



The green shift: harnessing leadership, HR, and culture for sustainable success

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ABSTRACT

This study examines the influence of Green Transformation Leadership (GTL), Green Human Resource Practices (GHRP), and Green Culture (GC) on Environmental Sustainability (ES), with Employees' Pro-Environmental Behavior (PEB) acting as a mediating variable. Data were collected from 358 employees across resource-intensive sectors including hospitals, transport, chemical industries, and tanneries in five major Pakistani cities. Structural Equation Modeling (SEM) was employed to evaluate the relationships among variables. Findings reveal that Green Culture exerts a strong direct and indirect impact on sustainability through PEB. GTL demonstrates the importance of leadership commitment, while GHRP enhances outcomes when integrated with cultural and leadership strategies. The R² values indicate strong relationships between Green Transformation Leadership, Green HR Practices and Green Culture with Employees' Pro-environmental Behavior and between these factors with Environmental Sustainability. These components together produce essential outcomes for promoting sustainable practices in organizations. The proposed model underscores the role of employee engagement in driving sustainability and offers practical recommendations for business leaders and policy-makers. This study contributes to the sustainability literature by validating a holistic model and offering actionable insights for advancing green initiatives in emerging economies like Pakistan.

Introduction

The industrial sector of Pakistan plays a fundamental role in driving environmental sustainability (ud Din et al., 2025). It is important particularly in Lahore, Kasur, Faisalabad, Karachi, and Sialkot. Because these cities are industrial hubs of Pakistan and contribute a lot to the economy and environmental degradation as well. The economy of Pakistan gains a lot from these cities because they house essential production sectors including textiles and leather manufacturing alongside sports goods manufacturing (Tabassum et al., 2022; ud Din & Ahmad, 2023). As Pakistan's industry is growing at a fast pace, it has created environmental problems including air contamination and water contamination and excessive energy usage together with industrial waste creation. In order to tackle environmental concerns, various cities have started implementing green practices while adopting energy-efficient methods and sustainable waste management systems as their reaction to environmental concerns. An increasing number of textile manufacturers operating between Faisalabad and Lahore have

incorporated water recycling technologies together with eco-friendly dye solutions to minimize industrial water contamination. Leather tanneries in Kasur now operate effluent treatment plants which decrease the quantity of dangerous substances released into local water supplies thus enhancing environmental health together with public health benefits (Li et al., 2024; ud Din & Ahmad, 2023; Wassan et al., 2023). Fig 1.

Environmental degradation from industries primarily affected Karachi and Sialkot throughout history. Air and water pollution from unregulated industrial emissions and waste disposal into the sea create severe environmental problems throughout Karachi because it functions as Pakistan's biggest industrial center (Idrees et al., 2023). The organizations are currently implementing changes in their transition toward renewable power and efficient production techniques together with enhanced environmental regulations particularly in automobile and steel production. The Sialkot sports goods sector which previously faced global criticism for non-environmental practices now transforms its operations by adopting sustainable raw materials and ethical manufacturing systems for meeting international sustainability criteria

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(Saboor & Watto, 2023). The positive changes made in Pakistan's manufacturing sector meet significant opposition due to weak regulatory enforcement and financial incentive shortages and broad industrial sustainability practice ignorance. Subhani et al. (2021) claim that the manufacturing sector including textile, chemical, and tannery industries as well as the service sector including hospitals and transportation being the major consumers of resources, producers of waste, and polluters call for serious attention of scholars and the authorities for significant effect from sustainability initiatives in these industries, which encompass both manufacturing and service-based sectors. Additional research in this field needs to be performed to develop environmentally friendly solutions for converting Pakistan's industrial sector into an example of sustainable development (Adnan et al., 2024). Hence, the study's exclusive focus on these industries allows it to give light on how green culture, leadership, and HR practices may spur significant environmental benefits.

On the other hand, the world also places sustainability now at the forefront as an essential priority which forces organizations to put eco-friendly strategies within their strategic planning. Modern businesses must go beyond profitability targets because society demands active environmental preservation from them (M. Tanveer et al., 2024a,b). Organizations make this transformation because climate change worries intensified and regulations hardened while customers choose environmentally responsible options. The growing environmental challenges have led to the emergence of Green Transformation which highlights sustainable leadership together with environmental human resource practices and long-term ecological balance within corporate culture (ud Din et al., 2025).

According to Tanveer et al. (2025), business organizations hold crucial responsibility for environmental solution because their activities determine energy usage and carbon output and waste disposal and resources consumption levels. Moving toward sustainability needs more than just new policies because it calls for essential changes in leadership

methods together with workforce practices and cultural beliefs and individual employee conduct at organizations. This highlights the importance of integrated organizational change, where leadership, HR practices, and workplace culture must evolve together to support sustainable development. This transformation process relies heavily on the elements of Green Transformation Leadership combined with Green HR Practices and Green Culture. Employees' pro-environmental behaviors are formed by these factors leading to environmental sustainability results (Farrukh et al., 2022). A clear comprehension of how these factors work together enables organizations to build successful sustainability-oriented employee programs and reach their extended sustainability targets. The rising public understanding of sustainability leads many organizations to carry out their green initiatives but leadership barriers together with disengaged employees and weak corporate culture create obstacles to advancement thus turning sustainability practices into superficial policies instead of core business strategy elements (Ali Ababneh et al., 2021). Organizations which declare environmental responsibility frequently demonstrate irregular implementation of their policies while neglecting employee pro-environmental conduct (Hadi, 2018; Naz et al., 2022). The key obstacle exists in transforming sustainable promises into concrete and quantifiable operational activities.

According to ud Din et al. (2025), current scholarly evidence about the joint effects between Green Transformation Leadership and Green HR Practices and Green Culture is still insufficient. Research today for instance Tanveer et al. (2025), Al-Sabi et al. (2024), and Dakhan et al. (2020) investigate sustainability elements in separate aspects without integrating an approach that unites leadership approaches with human resources strategies and cultural alteration. Hence, research lacks a full analysis of environmental sustainability with its more domains. Therefore, this research studies Green Transformation Leadership effects on pro-environmental behaviors in employees as well as the impact of Green Human Resource Practices and green culture on sustainability development and the strengthening of environment. The research

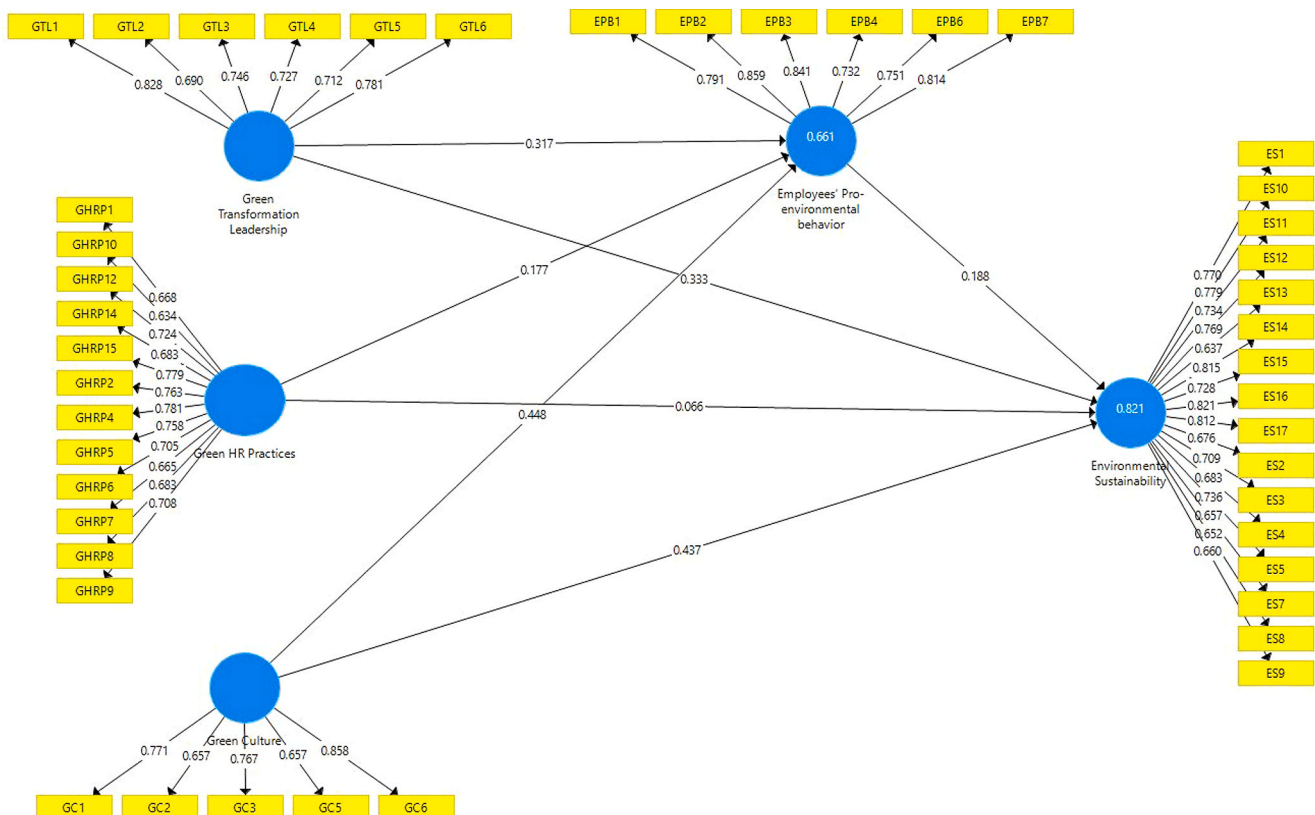


Fig. 1. SEM Analysis.

investigates both direct and indirect interplay between these elements as they affect environmental sustainability measures. Hence, the study provides essential knowledge to corporate leaders and HR professionals alongside policymakers which helps them establish effective green strategies to build environmental responsibility and achieve sustainable development.

Significance of the study

Multiple important values emerge from this study. The study contributes academically to the fields of sustainability and leadership and human resource practices and employee conduct by examining their combined effects in developing nations. The research delivers essential business recommendations to executives, leadership and HR personnel and policy authorities about developing environmentally focused workplace strategies that strengthen environmental outcomes. The findings from this research help develop sustainability policies at corporate and governmental institutions while promoting organizations to embrace green transformation practices. The analysis establishes a vital function in helping organizations achieve sustainable business practices through the development of environmentally conscious corporate cultures in this critical time of climate change urgency.

Literature review

The study incorporates established theories from leadership and sustainability and organizational behavior to reach its desired results. Leaders following Transformational Leadership Theory show employees how to participate in sustainable practices through their responsible leadership approach (Luo et al., 2025). Organizations gain enduring competitive advantages according to the Resource-Based View through their implementation of Green HR Practices which creates sustainability-minded employees (Sahu et al., 2024). Employees' pro-environmental behaviors are influenced by how they perceive their control of actions along with their attitudes and how social norms affect them according to the Theory of Planned Behavior (TPB) (Juma-Michilena et al., 2024). This research combines multiple theoretical models to generate a full picture of how authentic leadership and human resources systems and organizational settings activate sustainability at each organizational level.

Modern organizations implement environmentally responsible strategies through their operations to address sustainability concerns in their business practices. The three elements of Green Transformation Leadership, Green HR Practices and Green Culture demonstrate crucial influence on employee pro-environmental behaviors and organizational sustainability.

Green Transformation leadership and Employees' pro-environmental behavior

Organizational values, employee attitudes and corporate sustainability outcomes strongly rely on the effectiveness of leadership. Organizations in current business settings need leadership that combines knowledge of environmental challenges with operational integration of sustainability throughout their fundamental business operations (Luo et al., 2025). Under Transformational Leadership theory dedicated leaders demonstrate deep sustainability commitment which encourages their employees to practice sustainable methods. Through their role model behavior transformational leaders shape an organizational vision for environmental responsibility which inspires employees to extend their official duties as they work for sustainability. The leaders implementing Green Transformation Leadership (GTL) combine environmental elements into their strategic vision and decision processes and leadership methods as per Khaddage-Soboh et al. (2024). The leadership style embeds sustainability throughout organizational mission and values alongside long-term objectives making sustainability an integral

part of the organization. Green leaders advance their teams through their excellent conduct along with sustainable vision and their work to develop organizations with solid environmental priorities. Leaders who show dedication to sustainable policies generate multi-directional impact that drives team members to match organizational sustainability goals (Serpa & Sá, 2025).

Studies show green transformation leadership functions as a vital organizational factor that develops employees' pro-environmental behavior among employees through programs that recognize and reward sustainability values (ud Din et al., 2025). According to Ansari and Khan (2024), leadership support of green initiatives results in employee participation in energy efficiency and waste management practices. Staff members participate in workplace sustainability programs while they actively reduce paper waste and turn off electrical devices they do not need. Staff members demonstrate heightened environmental awareness through observing active sustainability initiatives of their leaders who implement green systems and minimize corporate emissions. According to Ren et al. (2024), employee adoption of environmentally friendly practices occurs through leader integration of sustainability goals into corporate agendas. Organizations become more effective at promoting sustainable actions when their sustainability principles become integrated throughout the company's policies so workers perform environmental tasks with personal devotion instead of treating sustainability as mandatory external instructions. Organizations which fail to establish supportive cultures for sustainable actions maintain separate leadership vision from the actions of their employees. Sustainability-oriented leaders in these situations do not achieve satisfactory environmental performance due to the poor connection between leadership strategies and employee engagement. Proper alignment between leadership communication while using incentives and performance metrics together produces tangible behavioral changes in employees who participate in sustainability initiatives. The alignment requires training programs along with well-documented green policies accompanied by reward systems that support employee environmental behaviors. Organizations need to sustain their sustainability efforts by securing support at all organizational levels ranging from high-level executives to front-line staff to develop genuine green organizational culture (Rafiq et al., 2024). Hence, the discussion sums up with the following hypothesis.

H1: Green Transformation Leadership has a positive impact on employees' pro-environmental behavior.

Green HR practices and Employees' commitment to sustainability

According to ud Din et al. (2025), the implementation of Green Human Resource Practices within organizations adopts environmental sustainability strategies through their recruitment methods and training initiatives and performance management systems and reward systems. Green Human Resource Practices has emerged as an essential mechanism which allows businesses to merge human resource functions with sustainability objectives because they increasingly understand their responsibility to environmental challenges. The integration of environmental-friendly policies within HRM structures enables organizations to protect natural resources and simultaneously builds their employer reputation which draws sustainable-minded job candidates (Tanveer et al., 2025). The Resource-Based View (RBV) indicates that organizations can gain enduring success through developing distinct internal assets including environmentally dedicated employees for achieving competitive advantages (Nson, 2024). Organizations gain competitive advantages through engaged personnel who demonstrate strong environmental values because these employees help execute sustainability initiatives successfully and help organizations stand apart from their competition (Zihan & Makhbul, 2024). GHRP enables organizations to achieve workforce motivation for pro-environmental conduct through sustainability integration with core Human Resources practices. Sustainability becomes part of regular HR operations through

this integration so it avoids being seen as an independent program while promoting an environmental-focused corporate culture (Gazi et al., 2024).

According to ud Din and Ahmad (2023), organizations employ green recruitment methods to draw job applicants who maintain solid environmental values. Organizations guarantee skilled employees with environmental alignment through their sustainability-based hiring criteria in job descriptions along with assessment procedures. When candidates demonstrate sustainability values they tend to practice pro-environmental actions which promotes an organization-wide green culture. Moreover, green training programs provide employees with enhanced environmental understanding together with the ability to carry out sustainability projects. A complete training system teaches staff members the necessary expertise and competencies to embed green approaches throughout their regular duties including power conservation methods and waste minimization along with sustainable choice-making. Through sustainability workshops and certification programs workers in the workplace can build sustainable behavior practices that continue after their initial training (Adegoke et al., 2024). Das and Dash (2024) are of the view that sustainable performance management tools linked with reward systems enable employees to achieve corporate sustainability targets. Organizations which establish sustainability targets with environmental measurement criteria for employee assessment build employee responsibility and drive through performance-based metrics. Moreover, they add that organizations should offer financial incentives in addition to recognition programs and career advancement chances for employees who advance sustainability goals to create positive action towards environmental protection. Organizations achieve sustainable commitment to green efforts when they establish direct connections between environmental performance and performance-based rewards. M. I. Tanveer et al. (2024) state that the successful implementation of GHRPs proves challenging for certain organizations because their sustainability strategies fail to link properly with their human resource plans. Organizations fail to achieve sustainability targets and employee participation because their human resource methods do not support their stated sustainability commitments. Organizations that display green initiative promotion experience inconsistent green behavior reinforcement because they lack mechanisms to measure employee environmental performance. A systematic system for evaluation and recognition of sustainability work will help maintain employee motivation for continued participation in environmentally beneficial activities. Organizations need to create precise sustainability Key Performance Indicators that should become part of their Human Resource management systems to achieve successful GHRP execution. Therefore, the findings of the past studies show green HR practices influence employees to achieve sustainability goals of organizations (Amjad et al., 2021; Janadari, 2021; ud Din et al., 2025). This leads to the following hypothesis.

H2: Green HR Practices positively influence employees' commitment to sustainability.

Green culture and environmental sustainability

Hooi et al. (2021) state that organizational culture forms the basic structure through which employees make their work-related decisions. The collective values and beliefs and assumptions that form organizational culture serve as a guide for employee actions which affects their sustainability approach at work places. In addition to this, green culture defines an operational framework that embeds sustainability as well as environmental responsibility together with eco-friendly values at its core (Maheshwari & Kaur, 2021). Therefore, an organization with a firmly established green culture integrates sustainability into all business routines without treating it as an isolated corporate program. Such organizational practices help workers develop environmental awareness through instinctual sustainable behavior rather than treating it as an external requirement.

Tadesse Bogale and Debela (2024) state with reference to Organizational Culture Theory that the organizational culture that exists deeply within a workplace have a stronger impact on employee actions than explicit directives and formal procedures. Because employees automatically adopt eco-friendly practices as part of their organizational culture because sustainability permeates throughout the business structure. The standardization of sustainability practices becomes organizational operations within organizations that have strong green cultures. The integrated structure makes environmental consciousness an essential part of the organization thus driving employees to sustain their dedication to green practices over the long term (Ahsan, 2024). Apart from better employee engagement with environmental initiatives organizations with ingrained sustainability values maintain stronger employee awareness of sustainability basics (Vargas-Hernández et al., 2024). Sustainability embedded as an essential organizational identity makes employees perceive environmental initiatives as personal and important thus boosting their interest in green behavior participation. The incorporation of green culture enables employees to connect better with their organization while advancing environmental goals thus driving their active support of sustainability programs (Abubakar et al., 2024). People working in cultures that support environmental practices will actively promote sustainable workplace practices while participating in green initiatives and encouraging environmentally friendly actions from their colleagues. The environment receives enhanced protection through enhanced intrinsic motivation from employees who work within organizations that support green culture (Rojak et al., 2024). Sajjad et al. (2024) state that as sustainability culture is pivotal for sustainability, it must gain continuous support from leadership alongside organized communication systems and organizational alignment to secure its strength in the future. They add that leaders who support sustainability initiatives enable their employees to adopt green practices which leads to full-scale environmental responsibility across every organizational level. When organizations lack genuine green culture their sustainability programs might be complied with by employees but not sincerely supported. Without genuine commitment sustainability practices stay superficial since employees stick to regulations but avoid integrating sustainability throughout their daily tasks. Organizations without a strong green culture will not reach their environmental impact goals even when they establish sustainability policies (Sánchez-García et al., 2024). Hence, this discussion is concluded at the following hypothesis.

H3: Green Culture has a positive impact on employees' pro-environmental behavior and environmental sustainability.

Employees' pro-environmental behavior as a mediator

GTL united with GHRP and Green Culture generates superior sustainability effects through their cohesive operation. These three sustainability factors work together to support each other and promote extended environmental responsibility in organizations. Their integrated action creates an organizational structure which internalizes sustainability principles across strategic planning as well as operational execution (Altassan & Ahmad, 2024; Tanveer et al., 2025; Wiredu et al., 2023). Thus, it is important to understand the role of employees as key agents of change within organizational structures. Green Transformation Leadership provides the strategic vision and motivational force that encourages employees to align their actions with environmental goals. Leaders who demonstrate eco-conscious values, involve employees in sustainable decision-making, and model green behavior significantly influence staff attitudes toward the environment (Chen et al., 2020). Similarly, Green HR Practices institutionalize sustainability through recruitment, training, performance appraisals, and reward systems that prioritize environmental responsibility. When these practices are implemented effectively, they foster awareness, competence, and motivation in employees to act in environmentally responsible ways (Jamil et al., 2023). In addition to this, Green Culture further reinforces

this behavioral shift by embedding sustainability into the organization's norms, values, and day-to-day operations. A supportive green culture cultivates a workplace atmosphere where environmental practices are encouraged and socially reinforced. In such environments, employees are more likely to adopt behaviors like reducing waste, conserving energy, and supporting green innovations (Tanveer et al., 2025). However, leadership, HR practices, and culture alone are not enough unless they translate into tangible pro-environmental actions by employees. These individual actions serve as the link—or mediating mechanism—that connects broader organizational strategies to real-world environmental outcomes. Therefore, employees' pro-environmental behavior acts as a crucial mediator by converting leadership vision, cultural values, and HR policies into practical sustainability performance. Hence, the discussion sums up with the following hypothesis.

H4: Employees' pro-environmental behavior mediates the relationship of Green Transformation Leadership, Green HR Practices, Green Culture and environmental sustainability.

Research framework

Research Methodology

A survey-based quantitative design serves this study for exploring the connections between Green Transformation Leadership and Green HR Practices with Green Culture and Employees' Pro-Environmental Behavior and Environmental Sustainability in Pakistani corporate settings. The study relies on survey data from 358 participants containing HR managers together with senior officials and other staff members who maintain permanent employment at their organizations exceeding five years. The research focused on hospital, transport, chemical industry and tannery from Lahore, Kasur, Faisalabad, Karachi, and Sialkot. An adapted version of the questionnaire by [ud Din et al. \(2025\)](#) served to evaluate the constructs through a five-point Likert scale with rating system ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The study implemented thorough ethical procedures which secured informed consent along with anonymous data collection that maintained complete confidentiality of the study participants. This methodological framework leads to important findings about how leadership interacts with HR practices and organizational culture to develop employee pro-environmental actions and sustainability in Pakistani corporate organizations.

Data collection and analysis

The researcher used structured questionnaire surveys to produce standardized and systematic data collection from study participants. A survey containing 550 questionnaires was shared with the employees to obtain the maximum number of responses for the sample size. The questionnaire was made available both online and face-to-face distribution based on participant convenience. The researcher selected purposive sampling as its data collection method to obtain responses from employees throughout various organizational levels. The reason behind using purposive sampling is to focus on the employees who were exposed to sustainability practices in their organizations or engaged in sustainability practices in organizations located in major industrial cities such as Lahore, Kasur, Faisalabad, Karachi, and Sialkot. This method helped in getting data from the participants who have firsthand experience in Green Leadership, HR practices, and Organizational culture. It was deemed appropriate to come up with relevant information in line with the study objectives since the random sampling technique might not have provided such relevant information.

The questionnaires were administered to HR Managers, Senior Officials and other permanent employees working in hospitals, transport companies, chemical industries and tanneries. A total of 550 surveys were shared, including 95 surveys across 10 hospitals, 80 surveys across 8 transport companies, 100 surveys across 10 chemical industries, and

83 surveys across 9 tanneries, averaging approximately 9–10 surveys per organization. The information about the research purpose and voluntary participation as well as the assurance of response confidentiality was provided to the participants before they received the questionnaire. The research team analyzed 358 surveys that were filled accurately from a total of 550 distributed questionnaires. The survey participants received instructions to give truthful answers with no fear of negative consequences while answering survey questions. The study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) for final dataset analysis to evaluate the hypotheses and study relationships between these variables. Moreover, the model assessment for construct reliability and convergent validity along with discriminant validity were tested before path coefficients and t-statistics and R^2 values were used for structural model evaluation.

Demographic statistics

Interpretation of demographic data

A demographic breakdown of 358 participants in [Table 1](#) gives important information about employees across hospitals and transport companies and chemical industries and tanneries operating in Lahore, Kasur, Faisalabad, Karachi and Sialkot. The analysis includes various organizational roles which combine HR managers with senior officials and permanent staff members who show expertise in evaluating their organizations' sustainability initiatives because they each have more than five years of experience.

The demographic analysis reveals male employees make up 69.8 % of the total respondents while female employees constitute 30.2 % demonstrating both gender groups actively contribute to sustainability initiatives. The vast majority (72.6 %) of participants belong to the middle-aged demographic of 35–54 years old indicating their position as professional leaders who actively pursue sustainability practices. The sample population consists of well-educated professionals who understand environmental sustainability and organizational policies because 50.3 % hold Master's degrees alongside 39.1 % who possess Bachelor's degrees. The study's credibility benefits from 10.6 % PhD holders because these researchers are capable of advancing sustainability strategies at an advanced level. The job position analysis shows HR managers (25.1 %) together with senior officials (30.7 %) make up the

Table 1
Demographic Data.

Demographic Variable	Categories	Frequency (n = 358)	Percentage (%)
Gender	Male	250	69.8 %
	Female	108	30.2 %
Age Group	25–34 years	80	22.3 %
	35–44 years	140	39.1 %
	45–54 years	120	33.5 %
	55 years and above	18	5.1 %
Educational Qualification	Bachelor's Degree	140	39.1 %
	Master's Degree	180	50.3 %
	PhD	38	10.6 %
Job Position	HR Manager	90	25.1 %
	Senior Official	110	30.7 %
	Other Permanent Employees	158	44.2 %
Years of Experience	5–10 years	160	44.7 %
	11–15 years	120	33.5 %
	16 years and above	78	21.8 %
Industry Type	Hospitals	95	26.5 %
	Transport Companies	80	22.3 %
	Chemical Industries	100	27.9 %
	Tanneries	83	23.3 %
City of Employment	Lahore	85	23.7 %
	Kasur	50	14.0 %
	Faisalabad	70	19.6 %
	Karachi	90	25.1 %
	Sialkot	63	17.6 %

majority of respondents while serving as important decision-makers and implementers for Green HR Practices, Green Culture and Green Leadership. Other permanent employees make up 44.2 % of the respondents which demonstrates an equal representation of staff members involved in sustainability work on location. The participant experience data reveals a majority group (44.7 %) who work between 5 and 10 years at the organization with additional participants (33.5 %) working between 11 and 15 years and (21.8 %) working more than 16 years. The survey participants demonstrate extensive long-term work history within organizations which makes them reliable sources for monitoring sustainability changes throughout time. The research design includes an almost equal distribution of hospital (26.5 %), chemical industry (27.9 %), tannery (23.3 %) and transport employees (22.3 %) which ensures data collection across different industrial sectors with specific environmental challenges. The survey participants reside in Karachi at 25.1 % while Lahore follows closely at 23.7 % and Faisalabad at 19.6 % then Sialkot at 17.6 % and Kasur at 14.0 %. These locations represent Pakistan's main industrial and service hubs which contribute extensively to environmental degradation.

Reliability and validity statistics

The [Table 2](#) presents reliability statistics. The constructs measured in this research underwent evaluation through Cronbach's Alpha and rho_A in addition to Composite Reliability (CR) and Average Variance Extracted (AVE) for reliability and validity assessment. The measurement model proves robust because all constructs meet appropriate standards for reliability and validity according to the results.

All constructs demonstrate superior internal consistency based on Cronbach's Alpha values which surpass the minimum reliability standard of 0.70. Specifically, Employees' Pro-Environmental Behavior (0.887), Environmental Sustainability (0.941), Green HR Practices (0.912), Green Transformation Leadership (0.842), and Green Culture (0.796) all exhibit satisfactory reliability. The reliability of the constructs remains strong according to the alternative reliability measure rho_A which shows similar patterns to Cronbach's Alpha values.

All measurement scales demonstrate high reliability according to Composite Reliability (CR) values which exceed 0.80. The measurement scales display the highest reliability through Composite Reliability with Environmental Sustainability (0.948) while Green HR Practices (0.926) comes next followed by Employees' Pro-Environmental Behavior (0.914) and Green Transformation Leadership (0.884) and Green Culture (0.861). The obtained values demonstrate that the constructs effectively measure their specified theoretical constructs throughout their assessment.

Discriminant Validity: Fornell-Larcker criterion

A discriminant validity assessment through the Fornell-Larcker criterion in [Table 3](#) shows results in this table where the square root of Average Variance Extracted (AVE) values (diagonal elements) exceed the construct inter-correlations (off-diagonal cells). Satisfactory discriminant validity emerges from the results as each construct distinguishes itself from other elements in the study model.

The Average Variance Extracted (AVE) values demonstrate acceptable construct validity as they exceed 0.50 for all constructs thus

indicating substantial indicator variance in each construct measurement area. The Employees' Pro-Environmental Behavior construct demonstrates the highest AVE value of 0.639 while Green Transformation Leadership follows with 0.561 then Green Culture with 0.556 and Environmental Sustainability with 0.533. The lowest AVE value belongs to Green HR Practices which amounts to 0.510 but surpasses the established minimum threshold. The results demonstrate that all constructs demonstrate adequate validity which enables researchers to study the relationships between green leadership and HR practices and workplace culture and environmental sustainability within the Pakistani corporate sector. The presented square root of AVE values appears on the diagonal for each construct. The Employees' Pro-Environmental Behavior (0.799) has the most significant diagonal value among all constructs while Green Transformation Leadership (0.749) and Green Culture (0.746) and Green HR Practices (0.714) and Environmental Sustainability (0.730) follow in descending order. The measurement values exceed their pairwise relationships with other constructs thus demonstrating that each variable displays greater variance with its own indicators than any other construct.

The analysis of correlations reveals Employees' Pro-Environmental Behavior demonstrates strong connections to Environmental Sustainability (0.792) and Green Culture (0.755) thus confirming that employee ecological actions create substantial impacts on sustainability achievements and workplace environmental culture development. The positive connection between Environmental Sustainability and Green Culture (0.843) and Green Transformation Leadership (0.801) signifies that workplace culture together with leadership play a key role in supporting sustainability. The relationship between Green HR Practices and both Employees' Pro-Environmental Behavior (0.550) and Environmental Sustainability (0.545) reveals how HR strategies aid environmental goals even though they need supplementary support from leadership and workplace culture.

The research demonstrates that all studied constructs maintain separate theoretical definitions thus ensuring their distinct measurement of concepts. The study model benefits from improved credibility because these results pave the way for new research regarding the environmental sustainability effects of green leadership combined with HR practices and workplace culture and employee behavior in Pakistan's corporate sector.

SEM analysis

The [Table 4](#), presents the result of SEM analysis. Environmental Sustainability receives its greatest direct influence from Green Culture at 0.437, which highlights the pivotal role that organizational values, norms, and practices play in shaping sustainability efforts. A strong green culture fosters an environment where sustainability becomes an intrinsic part of an organization's identity, encouraging both management and employees to integrate eco-friendly practices into their daily operations. Meanwhile, Green Transformation Leadership contributes 0.333, underscoring the importance of leadership commitment in driving sustainable initiatives. Leaders who actively promote green policies and practices set an example for employees, ensuring that sustainability is not just a theoretical concept but a tangible part of organizational decision-making. Green HR Practices provide 0.066, demonstrating that while HR policies contribute to sustainability, their direct impact is relatively minor compared to cultural and leadership influences. Nevertheless, HR strategies such as green recruitment, training programs, and performance incentives play a supporting role in fostering an environmentally responsible workforce. The three independent variables produce their environmental sustainability impact by way of Employees' Pro-Environmental Behavior, which serves as a crucial mediating factor. Employees who are encouraged and motivated to adopt eco-friendly behaviors help translate strategic sustainability initiatives into practical actions within the workplace. Their engagement in sustainable activities such as energy conservation, waste

Table 2
Reliability Statistics.

	Cronbach's Alpha	rho_A	Composite Reliability
Employees' Pro-environmental behavior	0.887	0.896	0.914
Environmental Sustainability	0.941	0.944	0.948
Green Culture	0.796	0.801	0.861
Green HR Practices	0.912	0.913	0.926
Green Transformation Leadership	0.842	0.846	0.884

Table 3
Discriminant Validity.

Variables	Employees' Pro-environmental behavior	Environmental Sustainability	Green Culture	Green HR Practices	Green Transformation Leadership	Average Variance Extracted (AVE)
Employees' Pro-environmental behavior	0.799					0.639
Environmental Sustainability	0.792	0.730				0.533
Green Culture	0.755	0.843	0.746			0.556
Green HR Practices	0.550	0.545	0.499	0.714		0.510
Green Transformation Leadership	0.710	0.801	0.691	0.471	0.749	0.561

Table 4
SEM Analysis.

Path Relationship	Direct Effect	Indirect Effect	Total Effect	R ² Value
Green Transformation Leadership → Environmental Sustainability	0.333	0.059596 (via Employees' Pro-Environmental Behavior)	0.3925	0.821
Green HR Practices → Environmental Sustainability	0.066	0.03327 (via Employees' Pro-Environmental Behavior)	0.0992	0.821
Green Culture → Environmental Sustainability	0.437	0.08422 (via Employees' Pro-Environmental Behavior)	0.5212	0.821

reduction, and resource optimization ensures that an organization's green objectives are effectively realized. Green Culture demonstrates the strongest level of indirect impact (0.08422) among the variables, whereas Green Transformation Leadership follows with (0.0596), and Green HR Practices rank third with (0.03327). This hierarchy of influence suggests that cultural transformation is the most effective means of indirectly fostering sustainability, followed by leadership-driven efforts, while HR practices provide a foundational but less substantial contribution. The total impact of Green Culture on Environmental Sustainability reaches 0.5212, thus demonstrating that developing a strong environmental culture within an organization is not just beneficial but essential for the promotion and successful implementation of sustainable practices. A workplace culture that prioritizes ecological responsibility encourages innovation in green solutions and ensures long-term commitment to environmental goals. The environmental outcomes receive significant influence from leadership commitment to sustainability, which generates a total influence of 0.3925. This finding reinforces the idea that when leaders champion sustainability and integrate it into the organization's strategic vision, employees are more likely to adopt green behaviors and initiatives. Leadership influence extends beyond policy enforcement—it shapes the organizational mindset toward sustainability, creating a ripple effect throughout the company. The impact of Green HR Practices on sustainability has been measured at 0.0992, indicating that HR policies contribute to sustainability but less significantly than leadership and cultural forces do. Although their overall effect is smaller, green HR practices remain a vital component in structuring an environmentally responsible workforce. By incorporating sustainability into hiring, training, and performance evaluation, HR departments can create a long-lasting impact that complements cultural and leadership efforts. As per the findings of Çop et al. (2021), green transformation leadership positively impacts environmental sustainability. Additionally, Aggarwal and Agarwala (2023) in the context of green HR practices and ud Din et al. (2025) in the context of green culture both claim positive impact of these predictors on environmental sustainability. Hence, the findings are in line with the past studies.

The model fit for Environmental Sustainability outcomes reaches a

strong and reliable level of 82.1 % because the R² value stands at 0.821. This high model fit percentage indicates that the independent variables—Green Culture, Green Transformation Leadership, and Green HR Practices—collectively explain a substantial proportion of the variance in environmental sustainability outcomes. This statistical robustness supports the argument that strategic organizational efforts in these areas can drive meaningful improvements in sustainability performance. Organizations that want to boost their environmental sustainability must develop green cultures and strengthen leadership dedication while implementing efficient human resources practices to increase employee pro-environmental conduct. By fostering an integrated approach that prioritizes cultural development, leadership commitment, and HR-driven sustainability efforts, businesses can achieve long-term ecological resilience and contribute positively to global sustainability goals.

Discussion

The findings of this study are of immense value for organizations, especially the hospitals, transporting companies, chemical industries, and tanneries in the major industrial cities of Lahore, Kasur, Faisalabad, Karachi, and Sialkot where industrialization has negative effects on the environment sustainability. All the proposed hypotheses (H1 to H4) are statistically supported thereby endorsing the theoretical framework of the study.

H1 investigated the direct relationship between Green Transformation Leadership and Environmental Sustainability. The results confirm a significant positive impact of Green Transformation Leadership on Environmental Sustainability. This suggests that when leaders prioritize and model environmentally responsible behavior, it fosters an organizational climate conducive to sustainable development. For example, organizational leaders in hospitals that introduce energy saving systems and waste management practices influence employees' behavior towards the environment. Likewise, leadership in the transport companies towards the introduction of fuel efficient technologies and reduction of emission also improves the overall sustainability performance.

H2 tested the direct relationship of Green HR Practices with regards to Environmental Sustainability. The results showed that the impact has a positive but not very strong impact with an effect size of 0.0992. This means that, although elements of green HR include eco-recruitment, the green performance evaluation, and training, they are considered weak by themselves. This is especially true with industries such as chemical manufacturing and tanneries where standalone HR policies may not yield significant environmental changes without other top-down management and cultural buy-ins.

H3 investigated the impact of Green Culture on Environmental Sustainability which emerged as the most influential factor. Green Culture has a direct effect of 0.437, along with an indirect effect of 0.08422 via employees' pro-environmental behavior, resulting in a total effect of 0.5212. These findings suggest that cultivating a culture where environmental values are embedded in everyday operations strongly predicts sustainable outcomes. Thus, the organizations with strong green culture can significantly reduce waste and pollution

through collective behavioral changes among staff.

H4 tested the mediating role of Employees' Pro-environmental behavior among green transformation leadership, green HR practices, green culture and environmental sustainability, the three antecedents of environmental sustainability. The results confirm that such behavior acts as a crucial conduit through which leadership, HR practices, and culture influence sustainable outcomes. When employees are encouraged and supported to engage in eco-friendly practices, it amplifies the effectiveness of organizational sustainability strategies.

In fact, the proposed structural model accounts for 82.1 % of the variance in Environmental Sustainability, $R^2 = 0.821$, which supports that green leadership, supported by HR practices, and culture through the positive behavior of employees can be a powerful model for achieving environmental sustainability. This offers practical recommendations for the industries in the mentioned cities to adopt and implement the structural, cross-organizational, and people-focused sustainable practices for significant positive impact on the environment.

Conclusion

The findings conclude that the combination of Green Transformation Leadership with Green HR Practices and Green Culture drives Environmental Sustainability advancement throughout hospitals and transport companies and chemical industries and tanneries that function in Lahore Kasur Faisalabad Karachi and Sialkot. Due to their major ecological impact these industries need well-developed sustainability initiatives to reduce their environmental impact. Multiple factors which include committed leadership and motivated employees alongside robust organizational culture help organizations sustain their business practices. The results of this study demonstrate that businesses must foster a robust green culture if they want to see tangible and enduring improvements to the environment. Research shows that when environmentally conscious values are deeply ingrained in an organization's culture and flow naturally into employee behavior, sustainability efforts get a boost. In addition to this, organizations aiming to boost sustainability initiatives need a comprehensive method that combines leadership-based sustainability strategies together with cultural organizational change programs alongside employee engagement. Businesses that merge leadership dedication with culture-building for environmental responsibility and add HR-focused programs can succeed in short-term sustainability targets while establishing long-term ecological strength and corporate social responsibility. The research concluded that sustainability should not be seen as a distinct role but rather as an integral part of an organization's strategy, and that strong leadership should demonstrate this via their actions and focused HR policies should back it up. The degree to which these factors are in harmony will determine the organization's capacity to achieve long-term sustainability.

Theoretical & practical significance

The research adds considerable value to scholarly works about sustainability together with leadership and HR practices and employee conduct. The study expands academic discourse while providing empirical data about environmental performance effects of these connected factors operating in developing countries. This research creates new knowledge in the literature by explaining how human resource practices fuel sustainable business transformation in nations with emerging environmental policies and green initiatives. Through research this study aids theoretical framework development which focuses on green management along with corporate social responsibility and organizational behavior to underline sustainability integration into business plans. This research strengthens academic knowledge about the way leadership alongside HR practices create environmentally engaged workers thus enabling ongoing exploration of sustainability-based business strategies. This research delivers practical benefits to business

leaders and HR experts alongside policymakers who need to understand how organizations can establish successful green workplace strategies. The research identifies sustainable HR approaches alongside exemplary practices to provide businesses with essential methods for developing workplaces that motivate employees to demonstrate environmentally friendly conduct. Organizations should utilize these research results to merge their HR policies with sustainability targets thus making green transformation a vital component of corporate decision-making. The study carries meaningful implications for both organization-wide sustainability policies and corporate strategies since it provides guidelines to governmental regulatory bodies for promoting green initiatives at an organizational level. This study establishes an essential role because it builds environmental consciousness while directing businesses toward sustainable practices which lowers their carbon impact while securing environmental sustainability across corporate operations. A collaborative method between business entities and HR professionals and policymakers stands essential to achieving meaningful change in creating an eco-conscious sustainable future.

Limitations and future research directions

This study like other research work also have some limitations that should be acknowledged. First, the research is geographically limited to Pakistan, which may restrict the generalizability of the findings to other cultural and economic contexts. Different countries may have varying environmental policies, corporate sustainability initiatives, and employee behaviors influenced by socio-economic and regulatory factors. Second, the study primarily relies on self-reported data, which may be subject to social desirability bias, where respondents might overstate their engagement in pro-environmental behaviors. Third, the model focuses on specific constructs such as Green Transformation Leadership, Green HR Practices, Green Culture, Employees' Pro-Environmental Behavior, and Environmental Sustainability. While these factors are critical, other potential determinants of environmental sustainability, such as government interventions, technological innovations, and industry-specific practices, were not included in the model. Lastly, the study employs a cross-sectional research design, which limits the ability to establish causality among the variables over time. A longitudinal approach could provide deeper insights into how green initiatives and employee behaviors evolve. Future research can address these limitations by expanding the study to other countries or regions to enhance the external validity of the findings. A comparative analysis between developed and developing nations could provide a broader understanding of how green leadership, HR practices, and workplace culture impact sustainability in different economic contexts. Additionally, future studies could incorporate a mixed-methods approach, combining qualitative interviews with quantitative surveys to mitigate self-reporting bias and gain deeper insights into employees' motivations and barriers to engaging in pro-environmental behaviors. Researchers could also integrate additional variables, such as regulatory frameworks, corporate social responsibility initiatives, and technological advancements, to develop a more comprehensive model of environmental sustainability. Furthermore, it calls for the need of longitudinal studies to be conducted to examine how the relationships between green HR practices, leadership, culture, and sustainability outcomes evolve over time. By addressing these areas, future research can contribute to a more nuanced and holistic understanding of sustainable business practices.

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CRediT authorship contribution statement

Mohi ud Din: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Muhammad Tanveer:** Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition, Formal analysis. **Muhammad Faizan Khan:** Writing – original draft, Visualization, Validation, Software, Resources.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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