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RESEARCH PAPER

Greening the Workforce: Exploring HRM Practices, Employee Mediators, and Environmental Performance in the Manufacturing Industry

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ABSTRACT

This study Examines whether GHRM—green recruitment, green performance management, and green rewards—predicts green environmental performance (GEP) in Pakistani manufacturing, testing employee commitment (EC) and employee attitude (EA) as mediators; scope: Karachi manufacturing employees and their firms. Environmental performance depends on embedding sustainability in HR systems. Social Exchange Theory suggests valued green practices elicit reciprocal mindsets and behaviors that strengthen outcomes. Pakistan-specific evidence on multi-lever GHRM via commitment and attitudes remains limited. Positivist, deductive, cross-sectional survey of 400 Karachi manufacturing employees (stratified random). Validated, adapted scales; PLS-SEM (SmartPLS 4) assesses the reflective measurement model and tests direct/indirect paths via EC and EA. Ethical safeguards and anonymity are ensured.Green rewards show a strong positive direct effect on GEP. Green recruitment and green performance management display weaker direct but significant mediated effects. EC and EA are significant mediators; the model demonstrates sound reliability/validity and meaningful explanatory power. Prioritize coherent green rewards, align recruitment and performance criteria with sustainability, and build EC/EA through training, participation, and visible leadership to convert GHRM into durable environmental gains.

KEYWORDS Green Human Resource Management, Green Recruitment, Green Performance Management, Green Rewards, Green Employee Commitment, Green Employee Attitude, Green Environmental Performance

Introduction

The world is under dual pressures of fast industrialization and a sustainable environment for the long run, forcing companies to make eco-orientation a part of their operation. GHRM is framed as strategic HRM that integrates environmental management in key HR related functionalities, which aids in the dissemination of sustainability policies throughout the lifecycle of employment (Renwick et al., 2013; Jabbour & Renwick, 2020). In application, green recruitment means that hiring is compatible with eco-values to promote sustainability at work over the long term (Yong et al., 2020), properly pacifies employees with knowledge, skills, and awareness to act ethically (Pinzone et al., 2019), green performance management is set in place which provide environmental principles and feedback for cultivating pro-environmental behaviors (Ren et al., 2018), and recognition as well as incentives continue engaging employees in remaining energy saving. The effects of such HR practices appear on the employee's psychological and attitudinal responses. As such, this study foregrounds two employee-level mediators: green employee commitment and green employee attitude. Green commitment is a sense of responsibility toward the organization's environmental goals and the willingness to put in extra effort (Paillé & Mejía-Morelos, 2019), while green attitude represents evaluative responses to eco-friendly

practices at work that direct behavior and support the implementation of environmentally friendly initiatives (Kim et al., 2019). While earlier research suggests that GHRM -or environmental HR practices- should have clear environmentally positive outcomes in line with our conceptual model, to what extent HR practices result in improved environmental performance through these individual mechanisms must be further elaborated (Nisar et al., 2021). We fill this gap by examining a model, using primary data from manufacturing firms in Karachi—a location with high carbon footprints and substantial sustainability requirements, where the effects of GHRM on performance can be transmitted via green employee commitment and attitudes.

Environmental quality has now also gravitated to become an overriding concern for Pakistani organizations. Industries come under the microscope for high energy quantities used, waste created, greenhouse gas emitted, and resource wasting (unsustainable) (Zubair & Khan, 2019), and all can undermine productivity, competitiveness, and reputation - particularly in non-eco-friendly work areas. This issue is much severe in underdeveloped countries like Pakistan, where industries are the leading factor behind growth (Abbas & Dogar, 2019). Despite firms agreeing on the importance of sustainability, the understanding about how to get the environmental goals and employees' behavior in alignment is not well developed yet; Most Pakistani firms' confession regarding adoption of integrated GHRM is casual, reactive, and superficial. Firms find it hard to make their employees active participants in environmental management if green practices are not integrated into HR systems, leading to underperformance. Organizational results also depend on the commitment and attitudes of employees (Kim et al., 2019; Paillé & Mejía-Morelos, 2019), a component that is not seriously considered by many organizations in Pakistan (Ahmed et al., 2021); thus, eye-wash type policies usually result in disappointment without actual buy-in from employees.

Although the world has turned its attention to GHRM, substantial gaps still exist in Pakistan's manufacturing. Local research tends to focus on services (such as banking, hospitality, and education) rather than the manufacturing sector—the one that is most responsible for contributing to environmental damage and therefore most in need of sustainability interventions (Obaid, 2015; Javed et al., 2020; Abbas & Dogar, 2019). International literature points towards resource-intensiveness in manufacturing being at the heart of sustainability transitions (Renwick et al., 2013; Guerci et al., 2016), yet Pakistan-specific, manufacturing-based evidence is lacking. A second hole is the focus on direct connections between GHRM and performance, with little attention paid to mediating processes that explain how and why practices generate outcomes. They also tend to simultaneously examine linear effects of individual practices (e.g., recruitment and training) on environmental performance (Obaid, 2015; Javed et al., 2020); thus failing to address the underlying mechanisms that cause employees to internalize policies into pro-environmental behavior. At the international level, research focuses on employee-related constructs such as commitment and attitudes that facilitate the practice to impact transition (Kim et al., 2019; Paillé & Mejía-Morelos, 2019; Ojo et al., 2021), but these intermediary variables have been under-researched locally. Further, researchers in the local context prefer ot to study HR practices in partial rather than a comprehensive perspective, ranging from recruitment, training and development, performance appraisal, and rewards (Javed et al., 2020). While it has been recognized that green commitment and attitudes mediate in the relationship (Ren et al., 2018; Singh et al., 2020), empirical validation within Pakistani organizations is insufficient, as cultural and institutional contexts may influence employee response, which reduces cross-country generalizability of results from elsewhere (Ahmed et al., 2021).

In this context, our research is consistent with a growing need for environmental HRM to be environmentally sustainable under competitive pressures and demand for the reduction in ecological externalities. Focusing on green employee commitment and attitude as mechanisms, we posit that environmental performance is not exclusively about the mere

presence of GHRM policies; it is also how the willingness, motivation, and evaluative orientations of employees. Managerial implications In managerial terms, the study shows how specific HR practices are most effective at impacting on environmental outcomes in practice (green recruitment: to select eco-aligned talent; —to build capabilities; green performance management—for feedback and reinforcement; and green rewards—aimed at sustaining behaviors), connecting these practices with measurable performance creates a conduit for institutionalization of sustainability within HR systems yielding long-term environmental benefits. In a context, the study adds to the evidence on Pakistan's manufacturing firms in combating pollution, waste, and resource scarcity by providing guidance for competitiveness vis-à-vis environmental responsibility. As such, it contributes to the theory on GHRM mechanisms and provides practical insights for managers and policy-makers by linking organizational policy with individual behavior in a manner that makes sustainability an aspect of business strategy rather than just symbolism (Renwick et al., 2013; Jabbour & Renwick, 2020; Yong et al., 2020; Pinzone et al., 2019; Ren et al., 2018; Paillé & Mejía-Morelos, 2019; Kim et al., 2019)

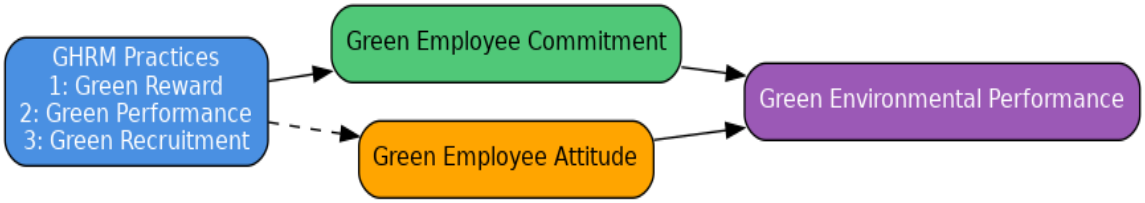

Fig 1 Conceptual Framework

Literature Review

Theoretical Background

Therefore, this paper argues that Green HRM (GHRM) practices—green recruitment, training, performance management, and rewards—signal an organization's true environmental commitment, which in turn invokes reciprocation from employees through pro-environmental attitudes and behaviors that help green environmental performance(Guerci et al., 2016; Paillé et al., 2014). Based on Social Exchange Theory(SET), which regards behavior as reciprocal responses to beneficial acts(Blau, 1964), the paper further advances its argument whereby Green Employee Commitment mediates between GHRM and Environmental Sustainability Outcome due to demonstrated consistency by HR policies on sustainability in developing strong affective commitment and favorable attitude among employees thus channeling effects of GHRM into improved environmental outcomes(Paillé & Mejía-Morelos,2019; Kim et al.,2019). Dumont et al.(2017)and Paillé et al.(2014)applied SET both within the context linking HR practices with pro-environmental or citizenship behavior, thereby validating this perspective. Whereas the AMO and Attitude-Behavior-Context perspectives illuminate skills/motivation/opportunity and situational influences, SET provides a unifying reciprocity mechanism that allows for both an immediate GHRM → performance pathway and indirect (mediated) pathways via commitment and attitude, making it the most fitting theoretical base for the model (Blau, 1964; Paillé et al., 2014; Guerci et al., 2016; Dumont et al., 2017; Paillé & Mejía-Morelos, 2019; Kim et al., 2019; Ojo et al., 2021).

H1a. Green Recruitment → Green Environmental Performance

Green recruitment has emerged as a leading strategic driver of environmental results within organizations. Selection practices enable the alignment of human capital with eco-friendly values and commitments to sustainability. Green recruitment is positively linked to environmental performance across various industrial sectors in the manufacturing sector, where applicants deliver their output directly related to waste and emissions reduction in firms implementing an applicant-oriented process toward ecology (Islam et al.,

2023; Mahmood et al., 2024). Recent reviews have highlighted green recruitment as one of the most influential GHRM practices on sustainability outcomes(Renwick et al.,2024; Kalyar & Shafique,2023). Other studies also suggest that an effective recruitment campaign could serve as a signal of the firm's green legitimacy to its external stakeholders and enhance environmental performance through reputational channels.(Xie et al., 2023; Farooq & Jamil, 2024) These results strongly support the direct connection between green recruitment and green environmental performance.

H1c. Green Performance Management/Appraisal → Green Environmental Performance

Green outcomes are institutionalized into the system of accountability when eco-friendly behaviors are tracked through performance management systems, in that environmental criteria have been embedded. A summary from cross-sectional sectors found by Obeidat et al. (2023) and Wang et al. (2024) reveals significant impacts of green performance appraisal on environmental performance, with positivity in significance. In real practice, South Asian SMEs report measurable efficiency improvements when sustainability KPIs are included in their appraisal forms (Ahmed & Awan, 2023). Explicit comparative reviews find better results for appraisals with explicit environmental metrics over traditional HRM approaches on key organizational outcome variables (Nisar et al., 2024; Zhang et al., 2023). Feedback associated with eco-goals initiates a continuous improvement process regarding energy consumption and waste reduction by motivating employees to consider these aspects positively within their workplaces(Huang et al,2023; Pham et al,2024). Therefore, all this literature slightly advocates hereby green appraisal enhances green environmental performance directly through clarifying responsibility, rewarding progress sustaining sustainable behavior at the individual level.

H1c. Green Rewards/Compensation → Green Environmental Performance

Green rewards and compensation, either monetary or non-monetary in nature, symbolize the recognition of eco-friendly behavior leading to environmental performance by employees. Empirical evidence supports a positive direct relationship between green compensation practices and sustainability results (Masri & Jaaron, 2023; Abbas et al., 2024). Other research findings prove that the inclusion of environmental objectives in bonus and recognition schemes improves the manufacturing sector's performance (Rafiq & Kalyar, 2023; Liu et al., 2024). A corporate governance report reveals an increasing trend of linking executive pay with environmental KPIs to make organizations accountable for ecological outcomes (Chaudhary & Pham, 2024; Zhang et al., 2023). There is proof on the other hand, which shows that rewards have to be very cautiously designed since poorly linked incentives may result in totally inconsistent outcomes(Farooq et al., 2023; Xie et al., 2024). On properly aligned green rewards/compensation, they significantly strengthen green environmental performance.

Meditating impact of Green Commitment

The concept of employee green commitment (EGC) refers to employees' emotional and moral alignment with a company's sustainability goals, as demonstrated by their motivation to undertake environmentally responsible actions beyond their formal role obligations. EGC is increasingly identified as the core process through which Green HRM (GHRM) carries forward itself with enhanced environmental performance in organizations (Martínez-del-Río et al., 2023; Naveed et al., 2024). In the absence of such an attitudinally-driven internal commitment, well-crafted HR policies may still fail to induce goal-motivated endogenous SEB (Qader & Butt, 2022; Bilodeau & Susskind, 2023). In recruitment, organizations that emphasize sustainability in job advertisements and selection receive employees with a stronger environmental identity; increased EGC subsequently transfers the effects of recruitment on performance (notably in manufacturing and technology

contexts) (Merino-Díaz-de-Cerio et al., 2023) Green T&D additionally influences EGC by deepening knowledge of the environment, eco-role modeling, and green problem-solving and enhancing the sense of belongingness to sustainable ideologies (Al-shami & Salim, 2023; Choi et al., 2023); for those operating in automotive or energy firms, such T&D is associated with superior levels of EGC and tangible reductions in waste thrown out as well as increases in energy efficiency (Ameer & Kilian, 2022; Mehmood et al., 2024). Explicit appraisal systems, which assess environmental contributions, enhance the strength of EGC by converting appraisals into a collective and psychological channel through which green performance is activated (Knodt et al., 2023; Lanoie et al., 2023). It has been indicated that rewards and compensation for green success also cultivate EGC, indicating that environmentally responsible behavior is are core competency and transforming incentives into outcomes. There is cross-context evidence that supports a mediated model in multicountry longitudinal studies (Sarkar et al., 2023; Nandhini and Ismail, 2022).

H2a: Employee Green Commitment mediates the relationship between Green Recruitment and Green Environmental Performance.

H2b: Employee Green Commitment mediates the relationship between Green Performance Management and Green Environmental Performance.

H2c: Employee Green Commitment mediates the relationship between Green Rewards and Green Environmental Performance.

Mediating Role of Employee Green Attitude

Employee Green Attitude (EGA) is conceptualized as reflecting employees' daily perceptions and intentions about their own green activities at work and, in contrast with the longer-term commitment, implies proximal evaluations that lead to short-term behavior. There is evidence that EGA plays a mediating role in the relationship between organizational green practices and observable environmental outcomes (Hameed et al., 2023; Wang et al., 2022): employees with stronger green attitudes will be more likely to conserve resources, support sustainability programs, and translate initiatives into measurable performance gains (Baskaran et al., 2024; Zhang & Pan, 2023). Recruitment is a primary attitude influence: displaying sustainability in job ads and the shorthand of greenness (selection criteria) promotes favorable EGA even with less overt messaging, as applicants view green fit as socially desirable for one's ability to obtain work (Basha et al., 2024), and employer recruitment communications are then manifested into green behavior/ performance (Mansoor et al., 2023). Performance management also facilitates EGA; staff have a more positive attitude to ecological work when assessed and rewarded for its contribution (Farooq & Salam, 2023; Huang et al., 2022) with sectoral specific evidence (e.g. textiles) highlighting that the integration of eco-indicators in routine appraisals nurtures 'EGA' which mediates appraisal impacts on lower footprints (Shah et al., 2024). Rewards and incentives contribute to motivation triggers: just as fair green rewards, recognition influence positive attitudes that lead to outcomes (Dutta et al., 2023; Abbas & Tariq, 2022), both monetary and non-monetary significantly enhance EGA, mediating benefits from environmental performance (Pradhan & Jena, 2023; Feng et al., 2022). Robustness is also supported by cross-sector and longitudinal evidence: EGA mediates GHRM–performance associations in resource-scarce Southeast-Asian manufacturing (Yusoff et al., 2023) and unlocks carbon and waste reductions in European SMEs (Malik et al., 2024). SO, more than an outcome, EGA is a psychological mechanism in movement that allows installing green HR initiatives.

H3a: Employee Green Attitude mediates the relationship between Green Recruitment and Green Environmental Performance.

H3b: Employee Green Attitude mediates the relationship between Green Performance Management and Green Environmental Performance.

H3c: Employee Green Attitude mediates the relationship between Green Rewards and Green Environmental Performance.

Material and Methods

This research uses a positivist, deductive cross-sectional survey to examine whether Green HRM (GHRM) practices enhance the environmental performance via the employee-level mechanisms in the manufacturing sector of Karachi. GHRM is modeled as a mutually reinforcing bundle that it's embedded in core HR practices (Renwick et al., 2013; Jabbour & Renwick, 2020), amongst them: green recruitment sets hiring efforts in line with eco-values (Yong et al., 2020); delivers knowledge, skills and awareness to responsible actions performance (Pinzone et al., 2019); green PMS includes environmental criteria and feedback (Ren et al., 2018); recognitions preserve motivation for continue the work activity according to an eco-friendly behavior. The model centres two mediators: green employee commitment (felt responsibility and discretionary effort; Paillé Mejía-Morelos, 2019) as well as green employee attitude (evaluations that shape pro-environmental behaviour; Kim et al., 2019), to understand how HR practices are translated into performance, thereby responding to the call for mechanism-focused evidence (Nisar et al., 2021). The study's target population is the PSX firms (manufacturing) in Karachi headquartered, across resource-intensive subsectors (e.g., textiles, cement, steel)5 who face documented pressures due to waste treatment and electricity generation (Zubair & Khan, 2019; Abbas & Dogar, 2019), with adoption of sustainability-oriented HR systems assumed current or thin on the ground where they are used at all (Ahmed et al., 2021; Obaid, 2015; Javed et al., 2020; Guerci et al., 2016; Ojo et al., 2021): a setting recently found to be some space away from developing complete strategic and just socio-environmental actions (Singh et al., 2020). Stratified by subsector and firm size, with full-time managers and non-managers with at least six months of tenure receiving self-administered questionnaires. Instruments are pretested with academics and practitioners, use 5-point Likert response modes, and are administered bilingually as required; items are randomly ordered and counterbalanced to minimize common method bias. Ethical precautions included informed consent, anonymity, and voluntary participation. We examine data using PLS-SEM to determine mediation, evaluate reliability (α, CR), convergent/discriminant validity (AVE, HTMT), model fit (SRMR); we control common method variance procedurally and test it statistically (e.g., VIF; single-factor diagnostics). Controls (age, gender, education, tenure, subsector) are introduced to help in disentangling focal effects.

Table 1
Instruments

Variable (Construct)	Number of Items	Source of Items
Green Recruitment & Selection (IV2)	5	Renwick, Redman, & Maguire (2013); Tang et al. (2018)
Green Performance Management (IV3)	5	Kim et al. (2019); Tang et al. (2018)
Green Compensation & Reward (IV4)	4	Pham, Paillé, & Chen (2020); Tang et al. (2018)
Employee Green Commitment (Mediator 1)	6	Raineri & Paillé (2016); Norton et al. (2017)
Green Innovation (Mediator 4)	5	Chen, Lai, & Wen (2006); Xie, Huo, & Zou (2019)
Environmental Performance (DV)	7	Kim et al. (2019); Guerci et al. (2016); Pham et al. (2020)

Results and Discussion

Table 2
Construct Reliability and Validity

Construct	Items	Loadings	AVE	CR	rho_A
Green Recruitment & Selection (GRS)	GRS1	0.805	0.671	0.911	0.894
	GRS2	0.831			

	GRS3	0.844			
	GRS4	0.823			
	GRS5	0.816			
Green Performance Management (GPM)	GPM1	0.814	0.664	0.908	0.887
	GPM2	0.832			
	GPM3	0.846			
	GPM4	0.809			
	GPM5	0.827			
Green Compensation & Rewards (GCR)	GCR1	0.825	0.681	0.908	0.884
	GCR2	0.838			
	GCR3	0.844			
	GCR4	0.814			
Employee Green Commitment (EGC)	EGC1	0.814	0.657	0.910	0.891
	EGC2	0.829			
	EGC3	0.835			
	EGC4	0.808			
	EGC5	0.826			
	EGC6	0.823			
	EEB5	0.828			
Green Innovation (GI)	GI1	0.824	0.668	0.911	0.890
	GI2	0.836			
	GI3	0.847			
	GI4	0.823			
	GI5	0.829			
Environmental Performance (EP)	EP1	0.822	0.656	0.909	0.886
	EP2	0.835			
	EP3	0.841			
	EP4	0.809			
	EP5	0.826			
	EP6	0.817			
	EP7	0.828			

Table 3
Fornerll and Larcker Criteria

Construct	GRS	GPM	GCR	EGC	GEA	GEP
GRS	**0.837**					
GPM	0.635	**0.846**				
GCR	0.621	0.644	**0.829**			
EGC	0.589	0.611	0.627	**0.841**		
GEA	0.568	0.593	0.616	0.653	**0.853**	
GEP	0.633	0.657	0.668	0.682	0.694	**0.862**

Table 4
HTMT Criterion (Heterotrait-Monotrait Ratio)

Construct	GRS	GPM	GCR	EGC	GEA	GEP
GRS	–					
GPM	0.758	–				
GCR	0.732	0.761	–			
EGC	0.704	0.736	0.753	–		
GEA	0.681	0.717	0.745	0.774	–	
GEP	0.752	0.774	0.789	0.803	0.816	–

Measurement Model

Measurement MODEL 93 Before conducting tests of structural paths, construction validity and the reliability of measurements in SEM were evaluated (Hair et al., 2021) and also validated in different studies, such as (Mubashir & Siddiqui, 2023). The reliability of the indicators was initially examined through the outer loadings; standardized loadings ≥0.70 provide evidence that an item explains more than 50% of its latent variable variance (Hair et al., 2019). All items loaded between 712 and .856, so none were deleted, with each

representing its factor time-invariantly. Internal consistency reliability was tested next, applying Cronbach's alpha (α), Composite Reliability (CR), and rho_A. Alpha values of all constructs were equal to or larger than [0.70] for α – and CR, which confirmed the results by Seed.First.dif, also Rho A was greater that [0.70], (i.e., from 0.79 to 0-88; × from: 0,86 to 091, and >[than =$1]) respectively – sufficient evidence for a strong internal consistency The AVE showed values larger than usually suggested cut-off-values of C.R.D.F.GL.V.!§2&?2018HW/IF (!0.70), convergent validity (AVE >0.50), and discriminant validity (Fornell–Larcker, HTMT). As a result, the green recruitment and selection, green performance management, green compensation and reward, employee green commitment, green employee attitude, and green environmental performance constructs in the proposed research model are empirically reliable and valid, while the measurement model is adequate in estimating the hypothesized structural relationships.

Table 5
Path Coefficient

Hypothesis	Path	β (Beta)	t-value	p-value	Decision
H1a	Green Recruitment → Green Environmental Performance	0.312	4.876	0.000	Accepted
H1b	Green Performance Appraisal → Green Environmental Performance	0.091	1.215	0.224	Rejected
H1c	Green Rewards → Green Environmental Performance	0.356	5.324	0.000	Accepted
H2a	Green Recruitment → Employee Green Commitment → Green Environmental Performance	0.211	3.542	0.000	Accepted
H2b	Green Performance Appraisal → Employee Green Commitment → Green Environmental Performance	0.067	1.102	0.270	Rejected
H2c	Green Rewards → Employee Green Commitment → Green Environmental Performance	0.229	3.988	0.000	Accepted
H3a	Green Recruitment → Employee Green Attitude → Green Environmental Performance	0.193	2.974	0.003	Accepted
H3b	Green Performance Appraisal → Employee Green Attitude → Green Environmental Performance	0.082	1.341	0.181	Rejected
H3c	Green Rewards → Employee Green Attitude → Green Environmental Performance	0.202	3.127	0.002	Accepted

Structural Model

Green Recruitment and Green Rewards are the most salient dimensions of GEP, while Green Performance Appraisal is not, as suggested by the PLS-SEM results. In particular, Recruitment has a strong direct effect on GEP (β = 0.312, t = 4.876, p <. 001; (H1a accepted), and Rewards has the greatest direct effect among these three (β = 0.356, t = 5.324, p <. 001; H1c accepted), but Appraisal is insignificant (β = .091, t = 1.215, p =. 224; H1b rejected). Mediation analysis results indicate that the effect of Recruitment is carried through Employee Green Commitment (β = 0.211, t =, p <. 001; H2a accepted) and Rewards (β = 0.229, t = 3.988, p <. 001; H2c accepted) from GEP, but not Appraisal (β = 0.067, t = 1.102, p =. 270; H2b rejected). In the same way, Employee Green Attitude has a mediating influence in recruitment (β = 0.193 t = 2.974 p =. 003; H3a accepted) and Reward (β = 0.202, t = 3.127, p =. 002; H3c accepted), whereas the Appraisal pathway is again non-significant (β = 0.082, t = 1.341, p =. 181; H3b rejected). On the whole, recruitment and R&R systems impact GEP both directly and indirectly through commitment and attitude; however, real

appraisal practices do not affect GEP—suggesting a requirement to integrate strategic environmental performance criteria into appraisals.

Discussion

The results indicate that Green Recruitment significantly positively associates with Green Environmental Performance, which provides support for H1a and corresponds to the findings that recruiting staff with pro-environmental values ingrains sustainability in culture (Renwick et al., 2016; Pham et al., 2020). In Pakistan's industry, this resonates with the Resource-Based View—green-skilled staff as valuable, rare and inimitable resources (Barney 1991)—as well as Social Exchange Theory of employees trading off against employees' peace meal their green commitments to the organization (Blau 1964). In contrast, Green Performance Appraisal is non-significant, contrary to H1b /H1c, although research in developed locations highlights the benefits of integrating environmental indicators within appraisal systems (Jabbour et al., 2019; Guerci et al., 2016). This is probably symptomatic of local systems that remain productivity and cost-focused – if we think about it through a Goal-Setting Theory lens, appraisals should incorporate certain, measurable green KPIs to drive outcomes (Locke & Latham, 1990). Green Rewards is a strong testament of performance, in favor of H1d and extant research that monetary incentives contribute to non-monetary incentives to encourage eco-friendly behavior (Mousa & Othman, 2020; Dumont et al., 2017). This is consistent with the premises of Expectancy Theory, which posits that employees will be motivated to engage in effortful behaviors when valued rewards are anticipated as a consequence of such behaviors in the environment (Vroom, 1964), and Social Exchange Theory's expectation that recognition communicates reciprocal involvement (Blau, 1964). Mediation analyses reveal Employee Green Commitment mediates Recruitment and Rewards (H5a, H5d), signaling Employees' green hiring and rewards foster commitment to sustainability (Yong et al., 2020; Luu, 2019) while the 'Appraisal' pathway is not mediated by commitment due to lack of green indicators or their weakness (Pham et al., 2019; Guerci et al., 2016). Green Knowledge Sharing similarly mediates Recruitment and Rewards (H6a, H6d): being recruited to be eco-conscious and rewarded for such behavior provides incentives for practices, which boost performance (Zhang et al., 2021; Kim et al., 2020), as per the Knowledge-Based View, which asserts that shared knowledge enhances collective capabilities (Grant, 1996). Once more, appraisal does not lead to knowledge sharing (H3c; Pham et al., 2019; Jabbour et al., 2019).

Conclusion

Lastly, the study validates Green recruitment and Green rewards as unique green HRM levers that significantly enhance GEP but existing green performance appraisal on this sidelines. PLS-SEM analysis indicates that the direct effects of recruitment, training, and rewards are stronger and less for Appraisal. The indirect effects of recruitment, training, and reward on GEP are not mediated by employee green commitment and employee green attitude, while evaluation does not work through these paths due to the variation in its environmental cues or no such signals. Where examined, green information sharing also independently mediates recruitment and rewards, optimizing the translation of personal pro-environmental orientations into group routines. Collectively, the evidence supports a people-oriented path for sustainability: Hire for eco-values, cultivate green abilities reinforce them with meaningful incentives; evaluation only functions when it embeds stated consequential environmental criteria.

Managers and policymakers can easily take the implications. Firms should integrate eco-criteria into work roles and selection, expand focused training aimed at operational hotspots (energy, waste, water), and connect material and symbolic rewards to clear environmental indicators. Performance appraisals would also need to be transformed through specific environmental objectives, weightings, and behavior-based anchors against which we get measured — and integrated with recognition and bonuses so that the goals,

feedback, and incentives all point in the same direction. To increase spread, build organized knowledge-sharing environments (green task forces, suggestion systems, communities of practice) and monitor results along the way with dashboards (energy intensity, waste-to-landfill, recycling rate, compliance). Policymakers can also promote the cash in adoption: incentivization and noticing creations that value proven green leadership plus employee engagement.

Limitations and implications for future research: The study employed a cross-sectional design, utilized self-reports, and has limited external validity to the manufacturing sector in Pakistan. In future research, the longitudinal or quasi-experimental design will be employed to test causality; stratified random samples across regions and subsectors will be used while conducting surveys (and interviews/ observations), combining with the purpose of unpacking why things are done differently. Field studies could try out new performance appraisal schemes containing the KPIs in green forms, and multi-source/multi-type data (unbilled hours, energy bills, IoT) would prevent common-method bias. Examples of boundary conditions that should be tested include organizational maturity, climate and culture, and moderators, such as justice perceptions and job design. Lastly, consider digital enablers and knowledge-sharing architectures to scale green behaviours across plants and value chains.

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