THE IMPACT OF GREEN HUMAN RESOURCE MANAGEMENT ON CORPORATE ENVIRONMENTAL PERFORMANCE WITH GREEN INNOVATION AS A MEDIATOR: A CASE STUDY OF IFLYTEK

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Abstract: This study aims to explore the impact of Green Human Resource Management (GHRM) on Corporate Environmental Performance (CEP) and analyse the mediating role of Green Innovation (GI) in this relationship. By distributing 388 questionnaires, data were collected from employees in various positions and functional departments within the company. Structural Equation Modelling (SEM) analysis was conducted to validate the hypotheses. The findings indicate that Green Human Resource Management (GHRM) significantly enhances Green Innovation, which in turn plays a crucial mediating role between GHRM and Corporate Environmental Performance. The direct impact of GHRM on Corporate Environmental Performance is not significant, indicating that GHRM indirectly promotes the improvement of Corporate Environmental Performance by driving Green Innovation. Through strengthening green skills training, fostering green awareness, and implementing green incentive mechanisms, GHRM motivates employees to participate in Green Innovation activities, thereby enhancing the company's environmental technology innovation and resource utilization efficiency. This study provides valuable insights for enterprises undergoing green transformation, particularly in the high-tech industry. Promoting the synergistic development of GHRM and Green Innovation can significantly enhance a company's environmental performance. Future research could further validate and deepen these findings by expanding the sample scope, adopting a longitudinal research design, and introducing external variables.

Keywords: Green Innovation, Green Human Resource Management, Corporate Environmental Performance

Introduction

As environmental issues such as global climate change and resource scarcity intensify, Corporate Environmental Performance (CEP) has emerged as a crucial indicator for measuring an enterprise's capacity for sustainable development. Governments worldwide are propelling enterprises towards green transformation through legislation and policy guidance. Exemplified by initiatives like

the EU's Carbon Border Adjustment Mechanism (CBAM) and China's "dual carbon" goals, compelling enterprises to integrate environmental protection into their core strategies (Mansoor et al., 2021). In this context, enterprises must strike a balance between economic and environmental benefits through Green Innovation (GI). Human Resource Management (HRM), as a pivotal component in implementing organizational strategies, is undergoing an inevitable green transformation.

Green Innovation (GI) is defined as an innovative model that integrates resource conservation, environmental protection, and economic benefits throughout the entire lifecycle of product design, production, use, and recycling. Existing research indicates that GI can enhance CEP through technological upgrades (e.g., the application of clean energy), management optimization (e.g., the circular economy model), and institutional innovation (e.g., green supply chain management). However, the implementation of GI heavily relies on the synergistic allocation of internal organizational resources. While HRM serves as the core mechanism for resource allocation, the catalytic role of green HRM in this process has yet to be fully elucidated (Kraus et al., 2022).

Green Human Resource Management (GHRM) embeds environmental concepts into recruitment, training, performance management, and other HRM processes, stimulating employees' green behaviours and driving organizational green transformation (Mouro & Duarte, 2021). Although prior research has confirmed the positive impact of green HRM on employees' environmental awareness and behaviours, the mechanism through which it indirectly influences CEP via GI remains to be further explored (Hameed et al., 2020). For instance, can green HRM accelerate the commercialization of GI outcomes by enhancing employees' green skills and promoting cross-departmental collaboration? Such questions require empirical validation.

Founded in 1999 and headquartered in Hefei, China, iFLYTEK went public on the Shenzhen Stock Exchange in 2008. As a leading enterprise in China's intelligent speech and artificial intelligence (AI) sectors, iFLYTEK has long been deeply committed to AI technologies (Wang, 2020). Intelligent speech, natural language processing, and machine translation rely on core technologies with independent intellectual property rights. Its speech synthesis and recognition capabilities have won numerous international championships, and in 2017. It was listed as one of China's first batch of national AI open innovation platforms. iFLYTEK's products cover consumer markets (e.g., iFLYTEK Input Method, translation devices, smart office pads) and intelligent solutions for industries such as education, healthcare, smart cities, and industry. iFLYTEK has deeply participated in international projects like the Beijing Winter Olympics, striving to "build a better world with AI" and promote technological inclusivity and social sustainable development (Wang, 2020).

As a leading enterprise in China's AI sector, iFLYTEK's GI practices hold significant industry-wide demonstrative significance. Leveraging AI technologies such as its Spark Model, iFLYTEK has developed smart environmental protection solutions (e.g., an integrated platform for

digital environmental protection services), realizing digital environmental supervision. It has implemented projects like smart water conservancy and smart steel super brains in Qinghai, Hangzhou, and other regions, promoting the application of green technologies. Through collaboration with Huawei, iFLYTEK has built a domestic 10,000-card intelligent computing power cluster named "Feixing No. 1," breaking through technological bottlenecks and providing computing power support for GI. However, iFLYTEK's exploration in Green Human Resource Management (e.g., employee green skills training, environmental performance assessment) has not been systematically studied, leaving a theoretical gap in the intrinsic correlations among its green HRM, GI, and environmental performance.

This section will list the research questions and corresponding research objectives for each question. These research questions and objectives will help address the research issues raised in the problem statement section and further clarify the research direction.

RQ1: What is the impact of Green Innovation on iFLYTEK's Corporate Environmental Performance?

RQ2: Does Green Human Resource Management have a positive impact on iFLYTEK's Corporate Environmental Performance and Green Innovation?

RQ3: How does Green Human Resource Management influence iFLYTEK's Corporate Environmental Performance through Green Innovation?

H1: Green innovation has a positive impact on corporate environmental performance.

Green innovation is regarded as an effective approach to improving corporate environmental performance. By implementing green technology and management innovations, enterprises can significantly reduce their environmental burden and enhance environmental compliance and resource utilization efficiency (Stanitsas & Kirytopoulos, 2021). Green innovation can assist enterprises in establishing an environmentally friendly corporate image, thereby enhancing their market competitiveness. With the growing demand for green products among consumers, enterprises that implement green innovation can better meet market needs, improve their environmental reputation, and gain market share. A good environmental reputation not only attracts more consumers but also garners policy support and investor favour. Green process innovation prompts enterprises to optimize their internal production processes and supply chain management, reducing resource waste and production costs (Solovida & Latan, 2017). This not only improves the enterprise's environmental performance but also enhances its overall operational efficiency.

Changes in government environmental policies and regulations can have a direct impact on green innovation. When faced with policy changes, enterprises may hesitate to make long-term green innovation investments, particularly if the policy direction is unclear or lacks sustained support. This uncertainty can hinder the continuous improvement of environmental performance through green innovation. (Ren et al., 2019). Green innovation is widely considered an effective means of improving

corporate environmental performance. By introducing green product and process innovations, enterprises can reduce resource consumption, lower pollution emissions, and enhance environmental compliance and market competitiveness. However, the effectiveness of green innovation is influenced by various factors, including enterprise resources, external pressures, organizational culture, and technological maturity. Despite its significant potential in enhancing environmental performance, enterprises also face challenges such as cost and technological uncertainty during the implementation process.

H2: Green human resource management has a positive impact on corporate environmental performance.

GHRM, which combines environmental sustainability with human resource management, has gained significant attention in recent years. CEP is a crucial indicator for measuring a company's environmental responsibility and sustainable development capabilities. GHRM integrates eco-friendly concepts into recruitment, training, and performance management to enhance employees' environmental awareness and improve the organization's overall environmental performance. GHRM involves integrating environmental management concepts into various stages of a company's HRM, including recruitment, training, performance appraisal, compensation, and incentives, to promote employees' environmental awareness and eco-friendly behaviours. GHRM encompasses green recruitment, green training, green performance management, and green compensation incentives, aiming to drive enterprises and their employees towards environmental protection and sustainable development. CEP is typically used to evaluate a company's performance in environmental protection. Based on practices in areas such as pollution reduction, resource conservation, waste management, and carbon footprint, CEP can be assessed across multiple dimensions (e.g., eco-efficiency, carbon emissions, waste treatment) (Liu & Shi, 2013). Numerous studies have shown that a company's CEP not only affects its market competitiveness but also enhances its social reputation and image.

Existing research generally posits that GHRM can significantly improve a company's environmental performance. By emphasizing environmental responsibility and green concepts in green recruitment, companies can attract candidates with environmental awareness. Such employees are more inclined to support and participate in the company's environmental protection activities, enhancing its environmental performance. Implementing systematic green training can enhance employees' environmental knowledge and skills, making them more mindful of energy conservation, emission reduction, and environmental protection in their daily work, ultimately improving the company's environmental performance (Solovida & Latan, 2017). By integrating environmental objectives into employees' performance appraisal systems, companies can encourage employees to prioritize environmental protection in their work, thereby driving the company towards better environmental performance. The effectiveness of GHRM to some extent relies on the degree of importance and support of top management for environmental issues. Active participation from top

management can provide resources and motivation for the implementation of GHRM, thereby better promoting the improvement of CEP (Renwick et al., 2008).

Challenges and limitations of GHRM's impact on CEP. The comprehensive implementation of GHRM may require substantial resource inputs, such as training expenses and the introduction of environmentally friendly technologies. This may increase the company's operating costs in the short term, dampening its enthusiasm for improving environmental performance. Literature suggests that while GHRM can significantly enhance a company's environmental performance, this impact is modulated and constrained by various factors. Through the reasonable implementation of GHRM, companies can not only improve their environmental performance but also enhance their market competitiveness and sustainable development capabilities.

H3: Green human resource management has a positive impact on green innovation.

GI encompasses two major categories: green product innovation and green process innovation. The first focuses on creating environmentally friendly products through sustainable design and development. The second implements green technologies and processes in production to save resources, cut pollution, and improve ecological efficiency. Research indicates that GHRM has a positive impact on enterprises' GI. By promoting employees' environmental awareness, providing green skills training, and establishing environmental incentive mechanisms, GHRM can effectively drive enterprises' GI activities. GHRM influences enterprises' GI through multiple avenues. By leveraging green training and communication mechanisms, GHRM can enhance employees' environmental awareness and sensitivity to environmental issues. This heightened awareness often prompts employees to participate more actively in GI activities.

Some employees may be sceptical or even resistant to the implementation of green policies, which will undermine GHRM's driving force for GI. Despite these challenges, GHRM significantly promotes enterprises' GI. By enhancing employees' green awareness, providing innovative impetus, and establishing green incentive mechanisms, GHRM offers crucial organizational support for enterprises' GI. The implementation effectiveness of GHRM is influenced by multiple factors, including employees' innovative capabilities, external environmental pressures, and industry characteristics. As global attention to sustainable development continues to grow, research on GHRM and GI will further deepen in the future, providing more theoretical and practical support for enterprises' green transformation.

H4: Green innovation mediates between green human resource management and corporate environmental performance.

GI plays a crucial mediating role in the relationship between GHRM and CEP. GHRM creates favourable conditions for GI by stimulating employees' green behaviours and fostering an organizational environmental culture, thereby improving a company's environmental performance through the implementation of GI. Therefore, the impact of GHRM on environmental performance is

not direct but rather achieved by influencing other key processes and innovative practices within the enterprise, with GI being considered a critical mediating variable (Awan et al., 2021). GHRM enhances employees' environmental awareness through means such as green training, promotion, and performance appraisal, prompting them to focus on energy conservation, emission reduction, and sustainable development in their daily work. GHRM encourages employees to participate in GI projects through incentive mechanisms, such as green performance rewards and recognition. This incentive mechanism not only boosts employee participation but also motivates them to actively engage in innovation activities related to environmental protection, providing impetus for the company's GI (Sun & Sun, 2021). GI can significantly reduce a company's resource consumption and pollution emissions by introducing cleaner production technologies and environmentally friendly equipment, thereby directly improving its environmental performance. GI has a significant mediating effect between GHRM and CEP. GHRM promotes the generation of internal GI within companies by enhancing employees' green awareness, stimulating innovation motivation, and providing skill support. In turn, GI drives improvements in CEP by reducing resource consumption, enhancing environmental compliance, and boosting market competitiveness.

Research Objectives

iFLYTEK engages in technological research, development, and manufacturing. These activities inevitably generate environmental impacts. Advanced concepts and practices like GI and GHRM hold significance for the enterprise's sustainable development. Therefore, it is crucial to conduct in-depth research. The research focuses on the relationships among Green Innovation, Green Human Resource Management, and iFLYTEK's Corporate Environmental Performance (CEP). This research has significant practical value in guiding iFLYTEK and other similar enterprises towards green development. The main objectives are as follows:

(1) To explore the impact of Green Innovation (GI) on iFLYTEK's Corporate Environmental Performance.

(2) To explore the impact of iFLYTEK's Green Human Resource Management on Corporate Environmental Performance and Green Innovation.

(3) To explore the impact of Green Human Resource Management (GHRM) on iFLYTEK's Corporate Environmental Performance (CEP) through Green Innovation (GI).

Methodology

This study employs a quantitative research approach. Quantitative methods, combined with questionnaires, are used to analyse the impact of GHRM on CEP, with GI as the mediator. Quantitative methods facilitate the collection of large-scale sample data to validate research hypotheses, ensuring the representativeness and generalizability of the findings. The study utilizes

SEM to test the relationships among research variables, enabling more in-depth quantitative analysis. Quantitative research methods aid in quantifying the impact of GHRM on CEP and support the testing of research hypotheses through data analysis. Therefore, questionnaires, as a data collection tool, align with the objectives of this study and assist enterprises in clarifying sustainable development goals, fostering the synergistic growth of environmental and economic benefits through innovation.

Population and Sample Size

The determination of the sample size for this study takes into account the statistical norms of SEM and the experiences of existing literature. Based on Fornell and Larcker's (1981) classic study on SEM sample sizes, a minimum of 200 observations is required to ensure parameter stability. This study increases the sample size to 400 questionnaires, aiming to enhance statistical power by expanding the database, thereby improving the reliability and generalizability of the research conclusions. In terms of sampling strategy, a simple random sampling method is adopted to systematically cover various demographic variables, including gender, age groups, educational levels, and years of service, ensuring that the sample structure aligns with the heterogeneity characteristics of the corporate employee population. Additionally, preset questionnaire quotas and data balance checks are implemented to strengthen the sample's explanatory power for the research questions. This design meets the complexity requirements of multivariate models (such as mediation effect tests), providing data support that combines theoretical rigor with practical orientation for the dynamic transmission mechanisms and their action pathways.

This study employs convenience sampling, a non-probability sampling method, targeting current employees of iFLYTEK. Priority is given to sample groups that can be efficiently reached through internal corporate channels. The choice of convenience sampling is based on the following considerations: First, given the exploratory and empirical nature of the research, data collection needs to be completed within a limited timeframe. This method allows for the rapid acquisition of basic data by minimizing access barriers. Second, the organizational characteristics of iFLYTEK as a technology-intensive enterprise, with employees predominantly concentrated in R&D, product, and functional departments, make it feasible to distribute questionnaires through internal collaboration platforms. This ensures sampling efficiency while covering diverse job roles and business scenarios as much as possible.

Research and Data Collection Instruments

This study uses questionnaires for data collection. The questionnaire comprises three sections: GHRM, CEP, and GI. Questions in each section are designed based on existing literature and pre-tested in a small-scale preliminary study to ensure the questionnaire's effectiveness and reliability. All questions utilize a five-point Likert scale, with participants selecting options according to their perceptions. The scale ranges from 1 to 5 (1 = strongly disagree, 5 = strongly agree).

The GHRM scale draws on the research of Ren et al. (2019) and Cui &Wang. (2022),

containing eight items. Example items from the scale include: "In our organization, environmental issues have become an essential part of job descriptions," and "Our company selects candidates with sufficient green knowledge to fill vacant positions." The internal validity of this scale is demonstrated by a high Cronbach's alpha value, indicating good reliability.

The indicator system for the CEP (Corporate Environmental Performance) scale has been utilized in prior research (Ubeda-Garcia et al., 2021; Wang et al., 2021). That study employed survey items such as "Our enterprise strives to minimize the environmental impact of its products and production processes," and "Our company has switched to renewable energy sources and reduced the use of fossil fuels." The Cronbach's alpha value for this scale indicates its reliability.

The relevant indicators for the GI (Green Intelligence) scale are derived from the studies by Kiefer et al. (2022) and Guo et al. (2020). The questionnaire includes sample items such as "Our enterprise adopts eco-friendly packaging for both new and existing product lines," and "Our enterprise considers ecological factors when producing goods and providing services."

Results

A total of 400 survey questionnaires were distributed in this study. During the data compilation process, questionnaires with missing values were excluded. Additionally, questionnaires completed in 30 seconds or less were also removed. Ultimately, 388 valid questionnaires were recovered, yielding an effective response rate of 82.75%. Data compilation was conducted to ensure the rationality of the data.

Descriptive Analysis

A total of 388 valid questionnaires were recovered in this study. To gain a deeper understanding of the respondents' basic characteristics, descriptive statistical analysis was performed on their demographic variables. In terms of gender, females accounted for a higher proportion, with 264 respondents (68.0% of the total sample), while males numbered 124 (32.0%). Regarding age distribution, the 35-to-44 age group had the largest number of respondents, accounting for 44.3%, followed by the 45-to-54 age group at 37.6%. Respondents aged 54 and above and those aged 18 to 34 accounted for 13.9% and 0.5%, respectively. Overall, the respondents were predominantly middle-aged, possessing relatively rich work experience. In terms of educational background, individuals with a master's degree constituted the highest proportion, at 57.0%, followed by those with a bachelor's degree at 30.2% and a doctoral degree at 8.0%. The remaining respondents held other types of qualifications, accounting for 4.9%. This indicates a relatively high overall level of education among the sample, which is conducive to understanding and accepting green management concepts. In terms of job level, mid-level employees were the mainstay, accounting for 51.0%, followed by junior-level employees at 36.6% and senior-level employees at 11.1%, with the remaining 1.3% in other positions. In terms of years of work experience, employees with 6 to 10 years of experience

accounted for the highest proportion, at 45.1%, followed by those with 11 to 15 years at 33.2% and over 16 years at 14.7%. Employees with 6 years or less of experience constituted the smallest proportion, at only 7.0%. The sample exhibits good diversity and representativeness, providing a reliable data foundation for subsequent analysis of the impact of GHRM on CEP through GI.

Table 1: Frequency and Percentage of Demographic Factor

Variable	Options	Frequency	Percent %
Gender	Male	124	32.0
	Female	264	68.0
Age	18-34	2	0.5
	35-44	172	44.3
	45-54	146	37.6
	Over 54	54	13.9
Education	Other	19	4.9
	Bachelor's degree	117	30.2
	Master's degree	221	57
	PhD/Doctorate	31	8
Position	Junior position	142	36.6
	Mid-level position	198	51.0
	Senior position	43	11.1
	Other	5	1.3
Tenure	5 years or less	27	7.0
	6–10 years	175	45.1
	11-15 years	129	33.2
	16 years and above	57	14.7
	Total	388	100.0

Confirmatory Factor Analysis

The data results reveal that the CR values for all variables exceed 0.7, indicating strong internal consistency and high reliability of the measurements. The AVE values for most variables also surpass 0.5, suggesting that the latent variables can adequately explain their measurement items, demonstrating good convergent validity and strong effectiveness of the measurement model. The statistical data for the measurement models of different variables include the estimates (Estimate), standard errors (S.E.), critical ratios (C.R.), significance levels (P), as well as the related factor loadings (Factor Loading), AVE, and CR. These statistics are primarily used to evaluate the convergent validity, reliability of the latent variables, and the significance of path estimates, thereby

determining the effectiveness of the measurement model.

This study employs Confirmatory Factor Analysis (CFA) to evaluate the measurement models of three variables: GHRM, GI, and CEP. The results indicate that the standardized factor loadings for GHRM's measurement indicators range from 0.761 to 0.865, with an AVE of 0.66 and a Composite Reliability (CR) of 0.94, suggesting good convergent validity and reliability for this variable. For the GI variable, the factor loadings for each item range from 0.771 to 0.825, with an AVE of 0.64 and a CR of 0.92, also meeting the requirements for convergent validity and internal consistency. The loadings for CEP's items range from 0.758 to 0.803, with an AVE of 0.62 and a CR of 0.91, which are within acceptable ranges. All factor loadings are significant (with P-values less than 0.001), indicating a significant structural relationship between each measurement item and its corresponding latent variable, thus validating the scientific construction of the scale and the robustness of the measurement model. The scales used in this study exhibit good reliability and validity, providing a solid data foundation for subsequent Structural Equation Modelling (SEM) analysis.

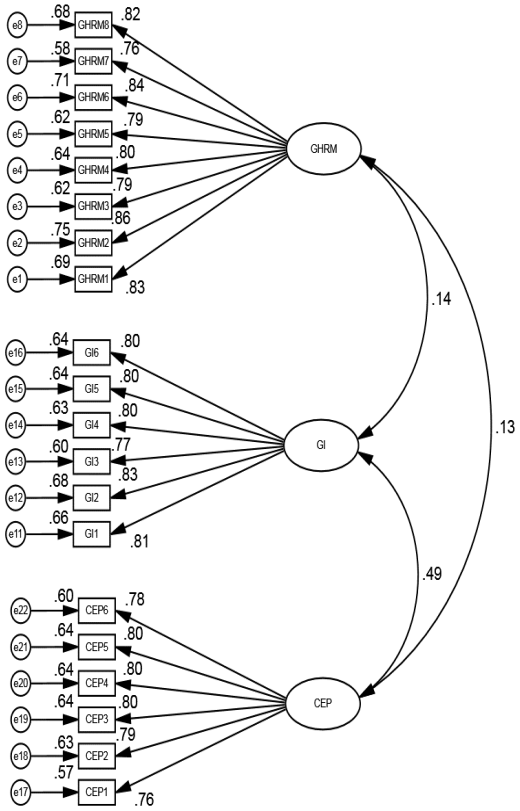

Figure 1 Confirmatory Factor Analysis

Correlation Analysis

The research data presents the correlation coefficients between the variables, along with the square root of the Average Variance Extracted (√AVE) for each latent variable. These data reflect the strength and direction of the linear relationships between the latent variables, and the significance

levels are marked to indicate the correlations ($p < 0.01$ denotes significance).

The analysis results of the correlation coefficients between different variables are provided, along with the degree of correlation and statistical significance for each pair of variables. Each variable has a corresponding √AVE value, representing the Average Variance Extracted (AVE) for that variable, which reflects the convergent validity of its measurement model.

From the results can be observed that the √AVE values for all variables are greater than the corresponding correlation coefficients between the variables. Specifically, the √AVE values are 0.812 for GHRM, 0.800 for GI, and 0.878 for CEP. This meets the Fornell-Larcker criterion, indicating good discriminant validity among the latent variables.

In variable correlations, a significant positive correlation is found between GHRM and GI, with a correlation coefficient of 0.125 ($p < 0.05$). This suggests that green management practices have a promoting effect on a firm's GI activities. The correlation coefficient between GHRM and CEP is 0.118, which is also statistically significant ($p < 0.05$), indicating that a firm's investment in green human resource policies has a positive impact on its environmental performance. The most significant correlation is observed between GI and CEP, with a correlation coefficient of 0.448 ($p < 0.01$). This implies that GI has a strong influence on driving the improvement of CEP.

Table 2: Results of Correlation to Discriminant Validity

	AVE	GHRM	GI	CEP
GHRM	0.812	1	0.125*	0.118*
GI	0.800	0.125*	1	0.448**
CEP	0.878	0.118*	0.448**	1

NOTE: * p<0.05 ** p<0.01 *** p<0.001

The Structural Equation Models and Hypothesis Testing

The results indicate that the model's chi-square value is 274.196, with a degree of freedom of 167. The ratio of chi-square to degrees of freedom is 1.642, which is significantly lower than 5 and close to the ideal range (i.e., less than 3), suggesting an overall good fit of the model.

Although the p-value of the chi-square test is 0.000, failing to meet the traditional criterion for non-significance, it is important to note that the chi-square value is sensitive to sample size. Therefore, relying solely on the p-value to judge the goodness-of-fit has certain limitations, and other fit indices need to be considered comprehensively for evaluation.

Various fit indices demonstrate excellent performance: The Goodness-of-Fit Index (GFI) is 0.934, the Adjusted Goodness-of-Fit Index (AGFI) is 0.917, and the Comparative Fit Index (CFI) is 0.980, all exceeding the recommended standard of 0.90. This indicates a high level of consistency between the model and the data.

The Root Mean Square Error of Approximation (RMSEA) is 0.041, which is significantly lower than 0.08, suggesting reasonable model residuals and good approximate fit.

Verification of Direct Effects

Based on the aforementioned indices, it can be concluded that the structural model possesses strong statistical adaptability and explanatory power. The research results provide a robust model foundation for the theoretical hypotheses proposed in this study.

This study verified the path relationships and mediating effect mechanisms among the variables. Based on the structural equation model, we analyzed the influence paths between GHRM, GI, and CEP.

The results show that the path coefficient from GHRM to GI is 0.136, with a standard error of 0.055, a critical ratio (C.R.) of 2.479, and a p-value of 0.013. This indicates a significant path relationship, suggesting that a firm's investment in GHRM positively promotes GI activities.

The direct path coefficient from GHRM to CEP is only 0.059, which does not reach a significant level (P = 0.220). This implies that the direct effect of GHRM on CEP is weak or not statistically significant.

In contrast, the influence of GI on CEP is the most significant. The path coefficient is 0.466, with a standard error of 0.055, a C.R. of 8.473, and a p-value less than 0.001. This indicates that GI plays a crucial role in driving CEP.

Verification of Mediation Effects

The study examined whether GI acts as a mediator between GHRM and CEP. We employed the Bootstrapping method to test the indirect effect. The results show that the total effect of GHRM on CEP is 0.117, with a p-value of 0.02. This indicates that the overall path is statistically significant, suggesting a certain positive impact of GHRM on CEP. Upon further decomposition of the influence paths, it was found that the indirect effect of GHRM on CEP through GI is 0.055. The confidence interval (LLCI = 0.012, ULCI = 0.100) does not include zero, indicating that the indirect effect is significantly established. This indirect path accounts for approximately 47.01% of the total effect, revealing that GI plays a mediating role in nearly half of the effect.

The direct effect of GHRM on CEP is 0.062, with a p-value of 0.172. The confidence interval includes zero, indicating that the direct effect is not statistically significant. This result confirms that GI partially mediates the relationship between GHRM and CEP, and the indirect path is more statistically significant. It implies that if GHRM aims to enhance CEP, it should focus on promoting the formation and transformation of GI capabilities within the organization.

Conclusions

This study takes iFLYTEK as the empirical subject and aims to explore how GHRM influences CEP through the mediating variable of GI. By conducting SEM analysis and Bootstrapping

mediation effect tests on 388 valid questionnaire responses, this study has yielded multiple findings that validate the proposed theoretical model and hypothesis relationships.

The study reveals that GHRM has a significant positive impact on GI (path coefficient = 0.136, p = 0.013). This indicates that when enterprises embed green concepts into recruitment, training, performance management, and employee incentives. They can effectively stimulate employees' enthusiasm for participating in green technology development, process optimization, and sustainable practices.

GI, in turn, has a significant impact on CEP (path coefficient = 0.466, p < 0.001). This suggests that when enterprises continuously promote the application and innovative practice of green technologies in their products, services, and processes. They can achieve remarkable results in pollution reduction, carbon emission reduction, resource conservation, and regulatory compliance.

However, the direct impact of GHRM on CEP is not significant (path coefficient = 0.062, p = 0.172). This indicates that the implementation of green personnel policies alone is not sufficient to improve environmental performance. Instead, the influence of GHRM on CEP relies on its indirect stimulating effect on GI capabilities, rather than a direct driving force.

Bootstrapping analysis further confirms the existence and significance of this mediating pathway. GHRM has a significant indirect effect on CEP through GI (effect size = 0.055, confidence interval LLCI = 0.012, ULCI = 0.100, excluding 0), and this indirect effect accounts for 47.01% of the total effect. This underscores the bridging role of GI in the implementation of corporate green strategies and provides a clear pathway for understanding how GHRM influences environmental performance.

The study suggests that in the pursuit of improved environmental performance, enterprises cannot solely rely on institutional-level GHRM. Instead, they must deeply integrate GHRM with GI activities. By stimulating employees' green awareness and technological participation, enterprises can drive a transition from management-driven to innovation-driven approaches.

Discussion

RQ1: What is the impact of GI on CEP at iFLYTEK?

The study reveals that GI has a significant positive impact on CEP. This finding suggests that in high-tech enterprises like iFLYTEK, GI is not only a manifestation of technological progress but also a core driver for continuously optimizing environmental performance. This result aligns with the findings of Stanitsas & Kirytopoulos (2021).

GI primarily encompasses the design of green products, the introduction of cleaner production processes, the application of energy-saving and environmentally friendly technologies, and the reshaping of the enterprise's overall sustainable operational model. In the development process of iFLYTEK, the application of green technologies is not only reflected in product development (Le &

Manh, 2022), such as the development of low-energy, biodegradable intelligent hardware products, but also integrated into daily management and production operations, including green office systems and digital energy management platforms. The research results indicate that these innovative initiatives have effectively reduced the company's resource consumption and pollution emissions, improved energy efficiency and environmental compliance levels, and ultimately enhanced overall environmental performance.

From a theoretical perspective, GI, as an important embodiment of integrating knowledge, technology, and environmental responsibility within an enterprise, does not operate in isolation. Instead, it is closely related to the enterprise's strategic orientation, human resource allocation, and organizational culture (Wang & Juo, 2021). GI not only helps enterprises enhance their adaptability in the face of increasingly stringent environmental regulations but also, to some extent, improves their external reputation and market competitiveness. Therefore, GI is not only a technological pathway for enterprises to environmental responsibilities but also a systemic practice integrated into corporate strategy, with sustainable and replicable effects on promoting environmental performance.

This study fully validates the positive role of GI in environmental performance. In technology-driven enterprises like iFLYTEK, GI has become a crucial lever for improving environmental performance and achieving a harmonious balance between ecological responsibility and economic benefits. If enterprises wish to take the initiative in green transformation, they should more systematically promote the construction of GI mechanisms and strengthen and deepen them as a key pathway for high-quality enterprise development (Kiefer et al., 2022; Guo et al., 2020).

RQ2: Does GHRM have a positive or negative impact on CEP and GI at iFLYTEK?

Through empirical data and structural equation modelling analysis, this study provides clear conclusions: GHRM has a significant positive impact on GI but does not have a significant direct impact on CEP, i.e., it fails to form a direct positive effect. This finding is consistent with the research of Kraus et al. (2020).

The path between GHRM and GI meets the significance criteria. This indicates that when iFLYTEK implements GHRM practices such as green recruitment, green training, green performance evaluation, and incentive mechanisms, it indeed promotes the enhancement of employees' green awareness and the occurrence of green behaviours, thereby stimulating GI activities within the organization. Through institutional-level green orientation, the enterprise cultivates an atmosphere conducive to environmental technology and process innovation at the cultural and value level (Le & Manh, 2022).

In the direct path between GHRM and CEP, the study did not find a significant statistical relationship. This suggests that GHRM itself cannot directly bring about significant improvements in environmental performance, or its direct effect is weak and difficult to yield practical results independently. This result hints that if enterprises introduce green elements at the institutional level

but lack GI as a bridge for implementation and transformation, there is still a "last mile" gap in achieving environmental goals such as energy conservation, consumption reduction, and pollution emission reduction.

Through mediation effect analysis, it was found that GHRM can indirectly and positively influence CEP through the mediation of GI, with an indirect effect value of 0.055, accounting for 47.01% of the total effect. This means that GHRM is not ineffective; rather, its true efficacy lies in the pathway of stimulating GI and then translating it into environmental performance. Therefore, GHRM has a positive impact on GI; it does not have a significant direct impact on CEP but produces a positive effect indirectly through GI. GHRM is a foundational force for enterprises to promote green strategies (Sun & Sun, 2021), but the true release of its value depends on its linkage with innovation mechanisms. In technology-oriented enterprises like iFLYTEK, only by transforming green management systems into GI achievements can environmental performance ultimately be improved.

RQ3: How does GHRM influence CEP at iFLYTEK through GI?

This study reveals the mechanism and effect of this influence pathway through mediation effect testing. The results indicate that GI plays a significant mediating role between GHRM and CEP. GHRM is not a direct determinant of CEP but indirectly enhances the enterprise's environmental performance level by stimulating GI activities. This research conclusion is consistent with the findings of Liu & Shi (2013).

This discovery emphasizes that the true role of GHRM is not to change environmental performance indicators but to cultivate a green culture, train green skills, and incentivize green behaviours, thereby stimulating employees' participation in innovative activities such as green technology research and development, process optimization, and energy conservation and emission reduction (Kiefer et al., 2022). By constructing a green capability system, enterprises indirectly promote the improvement of environmental performance. This mechanism is particularly evident in high-tech enterprises like iFLYTEK, where innovation activities are frequent and technological updates are rapid. GI can serve as an important channel for transforming GHRM into measurable performance outcomes. This result supports the perspectives of resource-based theory and dynamic capability theory: enterprises enhance their organizational GI capabilities through internal resource allocation (such as GHRM), thereby improving environmental adaptability and sustainable competitive advantages (Hameed et al., 2020). From a practical perspective, if iFLYTEK wishes to achieve significant results in green transformation, it should not merely remain at the level of institutional construction but should systematically infuse green management concepts into employee training and incentives to promote the implementation of GI mechanisms and achieve a win-win situation for environmental performance and organizational development.

The impact of GHRM on CEP through GI has a significant effect. Enterprises should design and implement GHRM and GI in a linked manner to unlock the performance value of green

management.

Business Implications

(1) Promoting GHRM as a Key Pathway for Enhancing GI

The research findings indicate that GHRM indirectly promotes the improvement of CEP by stimulating GI activities. Therefore, enterprises should integrate GHRM as a core component of their sustainable development strategies. Through measures such as green recruitment, green training, green performance management, and incentive mechanisms, enterprises can cultivate employees' green awareness and behaviours, providing the necessary knowledge reserves and skill support for GI. In high-tech enterprises, GI not only enhances environmental performance but also strengthens competitiveness and brand image within the industry.

(2) The Critical Role of GI in Improving Environmental Performance

Enterprises should fully recognize that GI is a manifestation of technological upgrading and a key driver for achieving green transformation. Technology-oriented enterprises like iFLYTEK can increase investment in green technology research and development, innovate energy-saving and consumption-reducing technologies and processes, thereby optimizing resource utilization efficiency and reducing environmental burdens. GI not only helps enterprises meet increasingly stringent environmental regulations but also establishes them as environmental pioneers in the market, attracting green consumers and expanding new market spaces.

(3) The Importance of Systematic and Synergistic Green Management Strategies

This study highlights the close connection between GHRM and GI, indicating that enterprises need to plan comprehensively at the strategic level when promoting green transformation. The implementation of GHRM should be coordinated with the green strategies of other departments, such as technological innovation, production operations, and marketing, to form a synergistic effect. Enterprises should not rely solely on single green technology innovations or environmental policies but should build a comprehensive, multi-layered green management system through the cultivation of a green culture involving all employees, thereby achieving an overall improvement in environmental performance.

(4) Integrating Medium- to Long-Term Green Development Strategies with Overall Corporate Strategies

The improvement of GI and environmental performance is a long-term process. Enterprises should formulate clear green development goals and incorporate them into their long-term strategic planning. Enterprises like iFLYTEK should strengthen cross-departmental cooperation, integrate external resources (such as government green policy support, industry partners, etc.), and promote the research, development, and application of green technologies, gradually achieving a transition from single environmental protection measures to comprehensive green transformation.

(5) Recognizing GHRM and GI as Key Factors for Enhancing Sustainable Competitiveness

Enterprises should recognize that GHRM and GI are not only crucial factors for promoting environmental performance but also important means for enhancing sustainable competitiveness. By systematically implementing green management measures, enterprises can make substantive progress in environmental protection and lay the foundation for achieving a balance between economic benefits, social responsibility, and environmental responsibility.

This study is innovative and has theoretical expansion significance, primarily reflected in the systematic exploration and model construction of variable relationships in the field of green management. By combining GHRM, GI, and CEP, the study constructs a relatively complete influence pathway, enriching the research perspectives in the intersection of green management and organizational behaviour. Through empirical analysis, it is found that the direct impact of GHRM on environmental performance is not significant, but it can indirectly enhance environmental performance through the mediation of GI. This conclusion supplements and revises existing literature that emphasizes the direct performance orientation of GHRM, contributing to theoretical deepening. In the context of Chinese local high-tech enterprises, using structural equation modelling to test the dynamic relationships among variables helps connect Western theoretical frameworks with local enterprise practices, promoting the localization of green management theory. This study fills the research gap on how GHRM indirectly affects CEP through GI and provides new theoretical support for understanding how green organizational capabilities are constructed and transformed into sustainable performance, with certain academic value and inspiring significance.

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