Level Disclosure of Green Intellectual Capital in Indonesian Mining Companies in Order to Save The Earth from Carbon Emissions

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Abstract. This study aims to investigate the level of green intellectual capital disclosure practices of Indonesian mining companies, including green human capital, green structural capital, and green relational capital. From 2016 to 2020, which published sustainability reports from 51 selected companies, the number of observations was 215 using purposive sampling. The level of GIC disclosure practice was determined by applying a dummy scale. This study shows that Indonesian mining companies apply different GIC level practices for each component of each GHC by 65.86% level 4. This study can also be used to expand GIC disclosure practices to support sustainable development in every business activity. This study is an initial effort to assess the level of GIC disclosure practices in Indonesian mining companies using a dummy scale based on the annual report.

Keywords: Green Intellectual Capital, Green Human Capital, Green Structural Capital, Green Relational Capital.

1 Introduction

Corporate resources in the digital era have experienced shifting from physical to non-physical change. Green intangible assets are strategic because they will affect the company's position to achieve sustainable advantages [1]–[3]. The non-Physical asset is referred to as green intellectual capital [4]–[12].

The problem in green intellectual capital is interesting to some researchers; although the research results confirm the positive effect of green intellectual capital on company performance and its effectiveness [2], [13]–[15], in achieving sustainable competitive advantage [1], [12], [16]–[18]. However, GIS is still relatively minor and gets limited recognition [2], [19]. However, the results of previous studies have confirmed that the disclosing GIC practice of Indonesian companies is still below 50% [20], [21].

Based on the above reasons, this study is expected to reduce and bridge the research gap between the limitation of subject literature and the empirical evidence to a certain extent. The

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concept and measurement of GIC are still developing [22]. GIC's position in the digital era deserves special attention and a special place in the mining sector because its activities are close to the exploitation of natural resources and its products are closely related to pollution. In this regard, GIC practices align with the triple bottom line principle [23]–[25].

In the era of globalization, companies must be more focused and closer to the environment to maintain the company's sustainable goals [26], in line with the perspective of sustainable development [27]. Pollution of the natural environment caused by the exploitation of business activities to fulfill people’s needs encourages the implementation of business strategies to maintain a balance of three goals; economic, environmental, and social [28]. Based on the above reasons, the practice of "greening," popularized in many industries, has shifted its approach to using organizational resources [29]. One of the practices is based on company operations on GIC towards organizational performances [2], [6], [7], [9], [10], [18]. Several other studies have also shown that the role of GIC is still relevant and is considered an important element in achieving corporate competitive advantage and environmental protection based on financial performance [1]. It has been found that GHC, GSC, and GRC simultaneously affect the company's competitive advantage by 17.6%. The components of GHC and GSC partial positively affect competitive advantage. The GRC component does not affect competitive advantage, and this can be seen from research [19] results on the perception of small and medium-sized companies in Malaysia about GIC, with eighteen GIC variables, questionnaires, and a seven-point Linkert scale. This research revealed that GHC and GRC in the organization got a good perception. GSC is the lowest factor among the three GIC dimensions; research results [9] of the small Taiwanese company. The result shows that GHC has become the organization's commitment to achieving environmental-based performance. However, the higher the education of employees, the less they are concerned about the organizational environment. Research [12] showed that GIC plays an important role in the growth of corporate sustainability in China and Pakistan. It shows; 1) GIC significantly affects differentiation strategy (DS) in Chinese companies. While the GRC component has no significant effect on DS in Pakistani companies. 2) GIC significantly affects Pakistani companies' cost leadership strategy (CLS). 3) GSC and GRC have an insignificant effect on the sustainable growth of Chinese companies. 4) as a mediating variable, DS partially mediates the relationship between GIC and sustainable growth in Pakistani firms, 5) DS mediates between RC and SG in Chinese firms, and 6) CLS partially mediates the relationship between IC and SG in Chinese firms. At the same time, CLS mediates the relationship between GHC and the sustainable growth of Pakistani Companies.

The results of this study are expected to verify the development of GIC disclosure practices in the latest Indonesian mining companies. This study focuses on the level of GIC disclosure practices on green human capital, green structural capital, and green relational capital by adopting GIC [8], [30]–[32]. The level of disclosure GIC adopts [22]. This study contributes to the subject literature for assessing GIC with the scoring method, detecting gaps in applying GIC disclosure practices in Indonesian companies that are relatively low [20], [21].

The novelty lies in using the Dummy scale method, the disclosure of 17 indicators of GIC items. Object mining companies on the Indonesia Stock Exchange publish sustainability reports from 2016 to 2020. This study is different from previous researchers, such as [8], who use 19 indicators of GIC items., Linkert scale. Survey method on Taiwanese companies. Research [19] instrumented 18 GIC indicator items with a questionnaire method of 168 to Top Managers on manufacturing SMEs in Malaysia. Research [33] GIC instruments as many as 14 items of GIC indicators. Survey method on small and medium-sized companies in Malaysia. It

is hoped that the findings of this study can also be used as the latest reference for the size of the company's commitment to invest in intangible resources based on GIC Indonesian mining companies as an important instrument for sustainable business. For those reasons, the GIC reporting management strategy is important. Based on the explanation above, the purpose of this study is to investigate the level of application of the GIC model disclosure in Indonesian mining companies as follows:

1. How is the implementation level of Green human capital (GHC) disclosure?
2. How is the application level of the Green Structural Capital (GHC) disclosure?
3. How is the implementation level of the Green Relational Capital (GRC) disclosure?

2 Literature

The significance of green intellectual capital is important for the growth of knowledge-based profitability as an intangible asset, and it shows an important role in replacing tangible assets [33], thus providing added value to the organization and an important source of GIC-based organizations [34]. This parallels the knowledge research [2], [18] in achieving sustainability [2], it represents the number of hidden assets in the company, and it will remain when employees leave [18]. Intellectual capital consists of three components; human, structural, and green relations [5]–[10]. With green human capital (knowledge, skills, abilities, experience, tendencies, personality traits, motivation, etc.), green structural capital includes: organizational culture, systems, methods, and processes, as well as organizational and information infrastructure that facilitates the transfer of knowledge within organizations and the use of human potential; relational capital (network architecture) is related to the totality of company relationships with external organizational stakeholders [18]. Intellectual capital consists of three components, and those are; human, structural, and green relations [5]–[10]

The interest in green intellectual capital has emerged relatively recently [8]. He argues that investment in environmental protection-oriented Intellectual Capital (IC), known as Green Intellectual Capital (GIC), serves not only management interests but also a competitive advantage. Some research on GIC has been going on for less than twenty years, but the concept is still in the early stages of development [22]. The literature lacks a permanent method for the assessment and measurement of GIC, while diagnostic models are still scarce [22]. The approach in the IC identification and measurement process refers to [35]: four components, they are; 1) Direct Intellectual Capital Methods (DIC), 2) Market Capitalization Methods (MCM), 3) Return on Assets (ROA), and 4) Scorecards Methods (SC). However, the above approach needs to be adjusted to the specific nature of GIC. The accounting aspect is still limited by literature and practices limitations, so the measurement of GIC still has problems with the quantification of intangible components such as justifying the use of qualitative factors., The approach in this study refers to [22], [36].

This research model adopts [8], [22]. Disclosure approach of three components of GIC: green human capital, green structural capital, and green relational capital [34], [37]. The research model is illustrated in Figure 1 below.

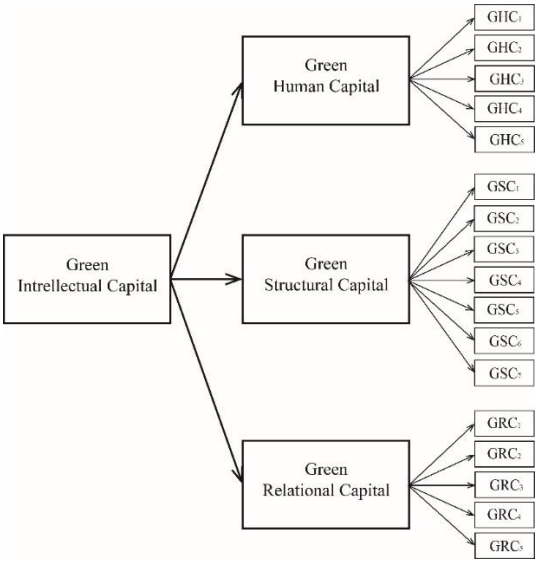

Fig. 1. Research framework.

Intellectual capital disclosure refers to [32], [38] by classifying intellectual capital into six categories. The classification was used and further developed by [31], [39]. Intellectual capital items are classified into six categories; (1) human resources, (2) customers, (3) information technology, (4) processes, (5) research and development, (6) and strategic statements.

Intellectual capital disclosure practices in Indonesia have been carried out since PSAK No. 19 (revised 2000) concerning Intangible Assets, including technology, design, system implementation, licensing, intellectual property rights, market knowledge, and trademarks. Disclosure of IC of a company that drives organizational performance and encourages value creation [5], [6], [40] IC disclosure is proxied by the GIC disclosure index [22] refers to disclosure IC by [32] in six categories; (1) employees; (2) customers; (3) information technology; (4) processes; (5) research and development; (6 strategic statements. In addition to those described in [32] research, the checklist of IC disclosure items in [32], has already covered the three main components of IC. Based on this explanation, disclosure of internal GIC is still voluntary [41].

Table 1. Measurement of GIC indicators.

GIC Components	Symbol	Indicator Items
GHC	GHC_1	Employees in the company engage in positive productivity and contribute to environmental protection
	GHC_2	Employees have sufficient competence in environmental protection.
	GHC_3	Employees provide high-quality services and products related to environmental protection
	GHC_4	Level cooperation of teamwork related to environmental protection is shown at a high level in the organization
	GHC_5	The manager strongly supports his employees to achieve their work in accordance with environmental protection
GSC	GSC_1	The company has a high management system for environmental protection.
	GSC_2	The company needs to/has formed a committee to advance the main issues of environmental protection
	GSC_3	The company has made detailed rules for environmental protection
GIC Components	Symbol	Indicator Items
GSC	GSC_4	The company makes sufficient investment in an environmental protection facility
	GSC_5	The company has a high ratio of employees who understand environmental management in total
	GSC_6	The overall operation process for environmental protection within the company runs smoothly.
	GSC_7	The system of knowledge management in the company works well for both the accumulation and sharing of knowledge about environmental management
GRC	GRC_1	Companies design products and services to meet consumer needs in their environment
	GRC_2	Consumers are satisfied with the environmental protection carried out by the company
	GRC_3	The cooperative relationship on environmental protection of both company and suppliers is steady.
	GRC_4	The cooperative relationship on environmental protection with major clients or consumers is steady.
	GRC_5	The company has steady cooperation with universities or other research institutions for sustainable differentiation products that are environmentally friendly with its strategic partners.

3 Methods

The data used in this study is secondary data consisting of quantitative data. Secondary data was obtained from the annual sustainability reports of 43 mining companies listed on the Indonesia Stock Exchange (IDX) starting from 2016 to 2020. The purposive sampling method was chosen in this study to obtain a total of 215 observations.

Data obtained from the website (*web.idx.id*). The measurement of this study refers to [32] with a dummy scale; the scoring system for each disclosure item is made by the company in the annual report. Each disclosure of an item will be given a value of 1 and 0; if the item is not disclosed, then the scores of each item will be added up to obtain the total score of each company disclosure. GIC disclosure value [5], [6], [36] in total of 17 items adopted [8], [31], [32] Appropriate measurement variables as follows:

(1). Green human capital measurement adopts [8], [31], [32] with the level of disclosure referring to [22]. Consist of 5 indicator items
(2). Measurement of Green structural capital adopted [8], [31], [32] with the level of disclosure referring to [22]. There are seven indicator items in total.
(3). Green relational capital measurement adopts [8], [31], [32] with reference to the level of disclosure [22]. There are five indicator items.

Level of disclosure. Level 1 is very low, and disclosure 5 is high. Referring to [22] with the following levels:

(1). Level 1 - disclosure practices with a score of 0-20% from the researched entity.
(2). Level 2 – disclosure practices with a value gain of 21-40% of the researched entity.
(3). Level 3 – disclosure practices with a value gain of 41-60% of the researched entity.
(4). Level 4 – disclosure practices with a score of 61-80% of the researched entity.
(5). Level 5 - disclosure practices with a score of 81-100% of the researched entity

4 Result

The study aims to investigate the level of GIC disclosure practices in Indonesian mining companies. The results of the study have been presented (see Table 2). The analysis results show that the level of GIC disclosure practices of Indonesian mining companies varies from 38.80% to 74.42%, with the following details.

4.1 GIC Indicator Item Analysis

The GHC component, which is most widely reported on component indicators, shows that Managers strongly support their employees to achieve their work in accordance with environmental protection with the acquisition of 74.42% of the entities studied and the least reported disclosure on indicators of company employees providing high-quality services and products related to environmental protection of 54.42% of the entities studied. The most reported GSC component in the indicator is that the company has made detailed rules on environmental protection, with a gain of 68.37% from the entities studied, and the least reported disclosure in which the company has a high ratio of employees who understand environmental management to a total of 42.79 % employees of the entity being researched. The GRC component that is most widely reported is the indicator of the cooperative relationship on environmental protection from companies with stable suppliers. Resulting in a gain of 55.81% of the entities studied. The last reported disclosures are five indicators that the company has a stable cooperative relationship with universities or other research institutions towards sustainable differentiated products that are environmentally friendly with strategic partners of 38. 60% of the entities being studied.

Table 2. Green intellectual capital disclosure performance Indonesian mining company.

GIC Component	Symbol of disclosure	Number of the entity performing disclosure	percentage of the number of companies performing GIC disclosure (%)	Average level disclosure GIC Component (%)	levels of disclosure GIC
GHC	GHC_1	150	69,77	65,86	level 4
	GHC_2	138	64,19		
	GHC_3	117	54,42		
	GHC_4	143	66,51		
	GHC_5	160	74,42		
GSC	GSC_1	144	66,98	60,40	level 3
	GSC_2	131	60,93		
	GSC_3	147	68,37		
	GSC_4	125	58,14		
	GSC_5	92	42,79		
	GSC_6	132	61,40		
	GSC_7	138	64,19		
GRC	GRC_1	87	40,47	47,81	level 3
	GRC_2	117	54,42		
	GRC_3	120	55,81		
	GRC_4	107	49,77		
	GRC_5	83	38,60		

4.2 GIC Disclosure Analysis

GIC component is at 4 out of 5 levels. The reason is that mining employees are providing high-quality services and products related to environmental protection in only 54.42% of the researched entities. It means that the orientation of human resources to environmentally friendly products is still at level 3 while the GHC1, 2, 4, and 5 indicators are at level 4.

The GRC component is at level 3 of (5) five levels, and the cause is the contribution of green structural capital disclosure with the GRC2 indicator. The company needs/has formed a committee to advance the main issue of environmental protection, amounting to 54.42% of the entity under study. GRC4 companies make considerable investments in environmental protection facilities and GRC5 indicators. The company has a high ratio of employees who understand environmental management, while the total number of employees reported at level three out of 5 is very low. GRC1 indicators: The company has a high management system for environmental protection; GRC3, IE, has made detailed environmental protection rules. GRC6 The overall operation process for environmental protection within the company runs smoothly. GRC7 The knowledge management system in the company works well for the accumulation and sharing of knowledge about environmental management at level 4 out of 5, in other words, 42% of the indicators are still at level 3, and the rest are at level 4.

The GRC component is in position 3 out of five levels because all indicators of the company's cooperation with other parties related to corporate environmental management only reached position three, and the lowest contribution from the company's collaboration with universities or other research institutions in environmentally friendly sustainable differentiation products. At level two (2) of (5) five levels. The second lowest is that the

company designs products and services to meet consumer desires for the environment (GRC 1 at level 2. Indicators of GRC 4 The cooperative relationship on environmental protection from the company with clients or main consumers is stable at level 3, and GRC Consumers are satisfied with environmental protection carried out by the company in level 3 means that the overall GRC disclosure condition is at level 3 out of 5 levels.

The average condition of GIC mining companies from the three components is 58% of all the researched entities, or at the disclosure, the level is at level 3 out of 5 levels [22]. It raises doubts about the commitment of mining companies to developing green products produced by entities that have been researched. The data show that the sustainability report as the basis for GIC refers to the indicators [8] developed by researchers into 17 items that have not been fully oriented, especially collaboration with universities or other research institutions to plan and stably produce sustainable differentiation products has not become the main priority. Companies use green regulation only limited to the terms of regulations, such as: 1) aspects of green human capital. Mining companies rely on managers' support towards their employees to achieve their work in accordance with environmental protection; 2) the structural capital aspect, which is still limited to productivity, detailed regulations on environmental protection, the creation of a management system for environmental protection and a knowledge management system within the company. 3) The green relational aspect is a weak point for mining companies in making GIC as environmentally friendly ecosystem; collaboration with universities and research institutions to design environmentally friendly products, and collaboration with other stakeholders such as consumers.

5 Discussion

Green Intellectual Capital research results are in 4th position with 61-80% range, around 65.86% of all entities studied. The GSC and GRC components are in the range of 41-60%, around 60.40% for the GSC and the value of 47. 81% for the GRC component of all companies studied. The results of this study suggest [20], [21] that the practice of disclosing GIC has experienced a slow development, although it is in the average position, GIC component is above 50%, around 58.33%. The main causes are 1) the lack of measurement regulation. 2) the lack of empirical evidence on GIC disclosure practices in mining companies. 3) disclosure is still voluntary, 4) GIC-based investment focus and orientation of companies was restricted due to COVID-19 in 2020, 5) GIC requires investment and environmental training for employees or long-term development, 6) promotion of green organizations takes time and resources. 7) GIC investment return rate is longer than physical investment 8) The company's green human resources are still directed into: a) working achievement is in line with environmental protection, b) positive productivity towards environmental protection c), the level of cooperation of the work team related to environmental protection is shown at a high level in the organization d) Company employees have sufficient competence in environmental protection but are weak in providing quality services and high products related to environmental protection., 9) Changing process is weak in making the sufficient investment in environmental protection facilities and high ratios of understanding environmental management to total employees have not been managed properly. 10) the weakness of the company in establishing collaboration with external parties such as collaboration with universities or other research institutions. Environmental protection of companies with stable

main clients or consumers, and designing products and services according to consumer interests and environmentally friendly.

Different results from several studies have shown that the role of GIC is still relevant and is considered a new strategy to gain a competitive advantage for companies based on environmental protection [1], [9], [12], [19]. and creating organizational performance [6], [7], [9], [10], [18], [22], [34]. This result is due to different measurements, such as [22] using the Linkert scale with a survey method on GIC disclosure practices with 30 questions. In the Polish company, the results show that the level of GIC disclosure is at level 3, the studies of GIC component for GHC are at level 4, and the other two components are at level 3, although on average, they are equal; at level 3 [8] uses 19 items of GIC indicators with a linkert decomposition scale in Taiwanese companies. The study [19] used 18 GIC indicator items using the 168-questionnaire method for Top Managers working in Malaysia's manufacturing SMEs. [33] conducted a GIC research using a survey method, using 14 GIC indicator items on small and medium-sized companies in Malaysia.

6 Conclusion

Research on the application of the GIC model conducted by the author shows that the commitment of Indonesian mining companies in overall GIC disclosure is at level 3, and the three components have different levels; the GRC and GSC components are at level 3. The GHC component is at level 4 of the five stages. Seeing from indicator items, among all those three components, GRC seems to need special attention because the potential of GHC to undergo GRC is still weak. Based on the above case, the researcher recommends mining companies in Indonesia encourage investment in GIC, especially the GRC component.

7 Implication

This study recommends that Indonesian mining companies immediately invest the maximum amount in GRC compared to GHC and GSC so that the level of GIC disclosure [22] can continue to increase to level 5. Companies can use a double strategy by increasing GIC with two balanced goals, cost reduction and focus on developing GRC. The strategy can be a middle ground, especially for companies with limited expertise and experience in environmental problems, especially the ex-coal mining environment. Companies can expand environmental cooperation with Higher Education in terms of research and collaboration with communities around mining or private researchers, or other research institutions. Designing quality mining products with environmental value according to consumer interests. Collaborating with customers, suppliers, and communities, can foster ecological values and a green reputation and strengthen all components of GIC.

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