 | | | | | | |
| ESG Combined | | | | | | | | | 0.12 | 1.69* | 0.16 | 2.37*** | | |
| Cyber Policy | 0.1 | 1.54 | 0.11 | 1.6 | 0.12 | 1.71* | 0.14 | 2.19** | 0.11 | 1.57 | | | 0.14 | 2.29** |
| Free Float | -0.01 | -0.24 | -0.01 | -0.24 | -0.02 | -0.3 | -0.01 | -0.19 | -0.02 | -0.27 | -0.02 | 0.33 | -0.1 | -0.23 |
| Analysts | 0.4 | 5.55*** | 0.39 | 5.40*** | 0.42 | 6.00*** | 0.45 | 6.78*** | 0.41 | 5.87*** | 0.43 | 6.24*** | 0.45 | 6.97*** |
| Year | Included | | Included | | Included | | Included | | Included | | | | | |
| R2 | 0.28 | | 0.28 | | 0.28 | | 0.27 | | 0.28 | | 0.28 | | 0.28 | |
| Adj R2 | 0.27 | | 0.27 | | 0.26 | | 0.26 | | 0.27 | | 0.27 | | 0.26 | |
| Prob > F | 20.32 | | 20.23 | | 19.56 | | 19.42 | | 20 | | 25.7 | | 25.2 | |
| Number of observations | 206 | | | | | | | | | | | | | |

Note: Coeff indicates coefficients for the models. ***, **, * Coefficients are significant at the 0.001, 0.01, 0.05 level respectively.

Similar to ESG, there appears to be a strong association between sustainability and firm performance, with a p-value of 0.09. No association is observed, however, between cyber security policy and firm performance. These findings indicate that sustainability does reflect Tobin Q. However, without considering ESG Combined, there appears to be an association between Cyber Policy and Tobin Q, with a p-value of 0.02 and an adjusted R-Square of 26%. To compare, the association between ESG Combined and Tobin Q also shows a positive and strong relationship, with a p-value of 0.01 and an adjusted R-Square of 26%. For all the tests, industry and time fixed effects were included. Clustering errors by the firm were accounted for by re-examining the analysis considering changes in sustainability from ESG to ESG Combined. Specifically, changes in ESG Combined between companies listed in Malaysia, Thailand, and Singapore were examined, resulting in the omission of ESG, ENV, SOC, and GOV as reported in Table 7 to minimize endogenous data collection.

## 5. DISCUSSION OF FINDINGS

### 5.1 DISCUSSION ON SUSTAINABILITY AND FIRM PERFORMANCE

This study addresses: How do sustainability and cyber security policies impact firm performance among ASEAN listed companies? It aims at offering insights into sustainability influence on firm performance, the synergy between sustainability and cyber security, and industry-specific variations. The study contributes industry-specific insights for ASEAN-listed firms, highlighting how robust sustainability practices attract investors and enhance corporate value.

Using Tobin's Q as a measure of firm performance aligns with recent literature emphasizing market value precision. Our analysis shows ESG and ENV factors impact firm performance significantly. Multiple regression analyses confirm a positive association between sustainability practices and firm performance in ASEAN-listed companies. From an Islamic perspective, organizational sustainability reflects a form of worship (ibadah), involving the entire organization in its pursuit.

### 5.2 DISCUSSION ON CYBER SECURITY POLICIES AND FIRM PERFORMANCE

The primary regression analysis, supported by prior research (Fatemi

et al., 2018; Galbreath, 2006), indicates that Malaysia, Thailand, and Singapore represent the ASEAN region well due to their robust stock exchanges and high prevalence of listed companies. The study also highlights the profound impact of sustainability on firm performance, aligned with the UN's 2030 SDGs. It discusses the Network and Information Security 2 Directive's global adoption since 2023 in the EU, prompting further exploration of cyber security policies to safeguard firm performance against data breaches and unauthorized access (Det Norske Veritas, 2023).

Additionally, our study reveals a significant relationship between cyber security policies and firm performance, particularly in data protection and information disclosure. Unlike Kang et al. (2022), which focused on specific attributes, our study examines the complex interaction between cyber security policies and Tobin's Q, considering both demand and supply dynamics.

Following Minkkinen et al. (2024), our study uses a dichotomous scale to support our hypothesis in models 3 and 4 regarding cyber policy. Global escalation of cyber security policies underscores their critical role in firm survival (Paulose and Sethi, 2023; Nakhli, 2022), echoing previous discussions on investor safeguarding. Amidst IR 4.0's digital transformation, enhancing cyber security policies is imperative to protect confidential information (Bissoondoyal-Bheenick et al., 2023), potentially influencing firm performance. Multiple regression analyses confirm a robust positive correlation between cyber security policies and firm performance, aligning with prior research.

## 6. CONCLUSION, LIMITATION AND FUTURE RESEARCH

This study suggests sustainability and cyber security policies significantly influence firm performance, measured by Tobin's Q, among ASEAN-listed companies, contributing to ASEAN studies and aligning with prior research. Limitations. however, include focusing only on Malaysia, Thailand, and Singapore, potentially missing industry diversity in ASEAN, and a narrow sample of companies with sustainability and cyber security policies. Theoretical frameworks of agency cost and stakeholder theories underpin the study's findings, consistent with global research. Practically, the findings underscore global sustainability debates and advocate for universal cyber security policies to protect investors. Regulatory bodies, such as Malaysia's

Securities Commission, can use the study to enhance data security. This research sets a foundation for future exploration in these crucial areas.

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