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Project Management Green Commitment in PMI, Saudi Arabia: How Green Intellectual Capital, Green HRM, Green Training and Innovativeness Influence Project Performance

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Abstract:

The study examined the influence of top management green commitment (TMGC) on green intellectual capital (GIC) and its subsequent impact on green human resource management (GHRM) and project performance. Additionally, the study explored the moderating effects of green innovativeness and green training on project management performance within the Saudi Project Management Institute (PMI). Utilizing a cross-sectional design, data were collected from 478 project managers through structured survey questionnaires. Structural equation modeling (SEM) was employed to analyze the relationships among the variables. The results demonstrated a significant positive impact of top management's green commitment to green intellectual capital, which positively influenced green human resource management and project performance. Green innovativeness was identified as the most influential moderator, highlighting its critical role in enhancing project performance. However, the interaction between green innovativeness and green human resource management revealed a negative yet significant moderating effect, suggesting potential complexities in aligning innovation with HR strategies. The research emphasizes the essential role of green practices in improving project management performance, offering novel insights within the Saudi context. These findings address a gap in the existing literature and advocate for the wider adoption and refinement of green strategies in project management practices.

Keywords: *Top management, Green commitment, Green intellectual capital, Green training, Green innovativeness, project performance, Saudi PMI.*

Introduction

Environmental sustainability has become a critical priority for businesses globally in recent years. Organizations are increasingly adopting innovative strategies to integrate green practices into their operations, aiming to achieve long-term competitiveness and align with global sustainability goals (Elkington, 1997; Schaltegger et al., 2016). In this regard, Total Quality Management (TQM) has been recognized as a robust framework for embedding sustainability into organizational processes (Zeng et al., 2007). In line with this trend, Saudi Arabia's Vision 2030 has placed sustainability and innovation at the forefront of its national agenda, creating a unique opportunity for startups to leverage green practices to enhance project performance and contribute to the Kingdom's broader economic transformation (Saudi Vision 2030, 2016).

This study focuses on the role of Top Management Green Commitment (TMGC) in driving project performance within Saudi startups. Specifically, it investigates how green intellectual capital (GIC), green human resource management (GHRM), green training, and green innovativeness influence adopting TQM and project outcomes. While previous studies have explored TQM and green practices individually (Daily & Huang, 2001; Govindan et al., 2016), a significant research gap remains in understanding their interplay within the Saudi context, particularly in the emerging startup ecosystem.

By addressing this research gap, the study aims to achieve the following objectives:

1. Evaluate the impact of top management's commitment to green practices on adopting Total Quality Management (TQM) and its influence on project performance.

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2. Investigate the mediating roles of green innovativeness and green training in enhancing the effectiveness of TQM and its contribution to project outcomes.

3. Provide actionable insights for policymakers and entrepreneurs to foster a sustainable and innovation-driven business environment in Saudi Arabia.

Using robust statistical analysis and established theoretical frameworks, this study contributes to the existing literature by demonstrating how green practices can catalyze operational excellence and sustainability within Saudi Arabia's rapidly growing startup sector.

Literature Review and Conceptual Development

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) is a robust theoretical framework for understanding how organizational resources influence performance and competitive advantage. According to RBV, firms achieve sustainable competitive advantage by leveraging resources that are valuable, rare, inimitable, and non-substitutable (VRIN) (Bakar et al., 2010; Rivard et al., 2006). In the context of green practices, RBV underscores the critical role of technical innovation, human capital, and green human resource management (GHRM) in driving organizational performance. Studies by Coates and McDermott (2002) and Irwin et al. (1998) have demonstrated that organizations that effectively manage their technical and intangible resources achieve superior performance and sustained competitiveness.

Recent research has further explored the intersection between RBV and green practices. For instance, Ullah et al. (2023) and Ahmed (2021) emphasized the importance of green intellectual capital (GIC) and GHRM in fostering innovation and employee behavior that supports sustainability. These intangible resources are considered the foundation of long-term organizational success. Similarly, studies by Shanker et al. (2017) and Örnek and Ayas (2015) highlighted the transformative impact of innovative behavior on organizational performance, further reinforcing the relevance of RBV in the context of modern green strategies.

In summary, RBV provides a strong theoretical foundation for understanding how green practices influence project management and organizational performance, particularly in pursuing sustainability and competitive advantage.

Top Management Green Commitment and Green HRM

Top Management Green Commitment (TMGC) is pivotal in embedding sustainability into organizational strategies and practices. Drawing on the Resource-Based View (RBV), the commitment of senior leadership to environmental sustainability enhances organizational resources and talent, enabling sustainable performance (Bakar et al., 2010; Ren et al., 2022). Specifically, TMGC drives the development of Green Human Resource Management (GHRM), which integrates environmental considerations into key HR functions such as recruitment, training, performance appraisal, and rewards (Ali et al., 2020).

Empirical evidence strongly supports the influence of TMGC on GHRM. For instance, Ren et al. (2022) found that CEO environmental beliefs significantly impact the adoption of GHRM practices, while Bangwal et al. (2017) demonstrated that GHRM practices enhance work-life balance and environmental performance. In Saudi Arabia, where the global sustainability movement intersects with the Kingdom's economic reliance on oil, the need for TMGC to guide green HR practices within project management institutions (PMI) becomes even more critical.

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Based on these insights, the study proposes the following hypothesis:

H1: TMGC significantly and positively influences GHRM within PMI in Saudi Arabia.

Top Management Green Commitment and Green Intellectual Capital

Top Management Green Commitment (TMGC) also plays a crucial role in fostering Green Intellectual Capital (GIC), essential for driving innovation and environmental performance. Studies by Haldorai et al. (2022) and Wei et al. (2023) have demonstrated that TMGC promotes pro-environmental behaviors and enhances organizational environmental success. These findings align with Malik et al. (2020), who revealed that TMGC significantly influences the three dimensions of GIC: Green Human Capital (GHC), Green Organizational Capital (GOC), and Green Relational Capital (GRC), all of which contribute to sustainable performance.

In the Saudi context, TMGC is particularly critical in addressing environmental challenges and building green intellectual capital to support the goals of Vision 2030. Empirical studies confirm that senior leadership's commitment to sustainability enhances GIC and its related dimensions, providing a strong foundation for the following hypotheses:

H2: TMGC significantly and positively influences Green Human Capital (GHC) within PMI in Saudi Arabia.
H3: TMGC significantly and positively influences Green Organizational Capital (GOC) within PMI in Saudi Arabia.
H4: TMGC significantly and positively influences Green Relational Capital (GRC) within PMI in Saudi Arabia.

Green Intellectual Capital and Green HRM

Green Intellectual Capital (GIC) and Green Human Resource Management (GHRM) are closely interconnected, playing vital roles in promoting sustainability within organizations. Malik et al. (2020) and Ye et al. (2022) highlighted that GHRM practices when driven by GIC, enhance employee engagement and organizational performance. These practices—such as green recruitment, green training, and green performance appraisal—foster environmentally responsible behaviors among employees (Pham et al., 2020; Nisar et al., 2021).

Globally, studies across diverse industries—including hospitality, banking, and manufacturing—have emphasized the critical role of GHRM in linking GIC to organizational outcomes. For example, Marco-Lajara et al. (2023) demonstrated the strong connection between GIC and green innovation in the Spanish wine industry, further underscoring the importance of integrating GIC into HR practices.

Based on these findings, the study proposes the following hypotheses:

H5: Green Human Capital (GHC) significantly and positively influences GHRM within PMI in Saudi Arabia.
H6: Green Organizational Capital (GOC) significantly and positively influences GHRM within PMI in Saudi Arabia.
H7: Green Relational Capital (GRC) significantly and positively influences GHRM within PMI in Saudi Arabia.

Green HRM and Project Performance

Green Human Resource Management (GHRM) practices significantly enhance project performance by integrating sustainability into key HR functions. Studies by Wei et al. (2023) and Haldorai et al. (2022) have demonstrated that GHRM practices improve environmental performance and enhance organizational

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reputation. Additionally, GHRM fosters innovative employee behaviors, which are critical for achieving sustainable project outcomes (Shanker et al., 2017).

In Saudi Arabia, the role of GHRM within Project Management Institutes (PMI) is particularly significant, given the Kingdom's strong focus on sustainability and innovation under Vision 2030. Organizations can enhance employee commitment and drive superior project performance by embedding green practices into HR functions—such as recruitment, training, and performance management.

Based on these insights, the study proposes the following hypothesis:

H8: GHRM significantly and positively influences project performance within PMI in Saudi Arabia.

Moderating Role of Green Innovativeness

Green innovativeness is a critical moderator in the relationship between Green Human Resource Management (GHRM) and project performance. Studies by Haldorai et al. (2022) and Wei et al. (2023) have emphasized that organizations that effectively leverage green innovation achieve higher performance levels and enhance their environmental reputation. Furthermore, Al-Jinini et al. (2019) highlighted the connection between intellectual capital and entrepreneurial orientation, underscoring the mediating role of innovation in driving organizational success.

In the Saudi context, green innovativeness is essential for Project Management Institutes (PMI) as it enables organizations to address environmental challenges and improve project outcomes. By fostering a culture of innovation, PMI organizations can align their green practices with the broader goals of Vision 2030, ensuring sustainable and competitive project performance.

Based on these insights, the study proposes the following hypothesis:

H9: Green innovativeness significantly and positively moderates the relationship between GHRM and project performance within PMI in Saudi Arabia.

Moderating Role of Green Training

Green training equips employees with the knowledge and skills to adopt sustainable practices. Studies by Memon et al. (2022) and Nisar et al. (2021) have demonstrated that green training enhances organizational environmental performance and improves project outcomes. Organizations can effectively align their operations with global environmental standards and goals by fostering a workforce well-versed in sustainability principles.

In Saudi Arabia, green training is particularly vital for Project Management Institutes (PMI) as it builds the capacity needed to achieve the ambitious objectives of Vision 2030. Through targeted training programs, PMI organizations can empower employees to implement green practices, thereby driving sustainable project performance and contributing to the Kingdom's broader economic and environmental transformation.

Based on these findings, the study proposes the following hypothesis:

H10: Green training significantly and positively moderates the relationship between GHRM and project performance within PMI in Saudi Arabia.

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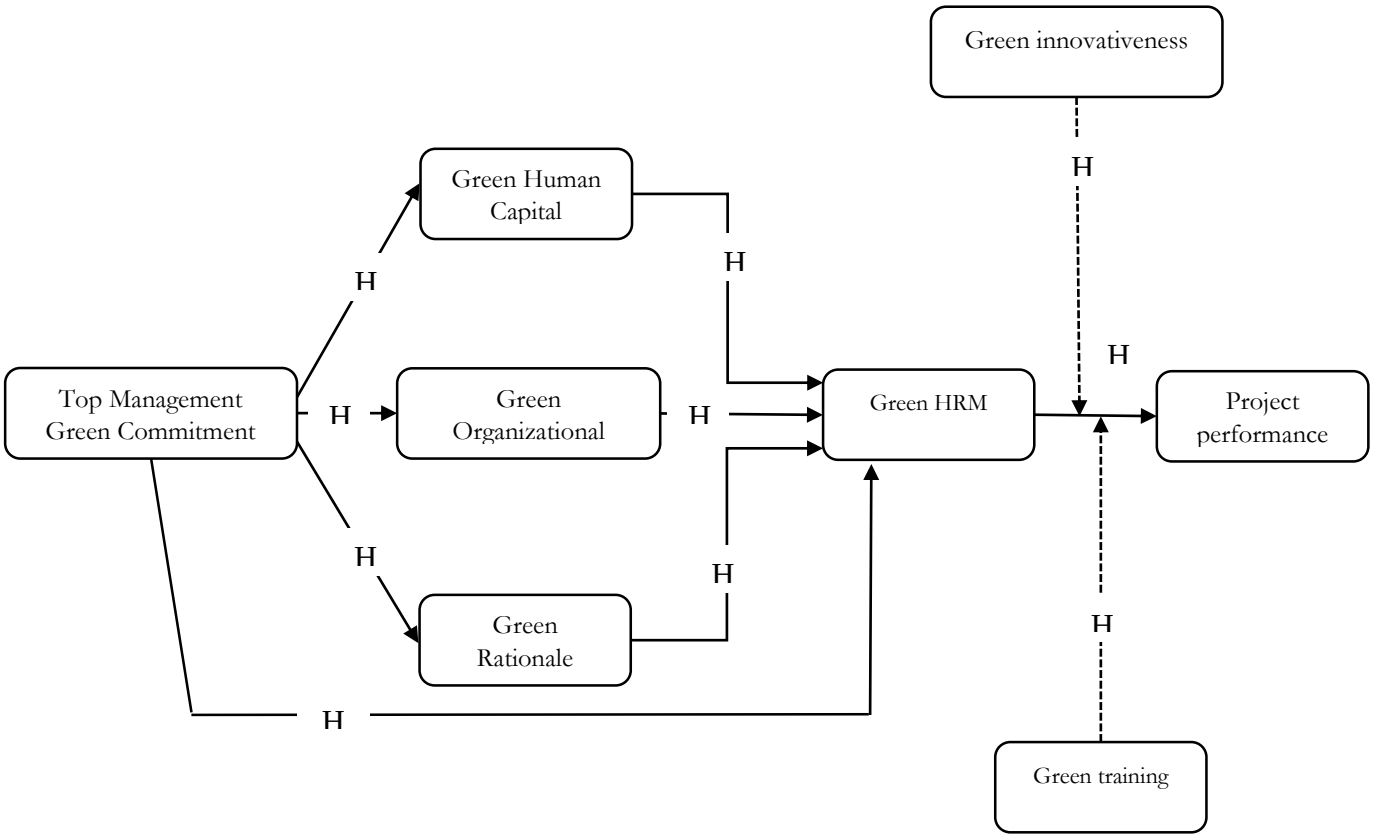

Figure 1. Conceptual framework

**Source:* Data prepared by the author for illustrative purposes

Materials and Methods

This study adopts a quantitative research design, which is well-suited for testing hypotheses and exploring relationships between variables. According to Creswell (2003), quantitative research involves collecting and analyzing numerical data through statistical techniques to explain phenomena. The study employs a descriptive and causal design to examine how green HRM practices and top management green commitment (TMGC) influence project performance within the Project Management Institute (PMI) in Saudi Arabia.

This approach ensures objectivity and reliability by utilizing structured data collection tools validated through prior research. By focusing on measurable variables and employing robust statistical methods, the study aims to provide empirical insights into the impact of green practices on project performance in the Saudi context.

Sample Size and Data Collection Procedure

The study's population comprises 10,001 employees working within the Project Management Institute (PMI), a non-profit organization based in Dhahran, Saudi Arabia, specializing in coaching and training professionals. A random sampling method was employed to ensure representativeness, giving every individual in the population an equal chance of being selected. Data were collected from professionals and senior management officials using a structured online questionnaire.

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To determine the appropriate sample size, the study followed Krejcie and Morgan's (1970) sample size determination table, which recommended a target sample of approximately 384 participants. A total of 478 survey links were distributed via email, resulting in a response rate of 66.53%, with 318 valid responses collected. The data collection process spanned three months, during which reminders were sent to participants to improve participation rates. Participation was entirely voluntary, and respondents were assured of confidentiality and anonymity throughout the process.

Measurement Scales and Items

The study utilized validated measurement scales from prior research, all demonstrating reliability values exceeding 0.70. The scales were adapted to measure the following constructs:

1. Top Management Green Commitment (TMGC):
    - 5 items adapted from Memon et al. (2022).
2. Green Human Resource Management (GHRM):
    - 6 items adapted from Karatepe, Hsieh, and Aboramadan (2022).
3. Green Intellectual Capital (GIC):
    - 14 items divided into three dimensions:
        - Green Human Capital (GHC)
        - Green Organizational Capital (GOC)
        - Green Relational Capital (GRC)
    - Adapted from Sharif et al. (2022).
4. Green Training:
    - 3 items adapted from Memon et al. (2022).
5. Green Innovativeness:
    - 3 items adapted from Aboramadan (2022).
6. Project Performance:
    - 7 items adapted from Wallace, Keil, and Rai (2004).

All items were measured using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure the questionnaire's clarity and reliability, a pilot test was conducted with 30 participants. Feedback from the pilot test was used to refine the questionnaire and improve its overall quality.

Data Analysis

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Data analysis was conducted using SPSS for demographic and descriptive statistics and Smart PLS 4 for advanced statistical modeling.

- **Descriptive Analysis:**
  - SPSS was used to calculate means, standard deviations, and frequency distributions to profile respondents based on demographic and organizational characteristics (Field, 2013). This step provided a comprehensive overview of the sample's composition and key trends.
- **Structural Equation Modeling (SEM):**
  - Smart PLS 4 was employed to test the hypotheses, validate constructs, and measure the relationships between latent variables. This method is particularly suitable for studies involving prediction and new research phenomena, as it accommodates non-normal data distributions (Hair et al., 2017).
- **Reliability and Validity:**
  - Cronbach's alpha and composite reliability scores were calculated to ensure internal consistency, with all values exceeding the recommended threshold of 0.70.
  - Convergent and discriminant validity were also tested to confirm the robustness of the measurement model. These tests ensured that the constructs were both reliable and distinct from one another.

Results of the Study

Demographic Information

Table 1 provides a detailed demographic and professional profile of the study's participants, offering valuable insights into the characteristics of the sample.

- **Gender Distribution:**
  - The sample exhibits a significant gender imbalance, with males constituting 88.1% and females only 11.9%. This disparity likely reflects the male-dominated nature of the industry or professional environment within the PMI context in Saudi Arabia.
- **Marital Status:**
  - Married individuals represent 57.5% of the sample, compared to 42.5% single. This trend could be attributed to the industry's potential preference for more experienced and stable professionals, which may correlate with marital status.
- **Professional Roles:**
  - The sample is evenly split between coaches (56.9%) and trainers (43.1%), suggesting a balanced demand for these roles within the PMI. This balance highlights the diverse professional landscape within the organization.

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- **Work Experience:**
    - Most participants are in the early to mid stages of their careers. The largest group (38.7%) has 1-2 years of experience, followed by those with 3-6 years (30.5%). A smaller percentage has less than one year (8.5%) or more than six years (22.3%). This trend suggests that the industry is particularly favorable for professionals in the developmental stages of their careers.
- **Age Distribution:**
    - Most participants (67.6%) fall within the 31-35 age range, followed by those aged 26-30 (18.6%). Participants below 25 or above 35 constitute a minority, emphasizing the dominance of middle-aged professionals in this field.
- **Educational Attainment:**
    - The data reveals that most participants hold graduate-level qualifications (65.4%), with undergraduates comprising 25.2% and postgraduates representing the smallest proportion at 9.4%. This distribution suggests that while higher education is a key requirement, advanced degrees are not as common in this context.

Overall Insights

The demographic data paints a comprehensive picture of a predominantly male, middle-aged workforce, primarily in the early to mid-stages of their careers. The participants are well-educated, with a significant balance between professional roles as coaches and trainers. These characteristics provide a contextual foundation for interpreting the study's results and understanding the dynamics within the Project Management Institute (PMI) in Saudi Arabia.

Table 1. Demographic information

Category	Status/Range	Frequency	Percent	Valid Percent	Cumulative Percent
Marital Status	Single	135	42.5%	42.5%	42.5%
	Married	183	57.5%	57.5%	100.0%
Employee Status	Coach	181	56.9%	56.9%	56.9%
	Trainer	137	43.1%	43.1%	100.0%
Gender	Male	280	88.1%	88.1%	88.1%
	Female	38	11.9%	11.9%	100.0%
Working Experience	Less than 1 Year	27	8.5%	8.5%	8.5%
	1 - 2 Years	123	38.7%	38.7%	47.2%
	3 - 6 Years	97	30.5%	30.5%	77.7%
	More than 6 Years	71	22.3%	22.3%	100.0%
Age	20 - 25 Years	5	1.6%	1.6%	1.6%
	26 - 30 Years	59	18.6%	18.6%	20.1%
	31 - 35 Years	215	67.6%	67.6%	87.7%
	Greater than 35 Years	39	12.3%	12.3%	100.0%
Education	Undergraduate	80	25.2%	25.2%	25.2%
	Graduate	208	65.4%	65.4%	90.6%

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Postgraduate	30	9.4%	9.4%	100.0%

Source: Data prepared by the author for illustrative purposes

Assessment of measurement model

The measurement model was rigorously evaluated to ensure its robustness and alignment with established validity and reliability standards. Convergent validity and reliability tests were conducted following the guidelines provided by Hair et al. (2017), Ringle et al. (2015), and Henseler et al. (2015). These tests were essential to confirm that the constructs used in the study were reliable and valid, ensuring the accuracy and credibility of the results.

Convergent Validity

Convergent validity assesses the extent to which the items of a construct share a high proportion of variance. To evaluate this, two primary indicators were used:

- **Factor Loadings:**
  - All items exhibited factor loadings greater than 0.70, meeting the threshold suggested by Hair et al. (2017) for robust convergent validity. Items with loadings below 0.70 were removed to maintain the integrity of the constructs.
- **Average Variance Extracted (AVE):**
  - The AVE values for all constructs exceeded the recommended threshold of 0.50, indicating that each construct captures more than 50% of the variance of its indicators. Notably, the 'Green Innovativeness' construct demonstrated the highest AVE (0.765), reflecting its strong capacity to explain variance within its indicators. This result aligns with prior studies that emphasize the centrality of green innovativeness in driving project performance (e.g., Aboramadan, 2022).

Reliability

Reliability was assessed using two key metrics: Cronbach's Alpha and Composite Reliability (CR).

- **Cronbach's Alpha:**
  - All scales achieved Cronbach's Alpha values above 0.70, confirming strong internal consistency. This result aligns with the findings of Henseler et al. (2015) and reinforces the reliability of the constructs used in the study.
- **Composite Reliability (CR):**
  - All constructs demonstrated CR values exceeding 0.70, with 'Green Organizational Capital' (GOC) exhibiting the highest CR (0.927). This indicates that the items collectively represent their respective constructs with high reliability, ensuring the measurement model is robust and dependable.
- **Critical Observations:**
  Removing items with low factor loadings (<0.70) had a minimal impact on the model's overall structure, ensuring that the constructs remained valid and reliable. This step was crucial in

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maintaining the integrity of the measurement model. Additionally, the high AVE (Average Variance Extracted) and CR (Composite Reliability) values suggest that the selected constructs are well-suited to capturing the dynamics of green practices within the Project Management Institute (PMI) in Saudi Arabia. These results indicate that the measurement model is robust and effective in representing the relationships between the variables under study.

Implications for the Study

The measurement model's results confirm its robustness and alignment with established validity and reliability standards. Constructs such as Green Innovativeness and Green Organizational Capital demonstrated high reliability and validity, reflecting their strong potential to drive sustainable practices within Project Management Institutions (PMI). For instance, the AVE (Average Variance Extracted) for 'Green Innovativeness' (0.765) highlights its capability to explain variance effectively, which is pivotal for fostering innovative practices in sustainability-driven projects.

Furthermore, the HTMT (Heterotrait-Monotrait) ratios validated the model's discriminant validity, with all values below the recommended threshold of 0.85 (Henseler et al., 2015). This demonstrates the distinctiveness of the constructs, ensuring that overlapping constructs do not confound the relationships observed. These findings underscore the effectiveness of the measurement model in capturing the dynamics of green practices and their impact on project performance within the Saudi context.

Table 2. Validity and reliability

Scales	Items	Factor loadings	Cronbach Alpha	Composite reliability	AVE
Green HRM			0.852	0.890	0.575
	GHRM1	0.719			
	GHRM2	0.721			
	GHRM3	0.776			
	GHRM4	0.801			
	GHRM5	0.765			
	GHRM6	0.763			
Green human capital			0.792	0.878	0.706
	GHC1	0.861			
	GHC2	0.842			
	GHC3	0.818			
Green innovativeness			0.846	0.907	0.765
	GI1	0.868			
	GI2	0.891			
	GI3	0.864			
Green organizational capital			0.900	0.927	0.717
	GOC1	0.752			
	GOC2	0.884			
	GOC3	0.868			
	GOC4	0.874			
	GOC5	0.849			
Green relational capital			0.879	0.912	0.675
	GRC1	0.808			
	GRC2	0.806			
	GRC3	0.888			
	GRC4	0.860			

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	GRC5	0.737			
Green training			0.716	0.839	0.636
	GT1	0.798			
	GT2	0.744			
	GT3	0.846			
Project performance			0.878	0.907	0.620
	PP2	0.781			
	PP3	0.719			
	PP4	0.848			
	PP5	0.791			
	PP6	0.796			
	PP7	0.786			
Top management green commitment			0.713	0.839	0.635
	TMGC2	0.817			
	TMGC3	0.747			
	TMGC4	0.824			

Note: AVE=Average variance extracted* *Source:* Data prepared by the author for illustrative purposes

The HTMT (Heterotrait-Monotrait) ratio, as shown in Table 3, has gained recognition as a robust method for assessing discriminant validity. This approach compares the size of heterotrait-heteromethod correlations with monotrait-heteromethod correlations (Henseler et al., 2015). Discriminant validity confirms that a construct is distinct from other constructs in the model, meaning it is not highly correlated with them. According to Henseler et al. (2015), an HTMT value below 0.85 provides strong evidence of discriminant validity. In other words, if the ratio between two constructs is less than 0.85, they are considered sufficiently distinct.

Overall, the results indicate that the constructs in the model are predominantly distinct and well-defined, with minimal overlap between them. This reinforces the robustness of the measurement model and ensures that high correlations do not confound the relationships observed between constructs.

Table 3:(HTMT) Ratio

Constructs	1	2	3	4	5	6	7
Green HRM							
Green human capital	0.607						
Green innovativeness	0.617	0.859					
Green organizational capital	0.608	0.649	0.603				
Green relational capital	0.722	0.623	0.631	0.651			
Green training	0.668	0.692	0.741	0.584	0.641		
Project performance	0.750	0.682	0.635	0.647	0.834	0.661	
Top management green commitment	0.751	0.847	0.757	0.630	0.663	0.820	0.750

Source: Data prepared by the author for illustrative purposes

Assessment of path model

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The structural model analysis provides compelling insights into the relationships among the constructs, affirming the study's hypotheses and offering actionable implications for sustainable project management in Saudi Arabia. By examining the direct, indirect, and moderating effects, the analysis reveals how green practices—such as Top Management Green Commitment (TMGC), Green Intellectual Capital (GIC), and Green Human Resource Management (GHRM)—interact to influence project performance. These findings validate the theoretical framework and provide practical guidance for organizations aiming to integrate sustainability into their project management processes.

Direct Effects

The results highlight the significant positive impact of Top Management Green Commitment (TMGC) on organizational assets:

- Green Human Capital (GHC): $\beta = 0.638$, $p = 0.000$.
- Green Organizational Capital (GOC): $\beta = 0.508$, $p = 0.000$.
- Green Relational Capital (GRC): $\beta = 0.528$, $p = 0.000$.

These findings affirm that TMGC is a pivotal driver of organizational resources, fostering a sustainability-focused culture within the Project Management Institute (PMI). Consequently, hypotheses H2, H3, and H4 are supported.

Indirect Effects (Mediation)

The mediation analysis reveals the critical role of GHC, GOC, and GRC in facilitating the adoption of Green Human Resource Management (GHRM):

- GHC -> GHRM: $\beta = 0.173$, $p = 0.004$.
- GOC -> GHRM: $\beta = 0.189$, $p = 0.002$.
- GRC -> GHRM: $\beta = 0.429$, $p = 0.000$.

These results underscore the importance of cultivating organizational resources—such as GHC, GOC, and GRC—to enhance the effectiveness of green HR practices. This supports hypotheses H5, H6, and H7, demonstrating that these resources are key mediators in the relationship between TMGC and GHRM.

Moderating Effects:

Two key moderating variables—Green Innovativeness and Green Training—yield contrasting impacts on the relationship between Green Human Resource Management (GHRM) and Project Performance:

- Green Innovativeness x GHRM -> Project Performance:
    - $\beta = -0.125$, $p = 0.031$.
    - This negative interaction suggests potential conflicts or complexities when green innovativeness is not aligned with HRM strategies. This finding indicates a need for further investigation to understand better how to harmonize innovation initiatives with HR practices to avoid unintended negative effects.
- Green Training x GHRM -> Project Performance:

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- $\beta = 0.175$, $p = 0.003$.

- The positive moderation highlights the indispensable role of sustained training in amplifying the benefits of GHRM. This emphasizes the importance of continuous skill development in sustainability practices to enhance project outcomes.

Overall Implications

The findings reinforce the centrality of Green Human Resource Management (GHRM) in driving project performance ($\beta = 0.458$, $p = 0.000$), thereby validating H8. This highlights that integrating sustainability into HR strategies enhances environmental conscientiousness and delivers superior project outcomes in the Saudi context. These results underscore aligning HR practices with sustainability goals to achieve operational excellence and environmental responsibility.

Table 4. Direct, Mediating, and Moderating effects

	Beta value	t-value	p-value
H1. Top management green commitment -> Green HRM	0.589	15.374	0.000
H2. Top management green commitment -> Green human capital	0.638	14.816	0.000
H3. Top management green commitment -> Green organizational capital	0.508	10.353	0.000
H4. Top management green commitment -> Green relational capital	0.528	10.983	0.000
H5. Green human capital -> Green HRM	0.173	2.850	0.004
H6. Green organizational capital -> Green HRM	0.189	3.050	0.002
H7. Green relational capital -> Green HRM	0.429	7.532	0.000
H8. GHRM-> Project performance	0.458	7.896	0.000
Green innovativeness -> Project performance	0.199	3.193	0.001
Green training -> Project performance	0.183	2.781	0.005
H9. Green innovativeness x GHRM-> Project performance	-0.125	2.158	0.031
H10. Green training x GHRM-> Project performance	0.175	2.967	0.003

**Source:* Data prepared by the author for illustrative purposes

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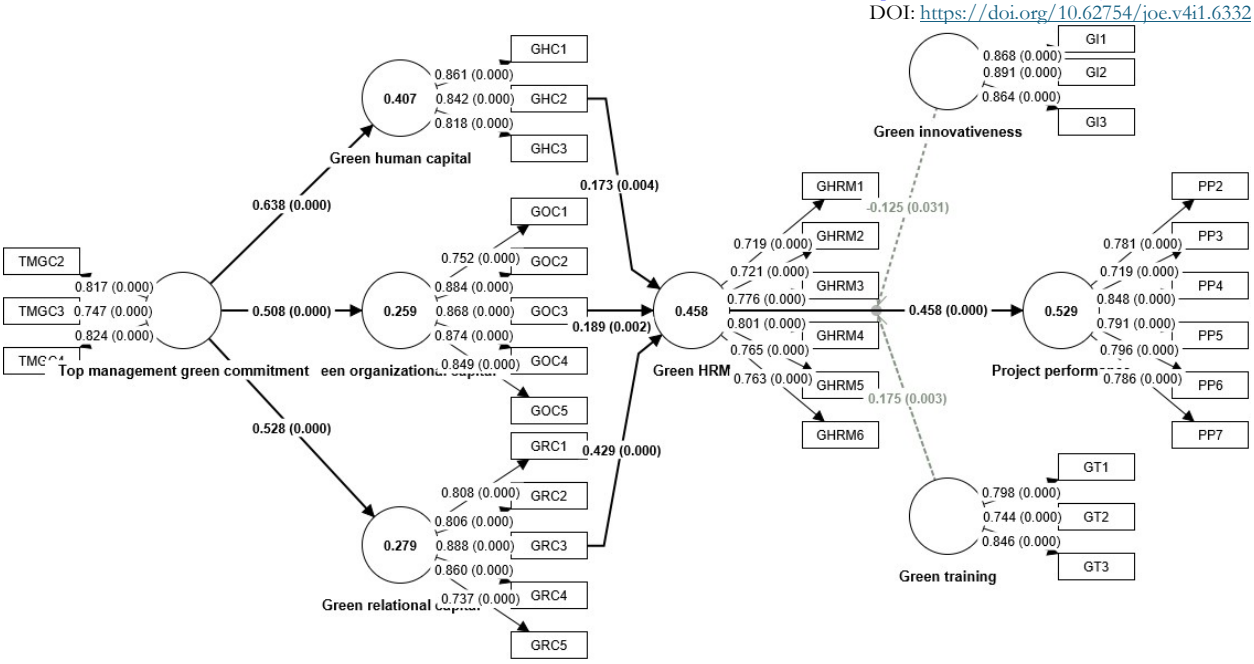

Figure 2. Structural equation modeling (SEM)

***Source:* Data prepared by the author for illustrative purposes

Assessment of model fitness

The fitness of the structural model was evaluated using two key metrics: f^2 (effect size) and R^2 (variance explained), in line with established guidelines from Cohen (1988) and Hair et al. (2017). These measures provide critical insights into the model's constructs' explanatory power and effect strength.

Effect Size (f^2)

The f^2 value, or effect size, measures the strength of individual predictors in explaining variance within the dependent variables. According to Cohen's (1988) classification:

- Small effect: $f^2 \geq 0.02$.
- Medium effect: $f^2 \geq 0.15$.
- Large effect: $f^2 \geq 0.35$.

This study's f^2 values confirm that the predictors meet the required thresholds. Several constructs demonstrate medium to large effects, particularly their influence on project performance and Green Human Resource Management (GHRM). This underscores the robustness of the model in explaining key relationships.

Variance Explained (R^2)

The R^2 values indicate the proportion of variance in the dependent variables explained by the independent variables, with higher values reflecting greater explanatory power. Table 5 summarizes the R^2 and adjusted R^2 values for each construct:

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Table 5. summarizes the R^2 and adjusted R^2 values for each construct

Construct	R^2	Adjusted R^2
Green HRM (GHRM)	45.8%	45.3%
Green Human Capital (GHC)	40.7%	40.5%
Green Organizational Capital (GOC)	25.9%	25.6%
Green Relational Capital (GRC)	27.9%	27.7%
Project Performance	52.9%	52.1%

Source: Data prepared by the author for illustrative purposes

The results demonstrate substantial explanatory power for most constructs, particularly Project Performance (52.9%) and GHRM (45.8%). This suggests that the model effectively captures the dynamics between green HRM practices and organizational outcomes, reinforcing its validity and reliability.

Critical Observations and Implications

- **Project Performance**
    - The highest R^2 value indicates that project performance is strongly influenced by the independent variables, reflecting the centrality of this construct in the model.
    - This aligns with the study's focus on enhancing project outcomes through sustainability-driven practices.
- **Moderate R^2 Values for GOC and GRC:**
    - The relatively moderate R^2 values for GOC (25.9%) and GRC (27.9%) suggest opportunities for future research to explore additional predictors or mediating variables that might enhance their explanatory power.
    - These results may reflect the complex nature of these constructs in organizational contexts.
- **Adjusted R^2 Values:**
    - The slight decrease in adjusted R^2 values accounts for the number of predictors in the model, reinforcing the validity of the results.
    - The consistency between R^2 and adjusted R^2 values indicates the stability and reliability of the model.

5. **Comparison with Literature:**
The R^2 values for Project Performance (52.9%) and Green Human Resource Management (GHRM) (45.8%) are comparable to findings in previous studies (e.g., Henseler et al., 2015;

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Hair et al., 2017), where substantial explanatory power (>40%) is observed for key constructs. This highlights the alignment of the current study with established research while offering unique insights into the Saudi PMI context. The consistency in results reinforces the validity of the model and its applicability to understanding the dynamics of green practices and project performance in a culturally and economically distinct setting.

6. Conclusion:

The assessment of model fitness confirms the robustness and validity of the structural model. The substantial explanatory power of key constructs, particularly Project Performance (52.9%), underscores the effectiveness of Green Human Resource Management (GHRM) practices in driving sustainability and project success. These findings provide a strong foundation for testing the study's hypotheses and contribute to the growing literature on sustainability in project management. By demonstrating the significant impact of green practices on organizational outcomes, this study offers valuable insights for academics and practitioners aiming to integrate sustainability into project management frameworks.

Table 6. Model fitness

Constructs	Green HRM	Green human capital	Green innovativeness	Green organizational capital	Green relational capital	Green training	Project performance	Top management green commitment	R-square	R-square adjusted
Green HRM	-	0.035	-	0.038	0.204	-	-	0.686	0.458	0.453
Green human capital	-	-	-	-	-	-	-	-	0.407	0.405
Green innovativeness	-	-	-	-	-	-	-	0.349	-	-
Green organizational capital	-	-	-	-	-	-	-	-	0.259	0.256
Green relational capital	-	-	-	-	-	-	-	0.387	0.279	0.277
Green training	-	-	0.043	-	-	-	-	-	-	-
Project performance	-	-	-	-	-	-	-	-	0.529	0.521
Top management green	0.283	-	-	-	-	-	-	-	-	-

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commitment										

***Source:* Data prepared by the author for illustrative purposes

Discussion

This study contributes to the growing body of research on sustainable project management by examining the relationships between Top Management Green Commitment (TMGC), Green Intellectual Capital (GIC) dimensions (GHC, GOC, GRC), Green Human Resource Management (GHRM), and project performance, with a specific focus on the Saudi PMI context. The findings align with existing literature while offering unique insights that reflect the region's cultural, regulatory, and economic nuances. By bridging the gap between theory and practice, this study provides a deeper understanding of how green practices can be effectively integrated into project management to achieve sustainability goals and enhance organizational performance in the Saudi context.

Analysis of Key Findings

The Role of TMGC

The study underscores the significant influence of Top Management Green Commitment (TMGC) on Green Intellectual Capital (GIC) dimensions, consistent with research by Alshamaila et al. (2013) and Timothy (2022). High beta values (e.g., $\beta = 0.638$ for Green Human Capital (GHC)) reflect the pivotal role of top management in fostering a sustainability-oriented culture. This finding supports the argument that senior leadership commitment is essential for driving green initiatives and achieving organizational success.

The Interplay between GIC and GHRM

The positive impact of GIC dimensions (GHC, GOC, GRC) on Green Human Resource Management (GHRM) aligns with the findings of Malik et al. (2020) and Asiaei et al. (2023). These results emphasize the importance of integrating green intellectual capital with HR practices to enhance organizational performance, particularly in a project management setting.

- **GHRM and Project Performance:**

The study demonstrates a strong positive relationship between GHRM and project performance ($\beta = 0.458$, $p < 0.000$). This aligns with prior research (e.g., Chawewong and Naipinit, 2023; Wei et al., 2023), highlighting how sustainable HR practices can drive superior project outcomes.

- **Moderating Effects:**

The interaction between GHRM and green training positively influences project performance, while the negative interaction with green innovativeness suggests potential resource conflicts or misalignments. These findings deviate from Yong et al. (2022) and Marco-Lajara et al. (2023), indicating a need for further investigation into the contextual factors affecting these dynamics.

Managerial Implications

The study offers several actionable insights for managers in the Saudi PMI context, providing a roadmap for integrating sustainability into organizational practices:

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- **Strategic Integration of Sustainability:**
    - Organizations should embed environmentally friendly objectives into their strategic plans, with top management leading by example.
    - Regular communication of environmental goals can foster alignment across all organizational levels, ensuring sustainability becomes a core part of the organizational culture.
- **Investing in Green HRM Practices:**

Recruitment processes should prioritize candidates with a sustainability mindset, ensuring that new hires align with the organization's green objectives.

Continuous training on environmentally conscious practices can enhance employee morale and project performance, creating a workforce that is both skilled and committed to sustainability.

- **Balancing Green Innovativeness and HRM:**

Managers should carefully align green innovativeness initiatives with HR strategies to mitigate potential resource conflicts and maximize benefits. This alignment ensures that innovation efforts complement rather than hinder HR practices.

- **Building Long-Term Partnerships:**

Collaborations with external stakeholders, clients, and suppliers on sustainability-focused projects can amplify organizational impact. These partnerships can drive collective efforts toward achieving broader environmental goals.

- **Adopting Performance Metrics:**

Integrating sustainability metrics into performance evaluation systems ensures accountability and continuous improvement. Organizations can reinforce their commitment to environmental responsibility by measuring and rewarding sustainable practices.

Limitations and Future Directions

Limitations

- Geographic Scope:

- The study is limited to Saudi Arabia, which may restrict the generalizability of the findings. Cultural and regulatory factors unique to the region may have influenced the results, challenging applying the findings to other contexts.

- Cross-Sectional Design:

- The study provides a snapshot of green practices and their impact, which may not capture dynamic changes over time. A longitudinal approach could offer deeper insights into how green initiatives evolve and affect project performance.

- Self-Reported Data:

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- The reliance on self-reported measurements introduces the potential for response bias, which could affect the validity of the findings. Future studies could incorporate objective measures to complement self-reported data.

Future Research Directions

- **Exploring Other Contexts:**
  - Replicating the study in diverse geographical and cultural settings can help differentiate between universal and context-specific patterns, enhancing the generalizability of the findings.
- **Longitudinal Studies:**
  - Future research could adopt a longitudinal design to understand better the evolving impact of green initiatives on project performance over time. This approach would provide insights into the long-term sustainability of green practices.
- **Examining Negative Interactions:**
  - Investigating the underlying causes of the negative interaction between GHRM and green innovativeness could provide valuable insights into aligning these aspects better and mitigating potential conflicts.
- **Integrating Additional Variables:**
  - Exploring the roles of leadership styles, technological infrastructure, and cultural factors as mediators or moderators could enrich the understanding of green practices in project management. These factors may offer additional complexity and opportunity for optimizing sustainability efforts.

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