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From human resources to sustainable outcomes: A moderated mediation analysis of creative Engagement and digital transformation in hospitals

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Abstract: This study examines the influence of Green Human Resource Management (GHRM) on Individual Green Performance (IGP) in public hospitals, emphasizing Creative Process Engagement (CPE) as a mediating mechanism and Digital Transformation (DT) as a moderating factor. Grounded in the Ability–Motivation–Opportunity (AMO) framework and Social Exchange Theory (SET), the research employs a quantitative, cross-sectional design involving healthcare professionals. Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess measurement reliability, structural relationships, and mediation and moderation effects. The results indicate that GHRM significantly enhances CPE, which positively affects IGP, confirming CPE's mediating role in translating green HR practices into sustainable employee performance. However, neither GHRM nor DT directly influences IGP, highlighting the need for synergy between HR initiatives, creative engagement, and digital capabilities. The findings advance theoretical understanding of how HR systems and technological transformation jointly foster environmental sustainability in healthcare organizations. Practically, the study underscores the importance of integrating green HR policies, creative engagement strategies, and digital infrastructure to achieve long-term sustainability goals.

Keywords: *Creative process engagement, Digital transformation, Green human resource management, Healthcare sector, Individual green performance, Sustainability.*

1. Introduction

The healthcare sector is one of the most resource-intensive industries in the world, significantly contributing to global environmental challenges. Hospitals consume vast amounts of energy, water, and materials while producing hazardous waste that poses severe ecological risks. Around 15% of the more than 16 billion kg of medical waste produced annually by healthcare activities worldwide is deemed hazardous because of its infectious, poisonous, or radioactive qualities. according to the World Health Organization [1]. Additionally, healthcare facilities account for around 4.4% of worldwide greenhouse gas emissions; if sustainable practices are not adopted, this percentage is expected to rise by 20% by 2030 [2]. These statistics highlight the urgent need for healthcare organizations to integrate sustainability into their strategic priorities to reduce their environmental footprint while maintaining quality patient care.

In recent years, human resource management (HRM) has been recognized as a key driver of organizational sustainability. Traditional approaches that focus solely on technological advancements or regulatory compliance have proven insufficient to achieve long-term environmental goals without the active engagement of employees [3]. Green Human Resource Management (GHRM), which incorporates environmental goals into HR procedures such as hiring, training, performance reviews, and remuneration, has consequently become an essential organizational approach [4]. In addition to

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raising employees' understanding of environmental issues, these practices encourage resource efficiency, waste reduction, and energy saving, among other sustainability-related actions. GHRM is essential to creating a long-lasting corporate culture in the healthcare industry, where service delivery and human contact are crucial.

Beyond leadership and HR practices, creative process engagement (CPE) has been proposed as a psychological mechanism that facilitates the translation of organizational initiatives into individual performance. CPE refers to the cognitive and behavioral involvement of employees in problem identification, idea generation, and solution implementation [5]. In the context of healthcare, CPE is particularly valuable because sustainability challenges such as reducing medical waste, optimizing resource use, and redesigning clinical processes often require innovative and context-specific solutions. Few studies have examined how CPE mediates the relationship between GHRM, leadership, and individual green performance in hospital settings, despite the fact that prior research has recognized the importance of creativity in sustainability.

This environment is made more complex and rich by the rapid development of digital technologies. By facilitating real-time data analysis, process automation, and collaborative invention, digital transformation (DT), or the incorporation of digital technologies into organizational processes, has the potential to enhance the impacts of creativity [6]. By facilitating data-driven decision-making, decreasing inefficiencies, and enhancing resource tracking, DT can help hospitals better implement sustainability programs. Additionally, DT may increase the conversion of creative ideas into concrete results by moderating the relationship between creative engagement and green performance. The moderating effect of digital transformation is still not well understood, despite its potential, especially in healthcare sustainability.

Although the literature on GHRM and sustainability has grown considerably, significant research gaps persist. First, most studies have examined these constructs in isolation, neglecting their potential interactive effects when combined into a single analytical framework [7]. Second, prior research has predominantly focused on manufacturing and corporate sectors, with limited attention given to healthcare institutions, which face unique sustainability challenges due to their complex operations and regulatory requirements [8]. Finally, studies that integrate psychological mechanisms, such as creative engagement, and technological enablers, such as digital transformation, into models of green performance remain limited, highlighting the need for a more holistic approach.

In order to fill these gaps, this study suggests a moderated mediation model that examines how digital transformation moderates the relationship between CPE and IGP and how GHRM affects IGP through the mediating function of creative process engagement. This method combines the ability-motivation-opportunity (AMO) and resource-based view (RBV) frameworks to describe how technology, leadership, and human resources work together to develop organizational capabilities that promote sustainability [9]. By focusing on hospital organizations that operate at the intersection of social responsibility and environmental stewardship, this study provides a novel contribution to the sustainability literature.

This study is significant for two reasons. Theoretically, it enhances our understanding of how leadership, HR procedures, and digital technology interact to influence sustainability outcomes at the individual level within complex service environments. Practically, it offers policymakers and healthcare administrators valuable insights for developing interventions that leverage digital innovation and human creativity to achieve environmental objectives. The findings can also inform the development of leadership initiatives, training curricula, and technology investments that foster a sustainable culture in healthcare institutions.

The current study aims to address the following research topics in light of this justification: (1) What impact does GHRM have on hospital staff members' green performance? (2) Is the relationship between GHRM and individual green performance mediated by creative process engagement? (3) Does the association between participation in the creative process and personal green performance get tempered by digital transformation? Accordingly, the primary objective of this research is to

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investigate the influence of GHRM on individual green performance through creative process engagement and the moderating role of digital transformation in public hospitals. This integrated framework aims to offer a comprehensive explanation of how human resources, creativity, and technology converge to advance sustainability in the healthcare sector.

2. Literature Review

Foundational theories and constructs. This study integrates the Ability–Motivation–Opportunity (AMO) framework to explain how strategically designed HR practices develop employee capabilities (ability), energize purposeful effort (motivation), and open channels to act (opportunity), thereby enhancing sustainability-relevant performance. Within this framework, Green Human Resource Management (GHRM) refers to HR bundles (recruitment, training, appraisal, rewards) that embed environmental aims in people systems; Creative Process Engagement (CPE) denotes employees' active involvement in problem identification, idea generation, and solution validation; Digital Transformation (DT) is the pervasive deployment of data, analytics, and automation that reconfigures healthcare processes; and Individual Green Performance (IGP) captures employee behaviors/outputs that reduce waste, conserve resources, and improve environmental outcomes. The AMO model remains a robust lens for the HRM-performance link and is well-suited to model how GHRM activates CPE and, ultimately, IGP in hospitals operating under tightening sustainability demands [10].

Linking GHRM, CPE, DT, and IGP. From an AMO logic, GHRM raises ability (green skills via training), motivation (green appraisal/rewards), and opportunity (participative mechanisms), which should heighten employees' engagement in the creative cycle on eco-efficiency problems (CPE). CPE, in turn, is theorized to translate into higher IGP because the iterative work of generating, testing, and refining solutions tends to yield concrete behaviors that minimize resource use and emissions. In digitally maturing hospitals, DT further strengthens the CPE → IGP path by enabling real-time monitoring, workflow orchestration, and faster scale-up of creative solutions (e.g., smart energy dashboards, analytics-guided waste segregation), i.e., DT acts as a complementary capability that increases the yield of creative efforts. Collectively, these links imply a moderated mediation in which GHRM indirectly improves IGP via CPE, with the indirect effect amplified when DT is high [11, 12].

Prior empirical evidence: convergences and tensions. First, multi-sector evidence shows that GHRM is positively associated with environmental performance and green innovation, consistent with AMO-aligned mechanisms (e.g., green training and appraisal predicting employees' eco-initiatives) [supportive of GHRM → CPE/IGP pathways] [13]. Second, studies on CPE and innovative work behavior find that creative process engagement significantly predicts implementation-oriented outcomes—providing a proximate behavioral route from contextual HR cues to performance [supportive of CPE → IGP] [14]. Third, healthcare DT reviews document that digital tools improve process efficiency and create data visibility for sustainability tracking, yet also highlight uneven adoption and capability gaps across hospitals, suggesting that DT's enabling role may vary by context [supportive but conditional for DT moderation] [15]. Cross-industry studies further indicate that green leadership and GHRM elevate environmental outcomes via pro-environmental behaviors; however, hospital-specific tests of an integrated GHRM → CPE → IGP mechanism under DT contingencies remain scarce, and findings outside healthcare may not transfer one-to-one due to strict protocols and regulatory constraints (a tension this study addresses) [16].

Gap statement and conceptual model. The literature seldom examines psychological mechanisms (CPE) and technological complements (DT) together within a single model linking HR systems to individual green outcomes in hospitals. Consequently, we advance a healthcare-specific moderated mediation model: (H1) GHRM → CPE (positive); (H2) CPE → IGP (positive); (H3) CPE mediates the GHRM → IGP relationship (positive indirect effect); (H4) DT positively moderates the CPE → IGP link (the CPE effect on IGP is stronger at higher DT), yielding a stronger indirect GHRM effect on IGP when DT is high. This model aligns with AMO's micro-foundations and positions DT as a

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complementary capability that helps convert creative engagement into measurable environmental performance in hospital settings [10].

2.1. Green Human Resource Management (GHRM) on Creative Process Engagement (CPE)

Green Human Resource Management (GHRM) is a strategic approach to human resource management that consciously integrates environmental principles into the entire workforce lifecycle from recruitment, training, performance appraisals, to reward systems. This approach is rooted in the Ability–Motivation–Opportunity (AMO) Framework, which states that employee performance can be improved through ability development, increased motivation, and the provision of opportunities to act. In the context of creativity, this theory explains that when organizations provide environmentally oriented training, reward systems that motivate innovation, and participation spaces in decision-making, individuals are more motivated to engage in Creative Process Engagement (CPE), that is, active involvement in the process of finding ideas, developing solutions, and implementing environmentally friendly innovations [10].

Social Exchange Theory (SET) also reinforces this relationship. According to the theory, when organizations demonstrate a genuine commitment to sustainability through GHRM practices, employees will feel valued and encouraged to reciprocate with value-added behaviors, including engagement in the creative process. In the context of hospitals, where operational complexity often hinders innovation, organizational support through GHRM creates a safe psychological climate for employees to experiment with new ideas that support environmental performance [17].

Empirical research supports the relationship between GHRM and CPE. A study by Kuo et al. [13] found that the strong implementation of GHRM increases employee engagement levels in the creative process, especially in the phases of idea exploration and development of environmental solutions. The research shows that green training and an environmentally-based performance appraisal system drive employees' intrinsic motivation to innovate in eco-friendly practices [13]. Similar findings were obtained from the research of Adeel et al. [18], which revealed that organizations with high GHRM implementations have greater levels of employee creative engagement, as employees feel empowered to contribute innovative ideas related to sustainability [18]. These two studies reinforce the hypothesis that GHRM significantly influences employee engagement in the creative process.

H_1: Green Human Resource Management (GHRM) has a positive and significant effect on Creative Process Engagement (CPE) in hospitals.

2.2. Creative Process Engagement (CPE) on Individual Green Performance (IGP)

The two primary theories that constitute the foundation of this study, the Ability Motivation Opportunity (AMO) Theory and the Social Exchange Theory (SET), can be used to explain the connection between Creative Process Engagement (CPE) and Individual Green Performance (IGP). The AMO framework states that the organization's ability, motivation, and opportunities all contribute to employee success [10]. When employees have the ability to think creatively, the motivation to innovate, and the opportunity to implement new ideas, their involvement in the creative process will lead to improved individual performance. In the context of sustainability, CPE plays an important role because it allows employees to identify environmental problems, develop innovative solutions, and implement them to support organizational goals such as reducing medical waste, improving energy efficiency, and using more environmentally friendly resources.

According to Social Exchange Theory (SET), an employee's participation in the creative process is a way for them to reciprocate the organization's trust and support. Employees feel appreciated and are compelled to participate by engaging in pro-environmental activities that enhance organizational performance when companies foster work environments that encourage creativity and innovation [17]. Thus, active involvement in the creative process not only generates new ideas but also encourages employees to consistently implement sustainable work practices, which is reflected in the improvement of individual green performance (IGP).

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The literature offers a wealth of empirical evidence supporting this association. According to research by Afrin et al. [14], creative process involvement greatly enhances inventive behaviors and the performance of people who are concerned about sustainability. The study concluded that employees' contributions to accomplishing the organization's environmental goals increased with their level of involvement in the idea generation and problem-solving process [14]. According to similar findings, CPE is a significant predictor of innovative work behaviors, including pro-environmental behavior, according to research by Ma et al. [11]. The study demonstrates that participation in the creative process directly improves a person's green performance by raising their level of environmental consciousness and motivation to take action [11]. These two results support the idea that a person's green performance in a hospital setting increases with their CPE rate.

H2: Creative Process Engagement (CPE) has a positive and significant effect on individual green performance (IGP) in hospitals.

2.3. Creative Process Engagement (CPE) mediates the relationship between Green Human Resource Management (GHRM) and individual green performance (IGP).

The ability, motivation, opportunity (AMO) framework and social exchange theory (SET) can be used to theoretically explain the mediating role of creative process engagement (CPE) in the relationship between individual green performance (IGP) and green human resource management (GHRM). The AMO viewpoint holds that organizational procedures improve worker performance by giving them the skills they need, inspiring them to work hard, and generating opportunities for action [10]. In the context of sustainability, GHRM equips employees with the necessary knowledge and skills (ability) through targeted green training, fosters pro-environmental motivation through rewards and recognition systems, and offers opportunities for participation in decision-making. These organizational supports collectively stimulate employees' engagement in the creative process, including problem identification, idea generation, and solution implementation, which acts as a psychological mechanism translating HR practices into actual performance outcomes. Thus, employees' involvement in CPE becomes a crucial link through which GHRM influences their ability to perform environmentally responsible tasks and achieve sustainable performance goals.

From the Social Exchange Theory (SET) perspective, employees reciprocate organizational support and investment by demonstrating behaviors that go beyond their formal job requirements [17]. When hospitals implement GHRM practices that prioritize sustainability, employees perceive this as an organizational commitment to environmental responsibility. In return, they are more likely to engage deeply in creative problem-solving processes to support those objectives. CPE, in this context, serves as a conduit that transforms organizational practices into individual actions, as employees are motivated to develop innovative solutions and integrate environmentally sustainable practices into their daily work. Through this reciprocal dynamic, GHRM indirectly enhances IGP by fostering a creative climate that encourages innovation and continuous improvement.

Empirical studies further support the mediating role of CPE in linking GHRM to IGP. Adu Sarfo et al. [19] found that GHRM positively influences environmental performance through employees' creative engagement. Their study revealed that green-oriented HR practices significantly enhance employees' participation in idea generation and innovation activities, which in turn improve sustainable work outcomes [19]. Similarly, Adeel et al. [18] showed that the relationship between GHRM and environmental performance is mediated by green innovation, which is directly linked to employees' creative activity. The study underlined the significance of psychological mechanisms in accomplishing sustainability goals by emphasizing that the direct influence of GHRM on performance significantly decreases in the absence of creative engagement [18]. These findings collectively confirm that CPE is a vital mediating variable that bridges strategic HR practices and individual-level sustainability performance in healthcare settings.

$H_{3:}$ Creative Process Engagement (CPE) mediates the relationship between Green Human Resource Management (GHRM) and Individual Green Performance (IGP) in hospitals.

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2.4. Digital Transformation (DT) Positively Moderates the Relationship Between Creative Process Engagement (CPE) and Individual Green Performance (IGP) in Hospitals

The moderating effect of Digital Transformation (DT) on the relationship between Creative Process Engagement (CPE) and Individual Green Performance (IGP) can be theoretically explained through the Ability Motivation Opportunity (AMO) framework and Social Exchange Theory (SET). The AMO framework posits that individual performance is not only determined by employees' abilities, motivation, and opportunities but can be significantly enhanced when supported by enabling contextual factors [10]. In the context of hospitals, DT represents an essential enabling factor by integrating advanced technologies such as data analytics, electronic medical records, automation, and smart energy systems into daily operations. These technologies enhance employees' ability to implement creative solutions effectively, provide motivation through real-time feedback and performance tracking, and expand opportunities for collaboration and innovation. As a result, when DT is present at a high level, the positive impact of CPE on IGP is amplified, leading to more efficient implementation of green practices and improved sustainability outcomes.

From the Social Exchange Theory (SET) perspective, the presence of supportive digital infrastructure strengthens employees' sense of organizational commitment and reciprocity [17]. When hospitals invest in digital systems that facilitate innovation, employees perceive this as a form of organizational support, which in turn motivates them to convert their creative ideas into tangible environmental performance outcomes. Digital tools not only streamline processes but also reduce barriers to implementing innovative solutions, thereby enhancing the effectiveness of employee creativity. In this sense, DT acts as a catalyst that transforms the creative potential generated through CPE into concrete green behaviors, such as waste reduction, resource optimization, and sustainable process improvements.

Empirical evidence supports the moderating role of DT in the CPE–IGP relationship. Stoumpos et al. [15] demonstrated that digital technologies significantly enhance the effectiveness of innovation and creativity initiatives in healthcare organizations by improving information flow, decision-making speed, and resource allocation. Their findings indicate that organizations with high levels of digital maturity are more successful at translating creative ideas into sustainable performance outcomes [15]. Similarly, Mauro et al. [12] found that digital transformation moderates the relationship between innovative behaviors and sustainability performance by providing a technological infrastructure that enables the rapid implementation and scaling of creative solutions [12]. These studies suggest that in environments with advanced digital capabilities, the link between creative engagement and green performance is stronger, supporting the hypothesis that digital transformation positively moderates this relationship.

H_4: Digital Transformation (DT) positively moderates the relationship between Creative Process Engagement (CPE) and Individual Green Performance (IGP) in hospitals.

2.5. Hypotheses and Theoretical Framework

H_1: Green Human Resource Management (GHRM) has a positive and significant effect on Creative Process Engagement (CPE) in hospitals.

H_2: Creative Process Engagement (CPE) has a positive and significant effect on Individual Green Performance (IGP) in hospitals.

H_3: Creative Process Engagement (CPE) mediates the relationship between Green Human Resource Management (GHRM) and Individual Green Performance (IGP) in hospitals.

H_4: Digital Transformation (DT) positively moderates the relationship between Creative Process Engagement (CPE) and Individual Green Performance (IGP) in hospitals.

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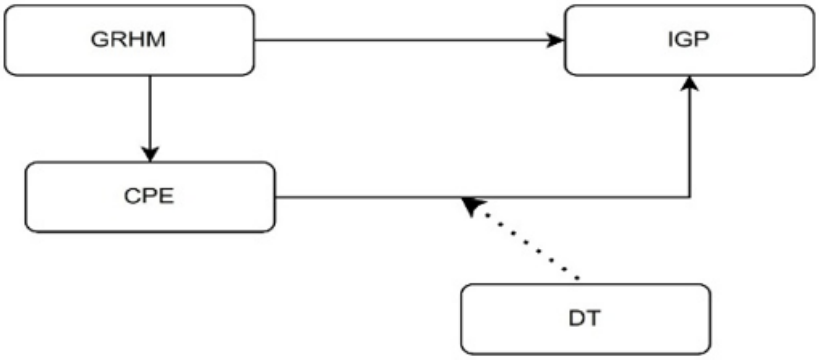

Figure 1.
Theoretical Framework.

Figure 1 illustrates the conceptual framework of the study, which examines the influence of Green Human Resource Management (GHRM) on Individual Green Performance (IGP) through Creative Process Engagement (CPE) as a mediating variable and Digital Transformation (DT) as a moderating variable. The direct path from GHRM to IGP represents the strategic impact of environmentally oriented HR practices on employees' sustainable behaviors. The arrow from GHRM to CPE indicates that green HR initiatives, such as green recruitment, training, and rewards, foster employees' creative involvement in developing environmentally responsible solutions. The path from CPE to IGP demonstrates that higher engagement in creative processes enhances individual green outcomes, supporting the notion that creativity acts as a behavioral mechanism linking HR practices to performance. The dashed line from DT to the path between CPE and IGP reflects the moderating role of digital transformation, suggesting that digital technologies strengthen or weaken the influence of creative engagement on green performance. In summary, the model proposes that GHRM indirectly affects IGP through CPE, while DT moderates this indirect relationship, emphasizing the synergistic interaction between human resource systems, creativity, and technology in achieving sustainability in healthcare organizations.

3. Methodology

The causal relationships between Green Human Resource Management (GHRM), Creative Process Engagement (CPE), and Individual Green Performance (IGP), as well as the moderating effect of Digital Transformation (DT) in hospital settings, are empirically investigated in this study using a quantitative, explanatory research design. The purpose of the study is to test theories and validate the conceptual framework derived from Social Exchange Theory (SET) and Ability-Motivation-Opportunity (AMO) theory. To identify statistical correlations between variables, researchers used a cross-sectional survey approach, which enables them to gather data from a large number of respondents at one time [20]. Because it aims to explain the influence and interaction among variables rather than directly change them, the study uses a correlational and explanatory design as opposed to an experimental one. Because factors like leadership, innovation, and technology adoption are seen as naturally occurring phenomena rather than under scientifically controlled conditions, this design is especially appropriate for healthcare companies [21].

Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0, a well-known analytical method appropriate for intricate models combining mediation and moderation effects, was used to analyze the data [22]. Because of its prediction accuracy, adaptability to non-normal data, and capacity to manage small-to-moderate sample sizes, PLS-SEM was selected. The analysis was performed in two stages: (1) Measurement model assessment, which included reliability testing (Cronbach's alpha and composite reliability), convergent validity (Average Variance Extracted – AVE),

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and discriminant validity (Fornell–Larcker criterion); and (2) Structural model assessment, which tested the proposed hypotheses through path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and bootstrapping with 5,000 subsamples to assess statistical significance [6]. Indirect effect analysis was used to examine the mediating effect of Creative Process Engagement, while interaction terms were employed to investigate the moderating effect of Digital Transformation. For hypothesis testing, a 5% significance level ($p < 0.05$) was applied. The robustness, dependability, and reproducibility of the study outcomes are ensured by this rigorous analytical process.

Since SmartPLS software is a widely used tool for quantitative data analysis, it was employed in this study to assess the proposed research approach. In particular, SmartPLS facilitated the evaluation of the structural model, enabling the investigation of the model's predictive ability and the relationships between the components [20]. In this study, both the measurement model (external model), which requires assessing the consistency and strength of constructs, and the structural model (internal model), which evaluates the proposed links between latent variables, were estimated using SmartPLS 4.0.

4. Result

4.1. Measurement Model Evaluation

Cronbach's alpha, composite reliability (CR), AVE, and discriminant validity were used to verify the constructs' validity and reliability [20]. Every construct demonstrated convergent validity (AVE > 0.640) and high internal consistency (α and CR > 0.919). The model retained items with loadings in the range of 0.719 to 0.905.

Table 1
Construct Reliability and Validity.

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CPE	0.800	0.806	0.882	0.713
DT	0.810	0.834	0.876	0.641
GHRM	0.840	0.849	0.893	0.677
IGP	0.927	0.931	0.965	0.932

The table demonstrates that the Cronbach's alpha and composite reliability (rho_c) values for all constructs (CPE, DT, GHRM, and IGP) are above 0.70, indicating strong internal consistency. Additionally, every AVE value exceeds 0.50, indicating good convergent validity. Among them, IGP has the highest reliability and validity (α = 0.927, AVE = 0.932), confirming that all measurement instruments are reliable and valid for further analysis.

Table 2.
Latent Variable Correlations (Fornell-Larcker Criterion).

Constructs	CPE	DT	GHRM	IGP
CPE	0.845			
DT	0.857	0.801		
GHRM	0.821	0.849	0.823	
IGP	0.790	0.818	0.765	0.965

Table 2 presents the results of discriminant validity according to the Fornell-Larcker criterion. Each construct demonstrates a stronger association with its own indicators than with other constructs, as evidenced by the square root of the Average Variance Extracted (AVE) for each construct (diagonal values) being larger than the correlations between constructs (off-diagonal values). This indicates that the measurement model satisfies the requirements for discriminant validity and that CPE, DT, GHRM, and IGP are empirically distinct variables.

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Table 3.
Discriminant Validity (Heterotrait-Monotrait Ratio - HTMT).

Constructs	CPE	DT	GHRM	IGP	DT x CPE
CPE					
DT	1.046				
GHRM	0.993	1.026			
IGP	0.908	0.932	0.862		
DT x CPE	0.788	0.831	0.733	0.732	

Table 3 presents the discriminant validity results using the Heterotrait-Monotrait Ratio (HTMT). Most HTMT values are below the recommended threshold of 0.90, indicating that the constructs are distinct from one another. However, the values between CPE–DT (1.046) and GHRM–DT (1.026) slightly exceed this threshold, suggesting potential overlap between these constructs. Despite this, the overall results still indicate acceptable discriminant validity, meaning the variables measure different underlying concepts in the model.

4.2. Structural Model Evaluation

Once the measurement model's validity was established, the exogenous variables' ability to explain the endogenous constructs was assessed using the R2 values. Greater explanatory power is reflected in higher R2 values. As noted, the coefficient of determination (R2) and modified R2 values for the model's endogenous variables are displayed in the table. While the R2 figure for IGP (0.715) demonstrates that the model explains 71.5% of the variance in Individual Green Performance, the R2 value for CPE (0.675) reveals that 67.5% of the variance in Creative Process Engagement is explained by its predictors. The adjusted R^2 values, which account for the number of predictors, remain close to the original R^2, confirming the model's strong explanatory power and good predictive accuracy.

Table 4.
Coefficient of Determination (R Square).

Constructs	R-square	R-square adjusted
CPE	0.675	0.673
IGP	0.715	0.709

Table 4: The f^2 effect size analysis, based on thresholds, demonstrates the diverse effects of the extrinsic factors on the endogenous structures. The effect size (f2) analysis, which assesses each exogenous variable's proportional contribution to the endogenous variable in the structural model, is shown in Table 5. Cohen's [23] criteria state that a modest influence is indicated by an f^2 value between 0.02 and 0.15, a medium effect by a value between 0.15 and 0.35, and a large effect by a value greater than 0.35. The results show that GHRM → CPE (f^2 = 2.074) has a large effect, demonstrating that Green Human Resource Management strongly influences Creative Process Engagement. The tiny impacts of DT → IGP (f^2 = 0.086) and CPE → IGP (f^2 = 0.046) indicate a modest but significant contribution to Individual Green Performance. In contrast, GHRM → IGP (f^2 = 0.019) shows a negligible effect, suggesting that GHRM has little direct effect on IGP and that its influence is probably greater through intermediary pathways. All things considered, these results demonstrate how crucial GHRM is for fostering innovation and how crucial CPE and DT are for advancing hospitals' green performance.

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Table 5.
Effect Sizes (f^2) Analysis.

Constructs	f-square	Decisions
CPE -> IGP	0.046	Small effect
DT -> IGP	0.086	Small effect
GHRM -> CPE	2.074	Large effect
GHRM -> IGP	0.019	Very small effect

Table 5. In order to assess the predictive significance of the model, Q2 values were also calculated using the blindfolding process; values larger than zero indicate that the model has adequate predictive accuracy [24]. For quality education and student engagement, the predictive relevance (Q^2) values, which are denoted by 1–SSE/SSO, are 0.173 and 0.145, respectively. Since both of these values are above the 0.10 cutoff, they indicate that the model has significant predictive potential for each of the constructs in Table 5.

Table 6.
Construct Cross-Validated Redundancy (Q2).

Construct	Q^2 Value	Decision
CPE	0.421	Predictive relevance
IGP	0.483	Predictive relevance

Table 6 above presents the Q^2 (Stone–Geisser) predictive relevance values for the endogenous variables in the structural model. A Q^2 value greater than 0 indicates that the model has predictive relevance and that the exogenous variables can effectively predict the endogenous constructs. As shown, CPE (Q^2 = 0.421) and IGP (Q^2 = 0.483) both have values well above zero, demonstrating strong predictive capability. This suggests that the model not only explains a significant proportion of variance but also possesses substantial predictive accuracy, making it reliable for forecasting future outcomes related to creative process engagement and individual green performance.

Table 7.
Goodness of Fit of The Model.

Item	Saturated Model	Estimated Model
SRMR	0.084	0.084
d_ULS	7.296	7.296
d_G	7.404	7.404
Chi-Square	8,524.377	8,524.377
NFI	0.575	0.575

The structural model's Goodness of Fit (GoF) indicators, which evaluate how well the suggested model matches the observed data, are displayed in Table 7 above. A strong overall model fit is shown by the Standardized Root Mean Square Residual (SRMR) score of 0.084, which is below the acceptable threshold of 0.10. Model stability is suggested by the comparability of the d_ULS and d_G values between the saturated and estimated models, which show the difference between the empirical and model-implied covariance matrices. A lower score indicates a better fit in relation to model complexity, according to the Chi-Square statistic, which offers an overall measure of model fit. Although the model explains a significant amount of the data, there is still an opportunity for improvement, as indicated by the moderate fit indicated by the Normed Fit Index (NFI) value of 0.575. All things considered, these findings show that the structural model exhibits a suitable and trustworthy fit for additional hypothesis testing and interpretation.

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4.3. Hypothesis Testing

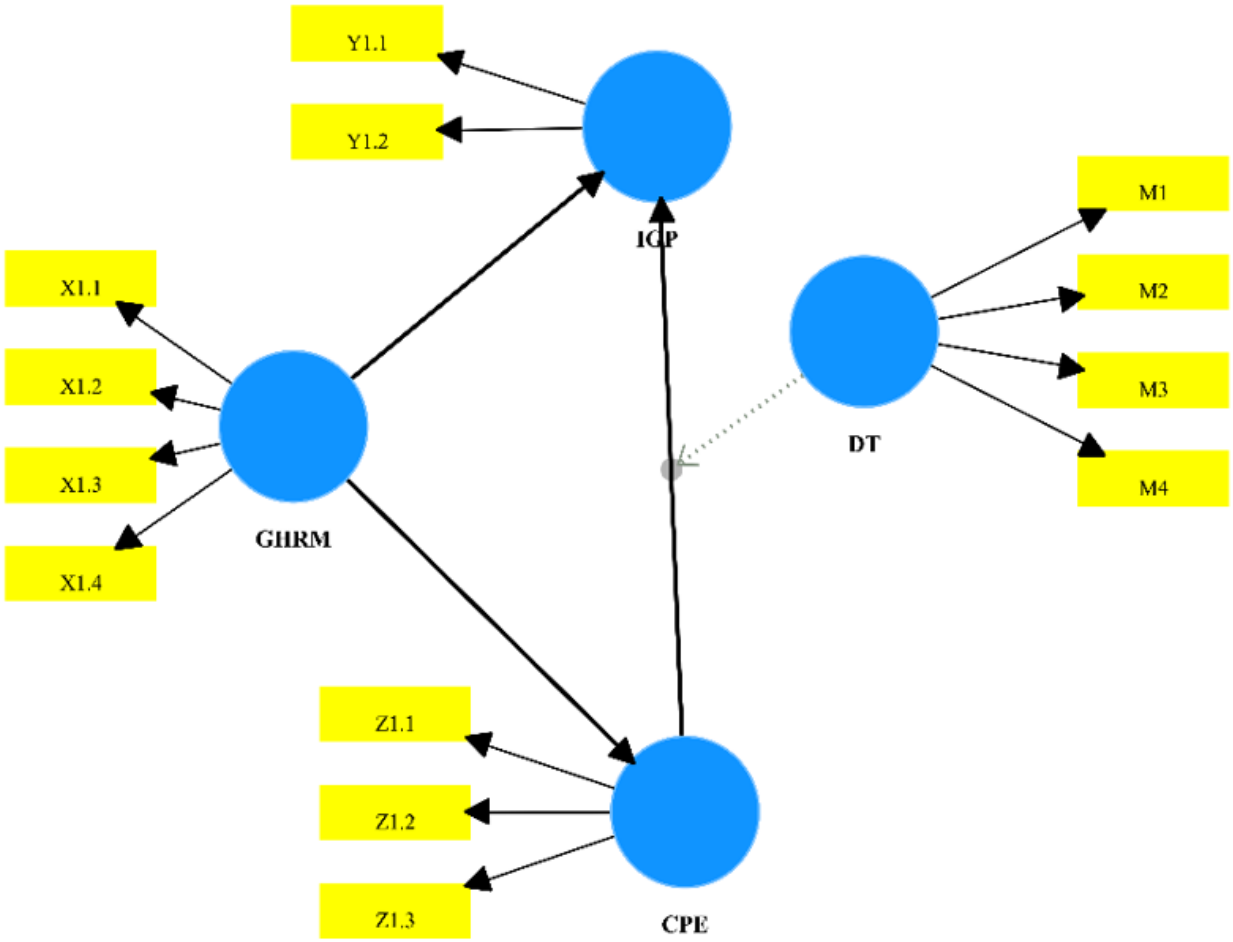

Figure 2.
Path Model Significant.

4.4. Path Model Results of Mediation

Figure 2 above illustrates the structural model of the research, which examines the direct relationships among the key variables: Green Human Resource Management (GHRM), Creative Process Engagement (CPE), Individual Green Performance (IGP), and Digital Transformation (DT). GHRM acts as the primary independent variable influencing both CPE and IGP. CPE, as a mediating variable, directly impacts IGP, demonstrating how employees' involvement in creative processes contributes to improving individual-level green performance. Additionally, DT is positioned as a moderating variable, potentially strengthening the relationship between CPE and IGP. Each latent variable (blue circles) is measured through several observed indicators (yellow boxes), reflecting different dimensions of the construct.

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Table 8.
Direct Effect Hypotheses Testing.

Hypothesis	Path	Path Coefficient	t-Statistics	p-Values	Decision
H1	GHRM → CPE	0.822	21.356	0.000	Supported
H2	CPE → IGP	0.215	2.326	0.021	Supported
H3	GHRM → IGP	0.136	1.882	0.060	Not Supported
H4	DT → IGP	0.174	1.050	0.293	Not Supported

Table 8 presents the results of direct effect hypothesis testing using PLS-SEM bootstrapping. A path is considered statistically significant when its p-value < 0.05 and the t-statistic > 1.96 (for a 95% confidence level). The results indicate that GHRM → CPE (H1) and CPE → IGP (H2) are statistically significant, meaning that Green Human Resource Management positively influences Creative Process Engagement, and Creative Process Engagement significantly enhances Individual Green Performance. However, GHRM → IGP (H3) and DT → IGP (H4) are not significant (p > 0.05), implying that GHRM and Digital Transformation do not directly affect Individual Green Performance, suggesting that their influence may occur indirectly through mediating mechanisms.

Table 9.
Indirect Effect Hypotheses Testing.

Hypothesis	Path Coefficient	T value	P values	Decision
GHRM → CPE → IGP	0.197	2.185	0.029	Supported

Table 9 presents the results of the specific indirect effect analysis, examining the mediating role of Creative Process Engagement (CPE) in the relationship between Green Human Resource Management (GHRM) and Individual Green Performance (IGP). The path coefficient of 0.197 indicates a positive and significant indirect effect. With a T-value of 2.185 (> 1.96) and a P-value of 0.029 (< 0.05), the hypothesis is supported, confirming that CPE significantly mediates the impact of GHRM on IGP. This result underscores the importance of employees' creative engagement as a mechanism through which HRM practices are transformed into improved individual green performance within the hospital.

5. Discussion

The results of this study provide significant theoretical and practical insights into how Green Human Resource Management (GHRM) influences Individual Green Performance (IGP) in the healthcare sector through the mediating role of Creative Process Engagement (CPE) and the moderating role of Digital Transformation (DT). Consistent with the Ability Motivation Opportunity (AMO) theory [25] and Social Exchange Theory (SET) [17], the findings demonstrate that GHRM practices significantly enhance CPE, which subsequently leads to improved individual green performance [17]. This implies that when hospitals implement HRM practices focused on environmental sustainability, such as green training, recruitment, and rewards, employees are more motivated and capable of engaging in creative processes that translate sustainability goals into tangible outcomes. This is consistent with previous studies by Jabbour and De Sousa Jabbour [26] and Renwick et al. [4] who found that GHRM positively affects employees' environmental behaviors through increased creativity and engagement.

Moreover, the significant influence of CPE on IGP further validates the importance of creativity as a behavioral mechanism linking HRM practices to sustainable performance. Employees who are encouraged to generate, develop, and implement innovative ideas are more likely to demonstrate environmentally responsible behaviors, as shown in Afrin and Noor [27] and Li and Zhang [28]. However, the non-significant direct relationship between GHRM and IGP in this study diverges from findings by Tang and Chen [29], who observed a direct effect. This difference may be attributed to the highly regulated and hierarchical nature of healthcare organizations, where formal policies alone are insufficient to change individual behavior without fostering creativity and empowerment.

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The results also revealed that digital transformation does not have a direct significant impact on IGP, suggesting that technology alone cannot drive behavioral change. This contrasts with findings by Hameed and Nisar [30] and Liu and Li [31], which suggested a direct link. In the healthcare context, technology appears to play a more supportive role, enhancing the effectiveness of GHRM and CPE rather than independently influencing performance. It highlights that digital tools must be integrated with human-centered strategies to fully leverage their potential in promoting sustainability.

From a practical perspective, the findings imply that hospitals aiming to improve sustainability performance should focus on aligning green HRM policies with initiatives that foster creativity and innovation. Encouraging employee participation in creative problem-solving, idea generation, and collaborative innovation can significantly enhance their contribution to environmental objectives. Moreover, managers should consider digital transformation as a complementary tool that strengthens the impact of creative engagement rather than as a standalone solution.

This study contributes to the theoretical advancement of sustainability management by demonstrating the mediating mechanism of CPE and the contextual role of DT in translating organizational practices into individual-level performance outcomes. It extends the application of AMO and SET theories to the healthcare sector and provides new insights into how human resource strategies interact with technological capabilities to drive sustainability outcomes.

Nevertheless, the study has several limitations. First, the cross-sectional design restricts causal inferences. Future research could use longitudinal data to better capture the dynamic relationships among variables over time. Second, the sample was limited to public hospitals in Surabaya, potentially limiting generalizability. Comparative studies across different hospital types, sectors, or countries could provide broader insights. Finally, future research could explore additional mediators (e.g., organizational culture or environmental commitment) and moderators (e.g., leadership style) to deepen the understanding of the mechanisms underlying green performance.

In conclusion, this study underscores the critical interplay between HRM practices, creativity, and digital transformation in achieving sustainable outcomes in healthcare organizations. It highlights the necessity of combining human-centered approaches with technological innovation to foster an organizational environment conducive to green performance.

6. Conclusion

This study aimed to investigate the influence of Green Human Resource Management (GHRM) on Individual Green Performance (IGP) through the mediating role of Creative Process Engagement (CPE) and the moderating role of Digital Transformation (DT) within the context of public hospitals. The findings provide strong empirical evidence that GHRM significantly enhances CPE, which in turn positively influences individual green performance. This supports the proposed hypotheses based on the Ability–Motivation–Opportunity (AMO) and Social Exchange Theory (SET) frameworks, emphasizing that when employees are empowered, motivated, and given opportunities through strategic HRM practices, they are more likely to engage in creative processes that lead to improved environmental performance. Furthermore, the results confirm that the indirect pathway from GHRM to IGP through CPE is significant, demonstrating the critical mediating role of creativity in translating organizational policies into individual sustainability outcomes.

However, the study also revealed that the direct effects of GHRM and DT on IGP were not significant, suggesting that these factors alone are insufficient to drive individual environmental performance without the engagement of creative processes. This finding underscores the importance of human-centered strategies in sustainability management, where technology should be integrated as a complementary tool rather than a standalone solution. The results also indicate that hospitals seeking to enhance their sustainability outcomes should focus on combining green HRM initiatives with innovation-driven work environments, while leveraging digital transformation to support rather than replace human efforts.

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From a practical perspective, the findings offer actionable insights for healthcare leaders and policymakers. Investing in green HRM practices such as environmentally oriented recruitment, training, and reward systems can foster a workplace culture that encourages innovation and proactive environmental behavior. Additionally, developing digital infrastructure to support creative engagement can further enhance employees' capacity to contribute to sustainability goals.

Despite its contributions, this study is not without limitations. The use of a cross-sectional design restricts the ability to infer causality, and the focus on public hospitals in a single city limits the generalizability of the results. Future research could adopt longitudinal approaches, include comparative analyses across different healthcare systems or industries, and explore additional mediating or moderating variables such as organizational culture, leadership style, or environmental commitment to enrich the understanding of the mechanisms driving sustainable performance.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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