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Green Economy Implementation and Green Human Resource Management as Drivers of Green Career Development in a Geothermal Power Unit

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Abstract

The transition toward a green economy requires energy organizations to align sustainable operation with human resource system that prepare employees for longterm green career demands. This study examines the effects of green economy implementation and green human resource management on green career development among employees of PLTP Kamojang PLN Indonesia Power UBP Kamojang. A quantitative explanatory survey was conducted using a saturated sample of all 134 employees of the Kamojang geothermal power unit. Data were collected throught a 39-item questionnaire measured on a five-point Likert scale and analyzed using partial least squares structural equation modeling with SmartPLS 3. The reflective measurement model met the required criteria for convergent validity, discriminant validity, and internal consistency. Green economy implementation had a positive and significant effect on green career development ($\beta = 0.458$; $t = 9.967$; $p < 0.001$), while green human resource management also had a positive and significant effect ($\beta = 0.446$; $t = 9.128$; $p < 0.001$). The model explained 45.4% of the variance in green career development. The findings show that sustainable operational practices and environmentally oriented HR systems jointly strengthen career meaning, skill acquisition, professional relationships, and awareness of changing green work demands. The single-site, cross-sectional, self-reported design limits causal inference and broader generalization.

Keywords:
Green economy implementation; Green human resource management; Green career development; Geothermal energy; PLS-SEM.

1. INTRODUCTION

The transition toward a green economy has altered organizational priorities by linking economic activity with resource efficiency, emission reduction, and workforce readiness. The energy sector is central to this transition because the expansion of renawable energy changes technologies, occupational structures, and the competencies required from employees. The International Energy Agency estimates that geothermal employment could expand substantially during this decade, but the sector may face skills shortages if workforce development does not keep pace with invesment (IEA, 2024). Renewable energy employment reached 16.2 million jobs globally in 2023, confirming that the transition is simultaneously an environmental, labor-market, and career-development issue (ILO, 2024).

Green career development is therefore relevant to organizations that must prepare employees for changing work roles rather than merely create green jobs. Green career guidance and workforce policies need to support skills development, lifelong learning, and adaptability to emerging occupations (Chang & Mann, 2024). Career sustainability similarly depends on employees' capacity to maintain meaningful work, acquire relevant skills, build professional relationships, and remain aware of environmental changes that affect career continuity (Hallpike et al., 2022), (Kim et al., 2024). In renewable energy organizations, these career dimensions are directly linked to technological change, environmental standards, and evolving competency requirements.

PT PLN Indonesia Power UBP Kamojang provides a relevant organizational setting because it operates geothermal power generation and supports Indonesia's energy transition. The unit has implemented sustainability-oriented operational practices, environmental programs, and employee development activities. Field observations and preliminary interviews indicate that employees receive training, work within environmental procedures, and experience cross-functional rotation accompanied by briefing and assistance. Rotation broadens experience and competence, but it also requires employees to interpret how new assignments, green competencies, and future roles connect to a sustainable career direction. The research problem is therefore not an absence of environmental activity; it is the limited empirical understanding of whether organizational green practices are translated into employees' green career development.

Green economy implementation represents the operational application of sustainability principles through energy efficiency, waste management, clean technology, low-carbon energy use, and organizational environmental commitment (Ali et al., 2021) (Misztal & Dziekański, 2023). These practices alter work processes and signal the knowledge and skills that will be valued in the future. Employees who are repeatedly exposed to resource-efficient technologies and environmental standards are expected to update their competencies and interpret their career prospects in relation to organizational transformation.

Green Human Resource Management (GHRM) provides the organizational mechanism that connects environmental objectives with employee management. It integrates environmental considerations into recruitment, training, performance management, and reward practices (Renwick et al., 2016) (Zihan & Makhbul, 2024). Recent reviews show that GHRM is commonly associated with employee attitudes, green behavior, engagement, innovation, and organizational performance, whereas career-related outcomes remain less developed (AlKetbi & Rice, 2024). The issue is important because sustainable operations cannot generate long-term workforce readiness unless HR systems convert environmental goals into learning opportunities, performance expectations, recognition, and career signals.

Prior research leaves three related gaps. First, green economy implementation has generally been examined at macro, policy, or sectoral levels, including its implications for green jobs and energy-sector competencies (Tănasie et al., 2022) (Kacprzak et al., 2022) (Kocot et al., 2024), but employee-level career consequences have received less empirical attention. Second, GHRM studies have primarily investigated green work engagement and pro-environmental outcomes (Ari et al., 2020) (Tran, 2023), while quantitative evidence on green career development demonstrates their relevance to innovative behavior and green employee performance (Heriyantiÿ et al., 2024) (Zhang & Chin, 2024), yet the organizational antecedents of those career outcomes are still insufficiently tested in geothermal power organizations.

his study addresses these gaps by testing green economy implementation and GHRM simultaneously as antecedents of green career development among employees of an Indonesian geothermal power unit. The novelty lies in connecting operational sustainability and green HR architecture with an employee-level career outcome using a quantitative PLS-SEM model. The study aims to determine whether green economy implementation and GHRM positively influence green career development and to identify the organizational aspects that require managerial strengthening.

1.1. Green Economy Implementation and Green Career Development

Green economy implementation at the organizational level is reflected in the consistent use of energy-efficient processes, systematic waste management, clean technology, low-carbon energy, and explicit environmental commitment. These practices do more than improve environmental performance. They reshape job content, introduce new procedures, and increase the value of competencies related to sustainability, technology, and adaptive learning (Ali et al., 2021) (Misztal & Dziekański, 2023).

Green career development refers to employees' perceived ability to sustain and advance their careers within an environmentally oriented organization through meaning perception, skill acquisition, relationship building, and environmental awareness (Kim et al., 2024). When employes work in an operational system that consistently applies green economy principles, they receive stronger signals about future occupational demands and gain opportunities to acquire competencies relevant to the energy transition. Evidence from renewable energy and energy-efficiency studies also indicates that green transformation increases the demand for new skills and strengthens the strategic role of employee competencies (Tănasie et al., 2022) (Kacprzak et al., 2022) (Kocot et al., 2024).

H1: Green economy implementation has a positive effect on green career developmet

1.2. Green Human Resource Management and Green Career Development

GHRM translates environmental strategy into employee experiences through green recruitment and selection, green training and development, green performance management, and green pay and reward. These practices communicate environmental values, develop sustainability-related competencies, incorporate environmental contributions into performance expectations, and reinforce desired behavior (Renwick, 2016) (Zihan et al., 2024).

Career development is strengthened when employees understand the competencies expected by the organization and receive opportunities, feedback, and recognition that support those competencies. GHRM should therefore increase career meaning, skill acquisition, professional relationships, and awareness of future

green work requirements. Research has shown that environmentally oriented HR practices influence engagement, pro-environmental outcomes, and career quality (Ari et al., 2020) (Tran, 2023) (Al-Oun & Al-Khasawneh, 2025). Extending these findings, GHRM is expected to contribute directly to green career development in a geothermal power context.

H2: Green human resource management has a positive effect on green career development.

2. RESEARCH METHOD

2.1. Research Design, Setting, and Sample

This study used a quantitative explanatory survey to test the effects of green economy implementation and GHRM on green career development. The research setting was the Kamojang geothermal power plant unit of PT PLN Indonesia Power UBP Kamojang in Garut, West Java, Indonesia. The organization had 237 employees across its wider business unit, while the defined population for this study comprised all 134 employees assigned to the Kamojang geothermal power unit.

A saturated sampling technique was applied because the entire defined population was accessible and relevant to the research contex (Sugiyono, 2023). A total of 134 questionnaires were distributed to employees representing 13 technical and supporting work units, and all questionnaires were returned in complete condition, resulting in a response rate of 100%. Engineering constituted the largest respondent group. This broad coverage enabled the study to capture employee perceptions of green economy implementation, Green Human Resource Management practices, and green career development across different functional responsibilities.

2.2. Instrumen Development and Data Selection

Primary data were collected through a structured questionnaire. The instrument contained 39 reflective indicators measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The indicators were adapted and contextually worded from the dimensions of green economy implementation proposed by (Misztal & Dziekański, 2023), the GHRM practices described by (Zihan et al., 2024), and the career sustainability dimensions validated by (Kim et al., 2024). The wording of the items was adjusted to the operational context of a geothermal power unit without changing the conceptual domain of each construct. A separate pilot test and formal expert-judgment procedure were not conducted. Therefore, the validity and reliability of the instrument were evaluated empirically through the reflective measurement-model assessment using PLS-SEM.

Questionnaire administration emphasized the academic purpose of the study, voluntary participation, confidentiality of responses, and the absence of correct or incorrect answers. The items were written in clear and neutral language to reduce ambiguity, evaluation pressure, and leading responses. Completed questionnaires were screened for completeness and response consistency before coding. Empirical instrument validation was conducted through outer loading, Average Variance Extracted, Cronbach's alpha, rho_A, composite reliability, and discriminant validity. No statistical common-method-bias test was reported because no supporting analysis was conducted. Since all variables were measured using self-reported responses from the same respondents at one point in time, the possibility of common method bias and social-desirability bias cannot be fully eliminated and is acknowledged as a limitation of the study.

Table 1. Research Construct and Measurement Dimensions

Construct	Dimensions	Indicators
Green Economy Implementation	Energy efficiency; waste management; clean technology use; low-carbon energy use; organizational environmental commitment	15
Green Human Resource Management	Green recruitment and selection; green training and development; green performance management; green pay and reward	11
Green Career Development	Meaning perception; skill acquisition; relationship building; environmental awareness	13

Source : Primary survei data, 2026

Table 2. Respondent Characteristics (n=34)

Characteristic	Category	Frequency	Percentage
Gender	Male	109	81,34%
	Female	25	18,66%
Age	<25 years	7	5,22%
	25-30 years	43	32.09%
	31-35 years	47	35,07%
	36-40 years	30	22,39%
	>40 years	7	5,22%

Tenure	> year	13	9,70%
	1-3 years	31	23,13%
	4-6 years	42	31,34%
	7-10 years	35	26,12%
	>10 years	13	9,70%

Source : Primary survei data, 2026

2.3. Data Analysis

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3. PLS-SEM was selected because the model contained latent constructs measured by multiple indicators and focused on explaining variance in green career development (Hair et al., 2022). All constructs were specified reflectively. The path estimates are interpreted as predictive statistical relationships within a cross-sectional design rather than as proof of temporal or absolute causality.

The measurement model was evaluated using outer loadings (>0.70), Average Variance Extracted (AVE >0.50), Cronbach's alpha and composite reliability (>0.70), and discriminant validity through the Fornell-Larcker criterion. The structural model was assessed using R^2, adjusted R^2, effect size (f^2), predictive relevance (Q^2), and bootstrapping with 5,000 subsamples. A relationship was considered significant when the t-statistic exceeded 1.96 and the p-value was below 0.05.

3. RESULTS AND DISCUSSION

3.1. Results

The descriptive assessment used item-total scores ranging from 134 to 670. Scores between 563 and 670 were categorized as very good. Table 3 shows that all constructs were perceived at a very good level. GHRM obtained the highest overall mean item-total score, followed by green economy implementation and green career development. The lower relative score of green career development indicates that employees perceived organizational sustainability and HR practices more strongly than the career outcomes produced by those practices.

Table 3. Descriptive Scores by Construct and Dimension

Construct	Dimension	Score	Category
Green Economy Implementation	Energy efficiency	583	Very good
Green Economy Implementation	Waste management	580	Very good
Green Economy Implementation	Clean technology use	585	Very good
Green Economy Implementation	Low-carbon energy use	580	Very good
Green Economy Implementation	Organizational environmental commitment	586	Very good
Green Human Resource Management	Green recruitment and selection	590	Very good
Green Human Resource Management	Green training and development	587	Very good
Green Human Resource Management	Green performance management	588	Very good
Green Human Resource Management	Green pay and reward	586	Very good
Green Career Development	Meaning perception	572	Very good
Green Career Development	Skill acquisition	571	Very good
Green Career Development	Relationship building	566	Very good
Green Career Development	Environmental awareness	568	Very good

Source: Primary survey data processed by the authors, 2026.

Green recruitment and selection were the highest-rated dimension, indicating that environmental values were strongly introduced when employees entered or were placed in the organization. Relationship building was the lowest-rated dimension, although it remained in the very good category. One item concerning the contribution of coworker collaboration to professional development obtained a score of 559, classified as good. This result identifies relational career support as the clearest area for improvement. The concentration of scores in the very good category should not be interpreted as evidence that all practices are without weakness. It may reflect the organization's established sustainability orientation, but the single-organization and self-reported design may also produce restricted response variation and socially desirable answers. For this reason, practical priorities are based on relative differences among dimensions and items, not solely on category labels.

3.1.1. Measurement Model Evaluation

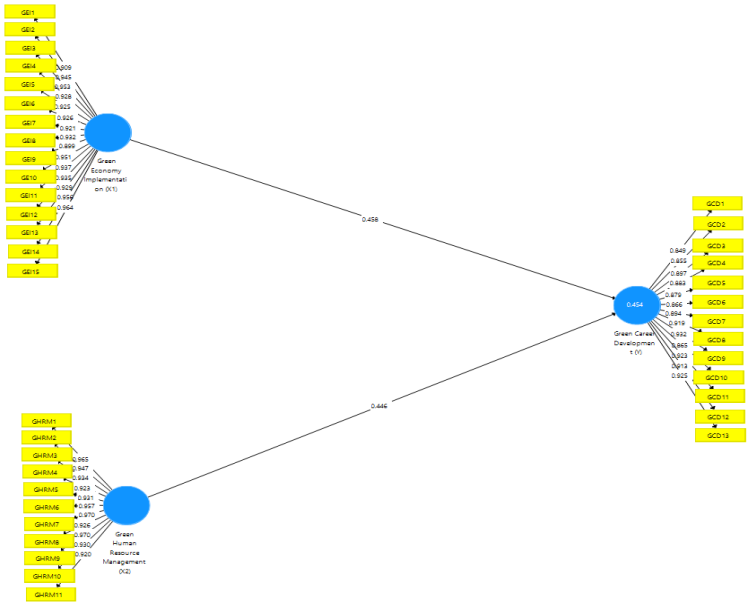

Figure 1. PLS-SEM Bootstrapping Model

The reflective measurement model was evaluated through indicator reliability, convergent validity, internal consistency reliability, and discriminant validity. All 39 indicators recorded outer loadings above 0.70, indicating that each item adequately represented its assigned construct. The detailed outer-loading results are presented in Table 4.

Table 4. Cross Loadings Results

	Green Economy Implementation	Green Human Resource Management	Green Career Development
GEI1	0,909	0,169	0,456
GEI2	0,945	0,124	0,430
GEI3	0,953	0,103	0,492
GEI4	0,928	-0,005	0,480
GEI5	0,925	0,112	0,458
GEI6	0,926	0,080	0,441
GEI7	0,921	0,096	0,437
GEI8	0,932	0,114	0,490
GEI9	0,899	0,117	0,414
GEI10	0,951	0,106	0,500
GEI11	0,937	0,111	0,484
GEI12	0,935	0,092	0,497
GEI13	0,929	0,154	0,534
GEI14	0,956	0,078	0,480
GEI15	0,964	0,093	0,488
GHRM1	0,085	0,965	0,473
GHRM2	0,156	0,947	0,464
GHRM3	0,074	0,934	0,409
GHRM4	0,092	0,923	0,476
GHRM5	0,188	0,931	0,524
GHRM6	0,112	0,957	0,516
GHRM7	0,106	0,970	0,480
GHRM8	0,030	0,926	0,416
GHRM9	0,119	0,970	0,489
GHRM10	0,056	0,930	0,408
GHRM11	0,096	0,920	0,462
GCD1	0,436	0,415	0,849
GCD2	0,392	0,502	0,855
GCD3	0,434	0,450	0,987
GCD4	0,492	0,445	0,883
GCD5	0,456	0,449	0,879

GCD6	0,422	0,485	0,866
GCD7	0,449	0,395	0,894
GCD8	0,466	0,425	0,919
GCD9	0,488	0,456	0,932
GCD10	0,440	0,378	0,865
GCD11	0,474	0,451	0,923
GCD12	0,476	0,466	0,913
GCD13	0,457	0,431	0,925

Source: SmartPLS 3 output, 2026

Outer loadings ranged from 0.899 to 0.964 for green economy implementation, from 0.920 to 0.970 for Green Human Resource Management, and from 0.849 to 0.987 for green career development. No indicator was removed because every loading exceeded the 0.70 criterion.

Discriminant validity was first examined through cross loadings. Each indicator loaded more strongly on its assigned construct than on the other constructs, showing that the indicators differentiated their respective constructs adequately.

Table 5. Average Variance Extracted (AVE)

	Average variance extracted (AVE)
Green Economy Implementation	0,873
Green Human Resource Management	0,890
Green Career Development	0,797

Source: SmartPLS 3 output, 2026

Table 6. Cronbach's Alpha & Composite Realibity

	Cronbach's Alpha	Composite Reliability
Green Economy Implementation	0,990	0,990
Green Human Resource Management	0,988	0,989
Green Career Development	0,979	0,981

Source: SmartPLS 3 output, 2026

The AVE values indicate that the constructs explained 87.3%, 89.0%, and 79.7% of the variance in their respective indicators. Cronbach's alpha and composite reliability values were substantially above the minimum threshold, confirming high internal consistency. Values approaching 0.90 or higher can also signal semantic similarity among some indicators; therefore, instrument refinement should examine possible item redundancy without removing theoretically necessary content.

3.1.2. Structural Model and Hypothesis Testing

The structural model was evaluated using the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and bootstrapping. The R^2 value indicates the proportion of green career development explained jointly by green economy implementation and Green Human Resource Management.

Table 7. Coefficient of Determination (R-Square)

	R-Square	R Square Adjusted
Green Career Development	0,454	0,445

Source: SmartPLS 3 output, 2026

Green economy implementation and Green Human Resource Management jointly explained 45.4% of the variance in green career development, while 54.6% was associated with factors outside the model. Under the criteria applied in this study, the explanatory power was categorized as moderate.

Table 8. Effect Size (F-Square)

	Green Economy Implementation	Green Human Resource Management	Green Career Development
Green Economy Implementation			0,380
Green Human Resource Management			0,359
Green Career Development			

Source: SmartPLS 3 output, 2026

Both exogenous constructs produced large effect sizes based on the f^2 criteria applied in this study. Green economy implementation had a slightly higher f^2 value than Green Human Resource Management, although

the difference was small. These effect-size results indicate substantive contributions to the explained variance and should not be conflated with statistical significance or the magnitude of the path coefficients.

Table 9. Predictive Relevance (Q-Square)

	SSO	SSE	Q^2 (=1-SSE/SSO)
Green Economy Implementation	2010,000	2010,000	
Green Human Resource Management	1474,000	1474,000	
Green Career Development	1742,000	1125,634	0,354

Source: SmartPLS 3 output, 2026

The Q^2 value for green career development was 0.354. Because the value was greater than zero and exceeded the 0.35 benchmark adopted in the study, the model demonstrated high predictive relevance for the endogenous construct. Q^2 reflects the model's out-of-sample-oriented predictive relevance under the blindfolding procedure; it is not interpreted as a percentage of causal influence.

Bootstrapping with 5,000 subsamples was used to test the direct effects. A path was considered significant when the t-statistic exceeded 1.96 and the p-value was below 0.05.

Table 10. Direct Effects and Hypothesis Decisions

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Green Economy Implementation (X1) -> Green Career Development (Y)	0,458	0,462	0,046	9,967	0,000
Green Human Resource Management (X2) -> Green Career Development (Y)	0,446	0,448	0,049	9,128	0,000

Source: SmartPLS 3 output, 2026

Green economy implementation had a positive and significant predictive relationship with green career development ($\beta = 0.458$; $t = 9.967$; $p < 0.001$), supporting H1. Green Human Resource Management also had a positive and significant predictive relationship ($\beta = 0.446$; $t = 9.128$; $p < 0.001$), supporting H2. The positive coefficients indicate that stronger sustainability-oriented operations and HR practices were associated with stronger green career development. Given the cross-sectional design, the results support the hypothesized directional model but do not establish temporal causality.

3.2. Discussion

3.2.1. Effect of Green Economy Implementation on Green Career Development

The positive and significant coefficient indicates that stronger implementation of green economy principles is associated with stronger green career development. The f^2 result indicates a large contribution to the model's explained variance, showing that operational sustainability is substantively relevant to employee careers. Energy efficiency, waste management, clean technology, low-carbon energy use, and organizational environmental commitment create recurring learning demands and clarify the competencies employees need to remain relevant in a transforming energy sector. The finding should nevertheless be interpreted as a cross-sectional predictive relationship rather than definitive evidence that operational practices alone cause career development.

This result supports the conceptual position that organizational green transformation changes both work systems and career requirements (Ali et al., 2021) (Misztal & Dziekański, 2023). It is also consistent with evidence that the green transition increases demand for new competencies and links employee capability with energy efficiency and sustainable development (Tănasie et al., 2022) (Kacprzak et al., 2022). The present study extends those sectoral findings by demonstrating an employee-level career outcome in a geothermal power unit.

Operational conditions at PT PLN Indonesia Power UBP Kamojang explain the relationship. Employees work within environmental rules that include waste separation, efficient material use, clean work procedures, electric equipment, electric vehicles, and a Clean Energy Day program. Environmental commitment is also visible through Kamojang Bersih (KASIH), conservation activities, and the organization's environmental performance recognition. These practices expose employees to sustainability-oriented routines and encourage them to update technical knowledge, understand future energy roles, and connect their work with the wider transition.

Organizational environmental commitment received the highest score within green economy implementation, while low-carbon energy use was relatively lower. The managerial implication is that

environmental commitment should be translated more evenly into employees' daily exposure to low-emission facilities and measurable unit-level achievements. Expanded access to low-emission equipment, clearer communication of emission-reduction results, and competency development linked to new technologies would strengthen the career value of existing sustainability programs.

3.2.2. Effect of Green Human Resource Management on Green Career Development

The positive and significant path from GHRM shows that environmentally oriented HR practices are associated with employees' green career development and make a large contribution to the explained variance. Recruitment and placement communicate environmental values, training develops relevant knowledge and skills, performance management clarifies expected environmental contributions, and rewards signal which behaviors and competencies are valued. These mechanisms help employees interpret career meaning and prepare for future work demands. The result does not imply that GHRM is the sole causal determinant because career development may also depend on leadership, culture, technology, job design, and individual learning orientation.

The result is consistent with GHRM theory, which positions HR practices as the channel through which environmental strategy becomes employee capability and participation (Renwick et al., 2016; Zihan & Makhbul, 2024). It also supports studies linking GHRM with engagement, pro-environmental outcomes, and career quality (Ari et al., 2020; Tran, 2023; Al-Oun & Al-Khasawneh, 2025). The contribution of this study is more specific: it demonstrates that GHRM is relevant not only to immediate attitudes or behavior but also to employees' perceived capacity to sustain a career in a green energy organization.

The finding is consistent with conditions at the research site. Environmental values are introduced through orientation and safety induction. Employees receive environmental and competency-related training, environmental considerations are incorporated into performance indicators, and rotation across functions provides opportunities to acquire broader experience. These practices can support career adaptability when employees are placed in roles that differ from previous assignments. Training, briefing, and assistance reduce the risk that rotation becomes merely administrative movement without development value.

Green pay and reward received the lowest score within GHRM. Although it remained very good, employees perceived environmental recognition less strongly than recruitment, training, and performance management. The organization should therefore establish more visible and structured recognition for individual or team contributions to environmental innovation, compliance, and improvement. Recognition can include internal publication of best practices, access to sustainability certification, development assignments, or formal appreciation connected to competency and career records.

3.2.3. Integrated Interpretation and Managerial Implication

The two antecedents had similar path coefficients and large effect sizes. Green career development is therefore produced by complementary systems. Operational sustainability creates the context and competency demand, while GHRM provides the mechanisms for learning, evaluation, recognition, and progression. Sustainability programs without an aligned HR architecture may generate operational compliance but weak career signals. GHRM without substantive green operations may likewise become symbolic because employees have limited opportunity to apply green competencies.

Green career development received a lower overall score than both antecedent constructs, and relationship building was its weakest dimension. Employees appear to gain career value mainly through work experience and skill acquisition, while mentoring, professional networking, and coworker support are less prominent. A formal green competency map should connect environmental training, rotation experience, performance results, and future roles. Mentoring across units, structured knowledge-sharing forums, and clearer comm.

3.2.4. Limitations and Future Research

The findings should be interpreted within several limitations. First, all constructs were measured through self-reported questionnaires from the same respondents at one point in time. Procedural safeguards were applied, but no statistical common-method-bias test is reported because no supporting output was available. Common method bias, social-desirability bias, restricted response variation, and reverse causality therefore cannot be ruled out. Second, the study involved a single geothermal power unit and saturated its local population; the results accurately describe that unit but cannot automatically be generalized to other renewable or conventional energy organizations. Third, the model included only two organizational antecedents and explained 45.4% of the variance in green career development. Leadership, organizational culture, technological innovation, perceived organizational support, job design, and individual learning orientation may account for additional variance. These variables were not added after data collection because doing so would require new validated measures and new observations. Future studies should test them prospectively using multisite, longitudinal, or multi-source designs. Fourth, the very high reliability values suggest that some indicators may be semantically close; future scale refinement should evaluate item redundancy and use additional discriminant-validity diagnostics.

4. CONCLUSION

This study finds positive and significant predictive relationships between green economy implementation, Green Human Resource Management, and green career development among employees of PT PLN Indonesia Power UBP Kamojang. Operational sustainability practices are associated with career development by creating work demands and learning experiences related to environmental efficiency, clean technology, low-emission energy, and organizational commitment. GHRM is associated with the same outcome by embedding environmental values in recruitment, training, performance management, and recognition. These findings answer the research objective while remaining subject to the limitations of a single-site, cross-sectional, self-reported design.

The findings show that green career development requires alignment between substantive sustainability practices and HR systems. Employees need not only exposure to green operations but also a clear understanding of how acquired competencies, assignments, performance contributions, and professional relationships support future career roles.

PT PLN Indonesia Power UBP Kamojang should prioritize three evidence-based improvements derived from the relatively lowest dimensions and items. First, low-carbon practices should be expanded across work units and their unit-level emission or energy-efficiency results communicated more clearly. Second, the relatively lower green pay and reward dimension should be addressed through visible, structured recognition of individual or team contributions to environmental innovation, compliance, and improvement. Third, the lowest green career development dimension, relationship building, should be strengthened through mentoring, cross-unit knowledge sharing, professional networks, participation in sustainability projects, and a green competency map that links training and rotation experience to future career pathways.

Future research should compare multiple renewable energy organizations and use longitudinal or multi-source data. Leadership, green organizational culture, technological innovation, perceived organizational support, and individual learning orientation should be tested as additional antecedents, mediators, or moderators. Importance-Performance Map Analysis and multi-group analysis may also identify more specific priorities across work units, tenure groups, or job levels.

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