

The Role of Intellectual Capital in Sustainability Performance

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ABSTRACT

The advancement of the global economy and technology has facilitated companies' production processes while also enabling greater exploitation of natural resources. Ignoring the sustainability principles of profit, people, and planet (3P) leads to environmental degradation. Therefore, a strong commitment to sustainable practices is essential to safeguard economic, social, and environmental well-being for present and future generations. This responsibility is carried out through environmental, social, and governance (ESG) performance. ESG is important because it is not only with stakeholders but also related to investors. An important thing that can maintain and improve this commitment is having intellectual resources. Resource-based view theory and legitimacy theory are the basis for this study. The research sample was 32 energy sector companies with 115 data. Data analysis used EViews because of the unbalanced data panel. This study shows that capital employed, structural, and human capital do not affect sustainability performance. In this study, the relational capital variable has a positive effect on sustainability performance. The intellectual capital variable measured by MVAIC does not affect sustainability performance.

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INTRODUCTION

Sustainability performance reflects how companies manage their economic, social, and environmental responsibilities, often described as a profit, people, and planet. In Indonesia, sustainability reporting has become increasingly common with Bursa Efek Indonesia (BEI) reported 873 listed companies or 97% of all firms submitting sustainability reports in 2023 (Antara News, 2025). Despite this growth, challenges remain in translating reporting into measurable outcomes in environmental and social impact, highlighting the importance of examining the factors that drive effective sustainability performance.

Sustainability issues were highlighted at the G20 Summit culminating in the Bali Leaders Declaration. The conference endorsed an energy transition mechanism and supported international initiatives to address the food crisis protect 30% of land and oceans by 2030, and achieve a voluntary 50% reduction in land degradation by 2040 (<https://indonesia.go.id/>). In the current global economic era, industrialization is driven by advanced technology enabling mass production. This extensive exploitation of natural resources has led to an environmental crisis (Yadiati et al., 2019), contributing to climate change, global warming, and extreme weather events (Jung et al., 2018). Scientists, activists, researchers, and world leaders are committed to protecting the environment from damage, ensuring that all natural resource management processes are oriented toward sustainability (Khalaf et al., 2023).

The Environmental, Social, and Governance (ESG) framework has recently gained prominence as a guiding principle for sustainable development, investment, and business operations. It comprises three main dimensions: environmental, which reflects a company's responsibility toward natural resources and the ecosystems surrounding its operations; social, which addresses how a company manages relationships with employees, suppliers, customers, and local communities, and governance, which encompasses corporate leadership, internal controls, and the protection of shareholder rights (Lokuwaduge & Heenetigala, 2017)

According to Paek et al. (2015), to align corporate interests with sustainability, companies require both internal and external capital. With increasing concern for sustainable development, corporate survival depends on increasing intellectual capital for innovation, creating competitive advantage, and sustaining sustainability (Li & Liu, 2018). Intellectual capital is considered the engine of growth, as the knowledge it possesses is a company's most important resource.

LITERATURE REVIEW

Resource-Based View Theory (RBV)

According to Barney (1986), Resource-Based View Theory (RBV) is based on three concepts which are company resources, competitive advantage, and sustainability. Company resources include capabilities, assets, attributes, organizational processes, knowledge, information, and so on. These resources can be controlled by the company to develop and implement strategies to increase efficiency and effectiveness. A company can achieve competitive advantage when it is able to develop and implement strategies that are not simultaneously implemented by competitors or potential competitors. A company achieves a sustainable competitive advantage when others are unable to duplicate the benefits of the strategies that generate its competitive advantage. A company's resources will generate a sustainable competitive advantage when they are valuable, rare, inimitable, and non-substitutable.

Barney (1986) also stated that a company's intangible resources can contribute to financial performance when these resources are integrated or combined. Furthermore, according to Ali (2021), the focus of the RBV is on assessing organizational effectiveness through knowledge management, such as information management systems and information technology systems.

Yong et al. (2019) explain the relationship between human resources and the environment. They state that an environmentally friendly concept in human resource management can provide a company with a competitive advantage. The importance of environmentally friendly human resources in demonstrating a company's competitive advantage. Therefore, better human resources will support a company's responsibility to protect the environment.

In a highly competitive business environment, companies face pressure from various stakeholders to implement sustainability management systems (Khan, 2024). Therefore, companies must possess and utilize resources optimally. According to resource-based theory, a company's intangible resources also contribute to achieving and maintaining superior performance when these resources are combined or integrated (Barney, 1986). The RBV conceptualizes that organizational resources are heterogeneous and permanently held by the organization (Barney, 1986). Differences in organizational performance are caused by the diversity of organizational resources and capabilities that are rare, valuable, non-substitutable, and imitable. Furthermore, an organization can have a sustainable competitive advantage when the strategies implemented cannot be easily imitated by competing companies.

Legitimacy Theory

Legitimacy theory in a social and organizational context explains how entities, particularly corporations, adapt and operate within societal norms and expectations. This theory plays a crucial role in maintaining an organization's survival by ensuring that its actions and operations are widely accepted

by society. In this view, legitimacy is not simply about complying with legal regulations but also relates to the acceptance and support received from various stakeholders. Corporations are expected to meet societal expectations, often expressed as a "social contract," to maintain legitimate and recognized operations (Adianto et al., 2021; Suryanto, 2019).

The application of legitimacy theory is sustainability reporting and Corporate Social Responsibility (CSR). Chandra & Shauki (2024) have shown that companies' strategy to maintain legitimacy and strengthen their market position based on past achievements is to increase sustainability reporting. This reflects the company's goal not only to gain legitimacy through positive actions but also to protect their achievements in the eyes of the public (Chandra & Shauki, 2024). Disclosure of CSR information is considered a tool to generate a positive impression among stakeholders, indicating an effort to build legitimacy (Anugerah et al., 2023).

More broadly, legitimacy is closely linked to how companies conduct their business practices in an increasingly socially and ecologically connected environment. Kurniawan (2017) highlights that to build strong legitimacy, companies must strive to mitigate potential conflicts between their operations and societal values. Furthermore, environmental legislation is also a tool for measuring corporate legitimacy regarding environmental compliance (Sayuti, 2024).

Sustainability performance

The growing prevalence of sustainability performance signals increasing corporate acknowledgement of environmental, social, and governance (ESG) responsibilities. Sustainability has long-term consequences (Gayen et al., 2024). These practices are expected to have a positive impact on both the company and society (Cantele et al., 2024). Sustainable performance is a measure of an organization's sustainability performance that covers three main dimensions: economic, environmental, and social (Hourneaux, et al., 2018). Likewise, according to Payán-Sánchez et al. (2018), sustainability is broadly defined as an effort to achieve a balance between social, economic, and environmental interests, known as the 3Ps (people, planet, and profit). The sustainability reporting is reporting based on the triple bottom line, namely the economic, social, and environmental aspects of a company's responsibilities and impacts.

Corporate sustainability reports are a necessity for companies to report their performance in social, economic, and environmental aspects to their stakeholders. Sustainability reporting is a reporting process conducted by companies to measure, disclose, and demonstrate the company's efforts to be accountable to all internal and external stakeholders, with the goal of achieving sustainable development (Rofelawaty, 2014). Contemporary approaches to corporate social responsibility focus on the triple bottom line: profit, planet, and people. Sustainability reports are useful for companies to report their accountability efforts in supporting sustainable development to stakeholders. The rationale behind triple bottom line performance is that it is voluntary and will yield results in the form of competitive advantages for the company, thereby providing added value, enhancing a positive image, reducing risks that negatively impact the company, and increasing shareholder and stakeholder trust.

Intellectual Capital

In today's knowledge economy, intellectual capital (IC) has been recognized as a unique asset capable of enhancing a company's superior performance and influencing its competitive advantage. The growing attention to IC as a unique asset for value creation is driven by the Resource-Based View Theory (RBV). IC is defined as a set of intellectual materials, information, intellectual property, knowledge, and experience that can be managed to create wealth. Intellectual capital is the knowledge, expertise, and intellectual innovation and procedures that provide a competitive advantage for an organization (Bhatti et al., 2024). IC has been considered a crucial determinant in generating value

within a company due to its intangible characteristics, and as a strategic component that ensures long-term sustainability. IC is increasingly recognized as a strategic asset (investment) and is necessary for companies to increase sustainable corporate value and profitability (Jordão & Novas, 2017; Matos et al., 2018; Muchran, 2020).

IC provides the basic assets and knowledge management that can drive sustainability across multiple dimensions (social, economic, and environmental). The use of this capital directs the development of production systems that prioritize the natural and social balance of the global ecosystem (Del Giudice et al., 2021). IC management can drive corporate sustainability activities. Companies strive to solve social and environmental problems by increasing environmental awareness or reputation resulting from activities that lead to more sustainable performance (Xu & Wang, 2018). Sustainability capabilities can determine their profitability and survival (de Villiers & Sharma, 2020). Improved sustainable performance can be achieved by utilizing all available resources and managing their IC with higher efficiency (Del Giudice et al., 2021; Jardon & Martínez-Cobas, 2019).

In a challenging business environment, intangible assets, such as learning capabilities, human resources, knowledge management, and stakeholder relationships become key sources of competitive advantage (Ahmed et al., 2020). From the Resource-Based View Theory (RBV) perspective, IC is seen as a crucial factor driving companies to greater success and competitiveness.

Previous study agreed that companies worldwide have been striving for sustainable competitive performance and sustained growth for decades (Xu & Wang, 2018). To achieve sustainable competitive performance, some companies invest in tangible resources such as machinery, technology, land, and equipment, while others prefer to invest in intangible resources such as IC, CSR, entrepreneurial activities, and knowledge.

Hypothesis development

Companies are mandated to be responsible and proactive in addressing environmental issues and are increasingly committed to sustainability strategies. However, sustainability performance should not be simply about regulatory compliance. The way companies approach environmental issues depends on their knowledge and understanding of those issues. This is certainly related to the company's IC. IC helps guide the achievement of company goals. IC plays a crucial role in companies focused on sustainability, by transferring knowledge about regulations, technologies, best practices, and initiatives to achieve the company's desired sustainability goals. The business challenge is to manage intangible assets, such as learning capabilities, human resources, knowledge management, and stakeholder relationships, to become key sources of competitive advantage. IC as intangible assets that organizations can use to create value (Ahmed, 2020).

IC and sustainability are interesting topics due to their complexity and interconnectedness (Massaro et al., 2018). Disclosures of social and environmental performance often reference intellectual capital. Intellectual capital has been considered a crucial determinant of value creation within a company due to its intangible characteristics, and is also a strategic component that ensures long-term sustainability. Dabic et al. (2021) also noted that intellectual capital is related to sustainability and value creation. This study will examine the influence of intellectual capital components and measurements (capital employed (CE), human (HC), structural (SC), and relational capital (RC)) on sustainability performance. This is explained in detail in the following paragraphs.

CE measures the physical capital dimension. Physical capital (monetary assets, accounts receivable, equipment, machinery, and other fixed assets) is acquired through financial markets. Companies have a large proportion of investment in physical assets and rely heavily on them for their daily operations. CE is a key driver of a company's sustainable performance (Nadeem et al., 2018). Ahmed et al. (2020),

Ali et al. (2021), and Akhtar et al. (2015) also found that physical capital has a greater impact on sustainable growth. Based on this explanation, hypothesis H₁ was developed.

H₁: Capital employed has a positive effect on sustainability performance

Based on the Resource-Based View, a company's human capital is a controllable resource (Litz, 1996). Human resources are a crucial organizational resource in ensuring organizational sustainability (Amjad et al., 2021). Companies that develop human resources will achieve a sustainable competitive advantage (Ployhart, 2021). Companies can create sustainable performance if human capital, as an internal supporting capital, is properly managed (Ahmed et al., 2020; Imasiku et al., 2020; Barney, 1986). Knowledge creation can influence human resource behavior. According to (Malik et al., 2020), human capital has a positive impact on corporate sustainability. HC helps improve organizational performance from economic, environmental, and social dimensions. This management creates ethical principles and an organizational culture related to the company's sustainable values. Increased sensitivity to environmental and social issues makes them more likely to undertake activities related to social and environmental commitments. HC will improve employee morale and working conditions, creating an environment and encouraging new ideas related to sustainability (Nirino et al., 2022). Based on this, hypothesis H₂ is developed.

H₂: Human capital has a positive effect on sustainability performance.

SC is conceptualized as an organizational resource, in the form of management systems, computer systems, organizational processes, management philosophy, organizational culture, patents, copyrights, brands, information technology, or management mechanisms (Yong et al., 2019; Yusliza et al., 2020). According to Pham & Dut (2022); Asiaei et al. (2022); Ahmed et al. (2020), the implementation of management systems, computer systems, organizational processes, management philosophy, organizational culture, patents, copyrights, brands, information technology, and management mechanisms will increase operational efficiency and service innovation. This will improve operational performance and sustainability. Environmentally oriented SC emphasizes the importance of sustainability-oriented processes and systems in improving environmental performance and supporting long-term sustainability goals (Abdelwahed et al., 2022). SC is associated with organizational structure and culture that support human capital and generate value through the effective application of technology. Based on this, hypothesis 3 is proposed.

H₃: Structural capital has a positive effect on sustainability performance.

Relational capital (RC) is identified as a company's interactive engagement with customers, suppliers, network members, and partners that facilitates value creation and the acquisition of competitive advantage (Khan et al., 2024). Enhanced RC indicates increased collaboration with customers, suppliers, network members, and partners to develop sustainability technologies, initiatives, and performance (Asiaei et al., 2022; Ahmed et al., 2020). This collaboration is based on a shared concern for improving the company's sustainability performance and innovation. Based on this, hypothesis 4 is proposed.

H₄: Relational capital has a positive effect on sustainability performance.

METHODOLOGY

The population of this study consisted of energy sector companies listed on the Indonesia Stock Exchange. Purposive sampling was employed, selecting companies listed between 2017 and 2023 that had complete information relevant to the study. The final research sample included 32 energy sector companies, yielding 115 data respondents. In this study, data analysis was conducted using EVIEWS due to the unbalanced nature of the panel data.

The independent variable in this study is Intellectual Capital, which is defined as an intangible resource that is an important source of competitive advantage and performance improvement (Haris et al., 2019). Intellectual capital is measured using equations 1–5.

1. Capital Employed Efficiency (CEE), is formulated as equation 1.

$$CEE = \frac{VA}{CE} \dots\dots\dots (1)$$

VA is Value Added, where VA = OUT – IN, OUT is total revenue, IN is total costs in the company, except employee salaries and benefits and CE is the book value of net assets.

2. Human Capital Efficiency (HCE), is formulated as equation 2.

$$HCE = \frac{VA}{HC} \dots\dots\dots (2)$$

HC is the total of employee salary and benefits.

3. Structural Capital Efficiency (SCE), is formulated as equation 3.

$$SCE = \frac{SC}{VA} \dots\dots\dots (3)$$

SC is obtained from VA minus HC

4. Relational Capital Efficiency (RCE), is formulated as equation 4.

$$RCE = \frac{VA}{RC} \dots\dots\dots (4)$$

RC is the total investment in marketing, sales, and advertising costs.

5. Intellectual Capital measurement using MVAIC, is formulated as equation 5.

$$MVAIC = CEE + HCE + SCE + RCE \dots\dots\dots (5)$$

The dependent variable in this study is the quality of sustainability performance, as measured by the Environmental, Social, and Governance (ESG) score. ESG performance quality is measured using the ESG score. Scores range from 0 to 100. A score below 50 is considered poor and a score above 70 is considered good. The regression model in this study is as shown in equations 6 and 7.

$$ESG = \alpha + \beta_1CEE + \beta_2HCE + \beta_3SCE + \beta_4RCE + \varepsilon \dots\dots\dots (6)$$

$$ESG = \alpha + \beta_1IC + \varepsilon \dots\dots\dots (7)$$

FINDINGS

Descriptive statistical analysis is shown in Table 1. Table 1 shows that a total of 115 data were used, which is an unbalanced panel data because some companies' ESG Score data was found to be inconsistent from 2017 to 2023. The average ESG score was 45.15, the score indicates that collectively, the measured entities have moderate or standard ESG performance, without significant excellence in sustainability or ethical practices.

Table 1. Descriptive statistical

Description	ESG Score	CEE	HCE	RCE	SCE	IC
Mean	45.15	42.50	1445.22	14.37	0.90	1502.99
Median	46.94	3.66	14.04	13.18	0.94	48.26
Std Deviation	16.86	162.26	10822.07	12.49	0.36	10816.92
Range	67.27	1162.81	91901.25	94.78	2.77	92522.76
Minimum	9.88	-629.05	-18.32	-27.95	-0.36	-630.37
Maximum	77.15	533.77	91882.93	66.83	2.41	91892.40

Table 2. Classical Assumption Test Result

Description	Normality	Multicollinearity	Heteroscedasticity	Autocorrelation
Probability	0.35783			
Correlation Value		< 0.8		
Breusch-Pagan LM			0.1695	
Durbin-Watson				1.276658

Based on Table 2, the data is normally distributed (Probability = 0.36), free from multicollinearity (Correlation Value < 0.8), and heteroscedasticity (Breusch-Pagan LM = 0.1695) and autocorrelation (Durbin-Watson = 1.28). This indicates that the regression model meets statistical requirements, resulting in valid and reliable analysis results. The regression analysis was performed using EVIEWS software. The research phase involved testing the Fixed Effect Model (FEM), Chow test, Hausman test, and Random Effect Model (REM). The test results are presented in Tables 3–6.

Table 3. FEM Test Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48.00410	8.250018	5.818667	0.0000
CEE	0.058563	0.020858	2.807711	0.0063
HCE	0.000194	0.000569	0.340520	0.7344
SCE	-11.65707	8.417648	-1.384837	0.1700
RCE	0.337069	0.158155	2.131249	0.0362
R-squared		0.840205		
Adjusted R-squared		0.769410		
F-statistic		11.86812		
Prob (F-statistic)		0.000000		

Table 4. Chow Test Result

Effects Test	Statistic	d.f.	Prob.
Cross-section F	12.400826	(31.79)	0.0000
Cross-section Chi-square	203.457771	31	0.0000

Table 5. Hausman Test Result

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.918577	4	0.2958

Table 6. Random Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	35.42758	5.824440	6.082572	0.0000
CEE	0.027158	0.014781	1.837362	0.0689
HCE	-8.17E-05	0.000194	-0.422159	0.6737
SCE	-2.005313	5.542149	-0.361829	0.7182
RCE	0.413733	0.133164	3.106951	0.0024
R-squared		0.135704		
Adjusted R-squared		0.104275		
F-statistic		4.317786		
Prob (F-statistic)		0.002780		

Table 7. Hypothesis testing result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	44.75691	1.237556	36.16556	0.0000
IC	0.000259	0.000617	0.419953	0.6756
R-squared		0.804682		
Adjusted R-squared		0.728460		
F-statistic		10.55711		
Prob(F-statistic)		0.000000		

Based on Table 4, the Chow test shows a probability value of 0.0000, which is less than 0.05, so the selected model is the Fixed Effect Model. Based on the Hausman test (Table 5), the Prob. value is greater than 0.05. This means the selected model is the Random Effect Model (REM). Based on the standard diagnostic test (Chow test), the selected model is the Fixed Effects Model. The Hausman test results recommend the Random Effects Model. The final decision was to use the Random Effects Model (REM) as the most appropriate model for the data analysis.

The results of the Random Effect Model test (Table 6) show an F-statistic value of 0.002780. The value is less than 0.05, so the regression model can be used for data estimation. The hypothesis testing of the influence of intellectual capital on sustainability is shown in Table 7.

DISCUSSION

The influence of capital employed on sustainability performance

Based on Table 6, it is known that the Capital Employed (CEE) variable has no effect on sustainability, with a probability value of 0.0689, which is greater than 0.05. Therefore, the first hypothesis cannot be accepted. This indicates that structural capital has no impact on sustainability (Agustia et al., 2021; Barak & Sharma, 2023).

According to Djaddang et al. (2023), sustainability performance is determined by invested capital and the relationship between capital efficiency and other performance indicators. Furthermore, it is highly likely that energy sector companies will further optimize capital use for asset optimization in an effort to generate maximum revenue and added value. In this study, using a significance level/alpha of 0.1, capital employed can influence sustainability performance.

The influence of human capital on sustainability performance

Table 6 shows that the influence of human capital on sustainability has a probability value of 0.6737. This condition means that human capital does not affect sustainability performance, so the second hypothesis is not accepted. This indicates that if human capital must be integrated with social capital, it will not be able to effectively promote sustainability. Garrigos-Simon et al., (2018) found that social capital is important in fostering resilience and facilitating collaboration, which indicates that human capital must be integrated within a strong social framework to produce sustainable benefits.

The interaction between human capital and other factors (such as quality management and innovation) indicates that sustainability performance depends on a complex interplay between human resources and other corporate systems and strategies. Human capital can mediate the relationship between management quality and sustainability practices (Tari et al., 2024). These findings suggest that human capital is not the sole determinant of performance. A company's structural and managerial foundations determine how effectively human capital can contribute to sustainability performance.

The influence of structural capital on sustainability performance

Table 6 shows that structural capital also does not affect sustainability, with a prob. value of 0.7182, so the third hypothesis is also rejected. This may be because sustainability is not entirely determined by structural capital components such as debt or equity, but is influenced by other, more complex factors. According to Wuliyanti & Laksmono (2022), excessive focus on structural capital management without considering key elements such as effective leadership and management can undermine efforts to achieve sustainable performance.

Furthermore, other factors often overlooked in the context of capital structure include external influences such as market conditions and social changes, which can influence investor and stakeholder

perceptions. Reporting on sustainability performance and engaging in Corporate Social Responsibility (CSR) practices can be more valuable than focusing solely on capital structure. Syahidun & Nawangsari (2022) echoed this sentiment, stating that structural capital alone is insufficient to improve sustainability performance without complementary mechanisms.

The influence of relational capital on sustainability performance

Another factor often overlooked in the context of capital structure include external influences such as market conditions and social changes, which can influence investor and stakeholder perceptions. Reporting on sustainability performance and engaging in Corporate Social Responsibility (CSR) practices can be more valuable than focusing solely on capital structure. Syahidun & Nawangsari (2022) have stated that structural capital alone is insufficient to improve sustainability performance without complementary mechanisms.

These communicative networks are crucial for implementing sustainable practices, as they enable companies to engage with diverse perspectives and resources, thereby enriching their sustainability strategies. Relational capital can foster knowledge exchange on environmental management practices, further supporting immediate sustainability goals and improving long-term performance. Trust and cooperation among stakeholders lead to more effective collaboration in sustainability efforts (Yu et al., 2021).

Furthermore, relational capital significantly contributes to the development and implementation of sustainability reporting practices. Evidence suggests that organizations with strong relational capital are more likely to adopt comprehensive sustainability frameworks and demonstrate transparency in reporting, which are crucial for stakeholder trust and engagement (Bananuka et al., 2021).

The influence of intellectual capital on sustainability performance

Table 7 shows that the IC variable ($MVAIC_i = CEE_i + HCE_i + SCE_i + RCE_i$) does not influence sustainability performance. This is indicated by a probability value of 0.6756, thus rejecting the fifth hypothesis. This may be due to the fact that sustainability practices in the study year were during the pandemic, which can be a fluctuating external pressure, undermining the consistent role of IC.

According to Agustia et al. (2021), the role of IC and sustainability is not always correlated because companies are not sufficiently committed to promoting truly sustainable practices that combine ecological and social dimensions. Furthermore, although intellectual capital is associated with better management practices, implementing environmentally friendly strategies requires a strong organizational culture and employee engagement, which may not be solely driven by IC factors (Yong et al., 2020).

CONCLUSION

Based on the analysis of this study, it can be concluded that the intellectual capital possessed by the company is unable to drive its sustainability performance. This is likely due to conditions of extreme pressure beyond the company's control. This is indicated by the COVID-19 pandemic during the 2019-2021 study period. Capital employed, structural capital, and human capital did not significantly influence sustainability performance, while relational capital had a positive effect.

Intellectual capital plays a crucial role in contemporary management discourse, but considerable evidence suggests that intellectual capital may not directly enhance sustainability. Sustainability governance determinants, such as organizational culture, regulatory frameworks, and stakeholder engagement, may be more influential. While intellectual capital can contribute to improved performance in certain contexts, it should not be overemphasized as the primary catalyst for sustainable

practices within organizations. Therefore, future research should incorporate additional variables to link intellectual capital to sustainability performance. Variables such as stakeholder engagement, organizational culture, and corporate governance could be used for further research.

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