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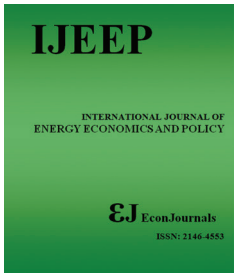

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Clustering of Companies Based on Sustainability Performance using ESG Materiality Approach: Evidence from Indonesia

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ABSTRACT

The framework for environmental, social, and governance (ESG) disclosure has become crucial throughout the world. Globally, various ESG reporting frameworks have emerged, but there are only few companies in Indonesia that are engaged in ESG. This research aims to develop an ESG performance assessment instrument based on material aspects of sustainability for all industries in Indonesia. The data was obtained by extracting 472 corporate sustainability reports in Indonesia during 2021 and ESG indicators were determined through focus group discussions and inter-rater reliability tests. The ESG performance assessment in this study adopted the methodology of the Refinitiv Institute and the ESG indicator weights were modified according to the new ESG indicators. A total of 65 ESG indicators were analyzed and these showed that the majority of companies in Indonesia have relatively satisfactory ESG performance and a moderate level of transparency in reporting important ESG data to the public. Cluster analysis with the K-means algorithm shows that each company needs to improve performance on at least one ESG pillar. The results of this research support the initiatives that have been taken by global regulators and stock exchanges in requiring companies to disclose ESG information in the future.

Keywords: Environmental, Social, and Governance, Refinitiv, Cluster Analysis, Focus Group Discussion, Sustainability Performance
JEL Classifications: C38, M14, Q56

1. INTRODUCTION

The increasing challenges related to climate and social change originating from the industrial world have demanded that the capitalist system be transformed into a driver of sustainability that will correct these problems (Clément et al., 2022). Stakeholders insist that companies can balance business growth with social progress and environmental sustainability (Kuo et al., 2021). This demand has been accompanied by the emergence of various strict regulations enacted by governments to encourage companies to reveal concrete plans and actions that can increase positive impacts on the environment and society, as well as the negative impacts of company activities through sustainability reporting.

One sustainability reporting framework that is increasingly in demand by stakeholders and has become an operational agenda globally is environmental, social, and governance (ESG) performance. ESG performance is widely used to evaluate a company's sustainability performance because it measures what companies actually do using a substantive approach (Atan et.al, 2018). Presenting sustainability information with a substantive approach will make it easier for report users (stakeholders) to assess the actions taken by companies in overcoming environmental and social problems, as well as governance commitments in supporting company sustainability efforts and making comparisons between companies (Cini and Ricci, 2020). In this case, ESG presents more holistic and comprehensive data in a quantitative form, so ESG has increasingly become the interest of stakeholders (Eliwa et al., 2021; Kiron et al., 2013).

Despite their advantages, in reality, ESG performance assessments create uncertainty for report users because there are differences

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in ESG performance from one rating agency to another (such as Thomson Reuters, Blomberg, Refinitiv, MSCI) (Baldini et al., 2018; Mura et al., 2018). Furthermore, Baldini et al. (2018) revealed that accurate performance assessments may not be possible because the definition and measurement of sustainability are complex and combine multidimensional aspects related to environmental, social, and governance issues. In addition, ESG performance is closely related to a company's internal characteristics, such as its size, operating location, industry problems, or materiality, as well as the availability of qualitative information, resulting in varying ESG performance (Baldini et al., 2018). These differences between ESG performance assessment results have given rise to criticism of the reliability of sustainability measurements because they have an impact on the representativeness and scope of the ESG rating provided and will ultimately influence the company's overall goals and targets (Eccles et.al, 2020; Shrivastava & Addas, 2014). The study by Mura et al. (2018) suggested that future research should adopt a multidimensional approach that presents a new measurement that is more generalizable.

In response to suggestions from researchers Mura et al. (2018) this study aims to develop a new ESG assessment indicator. Awareness of the complexity of measuring ESG performance motivated the authors to develop a framework for measuring ESG sustainability performance in Indonesia because of the low level of corporate initiative to engage in ESG performance (Ramadhani, 2022). Unlike in developed countries, ESG disclosure in many developing countries, such as Indonesia, is still voluntary and government regulations related to ESG focus on encouraging sustainable investment in the financial sector. Furthermore, Junius et al. (2020) revealed that companies in Indonesia that are involved in ESG exhibit low performance due to a lack of management understanding of ESG indicators, considering that sustainability involves multidimensional aspects and a broad range of stakeholders. Apart from that, weak government governance in evaluating sustainability performance is also one of the causes of low ESG performance in Indonesia.

Given the motivation for conducting this research as explained above, it is important for several reasons. Firstly, there is a crucial need for academics, managers, as well as investors to evaluate business processes according to different criteria and classify them as socially responsible businesses. For companies whose adoption of sustainability is at an early stage, such as in Indonesia, an ESG-based performance measurement framework is a fundamental requirement for mapping ESG into business processes. Second, there are differences in ESG performance provided by ESG data provider institutions due to differences in methods, assumptions, and the qualitative information used. Studies have found that these institutions do not always adequately recognize sustainability issues in the composition of the ESG scores they produce Rekker et al. (2020) so a new ESG measure is needed that is appropriate for the country and industry context. Third, several survey results and previous research have found that the high sustainability performance provided did not make real changes with regard to sustainability problems; in fact, it became worse than before (IPCC, 2021). This evidence indicates the possibility that the sustainability information conveyed is symbolic in nature, so what is needed is reporting with a substantive approach that is able to describe the extent of the company's contribution to sustainability in overcoming sustainability problems.

Specifically, this research aims to analyze corporate sustainability reports from all types of industries in Indonesia to develop a sustainability performance measurement based on the ESG framework. Measuring the sustainability performance using indicators is carried out by adopting the assessment methodology from the Refinitiv Institute and modifying the ESG indicators according to material topics in Indonesia. Governance arrangements in Indonesia, with a strong domestic legal and economic background, can provide lessons for other developing countries about participating in improving ESG. This analysis includes identifying the strengths of each ESG pillar through cluster analysis as an opportunity to improve sustainability performance in the future.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Sustainability Theory and Stakeholder Theory

Sustainability is the ability of the earth and its contents to survive extinction which includes economic (profit), social (people) and environmental (planet) aspects or commonly known as the triple bottom line. According to this theory, sustainability can be achieved when there is a balance between these three pillars. Another representation of the three pillar theory shifts from a focus on balance to a complete consideration of all pillars to express sustainability.

In line with the 2030 Agenda for Sustainable Development (SDGs)[1], companies are required to increase their contribution to sustainability. In this case, there are four SDGs pillars that must be achieved by companies, namely the pillars of economic development, environment, social, and law and governance (Ministry of National Development Planning/Bappenas, 2023). In an effort to increase transparency of company performance in terms of these development pillars, the government requires companies to disclose sustainability performance in sustainability reports. Therefore, companies must take strategic steps to support the achievement of these development goals by integrating sustainable practices into their activities with the aim of achieving corporate sustainability.

Sustainability theory is closely related to stakeholder theory. Stakeholder theory pertains to strategic issues related to how companies manage relationships with their stakeholders. Freeman et al. (2021) stated that stakeholder theory provides an extension

1 The 2030 Agenda for Sustainable Development or SDGs is a new development agreement that encourages changes that shift towards sustainable development based on human rights and equality to encourage social, economic and environmental development. SDGs/TPB are implemented with universal, integrated and inclusive principles to ensure that "No-one (will be) Left Behind". SDGs consist of 17 Goals and 169 Targets in order to continue efforts and achievements of the Millennium Development Goals (MDGs) which ended in 2015 (Ministry of National Development Planning/Bappenas, 2023).

that stakeholders are not limited to owners or investors, but also include customers, suppliers, labor unions, and communities. Gray et al. (1995) explained that companies must seek support from every stakeholder to maintain the company's survival. This support can be obtained by companies through disclosing sustainability practices, which is the current hope of all stakeholders. In line with (Jensen, 2001) according to enlightened maximization theory, maximizing stakeholder wealth will increase company value in the long term, because increasing company value is a product of the company's ethical and responsible behavior which aims to improve the welfare of society. Thus, these theories support the importance of increasing sustainability activities and transparency of disclosure, making it easier for stakeholders to assess the company's sustainability.

2.2. Enviromental, Social, and Governance (ESG)

As public awareness has increased with regard to the Sustainable Development Goals (SDG's), ESG has become increasingly popular with stakeholders. The emergence of ESG issues in business stems from movements advocating for limiting greenhouse gas (GHG) emissions and prioritizing climate change mitigation. This movement that has focused on environmental impacts gave birth to several events that contributed to the popularity of the Kyoto Protocol Agreement (1997) which focused on GHG reduction, the Principles of Responsible Investment (PRI) focused on promoting sustainable investment, and the Paris Agreement (2015) which focused on issues global climate. In 2015, the UN agreed on the SDGs which comprised 17 sustainable development goals. In agreeing on the SDGs, ESG issues also moved front and Center of the discussions, and this led to the emergence of the ESG framework.

The ESG framework is a broad dynamic concept, including activities related to corporate governance (CG), sustainability, and corporate social responsibility (CSR). Specifically, ESG consists of three pillars: Namely, the environmental pillar that assesses how companies protect the environment, including company policies taken to fight global warming and climate change; the social pillar that assesses how the company manages relationships with employees, suppliers, customers, and the community around the company: And thirdly, the governance pillar that assesses governance, company leadership, internal control mechanisms, and transparency of shareholder rights.

The importance of ESG information has garnered a positive response in many countries, especially companies in developed countries. Unfortunately, the ESG concept in ASEAN member countries is still not applied evenly. The Malaysian government has made policies related to the development of ESG in the environmental sector which has led to significant improvements. Likewise, in Singapore, Thailand, and the Philippines, ESG initiatives have been realized by establishing ESG councils in companies and mandatory open ESG reporting for companies. Indonesia is one of the ASEAN countries that has implemented the ESG concept, but public understanding is still not optimal. Based on the IBCSD survey in 2021, Indonesia's ESG index is still ranked 36 out of 47 in the world capital market. Apart from that, 40% of companies in Indonesia are still not aware of the important role of ESG. Nevertheless, companies in Indonesia are making various efforts to mitigate and overcome sustainability problems.

In the realm of research, some researchers often use ESG performance, although more and more literature shows that ESG performance does not measure sustainability in relation to sustainable development (Escrig-Olmedo et al., 2019; Gillan et al., 2021; Widyawati and Ningtyas, 2022). ESG performance is a measurement method that is calculated based on assumptions, knowledge concessions, and metrics from external parties so the calculations often produce different scores or values between ESG rating agencies and show less balanced comparisons between countries (Daugaard and Ding, 2022).

Considering that there is no consensus regarding the choice of the best ESG method and database, as well as the limited implementation of global ESG by companies in developing countries, this research seeks to enrich the literature by providing a measurement framework that is appropriate to the conditions of companies in Indonesia. This framework can provide information to stakeholders regarding the extent of the sustainability contribution of companies in Indonesia from an ESG perspective and serve as input for regulators.

3. DATA AND RESEARCH METHODOLOGY

3.1. Data Sources and Sample

This research aims to evaluate sustainability performance based on the ESG framework in the context of companies in Indonesia per industry group for the period 2021. The selection of this period is based on the rules of Financial Services Authority Regulation Circular No.16/SEOJK.04/2021 (hereinafter abbreviated as POJK 16/2021) which requires disclosure of company sustainability performance, not limited to companies in the financial sector as in the previous regulation (Financial Services Authority Regulation Circular No.51/POJK03/2017), meaning that in this period it is possible to analyze the sustainability performance of companies from all industrial sectors in Indonesia. The research also analyzes the most relevant sustainability factors as the strength of company sustainability in each industry. This objective is based on the idea of analyzing sustainability performance by selecting material aspects through relevant literature and studies for each ESG pillar.

The scope of this research covers the aspects of ESG, namely social, environmental and governance aspects. Environmental and social performance data are obtained by extracting sustainability information from stand-alone sustainability reports or those integrated into annual reports. Information from the sustainability reports are analyzed using the 2021 GRI Universal Standard framework because this framework details the sustainability strategy reported in document form (pdf). Governance information is obtained by conducting content analysis related to the implementation of governance in the annual report. Furthermore, this research conducts a focus group discussion involving all research members to determine material ESG indicators for companies from various industries in Indonesia.

Based on the research objectives, this study develops existing knowledge through exploratory research (Purba and Parulian, 2011) by adopting an ESG performance measurement method for all companies listed on the Indonesia Stock Exchange (IDX) and making modifications according to conditions in Indonesia. This study also groups companies based on ESG performance produced in the ESG performance assessment stage with new indicators. Thus, the population of this study consists of 852 publicly listed companies on the IDX, whether on the main board, acceleration or development, which are divided into 125 industrial sub-sectors. Table 1 describes the results of obtaining the research sample.

The samples that met the criteria amounted to 472 companies consisting of 258 companies (54.66%) on the main board, 205 companies (43.43%) on the development board, and the remaining seven companies (1.48%) on the acceleration board and two companies (0.42%) were listed as being on the new economy board. This indicates that companies/issuers on the main board, which are large companies and have a good financial track record, and have a higher capability in disclosing ESG performance compared to companies on other boards, which even tends not to have recorded net profits, thus not been able to demonstrate their commitment to ESG. Table 2 presents the sample distribution based on company registration boards.

Furthermore, the 472 samples obtained were grouped based on ESG industry classification into 36 industries (Appendix 1). This grouping aims to align the weighted ESG indicators for each industry. The classification results divide the sample into 36 industrial sub-sectors. Regarding these 36 industrial sub-sectors, the researchers further studied which industrial groups are most sensitive to environmental and social issues and what the ESG performance of companies in each industrial group is. The classification of sensitive industries refers to previous research (Raar, 2002) which grouped companies into five categories, namely the category industry 1 is assigned to the most sensitive industry and category 5 is assigned to the least sensitive industry. A score of 1 is given to companies that pose high risks to the environment, a score of 2 is given to companies that focus on consumer needs, a score of 3 is given to companies in the industrial sector, a score of 4 is given to companies operating in the services and communications sector, and a score of 5 is given to companies operating in the financial sector.

Table 1: Research sample

Number	Sample	n
1	Number of companies registered on the IDX in 2021	852
2	Companies that do not publish sustainability reports (stand alone or in annual reports)	380
3	Number of samples that meet the criteria	472

IDX: Indonesia stock exchange

Table 2: Sample based on company registration board

Number	Type of company	n (%)
1	Main board	258 (54.66)
2	Development board	205 (43.43)
3	Acceleration board	7 (1.48)
4	New economy board	2 (0.42)
	Total	472 (100) (rounded up)

3.2. Data Analysis: ESG Performance Assessment and Company Clusterization based on ESG Performance

The ESG sustainability performance measurement model in this research adopts the Refinitiv assessment methodology because the Refinitiv performance assessment model considers different weights for each material ESG indicator per industry category (Refinitiv, 2022). Modifications were carried out by adapting the ESG indicators that are within Refinitiv's scope to the sustainability framework that already exists in Indonesia, including using the GRI reporting framework for the environmental and social pillars, as well as governance indicators that have been determined by the Financial Services Authority. This modification will produce ESG performance that is different from the ESG produced by Refinitiv. Each ESG category indicator will ultimately provide different results for each individual and aggregate ESG performance. After obtaining the ESG performance for each company, this research conducted a cluster analysis to obtain information regarding the strengths and opportunities for improving ESG performance in the coming years. The input, output, and development of the ESG analysis model used in this study are shown in Table 1and Figure 1.

The first stage is to identify the concept of ESG performance measurement. The identification of ESG indicators includes ten ESG sub-topics, namely (1) the environmental pillar consists of three sub-topics (resource use, emissions, and innovation); (2) the social pillar consists of four sub-topics (labor, human rights, local society, and community); and (3) the governance pillar consists of three sub-topics (shareholders, CSR management, and transparency) (Refinitiv, 2022). Identification is carried out through focus group discussions to determine sustainability performance indicators for each environmental, social and governance topic. Focus group discussions are carried out by the entire research team by filling in check-lists for each indicator per topic and per industry as material indicators. The list of indicators obtained is collected and the indicators are selected based on the ranking of the most indicators selected by the research team, to obtain basic indicators for environmental, social and governance topics for all industries. In the first stage, researchers determined 98 material ESG indicators. These indicators consist of 32 environmental pillar indicators, 41 social pillar indicators, and 25 governance pillar indicators.

Table 3 shows the interrater-reliability analysis to test the level of agreement on ESG indicators. The results of the analysis show that the significance value is 0.000<0.05, which means that the hypothesis by which the researchers selected indicators randomly was rejected and the agreement level was 81.73%, which means that the researchers agreed 81.73% for indicators or 0.723% undecided indicators. Thus, this research analyzes 65 ESG indicators to evaluate 472 companies in Indonesia, or, in other words, this research analyzes 30,680 total ESG indicators (data points).

The second stage is to determine material indicators for each sustainability sub-theme. At this stage, the researchers carried out a check-list for each material indicator in each environmental, social and governance sub-theme. This stage produces 65 ESG indicators consisting of 21 environmental indicators, 19 social pillar indicators, and 25 governance indicators (Appendix 2).

Figure 1: ESG cluster assessment and analysis framework

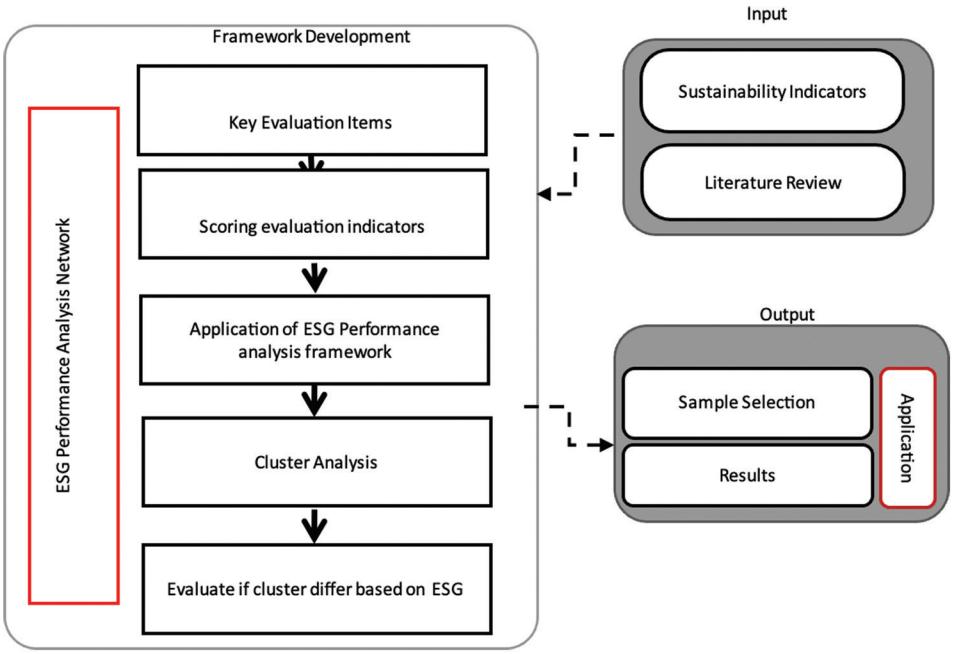
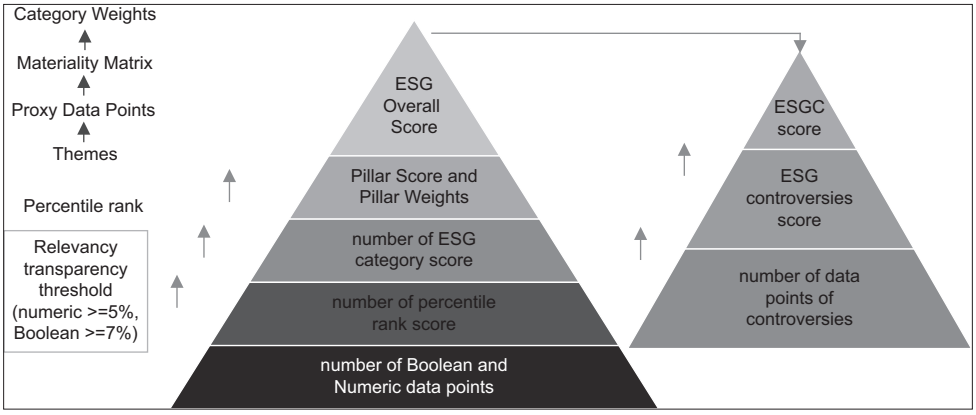


Figure 2: Environmental, social, and governance performance calculation method



Source: Modification of Refinitiv, 2022

Table 3: Kappa-Interrater Agreement Analysis

Numerator 1	Rater			Total
	1	II	III	
1	37	0	0	37
2	2	25	4	31
3	0	12	18	30
Total	39	37	22	98
Agreement (%)	81.63			
Expected Agreement (%)	33.84			
Kappa	0.7224			
Std.Error	0.0711			
Z (p.value)	10.16 (0.000)			

The third stage is to calculate the ESG score per pillar and the aggregate ESG score. Initially, the company value for each indicator is assessed based on the complexity of the disclosure. Data processing is carried out using Boolean and numerical techniques to obtain answers regarding the availability or absence of information. Boolean questions are usually answered with "Yes," "No" or "Null," and each measure has a polarity indicating whether the higher value is positive or negative. Boolean data assessments are converted into numeric values for percentile score calculations. Relative percentile ranking is only applied if numeric data points are reported by the company. In this assessment, some indicators are industry-specific and therefore not relevant for all companies. If an indicator is not relevant for a particular sector, then the indicator is excluded from the calculation and its value will be considered irrelevant (N/R).

In this research, a value of 1 is given for complete and substantive disclosure, and if not, a value of 0 is given. The value obtained is used to calculate the company's score compared to other companies using the transparency weight method. Calculations using this method are carried out using Boolean data, namely the value "Yes" for indicators with a value of 1, or the value "No" for indicators with a value of 0, as well as N/R for each type of immaterial indicator. The calculation of indicators for the governance pillars uses the count all data point method, namely by adding up the indicators in one sub-theme divided by the total disclosure of the sub-theme.

The next analysis is to calculate the weighted indicators per industry based on the materiality of the ESG indicators. Materiality for Refinitiv ESG is defined in the form of category or theme weights. Theme weights are calculated based on an objective and data-based approach to determine the relative importance of each theme for each industry group. Based on the themes covered in each theme, indicators with adequate disclosure are used as a proxy for industry size. For some themes, there are no data points that can be used as a good proxy for relative importance, mainly because of inadequate disclosure. In order to apply an objective assessment of each ESG theme to different industries, the Refinitiv ESG magnitude matrix was developed as a proprietary model and applied at the category level. Thus, the weights for the ESG and aggregate ESG pillars were carried out by ranking the weights by the research team and the results were similar to the ESG materiality matrix-Refinitiv weights. In this weighting, there is one sub-sector added for sectors in Indonesia, namely the seed and plant sector, which in this analysis results in the same weighting as the weighting for the plant and forest sub-sector.

The final step in ESG performance assessment is calculating the ESG pillar score and the aggregate ESG score. Performance calculations per pillar and aggregate are obtained by multiplying the total indicators in each sub-theme with the ESG magnitude matrix per industry based on Refinitiv. ESG pillar performance is the total indicator score per sub-theme multiplied by the matrix for the ESG pillar, while aggregate ESG performance is the total indicator per sub-theme multiplied by the matrix for aggregate ESG. This stage produces output in the form of four ESG performance/scores, namely environmental ESG, social ESG, governance ESG and aggregate ESG scores. Figure 3 presents Refinitiv's modified ESG performance calculation method.

The fourth stage in this analysis is clustering the company's ESG scores. Clustering is the process of grouping objects or data that are similar to points into clusters in such a way that they become a cluster (Sariyer and Taşkın, 2022). A cluster is a collection of data that is similar to each other and dissimilar to other cluster data. Thus, the aim of clustering is to produce groups of objects that are similar to each other within a particular group, which in this case is a group of companies that have homogeneous ESG performance characteristics.

In this research, the clustering of ESG scores uses K-means clustering algorithm analysis with R Studio tools. K-means has been widely used in previous research because it has several advantages, including: (1) it considers a collection of observations (x1, x2,…, xn); and (2) simplicity, fast convergence, and good scalability (Kwedlo and Czochanski, 2019; Meguelati et al., 2019). Determining the optimal number of clusters (k) that can be formed in K-means analysis uses three methods (Kaufman and Rousseeuw, 1990) as follows: (1) The Elbow method uses the total value of WSS (within-cluster sum of squares) as a determinant of optimal k; (2) the Silhouette method uses an average value approach to estimate the quality of the clusters formed; and (3) Gap Statistical Method for making decisions regarding optimal clusters from the Elbow and Silhouette method.

4. RESULTS AND DISCUSSION

The results of descriptive statistical tests presented in Table 4 show that the average ESG pillar performance scores are respectively 12.56% for environmental performance (E score), 15.83% for social performance (S score), and 14.78% for governance performance. Overall, the average aggregate ESG performance of 472 companies was 43.16% with a maximum value of 93% and a minimum value of 10%. Based on rankings from Refinitiv, the average score received a grade of C+, which means the company has relatively satisfactory ESG and a moderate level of transparency in reporting important ESG data publicly. The maximum score of 93% is obtained from companies on the main board which are included in the construction and building materials sector group, and the minimum value is obtained from companies on the development board which are included in the oil and gas industry sector group.

This research implements k-means in order to cluster ESG scores. K-means is an important and widely used clustering algorithm

Figure 3: Environmental, social, and governance score clusterization

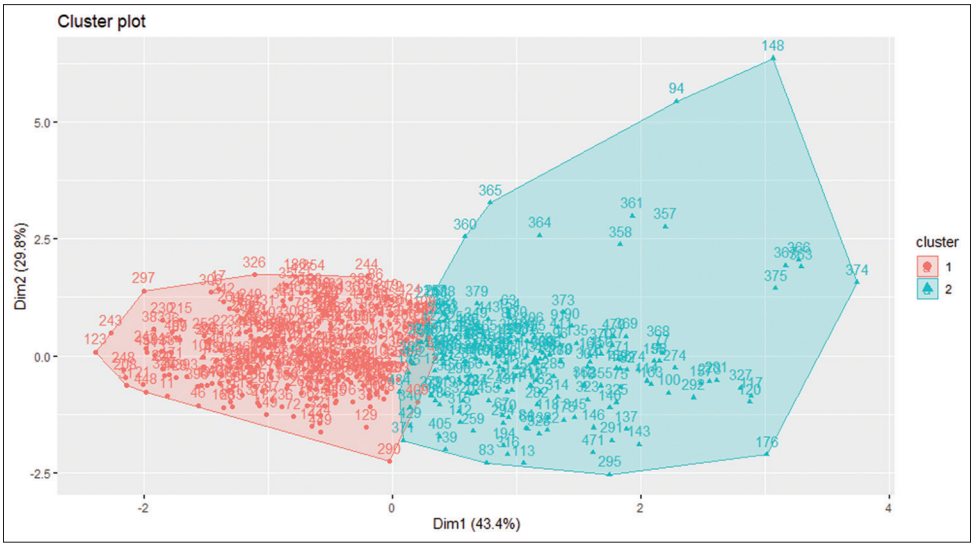


Table 4: Descriptive statistics of environmental, social, and governance scores per pillar and aggregate scores

Variable	Observation	Mean	SD	Minimum	Maximum
E score	472	0.1256356	0.1112848	0	0.6
S score	472	0.1583051	0.0760998	0	0.41
G score	472	0.1478602	0.0774259	0	0.40
ESG score	472	0.4316314	0.1647571	0.1	0.93

ESG: Enviromental, social, and governance, SD: Standard deviation

Figure 4: Optimal cluster analysis with the elbow method

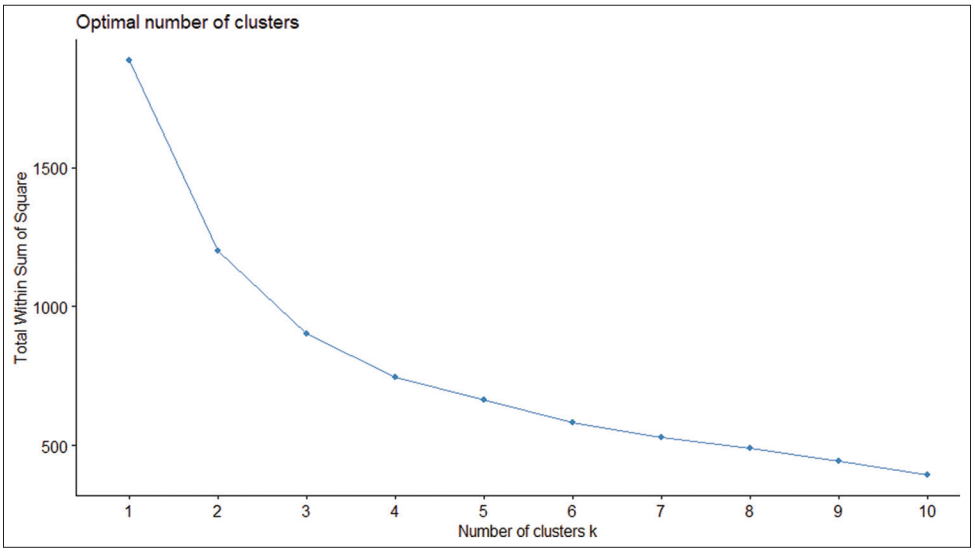
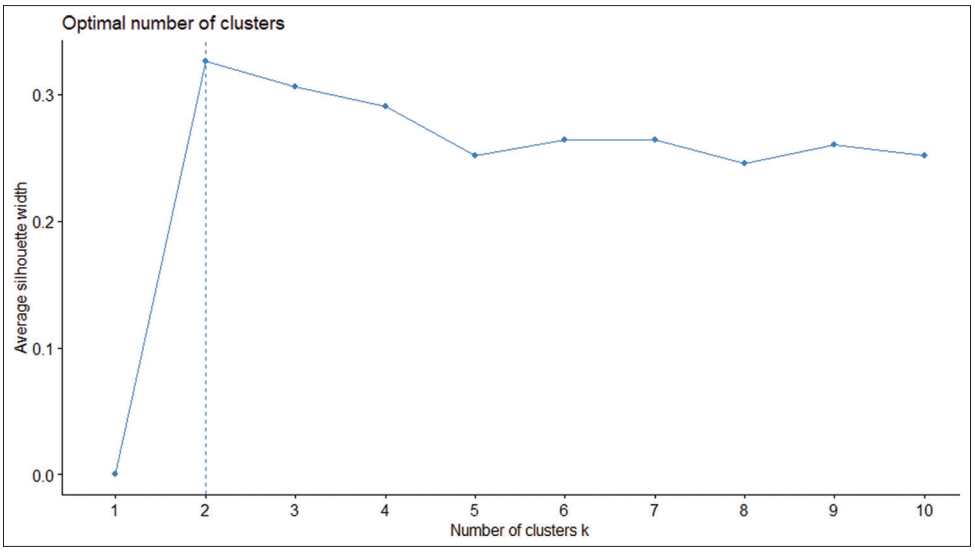


Figure 5: Optimal cluster analysis with the silhouette method



that considers a collection of observations (x1, x2,…, xn). Researchers state that the advantages of k-means are simplicity, fast convergence, and good scalability (Kwedlo & Czochanski, 2019; Meguelati et al., 2019). Based on (Celebi et al., 2013), k-means is obtained as follows:

$$\underset{s}{argmin}\sum_{i=1}^{k}\sum_{x\hat{I}Si}\left\|x-m_i\right\|^2 \quad (1)$$

Where: μi is the principal point in Si. In Equation (1), argmin is the minima argument or data point of the domain function where the function value is minimized. K-means divides n observations into k sets or clusters, ($k \leq n$), S = {S1, S2,…, Sk}, to minimize the sum of squared within-cluster distances. Each node in k-means is a d-dimensional real vector. In this research, clustering was carried out by dividing the data into two data points for the ESG pillar score and the aggregate ESG score using principal component analysis (PCA) as shown in Figure 3.

This research clusters scores for Environmental, Social, and Governance sustainability for 472 companies listed on the IDX in 2021. This is based on the number of companies used in the

Figure 6: Optimal cluster analysis with gap statistics method

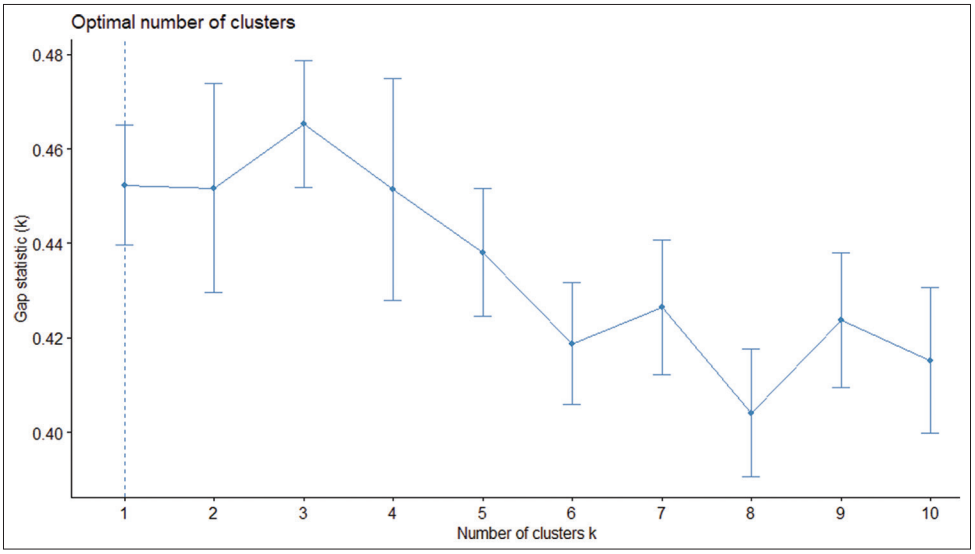
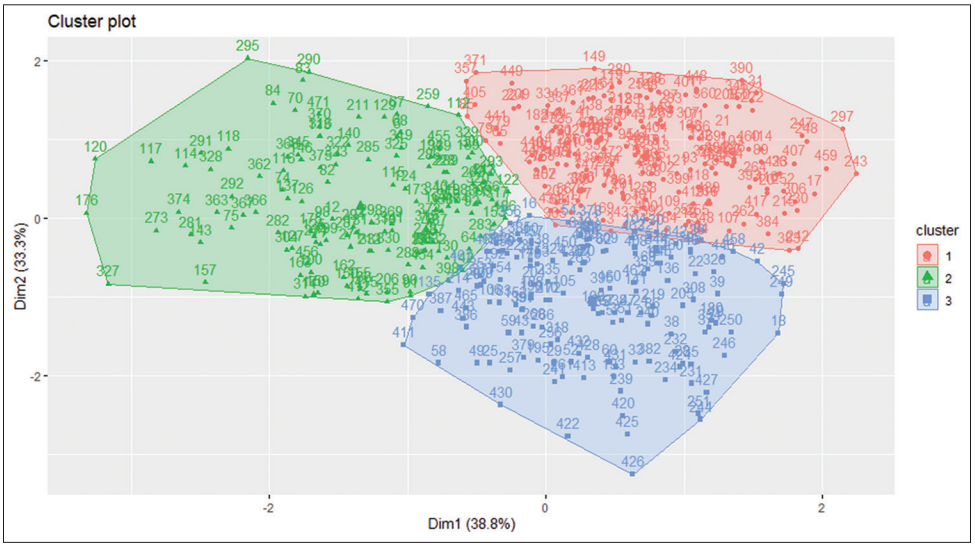


Figure 7: Gap statistic analysis of environmental, social, and governance score for k=3



sample. Analysis using the Elbow Method in Figure 4 shows that the line experiences a fracture which forms an elbow when k = 3. Therefore, by using this method, the optimal k is obtained when it is at k = 3. To create a comparison, other tests are carried.

In the Silhouette Method analysis, number of cluster (k) indicated that the optimal cluster created in this model. Figure 5 presents the result of analysis using average value approach. Results shows that many optimal clusters are formed at k = 2, meanwhile, the second option is at k = 3, thus, value at k = 2 and k = 3 is the highest compared to the others.

The final cluster determination analysis uses Gap Statistics as shown in Figure 6. The result obtained is that k = 3 is optimal for forming clusters. So, if compared with the previous method, it can be concluded that the optimal k value for forming clusters is 3.

Finally, the sample analyzed using Gap Statistic Analysis with three clusters (k=3), namely environmental, social, and governance scores, which is presents in Figure 7.

Cluster 1 consists of 125 companies that have an average environmental performance (Environmental score) of 25.9%, social performance (Social score) of 21.9%, and governance performance (Governance score) of 15.6%. Based on the ESG ranking, the aggregate ESG score of 63.5% is included in the B rating, indicating relatively good ESG performance and an above-average level of transparency in reporting important ESG data publicly. This cluster is dominated by companies in industries that are most sensitive to environmental issues, such as companies whose activities are directly related to the environment (58%) and consumers (22%) and are on the main board (64%).

Cluster 2 consists of 146 companies that have an average environmental performance (Environmental score) of 7.4%, social performance (Social score) of 15.6%, and governance performance (Governance score) of 22.3%. Based on the ESG ranking, the aggregate ESG score of 45.4% is included in the C rating which indicates relatively satisfactory ESG performance and a moderate level of transparency in reporting important ESG data publicly. This cluster is dominated by companies on the main board (90%)

Table 5: Environmental, social, and governance cluster data and profiling

Cluster	Sample size (n)	Environmental score (mean)	Social score (mean)	Governance score (mean)	ESG aggregate	Cluster label
Cluster 1	125	0.259	0.219	0.156	0.635	High E and S, moderate G, high ESG
Cluster 2	146	0.074	0.156	0.223	0.454	Low E, moderate S, and high G, moderate ESG
Cluster 3	201	0.079	0.122	0.087	0.288	Moderate E, low S and G, low ESG

ESG: Environmental, social, and governance

and the majority belong to industrial groups that are not sensitive to environmental issues, namely companies operating in the financial sector (31%), as well as services and telecommunications (22%).

Cluster 3 consists of 201 companies that have an average environmental performance score of 879%, social performance of 12.2%, and governance score of 8.77%. Based on the ESG ranking, the aggregate ESG score of 28.8% is included in the C rating, indicating relatively satisfactory ESG performance and a moderate level of transparency in reporting important ESG data publicly. This cluster is dominated by companies on the development board (54%) and the majority come from industrial groups that are sensitive to environmental issues (57%) and industrial (30%).

Based on the figure above, it is possible to profile each group formed based on the mean value of each ESG pillar as presented in Table 5. Cluster 1 is a group of companies with high environmental and social performance and moderate governance performance. Cluster 2 comprises companies with a high average value of governance performance as well as low environmental performance and moderate social performance. Cluster 3 comprises companies with a low average value of social and governance performance, and have moderate environmental performance. Based on aggregate ESG scores, on average, companies in Cluster 1 obtained high ESG performance, while Cluster 2 obtained moderate ESG performance, and Cluster 3 comprised companies with low ESG scores.

The mean values in Table 5 reveal several findings. First, although on average Cluster 1 companies have high E and S performance, they do not have high governance performance. The cluster that has a high average governance performance is Cluster 2, but on the contrary, this cluster has a low E performance. Companies in Cluster 1 mostly consist of those on the main board (64%), namely companies that have better resource capabilities in improving ESG performance, especially in dealing with environmental and social issues. The high environmental and social performance in Cluster 1 is also due to the majority of the companies belonging to industrial groups that are sensitive to environmental issues and so they are more focused on increasing the positive impact of their business activities on environmental and social aspects.

Furthermore, Cluster 2 shows that the majority of companies are on the main board (61.64%) so the companies have a high G score or good sustainability governance. However, this cluster tends to have lower social and environmental performance than governance performance because it is dominated by companies in industries that are less sensitive to social and environmental issues, for example, the banking and services and communications sectors (45%).

Finally, Cluster 3 has the lowest average social performance (S score) and governance (G score) among other clusters, while environmental performance (E score) is at a moderate level. This cluster is dominated by companies that are at the development stage (53%) and the majority of companies belong to industries that are sensitive to social and environmental issues. Companies that are on the development board have not been able to record net profits so they have moderate capabilities in meeting environmental litigation. Apart from that, low capabilities also cause low S and G scores for companies in Cluster 3. This means that companies need to increase their social impact related to labor, human rights, community, and product liability as well as improve governance management and transparency with stakeholders.

These findings give rise to various theoretical and practical implications. They are in line with previous research (Garcia et al., 2017; Gunawan et al., 2022; Qureshi et al., 2020; Raar, 2002) which revealed that ESG performance is closely related to the company's internal characteristics. Companies in sensitive industries tend to face higher demands from stakeholders to improve their sustainability performance compared to companies that are not in sensitive industries. The company's capability to fulfil litigation related to environmental regulations, as well as the ability to improve social welfare, can be achieved if the company has strong financial resources and support from good governance. On the other hand, companies in sensitive industries that are not supported by high internal capabilities and commitment will achieve low sustainability performance because they are unable to meet environmental, social, and sustainability governance compliance indicators.

5. CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS FOR PRACTICE

5.1. Conclusions and Limitations

This research has evaluated the ESG-based sustainability performance of 472 companies listed on the IDX. This research also performed clustering using K-means on the resulting ESG scores to clarify differences between ESG sustainability practices. The ESG calculation results produce three scores, namely environmental, social, and governance pillar scores with an average value of C+, which means that the company has a relatively satisfactory ESG performance and a moderate level of transparency in reporting important ESG data publicly. Cluster analysis provides interesting results regarding the relationship between internal characteristics of ESG performance companies.

Companies on the main board that are in industries sensitive to social and environmental issues exhibit higher environmental

and social performance than companies on other boards and those that are less sensitive. Meanwhile, companies that are on the main board, but are in industries that are less sensitive to social and environmental issues, tend to exhibit moderate or low environmental and social performance and are more focused on governance performance. Another interesting aspect is that companies outside the main board, even though they are in sensitive industries, tend to exhibit lower ESG performance than companies on the main board. Based on the results of this research, it can be concluded that these 472 companies require performance improvements in at least one ESG pillar. As for the limitation of this research, its results cannot be generalized to companies other than the sample studied. Empirical studies are needed regarding the factors that can encourage increased ESG in Indonesia.

5.2. Implications for Practice

The contribution of this research is that it can address the ongoing theoretical debate regarding corporate ESG performance measures and compliance with stakeholder expectations. Academics and researchers can use this ESG performance measurement model to research the sample of companies, and, if possible, the data are complete so that they can be used as a basis for assessing ESG performance in subsequent years. For companies, this measurement framework is useful for identifying opportunities and risks, and establishing better sustainability strategies in the future. Regulators can use this framework as one of the new sustainability reporting frameworks in Indonesia. The research results can be used as a consideration for investors in investment decisions. When assessing ESG performance, low ESG practices can be a consideration regarding the company's risks and opportunities in the future, so proper evaluation of ESG pillars based on the industry is needed. Finally, the results of this research can be aligned with the Sustainable Development Goals.

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APPENDIXS

Appendix 1: Industry groups based on environmental, social, and governance classification

ESG Industry Classification	Board Utama	Pengemban	Akseleras	Ekonomi B	Total
banking service	29	15	0	0	44
realestate operations	18	17	0	0	35
food and drug retaili	14	13	1	0	28
metal and mining	10	16	0	0	26
plantation and crops	14	5	0	0	19
chemicals	13	5	0	0	18
personal and househol	13	5	0	0	18
sotware and it svc	7	7	2	2	18
automobile and auto p	11	5	0	0	16
coal	9	7	0	0	16
hotel and entertainme	1	14	0	0	15
transport and infrast	12	3	0	0	15
oil and gas erelated	7	7	0	0	14
freight anf logistic	3	10	0	0	13
household goods	5	5	3	0	13
insurance	7	6	0	0	13
textiles and apparel	5	8	0	0	13
construction and engi	10	2	0	0	12
containers&packaging	6	6	0	0	12
telecomunication svc	9	2	0	0	11
leisure product	4	5	0	0	9
oil and gas	6	3	0	0	9
pharmaceuticals	6	3	0	0	9
inv holding comp	1	7	0	0	8
paper and forest prod	3	5	0	0	8
beverage	5	2	0	0	7
construction material	5	2	0	0	7
electric utilities	5	2	0	0	7
healtcare providers	5	1	0	0	6
electronic eq	1	4	0	0	5
homebuilding and cost	3	2	0	0	5
media and publsihing	3	2	0	0	5
proffesional and coom	1	3	1	0	5
food and tobacco	3	1	0	0	4
investment banking n	3	0	0	0	3
machine, tools, heavy	1	2	0	0	3
passenger transp svc	0	3	0	0	3
Total	258	205	7	2	472

Appendix 2: Environmental, social, and governance indicators based on materiality disclosures in Indonesia

Number	Pillar	Theme	Sub-theme	Indicator
1	Environment	Use of resources	Raw materials	Type of material used in production
2			Energy	Total fuel consumption in the organization both renewable and nonrenewable
3				Total energy use
4				There is a reduction in water and waste
5			Water and effluent	There is a description of the company's interaction with water, how/where the water is taken and discarded, and the impact of water
6				Total water consumption
7		Emissions	Biodiversity	There is a description of the geographical location; company position with protected areas (inside/outside); what biodiversity is protected
8				There is a description of the impact on biodiversity
9			Carbon emissions	Total direct carbon emissions (scope 1)
10				Total indirect carbon emissions (scope 2)
11				Total other indirect carbon emissions (scope 3)
12				Total carbon emissions from scope 1, scope 2, and scope 3
13			Waste	There is a description of the input, process, and output that causes waste and the impact of waste
14				Total waste generated
15			Environmental compliance	There is a description of sanctions or fines from the government
16			Supplier environmental assessment	There is a description of the negative environmental impacts of the supplier or supply chain
17		Innovation	Recycling innovation	There is a description of the amount of recycled material input in production either in the form of a percentage or number
18			Water and waste innovation	There is a standard description for the disposal of waste water (effluent)
19			Biodiversity innovation	There is a description of how to protect/how to restore/location/size of protected habitat
20			Waste innovation	There is a description of waste management and prevention
21			Innovation of supplier environmental criteria	There is a description of new suppliers with environmental criteria
22	Social	Tenaga kerja	Staffing	Total number and rate of new employee recruitment; total number and turnover rate of employees by age group, gender and region

(Contd...)

Appendix 2: ***(Continued)***

Number	Pillar	Theme	Sub-theme	Indicator
23				Standard benefits for employees, for example insurance, health care; disability and disabled coverage; maternity leave; preparation for retirement; shareholding
24			Occupational health and safety	a. statement of whether an occupational health and safety management system has been implemented
25				b. work related hazards which creates a risk of work accidents with high consequences
26			Training and education	Average hours of training carried out by the organization's employees per employee category
27				programs implemented and assistance provided to improve employee skills.
28		Human rights	Diversity and equal opportunity	a. Percentage of individuals in the governance body
29				b. Percentage of employees per employee category
30				Ratio of basic salary and remuneration for women compared to men
31			Child labor	Operations and suppliers that have a significant risk of incidents of child labor or young workers exposed to hazardous work
32			Forced or compulsory labor	Operations and suppliers that have a significant risk of incidents of forced or compulsory labor in terms of
33		Community	Local community	Percentage of operations with implemented local community involvement, impact assessments, and/or development programs,
34				Actual and potential operations have significant negative impacts on local communities
35		Product liability	Customer health and safety	Percentage of significant product and service categories that have their health and safety impacts assessed for improvement
36				The total number of incidents of noncompliance with regulations and/or voluntary regulations involving the health and safety impacts of products and services
37			Marketing and labeling	Is there any information regarding: Source of product or service components; substances that may produce environmental or social impacts; product safety, disposal
38				The total number of incidents of noncompliance with regulations and/or voluntary regulations concerning product and service labeling and information
39				Total number of incidents of noncompliance with regulations and/or voluntary regulations involving marketing communications
40			Customer privacy	The total number of substantiated complaints received regarding violations of customer privacy
41	Governance	Shareholders	Quality of implementation	Have technical methods or procedures for collecting votes (voting) both openly and privately that prioritize independence and the interests of shareholders
42			of duties and responsibilities of the	All members of the board of directors and members of the board of commissioners of public companies are present at the annual GMS
43			board of commissioners	A summary of the GMS minutes is available on the public company website for at least 1 (one) year
44			Quality of	Have a communication policy with shareholders or investors
45			public company communication with shareholders or investors	Disclose the public company's communication policy with shareholders or investors on the website
46		Management governance	Membership and composition of the	Determining the number of members of the board of commissioners takes into account the conditions of the public company
47			board of commissioners	Determining the composition of members of the board of commissioners takes into account the diversity of skills, knowledge and experience required
48			Quality of implementation	The board of commissioners has a self-assessment policy to assess the performance of the board of commissioners
49			of duties and responsibilities of the	The self-assessment policy for assessing the performance of the board of commissioners is disclosed in the public company's annual report.
50			board of commissioners	The board of commissioners has a policy regarding the resignation of members of the board of commissioners if they are involved in financial crimes
51				The board of commissioners or the committee that carries out the nomination and remuneration function prepares a succession policy in the nomination process for members of the board of directors
52			Membership and composition of the	Determining the number of members of the board of directors takes into account the condition of the public company and effectiveness in decision making
53			board of directors	Determining the composition of members of the board of directors takes into account the diversity of skills, knowledge and experience required
54				Members of the board of directors who are in charge of accounting or finance have expertise and/or knowledge in the field of accounting

(Contd...)

Appendix 2: ***(Continued)***

Number	Pillar	Theme	Sub-theme	Indicator
55			Quality of implementation of director's duties and responsibilities	The board of directors has a self-assessment policy to assess the performance of the board of directors
56				The self-assessment policy for assessing the performance of the board of directors is disclosed in the public company's annual report
57				The board of directors has a policy regarding the resignation of members of the board of directors if they are involved in financial crimes
58		Openness to stakeholders	Stakeholder participation	Has a policy to prevent insider trading
59				Has an anti-corruption and anti-fraud policy
60				Has a policy regarding the selection and improvement of supplier or vendor capabilities
61				Has a policy regarding the fulfillment of creditor rights
62				Has a whistleblowing system policy
63				Has a policy of providing long-term incentives to the Board of directors and employees
64				Public companies make wider use of information technology apart from websites as a medium for information disclosure
65				The annual report discloses the ultimate beneficial owner of a public company who owns at least 5% (five percent) of the shares, in addition to disclosure of the ultimate beneficial owners of a public company who own shares through the main and controlling shareholders