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The Effect of Green Intellectual Capital on Environmental Performance with Green Human Resource Management as a Mediating Variable

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Abstract

Green Intellectual Capital refers to an intangible asset that encompasses informational resources, innovation, and knowledge aimed at improving competitive advantage while ensuring environmental sustainability, thereby enhancing sustainable performance. This form of capital enables organizations to adhere to stringent international environmental regulations, increase customer awareness regarding environmental concerns, and create additional value in their operations. Following the Resource Based View theory, businesses must cultivate and effectively combine a unique array of strategic resources to attain superior performance. Consequently, this research explores the connection between Green Intellectual Capital and Environmental Performance, with Green Human Resource Management (GHRM) acting as a mediator between these two variables. The research utilizes a quantitative approach employing Structural Equation Modelling (SEM) techniques, specifically based on Partial Least Square (PLS). The research instrument applied is SmartPLS 4. A Simple Random Sampling approach was employed to select the sample, involving 272 participants from the hotel industry in Surakarta. The findings indicate that Green Intellectual Capital positively and significantly affects both Green Human Resource management and environmental performance.

Keywords: Green Intellectual Capital, Green Human Resouce Manajemen, Environmental Performance

1. Introduction

The management and preservation of the natural environment, often referred to as "the environment," has emerged as a topic of significant discussion among governments. All industries need to adopt environmental protection measures to tackle the environmental challenges that have become a key concern for business stakeholders. According to ISO Center Indonesia, there is external pressure directed at large companies, requiring them to comply with the Environmental Management System (EMS) regulations in accordance with ISO standards, as well as to disclose their environmental performance in annual reports, either voluntarily or mandatorily. Melnyk *et al.*, (2023) states that many manufacturers focus on reducing waste

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generated during both the production and disposal stages of their products, working to improve their environmental performance. Intellectual capital aligns with the four key attributes of a company's resources: "rare," "valuable," "difficult to imitate," and "non-substitutable." This connection indicates that the literature on intellectual capital is closely linked to the Resource-Based View (RBV) theory (Peppard & Rylander, 2001). Therefore intellectual capital is seen as context-specific, with investment levels varying based on the type of organization (Bontis *et al.*, 1998). The topic of intellectual capital has become a focal point for many researchers in the field of management, yet the fusion of environmental concepts with green intellectual capital, first proposed by Chen in 2008, has not yet evolved into a widely recognized area. According to Kamasak (2017), the role of organizational resources, including intellectual capital, in affecting a company's environmental performance is still relatively unexamined in scholarly research. An organization's environmental performance is an indicator of its commitment to safeguarding the environment, often measured through criteria including pollution control, recycling efforts, and waste reduction programs (Molina-Azorín *et al.*, 2015).

Given the importance of the role of sustainability-conscious human resources within an organization, this study connects environmentally friendly human resources to the hotel industry. The abbreviation GHRM stands for Green Human Resource Management. This method involves recruiting and keeping employees who are environmentally conscious, offering them environmental training, and factoring their contributions to environmental initiatives into performance evaluations (Tamu, 1997). GHRM is essential for effective environmental management as it helps organizations reach their eco-conscious objectives (Jabbour & Santos, 2008; Bohdanowicz *et al.*, 2011; Paillé *et al.*, 2014). When top management endorses environmental initiatives, it fosters positive perceptions of sustainable practices among employees, ultimately leading to improved environmental performance.

Green Intellectual Capital and GHRM are critical elements that enhance environmental performance for several reasons. According to the RBV theory, in order to achieve outstanding performance, companies must develop and skillfully integrate a unique collection of strategic resources (Barney *et al.*, 1991). Employees who are environmentally conscious and well-trained can significantly aid in implementing sustainable practices in hotels, including efficient waste management, energy conservation, and the utilization of eco-friendly materials. Meanwhile, intellectual capital is essential for formulating strategies and innovations that bolster the environmental performance of hotels. For instance, utilizing advanced technology to improve energy efficiency or reduce water consumption.

From the above statements, it is clear that further thorough research is essential to investigate the connection between Green Intellectual Capital and GHRM, in addition to their effects on environmental performance. The objective of this study is to delve into how Green Intellectual Capital and GHRM contribute to environmental performance, with Green Human Resource Management serving as a mediator variable in this context. This study proposes that Green Intellectual Capital (GIC) serves as the primary foundation for enhancing Green Human Resource Management (GHRM). As stated by Chen (2008), GIC encompasses intellectual assets

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oriented toward environmental sustainability, which can drive the implementation of greener HR practices. Furthermore, effective GHRM practices, such as eco-friendly recruitment and sustainability training, have been proven to be significant mediators in improving Environmental Performance (EP) (Renwick *et al.,* 2013). Therefore, the relationship between GIC and EP is grounded in the strategic intervention of GHRM (Jabbour & Santos, 2008). The connectivity of the theoretical framework involving Green Intellectual Capital (GIC) as an independent variable, Green Human Resource Management (GHRM) as a mediating variable, and Environmental Performance (EP) as a dependent variable demonstrates that investing in GIC can lead to improved GHRM practices, ultimately enhancing the environmental performance of organizations. This study highlights the importance of a holistic approach to human resource management and environmental sustainability.

1.1 Introduce the Problem

1) Does Green Intellectual Capital Influence Environmental Performance?
2) Does Green Intellectual Capital Influence Green Human Resouce Management?
3) Does Green Human Resource Management Impact Environmental Performance?
4) Does Green Human Resource Management Mediate the Influence of Green Intellectual Capital on Environmental Performance?

2. Literature Review

2.1 Green Intellectual Capital

Chen (2008) was the first to present the idea of Green Intellectual Capital in light of the rising trend of green politics. He characterized it as the totality of intangible assets held by a company, which includes knowledge, skills, and connections related to environmental preservation and green innovation at both the human and corporate scales. This form of capital allows businesses to adhere to rigorous international environmental regulations, respond to the growing consumer demand for sustainability, and create value for the organization at the same time. Supporting the views of Bakhsha *et al.*, (2018) and Choong (2008), intellectual capital is described as the combined knowledge, information, technology, intellectual property rights, communication systems within teams, customer relationships, and trademarks that contribute to a company's value. Therefore, intellectual capital encompasses all intangible assets acknowledged in contemporary accounting, particularly those associated with human resources and the technologies utilized (Ivashchenko *et al.*, 2017).

Green intellectual capital encompasses 3 types: green structural capital, green relational capital and green human capital. As stated by Chen (2008), green human capital includes the entirety of an individual’s competencies, knowledge, experiences, skills, creativity, behaviors, and dedication to protecting the environment or promoting green innovation. Green structural capital refers to organizational assets such as culture, trademarks, patents, software, hardware, databases, and internal competencies that remain with the firm even when personnel leave. Chen (2008) defines it as the resources of the organization in terms of knowledge managerial philosophy, management systems, capabilities, commitment, culture, copyrights, image, patents, and trademarks relating to environmental conservation and green innovation. Conversely, green

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relational capital refers to the connections between the organization and its main stakeholders, including suppliers, partners, customers, and is defined as the organization's interactive resources related to environmental management and green innovation (Johnson, 1999; Chen *et al.*, 2006).

2.2 Green Human Resouce Management (GHRM)

GHRM includes the policies, practices, development, implementation, and sustainable upkeep of systems aimed at fostering eco-friendly behaviors among employees. This approach raises awareness of the organization's environmental impact, benefiting individuals, society, the natural environment, and the business as a whole. It is a facet of human resource management aimed at converting ordinary employees into environmentally aware individuals to achieve the goals of the organization or company, thus offering significant advantages to the environment (Opatha & Arulrajah, 2014). The objectives of GHRM include improving efficiency, reducing costs, and enhancing employee engagement and retention. These efforts contribute to lowering employee carbon emissions through practices such as minimizing carbon footprints, utilizing electronic document storage, encouraging carpooling, implementing job sharing, conducting teleconferencing, facilitating virtual interviews, promoting recycling, enhancing telecommunications, providing online training, and establishing energy-efficient workplace settings (Sheopuri and Sheopuri, 2015; Deepika and Karpagam, 2016; Pandey, Viswanathan, and Kamboj, 2016).

2.3 Environmental Performance

Environmental performance represents a quantifiable outcome of an environmental management system concerning the management of its environmental aspects. Evaluating environmental performance involves examining environmental policies, objectives, and specific targets (ISO 14031, 1999). The goal of an organization's environmental performance is to use positive means for the environment while conducting the company's operational activities. There are two main objectives related to environmental management: to enhance environmental quality to an acceptable standard and to monitor pollution levels in the company's surrounding environment (Yasamis, 2011). The successful execution of environmental performance can only occur when the organization has the right individuals equipped with the necessary skills and capabilities. Therefore, human resource practices must align with the strategic business objectives. Employee participation in environmental performance initiatives is vital, as noted by Harvey, Bosco, and Emanuele (2010). They found that employees are more inclined to work for organizations that prioritize environmental concerns, leading to higher levels of job satisfaction.

3. Hypothesis Development

3.1 Green Intellectual Capital and Environmental Performance

"Human resources" encompass the skills and knowledge typically acquired by employees during their time with an organization (Bontis, 1998). This encompasses attitudes, cognitive abilities, knowledge, education, experience, professional skills, creativity, and competencies. According to Wright *et al.*, (1994), strong human resources provide significant advantages to organizations because they are not only valuable but also challenging to replicate. Chen (2008) expanded on

this by introducing the idea of green, or environmentally friendly, intellectual capital in the context of environmental management. Green intellectual capital aids companies in adhering to stringent international environmental regulations, creating value, and fulfilling customer expectations related to environmental concerns. Yusliza *et al.,* (2019) conducted a study showing that Green Intellectual Capital positively influences Environmental Performance, suggesting that its various components enhance economic, environmental, and social results for manufacturing companies. Likewise, Mansur *et al.*, (2021) identified that green intellectual capital significantly influences a firm's environmental performance. Furthermore, Haldorai *et al.,* (2022) illustrated that environmental performance is positively influenced by green intellectual capital. Consequently, this research proposes:

H1: Green Intellectual Capital has a positive influence on Environmental Performance

3.2 Green Intellectual Capital and Green Human Resouce Management (GHRM)

There is a substantial relationship between intellectual capital, strategic HR practices, and key HRM theories. Intellectual capital should serve as a key catalyst in these connections (Kong and Thomson, 2009). They contend that the elements of intellectual capital are interconnected and must significantly influence GHRM practices for organizations to achieve maximum effectiveness in their human resources. Furthermore, evaluating both tangible and intangible assets helps organizational management make strategic decisions that enhance human resource management practices. Finding by Haldorai *et al.*, (2022) suggests that Green Intellectual Capital positively impacted on GHRM. Therefore, this study proposes:

H2: Green Intellectual Capital has a positive influence on Green Human Resouce Management

3.3 Green Human Resource Management (GHRM) and Environmental Performance

Becker & Gerhart (1996) argue that HRM improves organizational performance by improving effectiveness, managing costs, and producing value. Their extensive assessment of empirical data revealed a strong link between a company's systems and overall performance. For instance, human resource management activities like recruitment and compensation positively impact company performance. López-Gamero *et al.,* (2009) investigated the relationship between environmental management and environmental performance, identifying three factors within their environmental management framework, one of which relates to human resource management techniques (e.g., environmental knowledge management). These result support the idea that the combination of environmental management and GHRM leads to better environmental performance. Additionally, it has been shown that companies with strong environmental management systems attain superior environmental performance (Melnyk, Sroufe, & Calantone, 2003). In conclusion, environmentally conscious HRM is a vital element of environmental management systems. Finding by Kim *et al.,* (2019), Awan *et al.,* (2022), and Al-Sabi *et al.,* (2024) indicates that GHRM positively influences environmental performance in the hotel sector, underscoring its critical role in achieving effective environmentally friendly performance. Based on theoretical insights and previous research, the hypothesis concerning the effect between GHRM and environmental performance is proposed as follows:

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H3: Green Human Resource Management has a positive influence on Environmental Performance

3.4 Mediating Role of Green Human Resource Management (GHRM)

All individuals of a firm are better able to gather, integrate, store, share, and use information when they are viewed as members of a "knowledge crew." This emphasizes how crucial strategic human resource management procedures and practices are becoming (Kong & Thomson, 2009). Kong & Thomson also stress that intellectual capital entails "rethinking," "redesigning," and incorporating intellectual resources into organizational strategies. The promotion of Green Intellectual Capital within an organization occurs when the human resource management department actively implements initiatives focused on environmental issues. Consequently, the correlation between environmental performance and green intellectual capital is mediated by GHRM. (Mansur *et al.*, 2021). Research by Ali et al. and Yong *et al.*, (2022) demonstrates that the effect between Green Intellectual Capital and Environmental Performance is significantly moderated by GHRM. Likewise, the study by Haldorai *et al.*, (2022) affirm that GHRM serves as a vital mediator in the connection between Green Intellectual Capital and Environmental Performance.

H4: Green Human Resource Management mediating the influence of Green Intellectual Capital on Environmental Performance

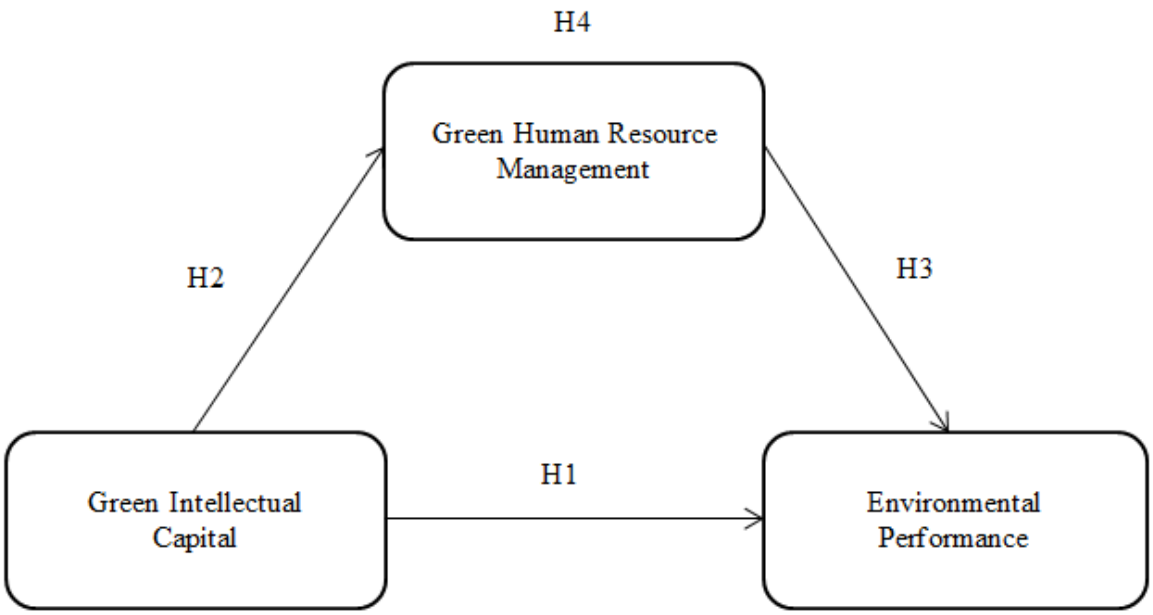

Figure 1. Theoritical Framework

4. Method

A quantitative survey methodology was utilized in this research, involving 272 workers from 14 major hotels located in Surakarta City, Indonesia. Data collection involved simple random sampling, with questions delivered online using Google Forms. Respondents' personal

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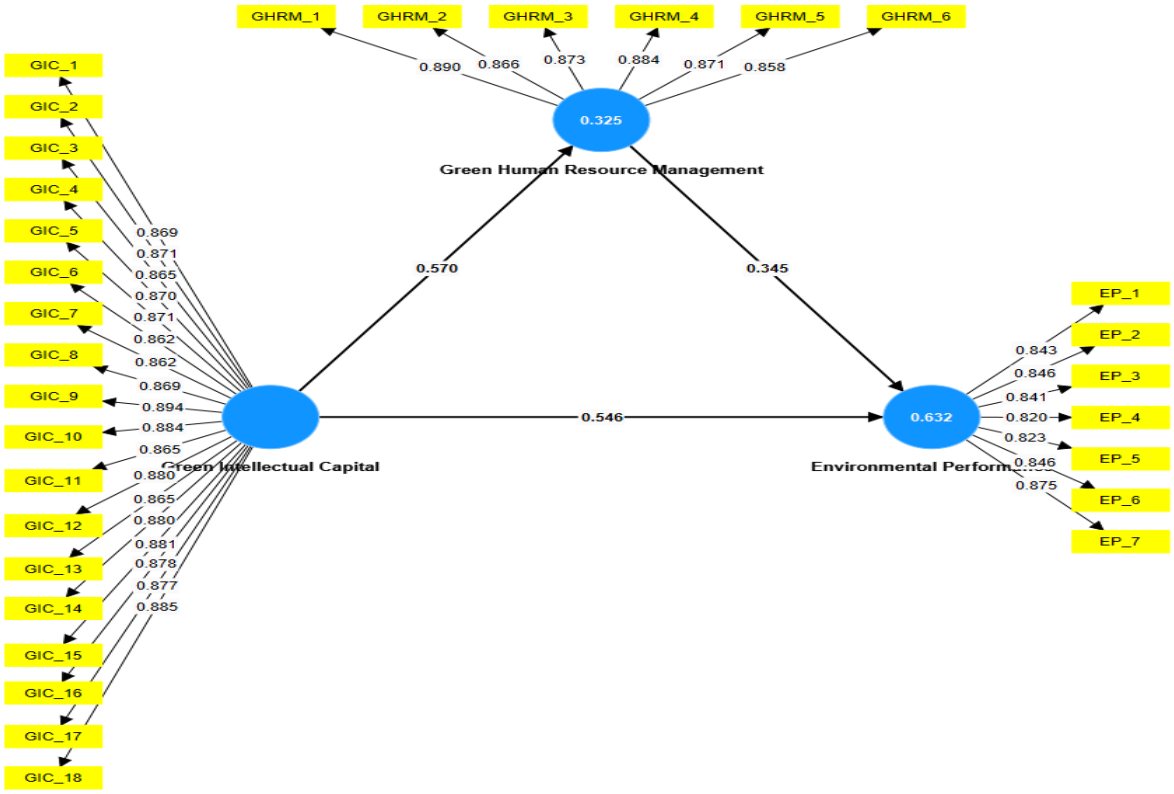
information and confidentiality were rigorously protected and not revealed to any third party. SmartPLS 4 software was used to analyze the data. As stated by Hair *et al.*, (2014), the requirement for a sample size of a minimum of five times the number of indicators is met, given that there are 31 indicators in total. The indicators for Green Intellectual Capital were evaluated utilizing a questionnaire created by Chen (2008) and verified by Haldorai et al. (2022). Indicators for Green Human Resource Management were assessed using questionnaires from Shen & Benson (2016) and Hsiao *et al.*, (2014), which were verified by Kim *et al.*, (2019). Environmental Performance indicators were measured using questionnaires created by Paillé *et al.*, (2014), Melnyk *et al.*, (2003), and Ilinitch et al. (1998), all of which were also verified by Kim *et al.*, (2019).

5. Results

During the processing step, a variety of statistical tests were run on the Smart PLS 4.0.9.9 software to successfully confirm the faults discovered in the field. This involved studies for validity, reliability, also hypothesis test, which led to the development of the subsequent outer model:



To evaluate the reflective measurement model, we assessed reliability, convergent validity, discriminant validity, and outer loadings. Convergent validity was analyzed using outer loadings and the average variance extracted (AVE), following the guidelines provided by Hair *et al.*, (2017). Table 1 demonstrates that every element factor loadings are within the suggested

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range of 0.6 (Chin *et al.*, 2008). The AVE values, which represent the total variation explained by the latent constructs, also surpass the suggested 0.5 (Hair *et al.*, 2014). We then applied the Fornell-Larcker Criterion to evaluate discriminant validity. Table 2 presents the results of this assessment, showing that the square root of the AVE (diagonal values) for each construct is greater than its corresponding correlation coefficients, confirming adequate discriminant validity (Fornell & Larcker, 1981). Cronbach's alpha and composite reliability were utilized to evaluate reliability, with a recommended cutoff of 0.7 for both measures (Hair *et al.*, 2014). All latent constructs have Cronbach's alpha and composite reliability ratings that exceed this benchmark, as shown in Table 1. Overall, the analysis concluded that reliability, convergent validity, and discriminant validity were sufficient for every construct. As a result, we used Smart PLS 4.0.9.9 to evaluate the structural model and test the research hypotheses. The evaluation of the structural model involved the use of the coefficient of determination (R^2) alongside predictive relevance (Q^2). Each endogenous variable's contribution to the variance is shown by its R^2 value. Hair *et al.*, (2019) define R^2 values as considerable over 0.75, moderate around 0.5, and weak below 0.25.

Tabel 1. Construct Validity and Reliability

	Items	Loading	Cronbach's alpha	rho_a	Composite Reliability	AVE
Green Human Resource Management	GHRM.1	0.890	0.938	0.938	0.951	0.763
	GHRM.2	0.866				
	GHRM.3	0.873				
	GHRM.4	0.884				
	GHRM.5	0.871				
	GHRM.6	0.858				
Green Human Capital	GIC.1	0.869	0.982	0.982	0.938	0.764
	GIC.2	0.871				
	GIC.3	0.865				
	GIC.4	0.870				
	GIC.5	0.871				
	GIC.6	0.862				
	GIC.7	0.862				
	GIC.8	0.869				
	GIC.9	0.894				
	GIC.10	0.884				
	GIC.11	0.865				
	GIC.12	0.880				
	GIC.13	0.865				
	GIC.14	0.880				
	GIC.15	0.881				
	GIC.16	0.878				
	GIC.17	0.877				
	GIC.18	0.885				
Environmental Performance	EP.1	0.847	0.932	0.933	0.945	0.709
	EP.2	0.846				
	EP.3	0.841				
	EP.4	0.820				
	EP.5	0.823				
	EP.6	0.846				
	EP.7	0.875				

Source : Data Processed, 2024

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Table 2 lists the conditions for determining discriminant validity, one of which is that the squares root of the AVE for every variable be bigger than the correlations coefficients between the constructs. In this research, the squares root of the AVE for Environmental Performance (EP) is 0.842, which exceeds its correlations with other variables. This shows that the correlation variables' discriminant validity is satisfactory. The same holds true for the other variables, as their respective square roots of the AVE also exceed the correlations between them. Therefore, the evaluation of discriminant validity has been successfully completed.

Tabel 2 Fornell-Larcker Criterion

	EP	GHRM	GIC
EP	**0.842**		
GHRM	0.656	**0.872**	
GIC	0.742	0.570	**0.874**

Source : Data Processed, 2024

Table 3 illustrates that the R^2 values of all the constructs included as endogenous variables in this study are regarded as being at a moderate level. Specifically, environmental performance is explained by green intellectual capital at a rate of 63.2%, while green human resource management is accounted for by green intellectual capital at 32.5%. Next, predictive significance was examined using the blindfolding process, concentrating on the Q^2 values. Hair et al. (2017) found that a Q^2 values over 0 suggests a model with appropriate predictive significance. Chin (1998) divides Q^2 values into three categories: high (0.35), moderate (0.15), and minor (0.02). According to Table 3, each endogenous factor exhibits a moderate level of predictability in relation to its respective exogenous variable.

Tabel 3. R^2 & Q^2

Endogenous Laten Construct	R^2	Q^2
EP	0.632	0.443
GHRM	0.325	0.224

Source : Data Processed, 2024

6. Hypothesis Testing

The PLS-SEM approach was used to examine the four hypotheses in this study. Using the boot strapping technique in SmartPLS application, hypothesis testing was conducted with a t-statistic greater than 1.96 and a significant level of 0.05 (or 5%) (Hair et al., 2022).

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Tabel 4 Result of Direct Effects

	Original Sample(O)	Sample Mean(M)	Standard Deviation (STDEV)	T statistic (|O/STDEV|)	P Value
GHRM →EP	0.345	0.346	0.049	7.027	0.000
GIC→ EP	0.546	0.543	0.055	10.000	0.000
GIC → GHRM	0.570	0.569	0.064	8.832	0.000

Source : Data Processed, 2024

Tabel 5 Result of Indirect Effects

	Original Sample(O)	Sample Mean(M)	Standard Deviation (STDEV)	T statistic (|O/STDEV|)	P Value
GIC→GHRM→EP	0.196	0,198	0.042	4.694	0.000

Source : Data Processed, 2024

7. Discussion

7.1 Green Intellectual capital and environmental performance

The study's findings show that green intellectual capital improves environmental performance, as outlined by a t-statistic value of 10.000 (> 1.96) and a p-value of 0.000, remaining within the critical signification level of 0.05 (5%). Furthermore, the coefficient value of 0.546 signifies a positive correlation, thus supporting H1. This supports the results of Haldorai *et al.*, (2022), which indicate that GIC significantly impacts EP. These result are also aligned with those of Yusliza *et al.*, (2019), who identified favorable effects of GIC aspects on manufacturing businesses' social, environmental, and economic performance. Additionally, Mansur *et al.*, (2021) emphasized that a organization's environmental performance is heavily based on green intellectual capital.

7.2 Green Intellectual capital and Green Human Resouce Management

The study's findings reveals that green intellectual capital positively effects GHRM, as outlined by a t-statistic values of 8.832 (> 1.96) and a p-value of 0.000, remaining within the critical signification level of 0.05 (5%). The coefficient value of 0.570 reflects a positive correlation, Thus supporting H2. This supports Haldorai et al. (2022) research, which suggest that GHRM is significantly impacted by green intellectual capital. This reinforces the evidence presented by Ali *et al.*, (2022), which revealed that green structural capital notably impacts GHRM. Furthermore, the studies of Yong *et al.*, (2022) indicate that GHRM mediates the effect of green human capital on environmental performance, and that GHRM is significantly affected by green relational capital.

7.3 Green Human Resource Management and Environmental Performance

The study's findings show that GHRM improves hotel environmental performance, as outlined by a t-statistic values of 7.027 (> 1.96) and a p-values of 0.000, remaining within the critical signification level of 0.05 (5%). The coefficient values of 0.345 suggests a positive correlation,

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Thus supporting H3. These outcomes are in agreement with prior reserach by Kim *et al.*, (2019), Awan *et al.*, (2022), also Al-Sabi *et al.*, (2024), which also demonstrated that GHRM significantly influences hotel environmental performance. Therefore, GHRM is crucial for achieving effective environmental performance, reinforcing the idea that integrating environmental management within human resource practices can enhance overall environmental outcomes.

7.4 Mediating Role of Green Human Resource Management

Findings from the study demonstrate that GHRM functions as a mediator factor between green intellectual capital and environmental performance, as outlined by a t-statistics values of 4.694 (> 1.96) and a p-values of 0.000, remaining within the critical signification level of 0.05 (5%). The coefficient values of 0.196 indicates a positive correlation, thus supporting H4. This lends confirmation to the findings of Haldorai *et al.*, (2022), who discovered that GHRM significantly mediates the correlation between GIC and EP. This concurs with the viewpoints articulated by Kong & Thomson (2009) and Yong *et al.*, (2019), who highlight the signification of intellectual capital in adopting human resource management methods that promote organizational performance.

8. Implication

This research underscores that the implementation of GHRM and green intellectual capital can significantly enhance hotel environmental performance. Therefore, hotel management needs to integrate environmentally friendly policies into human resource strategies, including green training, recruitment, and environmentally-based performance assessments. Human resources are essential in promoting a work culture that is environmentally conscious. Human resource practitioners should develop employee development programs focused on environmental awareness and green innovation to encourage better environmental performance outcomes. The research results demonstrate possibilities to examine the functions of additional aspects of intellectual capital, such as social capital or green technological innovation, in supporting GHRM and environmental performance in sectors beyond hospitality. These findings can serve as a foundation for governments and relevant institutions to formulate policies that encourage companies across various sectors to implement GHRM and optimize GIC to achieve sustainable development goals.

9. Conclusions

GIC and GHRM are key elements in driving environmental performance in the hospitality sector. These two components are complementary, with green intellectual capital providing strategic resources, while GHRM acts as an implementation driver to achieve optimal outcomes. Organizational strategies that integrate these elements have a greater potential to create a positive impact on environmental sustainability. GHRM is not just an additional component but a vital factor that bridges and enhances the influence of GIC on EP. For organizations to achieve effective environmental sustainability, they must focus on building GIC while concurrently optimizing their GHRM practices.

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10. Limitation and Suggestion

This study has limitations, particularly its dependence on quantitative methods to analyze the phenomena being studied. Future research could enhance understanding by employing a mixed-methods approach for a more thorough and nuanced exploration of the issues at hand. This research is based on perceptual data from hotel employees in four- and five-star hotels, which typically have better resources and intellectual capital compared to hotels with lower star classifications. This limits the generalizability of the findings to smaller hotels or those with different capacities, potentially introducing perception bias (self-report bias). Employees may provide responses that they believe align with social expectations rather than answers that fully reflect their behavior. Although several methodological strategies have been employed to minimize bias, such as measuring hotel environmental performance using a work behavior approach rather than work outcomes, reminding respondents that their answers aren't right or wrong, assuring confidentiality of responses, and conducting Common Method Variance (CMV) checks to ensure the results are free from bias, limitations still exist. Additionally, future research could explore different research subjects in different cities or countries. Further research might use a longitudinal approach to track changes in employee behavior and the long-term effects of environmentally friendly HR strategies and green intellectual capital on environmental performance. In addition, future research could employ different variables, such as environmental passion, employee organizational commitment, employee eco-friendly behavior, green organizational culture empowerment, green innovation, Task related pro environmental behavior, proactive eco friendly behavior, environmentally conscious actions, and general pro-environmental behavior act as mediators in the linkage between green intellectual capital and sustainable performance, encompassing economic, social, and environmental dimensions. This method seeks to analyze the mediating role in the relationship between green intellectual capital and various dimensions of sustainable performance.

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