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Green innovation, green accounting, and performance: The moderating role of green intellectual capital

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Abstract

Research aims: This study examines the impact of green innovation and green accounting on financial and environmental performance, with green intellectual capital (GIC) as a moderating variable.

Design/Methodology/Approach: The analysis is based on 188 firm-year observations from companies listed on the Indonesia Stock Exchange (2020–2023), selected through purposive sampling. Panel data moderated regression analysis is employed.

Research findings: Green process innovation does not significantly affect financial performance but improves environmental performance. Green product innovation negatively impacts financial performance yet positively influences environmental outcomes. Green accounting enhances financial performance but shows no effect on the environment. GIC strengthens the positive effect of green product innovation and green accounting on environmental performance, and also reinforces the link between green product innovation and financial performance. However, GIC does not moderate the effects of green process innovation or green accounting on financial performance.

Theoretical Contribution/ Originality: The study offers novel insights into the role of GIC as a strategic intangible asset that enhances the effectiveness of green innovation and accounting practices, thereby bridging a gap in the environmental accounting and sustainability literature, particularly within emerging markets such as Indonesia.

Practitioner/Policy implication: Findings underscore the importance of integrating GIC into corporate sustainability strategies and call for stronger collaboration between policymakers and business leaders to support green initiatives without compromising economic performance.

Research limitation/Implication: The use of purposive sampling may limit the generalizability of the findings to the broader population of listed firms.

Keywords: Environmental performance; Financial performance; Green Accounting; Green Innovation; Green Intellectual Capital

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Introduction

The company's financial performance is the main focus for investors because it describes the company's ability to generate profits and the basis for the sustainability of the company's activities (Majidah & Aryanty, 2023). Therefore, the demands of financial performance encourage companies to carry out various strategies to increase profits based on

investor expectations and pay attention to environmental conditions and the surrounding community (Majidah & Aryanty, 2023). However, rapid economic growth and investors' demands for high corporate performance are causing serious environmental problems. This is because specific industries exploit natural resources to maximize the company's financial performance (Wardhani & Rahadian, 2021). In Indonesia, high economic growth caused by increased corporate activity has adverse effects, such as increased air and water pollution at dangerous levels (Deswanto & Siregar, 2018; Sebayang & Surbakti, 2023).

Indonesia is one of the worst air-polluted countries in the world, and Jakarta has the highest air pollution. In 2023, air pollution in Jakarta reached dangerous levels with PM2.5 concentration levels that were 2.6 times the safe limit set by WHO, resulting in many cases of acute respiratory disease, with numbers approaching 200 thousand cases in August 2023. According to the Ministry of Environment and Forestry (KLHK), industrial activities ranked second in contributing to air pollution in Jakarta at 41% after motor vehicle pollution (Rahelliamelinda & Handoko, 2024). In addition, product packaging and company production processes also contribute to environmental pollution. BBC News Indonesia 2023 reported the occurrence of seawater pollution in Southeast Sulawesi caused by the disposal of nickel mining waste into the sea, resulting in a reduction in the economic income of the surrounding community who work as fishermen and underwater tour guides. The existence of environmental pollution encourages changes toward sustainable development, which requires companies to pay attention to their responsibilities to the environment. In addition, there is increasing consumer environmentalism amid severe environmental damage and climate change issues. Thus, consumers are increasingly aware and educated to take a role in protecting the environment, thus paying special attention to companies that apply the green concept. This is evidenced by the increasing number of consumers who care about environmentally friendly products by 112% from 2019 to 2020 (Mariyamah & Handayani, 2020).

Green innovation, the motive in the current industrial era (X. Chen et al., 2018), is an environmental management concept and one of the keys for companies to increase competitive advantage while maintaining environmental sustainability (Setyawan & Wijayanti, 2023). This is because adopting green innovation focuses on reducing waste, preventing pollution, promoting energy efficiency, and implementing environmental management systems caused by the production process and finished products resulting from company activities (Saudi et al., 2019). Companies that implement Green Innovation are considered capable of being responsible for the environment caused by the company's business activities. This is reinforced by legitimacy theory, which explains that a company is formed through continuous social interaction. These interactions create expectations that company operations will be run by social values and expectations (Crossley, Elmagrhi & Ntim, 2021; Suchanek, 2020). Thus, companies implementing green innovation can obtain high legitimacy because they can realize society's expectations of preserving the environment (Rahelliamelinda & Handoko, 2024). Furthermore, green innovation can also be a business strategy that can minimize environmental damage and attract consumers to improve the company's environmental performance (Kim et al.,

2023). In addition to adopting green innovation, accounting is also involved in improving company and environmental performance.

Green accounting provides information about the extent to which companies incur costs to be environmentally and socially responsible and provides this information to external and internal stakeholders (Riyadh et al., 2020). Green accounting can be used to reveal the benefits of environmental investment in generating profits and avoiding future environmental demands (Lusiana et al., 2021; Riyadh et al., 2020). Thus, companies that engage in green accounting practices are likely to experience improvements in their environmental performance. Findings from the research of Al-Hakim and Wahyuningtyas (2024), Agustia et al. (2019), Satrio and Kunto (2020) show that green accounting, as measured by environmental performance and disclosure, has a significant positive impact on profitability and firm value.

Efforts to carry out green innovation and accounting are related to the role of intellectual capital. Intellectual capital is a combination of intellectual and capital that indicates the importance of knowledge (Lev & Zarowin, 1999; Serenko & Bontis, 2013). Therefore, intellectual is recognized as an effort to increase a company's corporate value and competitive advantage (Y. S. Chen, 2008). Green intellectual capital (GIC) is the development of intellectual capital that is in line with Indonesian and international laws regarding environmental protection and aims to increase the awareness of every element of society about the importance of preserving the environment. Thus, the concept of "green" integrated into intellectual capital becomes a new paradigm (Sukirman & Dianawati, 2023). GIC is an intangible asset that complements the prospects for sustainable development in environmental protection knowledge and improves the company's competitive performance (Asiaei et al., 2023; Yadiati et al., 2019). Environmental performance comes from an organization actively engaging in environment-related knowledge and resources (M. Chen et al., 2023). Yadiati et al. (2019) found that GIC can improve company and environmental performance.

Several previous studies have examined the effect of green innovation and green accounting on company performance (Datta & Deb, 2012; Helmi & Widiastuty, 2023; Kuo et al., 2022; H. Li et al., 2023; Majidah & Aryanty, 2023; Mulaessa & Lin, 2021; Rahman, 2023; Shuwaikh et al., 2023; Sukiyaningsih & Hasanah, 2024), and environmental performance (Abid et al., 2022; Apriandi & Lastanti, 2023; Chang, 2011; Dura & Suharsono, 2022; Kazemian et al., 2022; Y. Li et al., 2018; Manzoor & Jahangir, 2024; Saudi et al., 2019; Ullah et al., 2024) given the importance of company performance and environmental performance for business sustainability and economic growth of a country, as well as environmental sustainability. Therefore, this study aims to examine the effect of green innovation and green accounting on corporate and environmental performance and the role of GIC in influencing the relationship between the independent and dependent variables. Although GIC has been recognized as an important factor in improving environmental and corporate performance, research that places GIC as a moderating variable in the relationship between green innovation and green accounting on corporate and environmental performance is still rare. Asiai et al. (2022) emphasized the need for further research to understand this mechanism. In addition, previous studies

have focused more on financial performance, firm value, and company operations as measures of success. No less important than financial aspects, environmental aspects such as environmental performance, which are increasingly crucial in global sustainability, have not been widely explored. Further research is needed to explore how GIC, green innovation, and green accounting affect environmental performance synergistically (Shahbaz et al., 2024). Therefore, this study incorporates environmental concepts into intellectual capital to improve financial and non-financial performance. In addition, this study will provide empirical evidence regarding the role of GIC in influencing the relationship between green innovation and green accounting on the Company's sustainability performance. The role of GIC is a strategic element that strengthens or weakens the relationship between GI and GA regarding corporate and environmental performance. GIC is considered to have an important role in building strong relationships between management, stakeholders, and environmental organizations.

This study makes several contributions, both theoretically and practically. First, this study contributes to the literature in filling the knowledge gap on the role of GIC as moderation in the relationship between green innovation, green accounting, and firm performance that has not been widely explored, especially in developing countries such as Indonesia, which have different challenges in implementing green innovation and green accounting. Thus, this study can address the need for a sustainability-based approach in the context of developing countries. Second, the observation year is relatively new (2020-2023) to get the latest study results. Third, this study will provide insight into how companies in Indonesia, with all the challenges of regulation, culture, and resources, can utilize GIC to achieve sustainability and the synergy of green innovation and green accounting. Fourth, the method of measuring green innovation in previous studies using log R&D (Salihi et al., 2024). However, this study is more detailed by dividing green innovation into processes and products.

Literature Review and Hypotheses Development

The relationship between green innovation and green accounting on financial performance and environmental performance and the role of GIC can be explained using legitimacy theory and Resource Based Theory. Legitimacy theory pressures companies to voluntarily disclose environmental and social information to maintain support from the community (Suchman, 1995). Thus, the company ensures its business activities follow the community's values, norms, and expectations. To reduce the legitimacy gap caused by differences in values between the company and the community that can affect the company's ability to continue its business. Thus, green innovation plays an important role in helping companies meet the demands of legitimacy theory. Environmentally friendly innovation allows companies to balance environmental responsibility and profitability, thereby improving company performance and environmental performance.

Furthermore, green innovation can reduce the environmental footprint caused by the company's operating activities, such as reducing carbon emissions, better waste management, and resource efficiency. Environmentally friendly innovation includes

developing environmentally friendly products and processes, improving operational efficiency, reducing costs, and meeting market demand that is increasingly concerned about immigrant issues. Ultimately, green innovation can strengthen the company's reputation and open up new market opportunities that improve the company's financial performance and competitiveness. This is reinforced by previous research, which revealed that green innovation is a new solution, method, and process related to reducing environmental damage and encouraging the efficient use of natural resources (Hojnik & Ruzzier, 2016). The findings are supported by (Biggi et al., 2023; Rahman, 2023; Serio et al., 2020), which reveal that companies that apply green innovation, such as resource-saving and pollution reduction, have a positive impact on the dynamics of sales employment and company productivity. Applying green innovation through an environmentally friendly production process by reducing carbon emissions or waste can affect higher business continuity opportunities, better corporate image, and competitiveness in the market, thus having a positive impact on financial and environmental performance. Therefore, the research hypothesis is as follows:

***H_1**: Green Innovation has a positive effect on Financial performance.*

***H_2**: Green Innovation has a positive effect on environmental performance.*

The relationship between green innovation on financial performance and environmental performance with the role of GIC can be explained by Resource Based Theory. Resource Based Theory explains that knowledge and utilization of intangible assets as unique and superior resources can benefit company performance in the long term (Ulum et al., 2016). GIC, as an intangible asset in terms of information resources, innovation, and knowledge, plays a role in increasing the company's competitive advantage while protecting the environment, which ultimately supports sustainable performance (Zalfa & Novita, 2023) by supporting strategic resources in the development and implementation of green innovation. Thus, a strong GIC allows the company to integrate green innovation into its operational strategy, ultimately improving its performance. This is supported by previous research, which found that GIC plays an important role in strengthening green innovation on financial performance and environmental sustainability (Haddad et al., 2024; Kurniawati & Widiayana, 2024; Manzoor & Jahangir, 2024; Nawangsari et al., 2025). Thus, the hypothesis is formulated as follows:

***H_3**: Green Intellectual Capital moderates the relationship between Green Innovation and Financial Performance.*

***H_4**: Green Intellectual Capital moderates the relationship between Green Innovation and Environmental Performance.*

Green accounting identifies measures, assesses, and discloses costs associated with company activities related to environmental issues and their mitigation. The goal is to reduce the impact of the company's activities on the environment and report this

information to stakeholders. Companies that implement green accounting can better demonstrate accountability for environmental impacts, thus attracting more investors and consumers who care about sustainable business practices. This provides a competitive advantage that has a positive impact on financial performance. Thus, Geen accounting applied by the Company can improve Company performance and environmental performance (Nggraeni et al., 2023; Rajak, 2022). In addition, implementing corporate green accounting can help avoid conflicts caused by pollution, fines, and natural disasters. This is because green accounting involves including environmental costs in financial statements, which helps companies recognize the economic and environmental benefits of sustainable practices. This integration is essential to bridge the gap between perception and practice, encouraging responsible business management (Rounaghi, 2019). By incorporating environmental factors, companies can better assess their operations' impact on the environment, leading to more informed decision-making regarding resource allocation and risk management (Juneja et al., 2024).

Legitimacy theory explains that companies seek social legitimacy from society by aligning their activities with social values, norms, and expectations (Anggita et al., 2022). In the environmental context, green accounting helps companies demonstrate transparency and commitment to environmental sustainability, which can increase legitimacy. When companies actively report sustainability efforts through green accounting, they can strengthen relationships with stakeholders (investors, consumers, and regulators) and reduce social pressure related to environmental issues. This encourages companies to take concrete actions that contribute to better environmental performance. Thus, applying green accounting can affect the company's financial performance directly or indirectly through increased social legitimacy (Putri et al., 2024). The positive effect of green accounting on corporate and environmental performance has been proven by several previous studies (Astuti et al., 2022; Choiriah & Lysandra, 2023; Datta & Deb, 2012; Nianty et al., 2023; Rajak, 2022; Riyadh et al., 2020). Therefore, the hypothesis formulation is as follows:

***H_5**: Green Accounting has a positive effect on financial performance.*

***H_6**: Green Accounting has a positive effect on Environmental Performance.*

According to Rounaghi (2019), green accounting can be a management communication tool for stakeholders to convey relevant information about the company's actions regarding environmental sustainability. Based on Resource Based Theory, excellent company performance results from the concept of intellectual capital. The higher the intellectual capital, the higher the ability to utilize company resources to generate profits. Companies that manage their resources effectively can create a competitive advantage over their competitors (Khotimah et al., 2024). Elements of GIC, such as economic, environmental, and social performance, derived from quality human resources used effectively and efficiently will reflect the performance achieved to create added value and contribute to the financial performance of the company (Asiaei et al., 2023; Bangun et al.,

2024; Liu et al., 2022; Tandioga & Prihatin, 2023; Yudianto & Yuliawati, 2024). Thus, Green Accounting can provide a framework for measuring environmental performance from a financial perspective. In contrast, the role of GIC is to provide resources and knowledge to ensure that sustainability reporting is done appropriately.

This is in line with the findings of Dura and Suharsono (2022); and Gantino et al. (2023), which show that green accounting and intellectual capital affect sustainable development that can improve financial performance and firm value. With GIC, companies can develop methods to assess the intangible value of GIC, and Green Accounting records how much capital impacts the value of assets and liabilities. Green Accounting then ensures that compliance with these regulations is reflected in the financial statements so that companies can avoid penalties and take advantage of incentives provided by governments or international institutions. Thus, GIC acts as a driving force for innovation and environmental compliance. At the same time, Green Accounting becomes a tool that records and reports the positive impact of implementing this green strategy. Based on the previous explanation, the hypothesis can be formed as follows:

***H_7**: GIC moderates the relationship between green accounting and financial performance.*

***H_8**: GIC has a moderating effect on the relationship between Green accounting and Environmental Performance.*

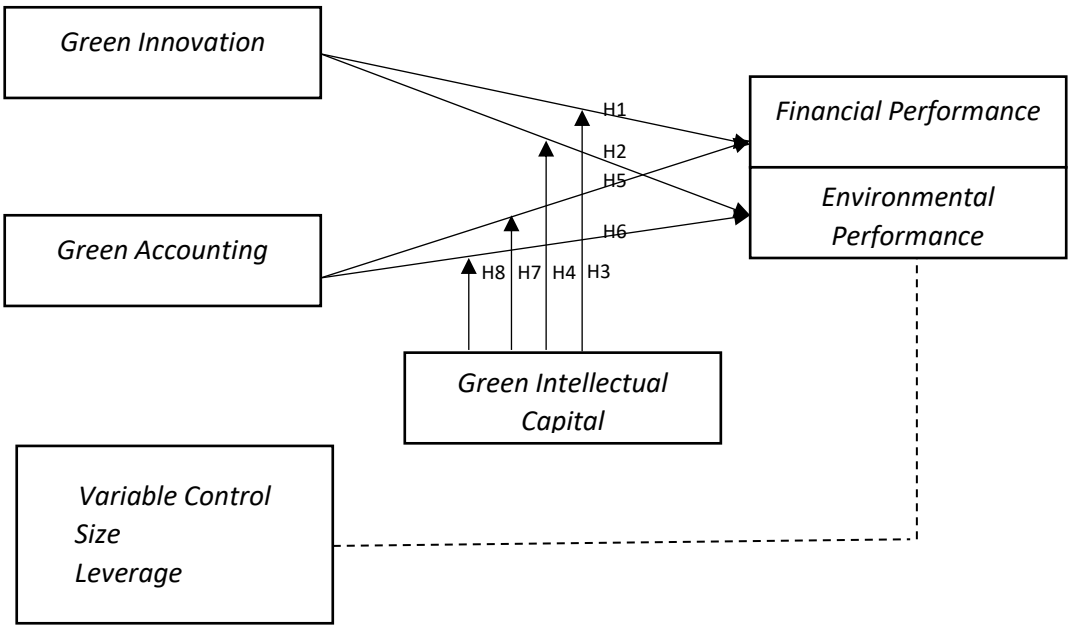

Figure 1 Conseptual Framework

Research Method

The research method employed in this study was a descriptive quantitative method with an associative causal research design. The purpose of associative causal research was to determine the effect of independent variables on dependent variables, as outlined in the problem formulation. Additionally, this research was based on positivist philosophy (concrete data), where the population or sample was examined by collecting numerical data that were analyzed using statistical tools for hypothesis testing, thereby allowing established hypotheses to be tested and conclusions to be drawn.

The population subject to this study consisted of companies listed on the Indonesia Stock Exchange (IDX), with a total of companies covering the observation period from 2020 to 2023. The type of data used in this research was quantitative, specifically secondary data obtained from company sustainability reports, annual reports, and associated financial statements.

Furthermore, the sampling method used in this research was purposive sampling, which was based on specific criteria. The first criterion excluded the financial sector due to its highly regulated nature. The second criterion required companies to publish comprehensive annual reports and sustainability reports. The third criterion mandated that companies disclose their PROPER (Corporate Performance Rating Program in Environmental Management) rankings in their annual reports.

From a total of 864 companies listed on the Indonesia Stock Exchange in 2023, the sample was selected based on several specific criteria. First, 107 companies from the financial sector were excluded from the analysis, given the different industry characteristics in sustainability reporting. Second, 220 companies were eliminated because they did not have a published sustainability report in the period 2020-2023, while 325 companies did not publish consecutive annual reports in the same period. Third, 115 companies did not disclose their proper ratings for 2020-2023, and 50 companies did not present information related to green innovation in the same period. After the selection process, 47 companies were obtained as samples in a year, and the final total sample amounted to 188 observations. This study uses four types of variables. The dependent variables include firm performance and environmental performance, while the independent variables consist of green innovation and green accounting. In addition, GIC is used as a moderating variable to analyze its effect on the relationship between the independent and dependent variables. To control for potential bias in judgment, this study also includes control variables, namely firm size and leverage.

The measurements and proxies for each variable are presented Environmental performance (EP) is measured using the Indonesian government's PROPER color rating system, which categorizes environmental compliance and performance into five levels: black, red, blue, green, and gold (Rajak, 2022). Financial performance (FP) is proxied by Return on Equity (ROE), calculated as the ratio of net income to total equity, reflecting the firm's profitability in relation to shareholder investment (Majidah & Aryanty, 2023). Green innovation is conceptualized as comprising two dimensions: green process innovation

(GPI) and green product innovation (GProdin). GPI is measured using a binary indicator based on ISO 14001 environmental management certification, where 0 indicates the absence and 1 the presence of certification. GProdin is assessed through content analysis, based on three criteria: (1) the selection of low-emission and energy-efficient materials, (2) the use of minimal, non-polluting, and non-toxic materials, and (3) the recyclability and reusability of products. Companies receive a score ranging from 0 (no relevant disclosure) to 3 (all criteria met) (Agustia et al., 2019; Jirakraisiri et al., 2021).

Green accounting (GA) is operationalized as a dummy variable, where a value of 1 indicates that a firm discloses Corporate Social Responsibility (CSR) expenditures in its annual report, and 0 otherwise (Majidah & Aryanty, 2023). Green intellectual capital (GIC) is measured using the Value-Added Intellectual Coefficient (VAIC™) framework, which includes three components: Value-Added Capital Employed (VACA), Value-Added Human Capital (VAHU), and Structural Capital Value-Added (STVA), as proposed by Sugiyanto and Febrianti (2021). This metric captures the efficiency with which a firm utilizes its green-related intangible resources to generate value. For control variables, firm size is measured as the natural logarithm of total assets, and leverage is measured using the debt-to-equity ratio (DER), defined as total liabilities divided by total equity (Olayinka et al., 2017). These controls are included to account for potential variations in firm characteristics that may influence financial and environmental performance.

This research began with a preliminary study in which the researcher aimed to master the theory through various references to formulate the background, research objectives, and problem statement specifically. Relevant previous studies can be used as a basis for providing tentative answers to the research hypothesis. Secondary data obtained through document observation was required to test the hypothesis and subsequently processed using Eviews software.

The data analysis technique used to analyze the variables in this research was panel data regression analysis. Panel data regression employed the Eviews statistical program, as the data used in this research was panel data, which combined time series and cross-sectional data. The problem-solving approach using the panel data regression model was presented as follows:

$$FPit = \alpha + \beta 1GPIit + \beta 2GprodInit + \beta 3GAit + \beta 4[\{GPIit * GICit\}] + \beta 5[\{GprodInit * GICit\}] + \beta 6[\{GAit * GICit\}] + \beta 7Sizeit + \beta 8Levit + e \ldots\ldots\ldots (1)$$

$$EP_{it} = \alpha + \beta 1GPI_{it} + \beta 2GprodInit + \beta 3GAit + \beta 4[\{GPIit * GICit\}] + \beta 5[\{GprodInit * GICit\}] + \beta 6[\{GAit * GICit\}] + \beta 7Sizeit + \beta 8Levit + e \ldots\ldots\ldots (2)$$

Where FP_{it} as Financial performance at Company i in year t; EP_{it} define as Environmental performance at Company i in year t GPI_{it} as Green process innovation at Company i in year t; $GprodIn_{it}$ as Green product innovation at Company i in year t; Ga_{it} as Green accounting at Company i in year t; $GICi_t$ as Green Intellectual capital in Company i in year t; $Size_{it}$ as Company Size at Company i in year t as a control variable; and Lev_{it} as Leverage at firm i in year t as a control variable.

Result and Discussion

Table 1 presents the descriptive statistics of the eight research variables: green process innovation (GPI), green product innovation (GprodIn), green accounting (GA), green intellectual capital (GIC), company size (Size), leverage (Lev), environmental performance (EP), and financial performance (FP), with 188 observable sample data points. The GPI variable has a maximum value of 1 and a minimum value of 0, with a mean of 0.702, greater than the standard deviation of 0.458. This indicates that GPI has low fluctuation and variability, tending to cluster around the mean value. GPI is proxied by the ISO 14001 certification, an international standard ensuring that companies operate in an environmentally responsible manner and support environmental sustainability. Thus, the average GPI score of 0.702 for companies in Indonesia, close to the maximum value of 1, reflects the companies' concern for environmental sustainability issues.

The GprodIn variable has a maximum value of 3 and a minimum value of 1, with an average (mean) of 2.638, greater than the standard deviation of 0.563. This indicates that GprodIn has low fluctuation and variability, tending to cluster around the mean value. GprodIn is proxied through content analysis based on the criteria specified.The average GprodIn score of 2.638 for companies in Indonesia, close to the maximum value of 3, reflects the companies' efforts to disclose green product innovation in their sustainability reports.

Table 1 Descriptive statistics

Variable	Obs	Maximum	Minimum	Mean	Std deviation
GPI	188	1.000	0.000	0.702	0.458
GprodIn	188	3.000	1.000	2.638	0.563
GA	188	1.000	0.000	0.701	0.427
GIC	188	264.328	-42.838	5.880	21.937
Size	188	32.716	24.654	29.779	1.550
Lev	188	50.189	-76.751	1.283	2.105
EP	188	5.000	2.000	3.446	1.358
FP	188	1.458	-2.548	0.126	0.351

The GA variable has a maximum value of 1 and a minimum value of 0, with an average (mean) of 0.701, greater than the standard deviation of 0.427. This indicates that GA has low fluctuation and variability, tending to cluster around the mean value. Thus, the average GA score of 0.701 for companies in Indonesia, close to the maximum value of 1, reflects the companies' efforts to allocate resources to support environmental sustainability.

The GIC variable has a maximum value of 264.328 and a minimum value of -42.838, with an average (mean) of 5.880, lower than the standard deviation of 21.937. This indicates that GIC has high fluctuation and variability. The average GIC score of 5.880 for companies in Indonesia, far from the maximum value of 264.328, shows that the results are not yet optimal. Still, it demonstrates a positive sign as companies are becoming more aware of the importance of developing knowledge related to sustainability practices.

The EP variable has a maximum value of 5 and a minimum value of 2, with an average (mean) of 3.446, greater than the standard deviation of 1.358. This indicates that EP has low fluctuation and variability, tending to cluster around the mean value. EP is proxied by the PROPER rating, as shown in Table 2. Thus, the average PROPER rating for companies in Indonesia indicates a blue rating. The blue rating means that companies have complied with environmental management efforts in accordance with legal regulations.

The FP variable has a maximum value of 1.458 and a minimum value of -2.548, with an average (mean) of 0.126, which is lower than the standard deviation of 0.351. This indicates that FP has high fluctuation and variability. FP is proxied by ROE. Thus, the average ROE for companies in Indonesia is 12.6%.

Table 2 Moderated Regression Analysis (MRA) Model 1

Variables	Coefficient	t-Statistic	Prob	Conclusion
C	-0.6425	-3.1223	0.0018	
GPI	0.0345	1.0590	0.2898	H_{1a} does not support
GprodIn	-0.0384	-2.2653	0.0085	H_{1b} does not support
GA	0.0919	3.0891	0.0021	H_5 supports
GIC	-0.0061	-1.6000	0.1099	
GPI * GIC	-0.0034	-1.3147	0.1889	H_{3a} does not moderate
GprodIn* GIC	0.0101	6.1127	0.0000	H_{3b} moderates
GA* GIC	-0.0023	-0.8174	0.4138	H_5 does not moderate
Size	0.0252	3.4059	0.0007	
Lev	-0.0731	-21.689	0.0000	
Adjusted R-squared	0.3987	Prob (F-Statistic)	0.0000	
F-Statistic	78.72906			

Model 1, as shown in Table 2, utilizes the Moderated Regression Analysis (MRA) approach to assess the impact of green innovation variables and the moderating role of green intellectual capital (GIC) on financial performance (FP). The adjusted R-squared value of 0.3987 implies that 39.87% of the variation in financial performance is explained by the model's predictors. Furthermore, the F-statistic value of 78.72906, significant at the 1% level ($p = 0.0000$), confirms the overall model's suitability and statistical significance.

The regression results highlight that green process innovation (GPI) does not significantly influence financial performance ($\beta = 0.0345$, $p = 0.2898$), resulting in the rejection of H_{1a}. Similarly, green product innovation (GprodIn) has a significant but negative effect on FP ($\beta = -0.0384$, $p = 0.0085$), leading to the rejection of H_{1b}. Conversely, green accounting (GA) shows a significant positive relationship with financial performance ($\beta = 0.0919$, $p = 0.0021$), supporting H_5.

Regarding the role of green intellectual capital (GIC) as a moderator, its direct effect is not significant ($\beta = -0.0061$, $p = 0.1099$). The interaction term GPI × GIC is also not significant ($\beta = -0.0034$, $p = 0.1889$), indicating that H_{3a} is not supported. In contrast, GprodIn × GIC demonstrates a significant positive moderating effect ($\beta = 0.0101$, $p = 0.0000$), supporting H_{3b} and suggesting that GIC enhances the impact of green product innovation on financial

performance. The interaction term GA × GIC is not significant (β = -0.0023, p = 0.4138), leading to the rejection of H_6.

Among the control variables, firm size has a significant positive effect (β = 0.0252, p = 0.0007), indicating that larger firms tend to achieve better financial performance. In contrast, leverage has a significant negative effect (β = -0.0731, p = 0.0000), suggesting that higher debt levels are associated with lower financial outcomes.

Table 3 Robust Least Squares (RLS) Model 1

Variables	Coefficient	Z-Statistics	Prob	Conclusion
C	0.3819	3.221238	0.0013	
GPI	0.0847	5.488706	0.0000	H_{1a} supports
GprodIn	-0.0491	-4.599295	0.0000	H_{1b} does not support
GA	0.0594	4.797013	0.0000	H_5 supports
GIC	0.0262	7.518075	0.0000	
GPI * GIC	-0.0347	-14.17160	0.0000	H_{3a} moderates
GprodIn* GIC	0.0167	19.62731	0.0000	H_{3b} moderates
GA* GIC	-0.0222	-17.19317	0.0000	H_5 moderates
Size	-0.0120	-3.225060	0.0013	
Lev	0.0045	1.738113	0.0822	
Adjust Rw-squared	0.8838			

Model 1, estimated using the Robust Least Squares (RLS) method, re-evaluates the impact of green innovations and green intellectual capital (GIC) on financial performance (FP), as shown in Table 3. The model demonstrates a high level of explanatory power, with an adjusted R-squared value of 0.8838, indicating that 88.38% of the variance in financial performance is explained by the included variables. These variables consist of green process innovation (GPI), green product innovation (GprodIn), green accounting (GA), and GIC, alongside interaction (moderating) terms and control variables (Size and Leverage).

The analysis yields several significant findings. GPI exerts a positive and significant effect on FP (β = 0.0847, p = 0.0000), supporting Hypothesis H_{1a}. In contrast, GprodIn demonstrates a negative and significant influence on FP (β = -0.0491, p = 0.0000), thereby rejecting Hypothesis H_{1b}. Meanwhile, GA shows a positive and statistically significant impact on FP (β = 0.0594, p = 0.0000), confirming Hypothesis H_5.

Regarding moderating effects, GIC not only exerts a direct positive and significant influence on FP (β = 0.0262, p = 0.0000), but also significantly moderates three interaction relationships. The interaction between GPI and GIC reveals a negative and highly significant coefficient (β = -0.0347, p = 0.0000), indicating that GIC weakens the influence of GPI on FP, thus supporting Hypothesis H_{3a} with a negative moderation effect. Conversely, GprodIn × GIC presents a positive and significant moderation (β = 0.0167, p = 0.0000), lending support to Hypothesis H_{3b}, and affirming that GIC strengthens the relationship between GprodIn and FP. Similarly, GA × GIC shows a significant negative moderating effect (β = -0.0222, p = 0.0000), supporting Hypothesis H_6, though indicating that GIC diminishes the influence of GA on FP.

the control variables yield mixed outcomes. Firm size (Size) has a negative and significant effect on FP (β = -0.0120, p = 0.0013), suggesting that in this context, larger firms may experience lower financial performance. Leverage (Lev), however, is not statistically significant (β = 0.0045, p = 0.0822), implying that the capital structure does not have a meaningful effect on financial performance within this model.

Table 4 Moderated Regression Analysis (MRA) Model 2

Variables	Coefficient	t-statistic	Prob	Conclusion
C	-4.8040	-8.2370	0.0000	
GPI	0.4751	5.3442	0.0000	H_{2a} supports
GprodIn	0.1781	4.3137	0.0000	H_{2b} supports
GA	-0.0423	-0.5022	0.6156	H_6 does not support
GIC	-0.0302	-2.7769	0.0056	
GPI * GIC	-0.0036	-0.4795	0.6317	H_{4a} does not moderate
GprodIn* GIC	0.0138	2.9397	0.0034	H_{4b} moderates
GA* GIC	0.0153	1.9178	0.0500	H_6 moderates
Size	0.1706	8.1247	0.0000	
Lev	0.0103	1.0822	0.2794	
Adjusted R-Squared	0.1896	Prob (F-Statistic)	0.0000	
F-Statistic	28.4322			

Model 2, which examines the influence of green process innovation (GPI), green product innovation (GprodIn), and green accounting (GA) on environmental performance (EP), is presented in Table 4. The adjusted R-square value of 0.1896 indicates that approximately 18.96% of the variation in the dependent variable (environmental performance, EP) can be explained by the independent variables: green process innovation (GPI), green product innovation (GprodIn), green accounting (GA), firm size (SIZE), and leverage (LEV), while the remaining 81.04% is attributable to other factors outside the model. Furthermore, the F-statistic value of 28.432, which is statistically significant at the 1% level (p = 0.0000), confirms that the overall regression model is valid and the set of predictors collectively has a significant impact on environmental performance.

The regression analysis provides detailed insights into the hypothesized relationships. Green process innovation (GPI) shows a positive and significant effect on environmental performance (β = 0.4751, p = 0.0000), thus supporting Hypothesis H_{2a}. Likewise, green product innovation (GprodIn) significantly and positively influences EP (β = 0.1781, p = 0.0000), leading to the acceptance of Hypothesis H_{2b}. In contrast, green accounting (GA) does not have a statistically significant effect (β = -0.0423, p = 0.6156), resulting in the rejection of Hypothesis H_6.

Regarding moderation effects, green intellectual capital (GIC) significantly moderates the relationship between GprodIn and EP (β = 0.0138, p = 0.0034), providing support for Hypothesis H_{4b}. This finding indicates that stronger intellectual capital enhances the impact of green product innovation on environmental performance. Additionally, GIC also significantly moderates the effect of green accounting on EP (β = 0.0315, p = 0.0500), providing marginal support for Hypothesis H_6 as a moderator. However, GIC does not

moderate the relationship between GPI and EP (β = -0.0036, p = 0.6317), thus rejecting Hypothesis H_{4a}.

As for the control variables, firm size (SIZE) exerts a significant positive effect on environmental performance (β = 0.1706, p = 0.0000), suggesting that larger firms are more likely to exhibit higher environmental performance. Meanwhile, leverage (LEV) does not show a statistically significant impact (β = 0.0103, p = 0.2794), indicating that capital structure has no notable influence on EP in this model.

Table 5 Robust Least Squares (RLS) Model 2

Variables	Coefficient	z-Statistik	Prob	Conclusion
C	-1.3277	-1.1548	0.0144	
GPI	-0.0530	-0.3664	0.3437	H_{2a} does not support
GprodIn	-0.1210	-1.2645	0.3002	H_{2b} does not support
GA	-0.1386	-1.2047	0.4120	H_6 does not support
GIC	-0.2964	-3.1306	0.0017	
*GPI * GIC*	0.0038	0.1519	0.1563	H_{4a} does not moderate
GprodIn GIC*	0.0148	1.8635	0.0624	H_{4b} does not moderate
GA GIC*	0.0090	0.2637	0.0079	H_6 moderates
Size	0.1676	4.5038	0.0000	
Lev	0.0572	1.8487	0.0645	
Adjust Rw-squared	0.4071			

Model 2, presented in Table 5, employs the Robust Least Squares (RLS) method to examine the influence of green innovations and green intellectual capital (GIC) on environmental performance (EP). The adjusted R-squared value of 0.4071 indicates that 40.71% of the variation in environmental performance can be explained by the model's predictors, demonstrating moderate explanatory power.

The analysis reveals that green process innovation (GPI) (β = -0.0530, p = 0.3437), green product innovation (GprodIn) (β = -0.1210, p = 0.3002), and green accounting (GA) (β = -0.1386, p = 0.4120) do not significantly affect environmental performance, leading to the rejection of H_{2a}, H_{2b}, and H_6 respectively.

While GIC shows a significant direct negative influence on EP (β = -0.2964, p = 0.0017), its moderating roles vary. The interaction terms GPI × GIC (β = 0.0038, p = 0.1563) and GprodIn × GIC (β = 0.0148, p = 0.0624) are not statistically significant, indicating that H_{4a} and H_{4b} are not supported. However, GA × GIC is significant with a coefficient of 0.0090 and a p-value of 0.0079, supporting H_6 and suggesting a strong positive moderating effect of GIC on the relationship between GA and environmental performance.

Regarding control variables, firm size significantly and positively affects EP (β = 0.1676, p = 0.0000), while leverage does not have a statistically significant impact (β = 0.0572, p = 0.0645).

Green Innovation and Financial Performance

The results of hypothesis testing show that green innovation is not proven to significantly improve firm performance with the proxy of green process innovation (GPI). This study found a positive but insignificant direction, in line with previous studies that found no evidence that GPI affects financial performance (Biggi et al., 2023; Helmi & Widiastuty, 2023; Maulana & Mulyadi, 2022; Ramadhan & Widiastuty, 2023; Wang & Ahmad, 2024). Legitimacy theory explains that companies try to obtain and maintain social legitimacy by adjusting their business activities to society's values, norms, and expectations. This finding implies that GPI has no significant effect on the Company's financial performance in the short term. This is because implementing GPI requires high initial costs, thus burdening the Company's finances to change the production process to be more environmentally friendly and efficient in the future. Therefore, this study supports previous opinions that the implementation of GPI is not always aimed at improving financial company performance in the short term but rather non-financial legitimacy (Wang & Ahmad, 2024).

However, different results were found through the RLS test, which showed that GPI has a positive and significant effect on financial performance, supporting the hypothesis. This result is in line with legitimacy theory, where companies adjust their business activities and processes to the values and expectations of society to gain social legitimacy (Suchman, 1995). In green process innovation, companies innovate to reduce negative environmental impacts, such as greenhouse gas emissions, industrial waste, and energy consumption (Nguyen et al., 2023; Zhang et al., 2024). Therefore, the implementation of green innovation can strengthen corporate reputation and open up new market opportunities, ultimately improving financial performance and competitiveness (Ojnik & Ruzzier, 2016; Liu et al., 2023; Mariyamah & Handayani, 2020; Wang & Ahmad, 2024; Xue et al., 2019; Zehir & Ozgul, 2020).

The findings show that green product innovation (GprodIn) negatively influences financial performance in both the MRA and RLS tests. These results indicate that GprodIn can reduce financial performance, contrary to legitimacy theory, which states that companies can improve their performance by gaining legitimacy from society (Biggi et al., 2023; Rahman, 2023; Serio et al., 2020; Yudianto & Yuliawati, 2024). This finding is reinforced by previous research (Helmi & Widiastuty, 2023; Rahman, 2023; Widiatami et al., 2023; Liang et al., 2022; Ji et al., 2023), which suggested that a reactive approach at the beginning of GprodIn adoption could threaten financial stability. This finding implies that the high cost of green innovations can reduce financial firm performance. However, the output produced from the product is environmentally friendly, which supports sustainability in the long run. However, in the short term, this adoption will sacrifice the firm financial performance.

The Influence of Green Intellectual Capital as a Moderating Variable on the Relationship Between Green Innovation and Financial Performance

The results of hypothesis testing prove that GIC does not moderate green innovation on the proxy of green process innovation (GPI) on financial performance (from the test

results MRA and RLS). This shows that investment in human intellectual capital does not necessarily strengthen the relationship between green innovation and financial firm performance. This result is not in accordance with Resource Based Theory, which explains that strategic resources, such as GIC, should provide a sustainable competitive advantage for the Company (Barney, 1991). However, this finding suggests that investment in human intellectual capital related to green innovation, particularly in green process innovation (GPI), has not been optimal in creating significant added value to firm performance. This may be due to the lack of ability of firms to effectively integrate GIC into the innovation process or to barriers in the management of human resources that support the implementation of GPI (Welly et al., 2023; Chen et al., 2023). Furthermore, this finding is in line with research showing that the success of green innovation is often influenced by contextual factors such as organizational culture, government policies, and technological readiness, so GIC may not have a significant moderating impact in all situations (Ar, 2012; Ha & Nguyen, 2022; Xue et al., 2019; Zhou et al., 2023). Therefore, a more holistic strategy to utilize GICs, including green skills development, continuous training, and green technology integration, is needed to ensure that GPIs can positively impact financial firm performance.

Further testing results show that the role of GIC strengthens the relationship between green innovation and the proxy of green product innovation (GprodIn) on financial firm performance in Indonesia (from the test results of MRA and RLS). Thus, hypothesis 3 can be accepted in the GprodIn proxy. This result supports Resource Based Theory, which explains that strategic resources that are valuable, rare, inimitable, and irreplaceable can provide a sustainable competitive advantage for the company (Barney, 1991). In this case, GIC is a key resource that enables firms to utilize green product innovation (GprodIn) to improve performance. GIC, which includes sustainability-focused human, structural, and relational capital, can strengthen a firm's ability to design high-value-added green products, enhance the firm's image, and attract more environmentally concerned consumers and business partners (Chen et al., 2023). This finding is in line with previous research (Liu et al., 2022; Manzoor & Jahangir, 2024; Sukirman & Dianawati, 2023), which shows that the success of GprodIn is highly dependent on the mastery and utilization of green knowledge within the company. Therefore, investment in GIC development has proven to be effective in strengthening the relationship between GprodIn and financial firm performance, especially in developing countries such as Indonesia, where the market increasingly values innovative and environmentally friendly products (Liu et al., 2023; Huang et al., 2023). These results also indicate that effective management of GIC can help firms develop innovative products that not only meet market needs but also strengthen the firm's competitive position. Thus, investment in GIC is a strategic move to support the relationship between Green Product Innovation and firm performance.

Green Accounting and Financial Performance

The test results of green accounting variables on financial performance show a positive and significant effect (from the test results MRA and RLS). Therefore, the research hypothesis is accepted. These findings are supported by researchers Deb et al (2023); Lestari (2023); Nggraeni et al (2023); Sukiyaningsih and Hasanah (2024); Rizal and

Yatminiwati (2020), which reveal that green accounting has a positive effect on financial company performance. This finding supports legitimacy theory, which explains that companies that gain legitimacy from society will impact the company's sustainability (Anggita et al., 2022). This proves that companies that consider environmental sustainability and allocate costs for environmental sustainability can contribute to improving company performance (Sukiyaningsih & Hasanah, 2024).

Disclosure of information related to the environment and environmentally oriented performance provides legitimacy to the company's operational activities in the eyes of the public. Green accounting is a form of voluntary disclosure that is reported in sustainability and annual reports. It can encourage transparency of information related to environmental and social activities, positively affecting financial company performance. This is because the company's operations still require support from the community, both as consumers, employees, and communities around its operational areas. Because the company operates in the community, community involvement cannot be separated from the company's activities, so it is expected that the company has a positive impact on the environment and surrounding communities to ensure environmental sustainability, social care, and the company's business activities run well. In addition, applying green accounting in companies can reduce unnecessary expenses and focus more on investments that support environmental sustainability. In this way, companies can avoid the risk of natural disasters related to the environment while attracting the attention of investors because environmental preservation is one of the signs of good management. This result is supported by Tagal et al. (2024), which shows that green accounting as a form of corporate attention to the environment positively impacts net income and company stock performance.

Moderating Effect of Green Intellectual Capital on the Relationship Between Green Accounting and Financial Performance

The results of hypothesis testing prove that GIC does not moderate green accounting (GA) on financial company performance (from the test results MRA and RLS). This result is not in line with Resource Theory, which explains that strategic resources that are valuable, rare, inimitable, and irreplaceable should be able to provide a competitive advantage for the company (Barney, 1991). However, the results of this study indicate that GIC has not been able to support GA effectiveness in Indonesia optimally. According to Chen et al. (2023), cross-functional collaboration and systemic support within the company are needed to strengthen the GIC with GA and financial performance. Furthermore, this result also provides evidence that external factors such as government regulations, market pressures, and technological readiness can be a determining factor in the effectiveness of GIC on GA. Previous research also mentions that in developing countries such as Indonesia, GA implementation often faces challenges related to initial investment costs, lack of knowledge, and organizational resistance, which may limit the moderating impact of GIC on this relationship (Rahman et al., 2023). Therefore, a more holistic approach is needed to utilize the potential of GIC in strengthening GA implementation to encourage improved financial company performance. The results of this study are in line with (Bangun et al., 2024; Lee et al., 2019) that the effectiveness of GIC requires a short period

for GIC to benefit company performance. In addition, there are obstacles, one of which is the lack of integration of GIC into the green accounting system, partly due to the initial stage of implementing green accounting practices. Thus, companies still focus on regulatory compliance without fully utilizing GIC to optimize company performance, so GIC has not been used strategically to improve financial company performance. These results contradict (Kristina & Az'mi, 2024; Chuang & Huang, 2018; Wang & Juo, 2021), which reveal that GIC can encourage collaborative relationships between external factors and GA related to environmental sustainability through environmental sustainability costs to increase corporate environmental awareness which will have an impact on improving corporate reputation.

Green Innovation and Environmental Performance

Green innovation on the proxy of green process innovation (GPI) and green product innovation (GprodIn) has a positive effect on environmental performance. The findings of this study are by legitimacy theory, which explains that companies try to ensure that their business activities are by the values and expectations of society in order to gain legitimacy from society. This finding proves that the implementation of GPI and GprodIn can contribute to improving environmental performance. Effective implementation of GI will provide environmental sustainability benefits and increase the company's legitimacy in the eyes of society, investors, and stakeholders. The findings also emphasize integrating green product innovation in business strategy to ensure environmental sustainability and societal recognition. The results of this study are in line with Rahmani et al (2024); Wang and Ahmad (2024); Zhang (2023); Asadi et al (2020); Liu et al., (2023; Park et al., 2024); Yao et al., 2023; Chen et al., (2023), which revealed that GPI and GprodIn have a positive effect on environmental performance. By minimizing production process waste, environmental performance can be improved. Cheng et al (2024) revealed that investment in pollution prevention technology positively impacts environmental performance. Preventive technology is a form of green product innovation (GprodIn) that will contribute to environmental sustainability and improve organizational effectiveness.

Furthermore, GprodIn can help companies comply with increasingly stringent environmental regulations. Such compliance contributes to the improvement of overall environmental performance. Companies make various efforts to improve environmental performance, such as following the international standard ISO 14001. Through ISO 14001, companies must innovate to overcome the negative impacts caused by the company's business processes by treating waste and reducing pollution and hazardous chemicals to maintain environmental sustainability.

However, different results were revealed through RLS testing, which provided findings that green innovation on the proxies of green process innovation (GPI) and green product innovation (GprodIn) had a negative and insignificant direction on environmental performance. This result is in line with (Widiatami et al., 2023; Zehir & Ozgul, 2020). Thus, this is not in accordance with legitimacy theory, which reveals that companies need to ensure that their activities are in accordance with the values, norms, and expectations of society to obtain social legitimacy (Suchman, 1995). In terms of these results show a

negative and insignificant relationship between green innovation, both in the proxy of green process innovation (GPI) and green product innovation (GprodIn), on environmental performance, indicating that the application of green innovation has not had the expected environmental impact.

The Influence of Green Intellectual Capital as a Moderating Variable in the Relationship Between Green Innovation and Environmental Performance

The results of testing the GIC variable as a moderating factor between green innovation on the proxy (GPI) on Environmental Performance in Indonesian Companies showed insignificant results (from the test results MRA and RLS). This result is not in line with Resource Theory, which reveals that GIC, as an intangible asset, can encourage the Company's competitive advantage, impacting the Company's performance and the environment (Barney, 1991). Wang (2009) revealed that investment in green knowledge and innovation should improve environmental performance. If this does not provide tangible results, then there is an indication of a misalignment between the GIC strategy and the real impact on the actual environment. Yao et al., 2023 Chen et al., 2023; (Nguyen et al., 2023, and Feng et al., 2023) argue that training and skills development support is needed, as well as integrating environmentally friendly management policies and strategies to achieve GIC effectiveness. Furthermore, Khotimah et al. (2024) revealed that the lack of influence of GIC on sustainability performance could be due to the absence of supporting factors in the management environment that support these practices. This is important, considering that an adequate management role can support innovation and creativity related to environmental issues (Asiaei et al., 2023; Astuti et al., 2022).

Furthermore, GIC can moderate and strengthen the relationship between Green Product Innovation and Environmental Performance in Indonesian Companies. This result is in line with the Resource Theory, which assumes that GIC as an intangible asset can contribute to competitive advantage and achieve environmental sustainability, which can encourage corporate and environmental performance. Haddad et al. (2024) proved that GICs can improve effective sustainability performance. Thus, GIC encourages companies to develop knowledge about sustainability practices, such as creating new products that reduce environmental degradation, such as recyclable raw materials, energy-efficient products, or technologies that use new renewable resources. This is supported by El Halawany and Shehata (2024); Yudianto and Yuliawati (2024), who prove that GIC significantly affects environmental performance. They further explain that GIC has a role in environmental performance. This role is like increasing employee awareness of environmentally friendly practices. In addition, GIC supports energy savings and compliance with government regulations that encourage the accumulation of knowledge and resources related to the environment, which ultimately improves overall environmental performance and operational efficiency. Furthermore, implementing GICs by utilizing the company's intangible assets can lead to a more substantial commitment to sustainability practices that encourage the creation of environmentally friendly products, ultimately leading to better environmental performance.

However, different results were revealed through the RLS test. The results of the hypothesis test prove that GIC does not moderate green innovation in Green Product Innovation (GprodIn) on Environmental Performance. This shows that investment in human intellectual capital does not necessarily strengthen the relationship between green innovation and company performance. These results indicate that although GIC is considered a strategic asset in Resource-Based Theory that can provide a competitive advantage, in some cases, companies may face obstacles in managing or utilizing GIC effectively to increase the impact of green innovation on environmental performance (Zhang et al., 2023; Chen et al., 2024). This result is different from the findings of (Manzoor & Jahangir, 2024), which revealed that GIC strengthens intellectual resources such as GprodIn to continue implementing sustainable business practices by maintaining environmental sustainability by complying with regulations in reducing waste and emissions.

Green Accounting and Environmental Performance

These results prove that green accounting has a negative and insignificant direction on environmental performance (from the test results MRA and RLS). This finding does not support legitimacy theory, which reveals that companies need to ensure that their activities and reports align with society's values, norms, and expectations to gain social legitimacy (Suchman, 1995). In green accounting, companies are expected to provide transparency regarding the environmental impact of their operational activities through appropriate reporting. However, the results of this study indicate that the application of green accounting has not significantly contributed to improving environmental performance in Indonesia. The results of this study are in line with the findings of Putri et al. (2024); Herny and Herawaty (2024), which show that Green Accounting (GA) has a negative and insignificant effect on sustainable development, which indicates its impact on environmental performance. This result reinforces the opinion that implementing green accounting practices may not have effectively improved environmental performance. Possible reasons for this result are the lack of firm commitment to implement GA practices thoroughly, limited resources to comply with complex environmental reporting standards, or the lack of external incentives from the government or market (Nguyen et al., 2023; Feng et al., 2023). In addition, in some cases, the implication of GA is only limited to the formality of reporting and fulfilling regulations, so environmental reporting (GA) does not reflect the company's concrete actions to improve environmental performance (Wang et al., 2024; Zhang et al., 2024). In Indonesia, the application of green accounting also faces challenges such as low corporate awareness of the importance of disclosing environmental information, lack of enforcement of environmental regulations, and limited accounting systems that support sustainability reporting (Chen et al., 2023; Yao et al., 2023). This causes green accounting not to be fully utilized as a strategic tool to improve environmental performance.

The Influence of Green Intellectual Capital as a Moderating Variable in the Relationship Between Green Accounting and Environmental Performance

Under the hypothesis that has been prepared, GIC can moderate and strengthen the relationship between Green accounting and Environmental Performance in Companies in Indonesia (from the test results MRA and RLS). This result is in line with Resource Theory, which states that GIC as an intangible asset can contribute to competitive advantage and the achievement of environmental sustainability (Barney, 1991). Previous studies also show that companies with high levels of GIC tend better to integrate green accounting practices into their operational strategies, significantly impacting environmental performance (Li et al., 2023; Rahman et al., 2024). By effectively utilizing GIC, companies can create a sustainable competitive advantage while meeting the expectations of society and stakeholders regarding their environmental responsibilities (Park et al., 2024; Liu et al., 2023). El Halawany and Shehata (2024) revealed that GIC collaboration with GA can improve environmental performance.

The collaboration is a GIC role that assists GA frameworks in recording, measuring, and reporting environmental costs and other information related to environmental sustainability to support sustainable business practices (Safitri et al., 2024). Thus, the role of GIC underscores the importance of integrating environmental considerations into strategic planning and management practices. GIC enhances an organization's ability to leverage intangible assets with environmental safeguards, facilitating more accurate decision-making and improving environmental and economic performance. Effective integration of GIC and GA can promote transparency and accountability and foster collaborative relationships with stakeholders, ultimately leading to improved environmental sustainability performance (El Halawany & Shehata, 2024). Riandy et al.(2023) proved that GA has an effect on intellectual capital, which suggests effective GA practices can increase the company's intellectual capital. The relationship implies that companies adopting GA tend to develop knowledge, skills, and innovative capabilities to better support sustainability goals. As such, this can enhance disclosure of corporate social responsibility (CSR). Furthermore, it confirms the role of intellectual capital serving as a driver of GA on environmental performance.

Conclusion

The research aims to investigate the influence of green innovation and green accounting on financial and environmental performance. Furthermore, this study seeks to explore further the role of GIC in moderating the relationship between green innovation, green accounting with financial and environmental performance. The findings indicate that green process innovation does not significantly affect financial performance but positively impacts environmental performance. Green product innovation has a significant negative effect on financial performance but a positive effect on environmental performance. Green accounting positively influences financial performance; however, it does not affect environmental performance. The moderating variable of GIC can strengthen the effects of green product innovation and green accounting on environmental performance, as well

as moderate and strengthen the effect of green product innovation on financial corporate performance. However, GIC does not moderate the relationship between green process innovation and green accounting on financial corporate performance.

This research has several limitations that should be considered, and it presents opportunities for future studies. Some of these limitations include the proxy for green accounting, namely the Company's CSR, which is deemed not to measure accurately. Additionally, the proxy for corporate performance only uses Return on Equity (ROE), which has not been explored widely and deeply. Future research is expected to expand the exploration of corporate performance by using proxies such as Return on Assets (ROA), Net Profit Margin (NPM), Earnings Per Share (EPS), and Tobin's Q, among others. To gain a more comprehensive understanding, future research should also explore the role of Green Human Resource Management (GHRM). This is important because the results of this study indicate that the role of GIC was unable to moderate the relationship between Green Process Innovation (GPI) and corporate as well as environmental performance. It is hoped that the GHRM variable can fill this research gap from the perspective of management policy in implementing sustainable environmental practices.

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