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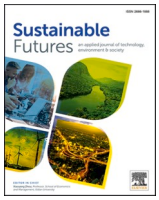

Impact of responsible leadership on construction employees' pro-environmental behavior: Exploring the mediating role of key variables

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ABSTRACT

Employees' pro-environmental behavior is crucial to the effectiveness of an organization's sustainability efforts and environmental management strategies. Despite its importance, the role of responsible leadership in shaping construction employees' pro-environmental behavior has received limited scholarly attention. This research contributes to the literature in two ways: (1) by examining the direct impact of responsible leadership on employees' pro-environmental behavior, and (2) by exploring the mediating roles of green shared vision, green management, and environmental consciousness in the relationship between leadership and employees' behavior. The study followed a deductive approach through a cross-sectional survey that received 305 responses from employees working at various construction sites. The data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings revealed that responsible leadership significantly influenced employees' pro-environmental behavior. Moreover, this relationship was mediated by green management, green shared vision, and environmental consciousness. Organizations can work toward sustainability encouraging leadership practices that support green initiatives, provide training, and establish clear environmental standards. This research was limited to the construction sector in a single country. Future research may include other sectors, more diverse samples from other countries and explore the role of additional factors such as motivation, commitment, and behavioral intentions.

1. Introduction

Public concerns about environmental protection and conservation have been rising recently due to increased awareness [1]. Such awareness has increased the pressure on businesses to prioritize environmental protection and rethink their operations [2]. However, the state of pro-environmental behavior and green management in construction organizations is still below par and needs to be uplifted in line with global sustainability endeavors such as the United Nation's Sustainable Development Goals (UN-SDGs). Ullah [3] identified the construction industry as a significant contributor to greenhouse gas emissions, mainly through energy-intensive processes, material production, transportation, and waste generation. Tackling these emissions requires comprehensive strategies that prioritize energy efficiency, sustainable sourcing of materials, and minimizing waste throughout the construction process. In the UK, the construction industry waste surpasses 100 million tonnes annually. Additionally, it consumes 6500 hectares of land each year and contributes to a third of all pollution incidents linked to industrial activities [4]. The construction sector, identified as the primary source of global greenhouse gas (GHG) emissions, plays a significant role in driving global warming [5]. The Intergovernmental Panel on Climate Change (IPCC) reports that the building sector consumes 40 % of global energy and is responsible for a quarter of worldwide CO2 emissions. Additionally, CO2 emissions from buildings have been increasing at an average rate of 2.7 % per year [5].

Companies must adjust their business strategies to align with environmental sustainability in line with endeavors such as the UN-SDGs. This involves reducing reliance on natural resources and demonstrating a genuine commitment to environmental concerns and climate change. Initiatives such as creating smart cities and sustainable communities [6] are leveraged accordingly. Other initiatives, such as corporate responsibility, have been started to boost the managers' self-awareness and accountability within the firm, thereby fostering an environmentally conscious workplace [7]. Promoting active employee participation in green initiatives is another key step contemporary organizations take to enable environmental sustainability [8]. Many

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organizations have started targeting a sustainable green environment through behavioral change in their employees [9].

People are the center of modern organizations and their behaviors dictate the success or failure of organizations [10]. Accordingly, the pro-environmental behavior of employees plays a pivotal role in the success of an organization's environmental management plans and sustainability endeavors. The term "pro-environmental behavior" is defined as actions taken proactively to conserve and/or protect the natural environment [11]. There are numerous approaches to encouraging employees to adopt green practices, such as educating employees about their potential environmental impact and preventive measures against environmental disasters [12]. Leaders exert a direct influence on both individual pro-environmental behavior and employees' perceptions of the environmental climate through a social learning process.

Responsible leadership is pivotal in influencing pro-environmental behavior [13]. Responsible leadership entails executive-level individuals adopting a mindset focused on meeting the needs of a firm's stakeholders. This involves identifying stakeholders, evaluating the legitimacy of their demands, and determining optimal methods for fulfilling their needs and expectations. Contemporary organizations can benefit from such leadership by refining their processes for selecting, evaluating, and developing leaders. Responsible leaders can effectively ingrain dedication to sustainable values and priorities within the employees of any organization [14]. The environmental ethics and best practices demonstrated by responsible leaders are contagious and generally quickly adopted by the employees. Therefore, enhancing the quality of responsible leadership and fostering stronger managerial interaction with employees can create a favorable environment for adopting pro-environmental practices in the workplace [15]. Consideration of responsible leadership values in promotions, training, and leadership development programs can motivate managers and leaders to develop such core values [16–18].

Other initiatives that help harness pro-environmental behavior in employees include embracing a green shared vision, green management, and environmental consciousness at the organizational level [13]. Organizations can encourage employees' pro-environmental behavior by adopting environment-conscious policies and practices, such as energy conservation, carbon emission reduction, and resource reuse. Studies have shown a correlation between environmental awareness, responsible and green leadership, green management, environmental attitude, shared green vision, green commitment, and pro-environmental behavior [13,19]. However, in the relevant studies, these factors have been evaluated independently [12], and a holistic assessment is missing to date. While certain research studies have delved into adopting environment-friendly behavior among employees, empirical research on the correlation between employees' motivation, environmental consciousness, and pro-environmental behavior is missing [20]. The connection between responsible leadership and the pro-environmental behavior of construction employees has not been investigated [21], presenting a gap targeted in this study.

This study examines the construction sector to assess how responsible leadership influences employees' pro-environmental behavior. Additionally, it investigates the mediating role of environmental consciousness, a shared green vision, and green management in this relationship.

The uniqueness of this study lies in its comprehensive approach, which holistically examines the relationship between responsible leadership and pro-environmental behavior while considering the mediating effects of key variables. It contributes to normative literature on responsible leadership and the pro-environmental behavior of construction employees, where influences of mediators such as environmental consciousness, a shared green vision, and management are investigated. Based on the results and pertinent discussions of this study, researchers can have food for thought and delve deeply into the intricacies of the relations to proposed contextual frameworks. For practitioners such as top managers, leaders, and CEOs of construction organizations, the current study highlights key variables for enabling pro-environmental behavior in their employees to help attain global sustainability targets. Accordingly, managers can develop successful strategies and inspire their subordinates to adopt environmentally responsible practices. The upcoming sections of the paper present a review of relevant literature, the proposed research hypotheses, an examination of relationships among variables, and a discourse on the research findings.

2. Theoretical development

2.1. Responsible leadership

Contemporary leaders easily navigate a dynamic, rapidly changing, and intensely competitive business environment [22]. In addition to focusing on financial success, such leaders focus on fostering environmentally responsible employee behavior. However, inciting a behavioral change in employees at an organizational level is not straightforward and requires rigorous plans and interventions. In this context, Maak and Pless [23] introduced the concept of responsible leadership, bridging realms of leadership and pro-environmental behavior literatureThey defined the responsible leadership as "the art of building and sustaining trustful relationships with stakeholders to achieve sustainable and shared value creation". Traditional leadership theories, including ethical, transformational, and servant leadership, primarily center on the leader-follower mechanisms within the organization. On the flip side, responsible leadership nurtures a reliable and sustainable relationship with a diverse array of stakeholders, including employees, clients, shareholders, and the ecological surroundings where the traditional approach is bypassed and a more teamwork-based approach is adopted for achieving holistic project goals [24].

Rooted in stakeholder theory, responsible leadership acknowledges employees and other parties as stakeholders within and outside the organization [25]. It recognizes the legitimate interests of diverse constituencies, including clients and business partners, in organizational activities [22]. Hence, responsible leadership is leaders' practical demonstration of corporate social responsibility [26].

Responsible leadership is an effective tool for enhancing the pro-environmental behavior of employees [27]. Responsible leadership yields positive outcomes for employees and the organization regarding pro-environmental behavior adoption and similar initiatives. It influences firm performance positively [15], enhances employee job satisfaction and retention [28], and promotes ethical conduct in employees when managers lead from the front and exemplify such conduct [16]. According to Voegtlin [14], green and responsible leadership bars employees' unethical behavior and nurtures organizational sustainable growth by focusing on social, economic, and environmental aspects.

2.2. Pro-environmental behavior

Employee involvement in environment-friendly behavior is crucial for organizations striving for sustainability [29]. Various terms such as pro-environmental, green, and environment-friendly behavior have been used to refer to the concept. These terms denote employees' efforts to minimize adverse environmental impacts or actively contribute to its enhancement [30]. Overall, pro-environmental behavior encompasses individuals performing a series of behaviors contributing to a sustainable environment to protect the environment [31]. These behaviors are typically undertaken without specific rewards, as employees commonly engage in them for the collective welfare of their environment and society [32].

Organizations are increasingly proposing sustainable solutions for building smart cities and are earnestly developing strategies to safeguard the environment in line with UN-SDGs. Smart cities foster pro-environmental behavior by using advanced technologies and data analytics to optimize resource use and reduce waste. Recognizing the

significance of employee involvement, organizations are actively working to motivate their staff to participate more frequently in environment-friendly behaviors [10]. Examples of such initiatives encompass minimizing the use of plastic cups, using both sides of the paper, buying green products, and appropriately dumping waste materials [33].

2.3. Theoretical underpinning

Social Learning Theory (SLT) suggested by Bandura [34], defines the basis of learning behaviors as the process of observation and social imitation through team interaction. Under this theory, organizations show that employees work inside networks shaped by both their leaders and peer colleagues alongside workplace social. Environmental issues affecting the construction sector receive important theoretical support from SLT because it explains responsible leadership's role in promoting pro-environmental employee behavior [20]. SLT explains that employees display sustainable workplace behaviors because they perceive their leaders as demonstrating and promoting environmentally responsible practices. By modeling behavior, work environment leaders teach other staff members how to conserve energy and reduce waste while making environment-friendly decisions and adhering to environmental regulations [13]. Employees develop environmental consciousness by observing their leaders and physical and verbal environmental advocacy, so they implement sustainable actions in their regular activities [14]. SLT corresponds to environmental consciousness, green management, and shared vision, which serve as mediators in developing employee sustainability practices [35]. Leaders make employees more environmentally conscious by continuous awareness promotion, sustainability training, and championing green initiatives [24]. This makes employees more aware of environmental challenges and their individual responsibility to reduce them. Such cognitive development leads employees to perform behavioral transformations, thus manufacturing sustainability into a mutual target rather than maintaining it as an isolated personal drive. Pro-environmental behaviors persist longer when employees experience their organization reflects such principles because they know their behaviors receive organizational recognition. SLT explains effectively how responsible leadership produces environmental and behavioral changes in construction employees. Leaders demonstrating sustainable practices while developing sustainable organizational cultures help build teams dedicated to sustainable construction methods. This perspective requires executive training alongside workplace sustainability standards, establishing an environmentally responsible organizational culture to sustain green management and sustainable development in the construction sector [36].

3. Research model and hypotheses development

Drawing from previous research, this study constructs a conceptual model incorporating responsible leadership, green shared vision, environmental consciousness, green management, and pro-environmental behavior. Fig. 1 showcases the conceptual model representing the association between the predictor variable (responsible leadership), mediating variables (green shared vision, environmental consciousness, and green management), and a criterion variable (pro-environmental behavior). Four key hypotheses are proposed in this study. The pertinent hypotheses and associated rationale are presented below.

3.1. Responsible leadership and pro-environmental behavior

Responsible leaders consider the needs and interests of their employees' self-awareness and professional growth. They encourage employees to enable and work in a green working atmosphere in the firm and construction sites [37]. Pro-environmental behavior is voluntary, where responsible leaders can lead by example [22]. Responsible leaders' concern for environmental protection and management incites them to set models for employees through administrative measures. Such commitments motivate employees to participate in pro-environmental behavior [13].

Responsible leaders motivate employees by conveying that green practices are acknowledged, welcomed, and anticipated at the construction sites and in the workplace [38]. Discussing and practicing pro-environmental behavior in daily office routines by responsible leaders fosters a sense of caring for nature and the planet among employees and persuades them to adopt green practices with positive implications for the broader community and future generations [39]. Responsible leadership encourages employees' integrity throughout the work process, inspiring them to rise above their interests for the improvement of both the construction organization and society. Responsible leaders guide their employees through intellectual discussions and dialogue, foster self-directed, morally conscious tasks that contribute to the betterment of both society and the construction organization, and provide meaning and purpose regarding their roles. Such interventions trigger pro-environmental behaviors [24]. Therefore, it is hypothesized that:

H1: Responsible leadership positively impacts construction employees' pro-environmental behavior.

3.2. Role of green shared vision

A shared vision gives a group a key idea that helps shape construction employees' activities [40]. A green shared vision establishes a

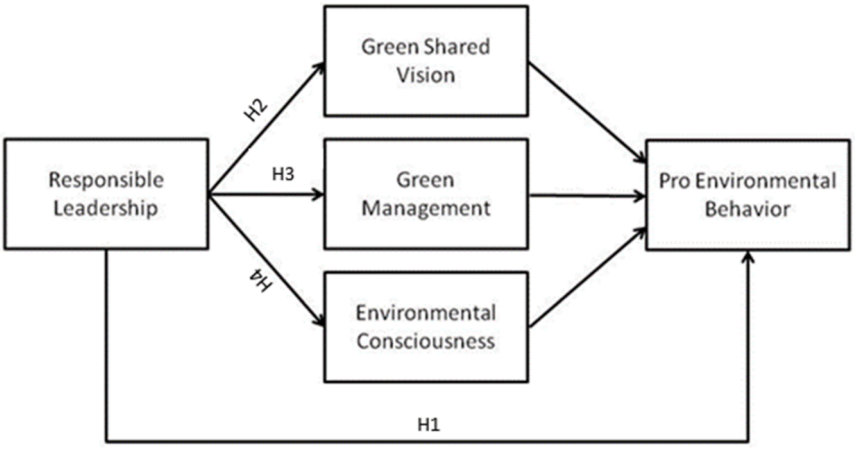

Fig. 1. Conceptual model.

strategic and transparent shared path, concentrating on achieving both the ecological goals and environmental ambitions of the business entity, embraced by its workforce [41]. Green shared vision deals with advancing new thoughts regarding green items, administrations, procedures, or rehearses as unique, novel, environment-friendly, and helpful [42]. Studies highlight that shared green vision impacts pro-environmental behavior and imagination in construction workers. A common vision mirrors the collective consciousness and goals of an organization's employees, paving the way for the future promotion of environment-friendly behavior within the construction organization [43].

The success of a vision relies on effective communication by organizational leaders. Carton [44] stressed that leaders should employ expressions to cultivate a shared sense of purpose among employees, ultimately enhancing organizational performance. Organizational mindfulness is supported by a shared vision of pro-environmental behavior. Responsible leadership is centered on comprehending, forecasting, and managing both personal and interpersonal dynamics, navigating how individuals influence one another to achieve shared objectives [45]. Similarly, the primary objective of green leadership is to provide a clear vision to inspire and motivate employees to contribute towards the organization's environmental objectives [46]. A responsible leader promotes acquiring new knowledge among its employees [47] and actively engages them in initiatives related to green processes at construction sites and product innovation, facilitating the launch of eco-friendly products/services and enhancing the construction firm's environmental performance [48].

Furthermore, responsible leaders promote the significance of environmental protection [49], actively staging a shared green vision by formulating plans for environmental stewardship. In construction organizations with a shared vision, workers view their efforts as meaningful [50], fostering a greater sense of belonging and comfort in expressing their ideas concerning potential environmental enhancements [20]. Accordingly, it is hypothesized that:

H2: A green shared vision mediates the impact of responsible leadership on construction employees' pro-environmental behavior.

3.3. Role of green management

Green management refers to integrating environmentally sustainable practices into human resources management. It signifies the construction organization's strong commitment to environmental protection, urging top management to prioritize processes and practices that encourage employee engagement in environmentally responsible behaviors at offices and construction sites. This, in turn, enhances environmental performance in the workplace [51].

Responsible leadership views green management as an additional cost that may diminish competitive potential, primarily acknowledging legal requirements [52]. However, contrary to the belief, construction organizations can reap numerous benefits by embracing proactive green management practices [53] such as environmental certification [54] and eco-labeling [55]. Implementing these practices boosts employee satisfaction and loyalty as they get a sense of paying back to society and preserving the environment for future generations. Currently, responsible leadership mainly incorporates environmental management into formulating strategies to gain a competitive advantage [56].

Green management practices encompass green quality management [57], energy management [58], and environmental management systems [59], among others. Green management practices function as a pivotal mechanism through which responsible leadership integrates environmental considerations into both organizational processes and corporate culture. By promoting and implementing such practices, responsible leaders can effectively translate their sustainability vision into tangible strategies, thereby fostering pro-environmental behavior among employees. In this regard, green management serves as an intermediary, linking responsible leadership with employees' environmentally responsible actions, and thereby contributing to the enhancement of organizational sustainability performance. So, it is hypothesized that:

H3: Green management mediates the impact of responsible leadership on construction employees' pro-environmental behavior.

3.4. Role of environmental consciousness

Environmental consciousness alludes to liability, consideration of nature, and attitudes reflecting a commitment to environmentally responsible behavior [60]. It pertains to an individual's captivating thoughts regarding specific matters and attitudes that mirror the consistent assessment, feelings, and inclination of employees towards pro-environmental behavior at construction sites [61]. Leaders' environmental consciousness significantly affects their capacity to deal with complex environmental issues, lead change, and advance development [62,63]. Responsible leaders take a more extensive and adaptable approach to environmental protection than other leaders. A transition to post-conventional stages in developing environmental consciousness among leaders can substantially enhance their leadership, ultimately fostering pro-environmental behavior on construction projects [20].

Responsible leaders such as directors and managers discuss green environment qualities and pass on eco-friendly practices and initiatives to construction employees as role models to take collective actions on environmental issues [64]. Such leaders play a pivotal role in promoting the advancement of organizational sustainable development through prioritizing performance in the social, economic, and environmental dimensions. Central to this process is environmental consciousness, which serves as a critical mediator between responsible leadership and employees' pro-environmental behavior. By promoting environmental awareness, responsible leaders can shape an organizational culture that prioritizes sustainability, thereby fostering positive environmental actions across all organizational levels. This emphasis on environmental consciousness is a fundamental determinant in shaping pro-environmental behavior within construction industry [37]. Accordingly, it is hypothesized that:

H4: Environmental consciousness mediates the impact of responsible leadership on construction employees' pro-environmental behavior.

4. Methodology

4.1. Data collection

This study adopts a deductive research methodology, employing a structured questionnaire survey to gather data from professionals within the construction industry. The target population comprises employees associated with the Pakistan Engineering Council working at various construction projects in the three provinces (Punjab, Sindh, and Khyber Pakhtunkhwa) of Pakistan . The emphasis is specifically on individuals occupying intermediate and senior managerial roles within the construction sector. A total of 450 questionnaires were disseminated to the chosen participants, resulting in 305 valid responses, thereby achieving a response rate of 68 %. This strong response rate enhances the credibility and representativeness of the findings, providing deep understanding into the perspectives of professionals in the construction sector.

4.2. Questionnaire development

The questionnaire consisted of structured research questions derived from established studies (Table 1). To evaluate employees' inclination toward environmental consciousness, nine items were adapted from prior research [65]. Pro-environmental behavior was assessed using four items [66], while six items measured green management [67]. Additionally, a green shared vision was examined through four items [68]., and responsible leadership was evaluated using five items from existing literature [14]. The collected data was analyzed using Smart PLS 3.0,

Table 1
Scale items to measure constructs of the research model.

Code	Items	Source
	Responsible Leadership	
RL1	My direct supervisor demonstrates awareness toward environmental issues	[14]
RL2	My direct supervisor considers consequences of decisions on environment	
RL3	My direct supervisor involves team while taking decisions that have environmental implications	
RL4	My direct supervisor weighs suggestions of team members in curtailing the impact of construction activities on environment	
RL5	My direct supervisor builds consensus on environmental protection plan before issuing work instructions	
	Green Shared Vision	
GSV1	A commonality of environmental goals presents in the company	[68]
GSV2	There is a total agreement on the strategic environmental directions	
GSV3	All employees in the company are committed to the environmental strategies	
GSV4	Employees are eager about the shared environmental mission of the organization	
	Green Management	
GMAG1	Whether your firm has been endeavouring to protect the environment	[67]
GMAG2	Whether your firm has been endeavoring to eliminate detrimental factors in the workplace	
GMAG3	Whether your firm has been endeavoring to wisely and responsibly use resources	
GMAG4	Whether your firm has been endeavoring to consciously minimize inputs of raw material by means of improving the efficiency of the production process	
GMAG5	Whether your firm has been endeavouring to use recycled materials	
GMAG6	Whether your firm has been endeavouring to respect nature and enhance environmental consciousness by conducting trainings for employees on environmental protection and incentivizing environment friendly initiatives	
	Environmental Consciousness	
ECON1	Reduced water consumption is necessary for sustainable development	[65]
ECON2	Preserving the variety of living creatures is necessary for sustainable development	
ECON3	For sustainable development, people need to be educated in how to protect themselves against natural disasters	
ECON4	I think that using more natural resources than we need will threaten the health and well-being of people in the future	
ECON5	I think that we need stricter laws and regulations to protect the environment	
ECON6	I think that it is important to take measures against problems which have to do with climate change	
ECON7	I recycle as much as I can	
ECON8	I always separate reusable waste before putting out the rubbish when I have the chance	
ECON9	I have changed my personal lifestyle in order to reduce waste	
	Pro-environmental Behavior	
PB1	At work, I take part in environmentally friendly programs	[12]
PB2	I share my knowledge about the environment with co-workers	
PB3	At work, I question practices that are likely to hurt the environment	
PB4	At work, I perform tasks that are not required by my firm	

enabling a statistical assessment of the proposed hypotheses within the conceptual framework.

4.3. Data analysis

This study employs Structural Equation Modeling (SEM) to analyze the collected data and derive meaningful insights. SEM is widely used for predictive data analysis due to its ability to capture complex relationships between variables [69]. This variance-based approach is frequently employed to evaluate proposed linkages inside a structural model. A principal feature of Partial Least Squares Structural Equation Modeling (PLS-SEM) is its capacity to accommodate datasets with limited sample sizes and non-normal distributions, rendering it exceptionally appropriate for diverse research situations [69]. In contrast to other statistical methods, SEM employs a multivariate regression technique, evaluating several associations concurrently. It also assesses essential factors such as the reliability and validity of the data, examining issues such as multicollinearity, correlation, and variance. Furthermore, SEM offers understanding of the model's general adequacy, confirming that the proposed relationships appropriately represent the data and facilitate solid, legitimate conclusions. This holistic methodology renders SEM an effective instrument for scrutinizing intricate datasets and evaluating theoretical frameworks.

The survey conducted an anonymous distribution of questionnaires and guaranteed participant confidentiality to minimize response bias. Anonymity encourages participants to provide truthful answers, especially when asked about important matters related to environmental awareness. The research included a wide-ranging participant sample involving 305 employees, improving the study findings' generalization potential. The development of the scales proved crucial as a measure to counter response bias. The researchers carefully selected existing validated items from pertinent studies to measure constructs, namely Environmental Consciousness, Pro-environmental Behavior, Green Management, Green Shared Vision, and Responsible Leadership. Measuring the constructs with validated and reliable scales reduces the possibility of measurement error in the research. The research employed Smart PLS 3.0 via SEM analysis to conduct detailed statistical assessments on model validity, including construct reliability and multicollinearity testing so that data collection biases could be identified for remediation. In this regard, multicollinearity was checked, and no multicollinearity was detected, as all VIF values were <5.

5. Results

5.1. Measurement model estimation results

The measurement model estimation evaluates latent variables and their attributed measures. Considering the PLS-SEM approach, evaluating the measurement model involves examining research instruments and the gathered data for internal consistency. The associated measures focus on reliability, convergent validity, and discriminant validity. Initially, the reliability of the constructs is gauged using 'Cronbach's Alpha.' Another criterion for assessing the internal consistency of the constructs is 'Composite Reliability.' Research indicates that the precise evaluation of the internal consistency of a construct falls within the range approximated by Composite Reliability and Cronbach's Alpha [70]. The threshold attributed to both criteria is a minimum of 0.7. Using this as the baseline, all constructs and their respective indicators in the current study were found reliable (Table 2). Results indicated that the AVE measure for environmental consciousness is equal to 0.50. However, the study kept all five measurement indicators to guarantee content validity and maintain the construct's theoretical breadth. The findings of Fornell and Larcker [71] allow the acceptance of AVE values under 0.50 when CR exceeds 0.60. This viewpoint is also reinforced by the studies of Huang et al. [72], Lam [73], and Maruf [74], which suggest that when CR is high, the construct's convergent validity remains acceptable even if the AVE falls below 0.50.

Further, aligned with the internal consistency of the opted constructs, studies have suggested that the outer loadings of the relevant indicators be valued above 0.7 to be included in the structural model [75]. If the regarding value is below 0.7 for a given indicator but above 0.4, it can still be included for statistical evaluation if its inclusion is critical for the study. Considering this criterion, one indicator (RL5) for responsible leadership, one (PB4) for pro-environmental behavior, four for environmental consciousness (ECON6–9), and two indicators (GMAG4, GMAG5) for green management were removed from the model to enhance the overall fitness of the model.

Convergent validity assesses the extent to which the indicators of a

Table 2
Constructs reliability and validity.

Indicator	No. of Items	Outer Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Environmental Consciousness	5		0.70	0.71	0.81	0.50
ECON1		0.69				
ECON2		0.68				
ECON3		0.74				
ECON4		0.61				
ECON5		0.64				
Pro-environmental behavior	3		0.60	0.70	0.79	0.56
PB1		0.79				
PB2		0.83				
PB3		0.60				
Green Management	4		0.70	0.70	0.82	0.53
GMAG1		0.75				
GMAG 2		0.76				
GMAG3		0.74				
GMAG6		0.65				
Green Shared Vision	4		0.70	0.71	0.81	0.52
GSV1		0.76				
GSV2		0.77				
GSV3		0.64				
GSV4		0.70				
Responsible Leadership	4		0.70	0.71	0.82	0.52
RL1		0.74				
RL2		0.77				
RL3		0.74				
RL4		0.65				

construct accurately reflect the essence of the construct. The convergent validity is gauged based on the 'Average Variance Extracted' (AVE), with a minimum threshold set at 0.5. Accordingly, all the constructs of the current study were found convergently valid (Table 2).

Discriminant validity evaluates the extent to which an indicator is distinct from others linked to different constructs, ensuring that each construct measures a unique concept. Establishing discriminant validity is crucial for confirming that variables do not overlap significantly, thereby enhancing the model's reliability. It is assessed using the Fornell-Larcker criterion (Table 3), which compares the square root of the average variance extracted (AVE) with correlations between constructs. Additionally, the Heterotrait-Monotrait (HTMT) ratio (Table 4) quantifies construct distinctiveness by examining trait correlations. Lastly, cross-loadings (Table 5) determine whether each indicator loads more strongly on its associated construct than on others. The analysis of cross-loadings proves there are no major concerns about multicollinearity within the model framework. The diagonal values demonstrate that every item achieves the best measurement within its defined construct with very weak relationship values when compared to other constructs. Environmental Consciousness (ECON1 to ECON5) items demonstrate greater correlation values with their intended construct than the other constructs suggesting well-defined distinction. Each item in the Pro-environmental behavior (PB1 to PB3), Green Management (GMAG1 to GMAG6), Green Shared Vision (GSV1 to GSV4), and Responsible Leadership (RL1 to RL4) groups exhibits solid measurement on its specific construct without noticeable cross-loadings with other constructs.

HTMT is widely regarded as the most precise method for evaluating discriminant validity due to its high level of specificity, with measurement precision ranging from 97 % to 99 %. This high precision makes HTMT a reliable approach in determining whether constructs are sufficiently distinct from one another. In comparison, the Fornell-Larcker Criterion and cross-loadings are less accurate, with their measurement precision ranging from 0.0 % to 20.82 %, which may not provide the same level of clarity in distinguishing between constructs. According to HTMT guidelines, for an indicator to be considered discriminantly valid, its value should be below 0.90 (Table 4). In the context of this research, all variables exhibited HTMT values lower than 0.90, thereby confirming the discriminant validity of the constructs. This result assures that the selected research items were able to accurately represent the variables they were intended to measure, ensuring that the constructs did not overlap or share substantial variance. The use of HTMT enhances the robustness of the study's findings by ensuring that each construct is uniquely defined, contributing to the overall reliability and validity of the research model.

5.2. Structural model estimation results

The structural model in the current study was evaluated to examine the collected data against the anticipated outcomes. The main measures employed to assess a structural model comprise path coefficients, their respective level of significance (P-Value, t-Value), and coefficient of determination (R^2). Further, the impact magnitude for each independent variable upon a dependent one is evaluated in terms of the effect size (f^2).

This study applied multiple regression analysis to explore the direct effect of responsible leadership on environmental consciousness, green shared vision, and green management. It further examined how these factors influence pro-environmental behavior. Lastly, the mediated impact of responsible leadership on pro-environmental behavior through green shared vision, green management, and environmental consciousness was assessed. The significance of the findings was

Table 3
Fornell-Larcker criterion.

	Environmental Consciousness	Pro-environmental Behavior	Green Management	Green Shared Vision	Responsible Leadership
Environmental Consciousness	0.68				
Pro-environmental Behavior	0.39	0.75			
Green Management	0.23	0.32	0.73		
Green Shared Vision	0.06	0.21	0.36	0.72	
Responsible Leadership	0.34	0.34	0.30	0.27	0.73

Table 4
Heterotrait-Monotrait ratio (HTMT).

	Environmental Consciousness	Pro-environmental Behavior	Green Management	Green Shared Vision	Responsible Leadership
Environmental Consciousness					
Pro-environmental Behavior	0.58				
Green Management	0.32	0.48			
Green Shared Vision	0.19	0.32	0.51		
Responsible Leadership	0.47	0.43	0.42	0.36	

Table 5
Cross loadings.

	Environmental Consciousness	Pro-environmental Behavior	Green Management	Green Shared Vision	Responsible Leadership
ECON1	0.69	0.29	0.23	0.10	0.24
ECON2	0.68	0.30	0.18	0.13	0.19
ECON3	0.74	0.25	0.10	0.07	0.30
ECON4	0.61	0.25	0.09	−0.06	0.22
ECON5	0.64	0.23	0.18	−0.09	0.16
PB1	0.30	0.79	0.29	0.18	0.21
PB2	0.39	0.83	0.19	0.16	0.30
PB3	0.17	0.60	0.24	0.14	0.27
GMAG1	0.14	0.20	0.75	0.29	0.22
GMAG2	0.11	0.19	0.76	0.30	0.20
GMAG3	0.22	0.31	0.74	0.23	0.20
GMAG6	0.18	0.19	0.65	0.22	0.26
GSV1	0.10	0.19	0.28	0.76	0.23
GSV2	0.04	0.17	0.28	0.77	0.18
GSV3	0.03	0.12	0.26	0.64	0.10
GSV4	−0.02	0.10	0.21	0.70	0.22
RL1	0.21	0.31	0.32	0.21	0.74
RL2	0.28	0.21	0.21	0.18	0.77
RL3	0.29	0.25	0.20	0.19	0.74
RL4	0.20	0.22	0.13	0.19	0.65

determined using a 95 % confidence interval.

Considering the path coefficients, all the relationships of the independent variable, i.e., responsible leadership, were found to positively influence the respective dependent variables, i.e., environmental consciousness, green shared vision, and management. Similarly, the current study's mediating variables, i.e., environmental consciousness, green shared vision, and management in their independent nature, were positively associated with pro-environmental behavior (Table 6).

Bootstrapping was conducted to determine the significance of the evaluated effects of constructs. Accordingly, path coefficients were determined using P-values and t-values. For a relationship to be significant, the P-value must be below the threshold of 0.05, while the t-value is expected to be above 1.96. Accordingly, the hypothesized relationships were found to be significant (Table 6). Similarly, the mediating effects using PLS-SEM were determined by calculating the pertinent indirect effects. These calculations highlighted the positive nature of the proposed effects. All associated levels were determined as significant to meet the suggested threshold. The associated coefficient of determination (R^2) revealed the extent of variance attributed to the independent variables on the dependent ones, with a value of 0.22. This signifies a 22 % variance predicted by the independent variables in determining the dependent variable. Lastly, the effect size for each construct in terms of f^2 was determined. The results indicate that all the constructs of the current study have minimum effects on the associated variables (Table 6).

6. Discussion

Environmental sustainability has become a pivotal concern in the present era, requiring the combined efforts of citizens, organizations,

Table 6
Results of the structural model.

Indicators	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	R^2	f^2	Hypothesis Support
Environmental Consciousness -> Pro-environmental Behavior	0.34	0.35	0.06	5.97	0.00	0.22	0.14	Accepted
Green Management -> Pro-environmental Behavior	0.19	0.19	0.07	2.95	0.00		0.04	Accepted
Green Shared Vision -> Pro-environmental Behavior	0.12	0.12	0.06	2.13	0.03		0.02	Accepted
Responsible Leadership -> Environmental Consciousness	0.34	0.34	0.07	5.15	0.00		0.13	Accepted
Responsible Leadership -> Green Management	0.30	0.31	0.06	5.08	0.00		0.10	Accepted
Responsible Leadership -> Green Shared Vision	0.27	0.28	0.05	4.86	0.00		0.08	Accepted
Responsible Leadership -> Environmental Consciousness -> Pro-environmental Behavior	0.11	0.12	0.03	3.41	0.00			Accepted
Responsible Leadership -> Green Management -> Pro-environmental Behavior	0.06	0.06	0.03	2.32	0.02			Accepted
Responsible Leadership -> Green Shared Vision -> Pro-environmental Behavior	0.03	0.03	0.02	1.74	0.08			Accepted

and government. Within organizational settings, encouraging employees to embrace environment-friendly practices is mostly dependent on the leadership. Accordingly, this study investigated the direct impact of responsible leadership on the pro-environmental behavior of construction industry employees, considering the mediating roles of environmental consciousness, green shared vision, and management.

6.1. Discussion on the hypotheses

According to H1 results, responsible leadership significantly influences the pro-environmental behavior of construction employees, thereby achieving the main objective of the research. Leadership is an important element that can influence how employees behave in a business [76]. Effective leaders foster a supportive workplace culture that encourages environmental stewardship by establishing clear expectations and standards for pro-environmental activity. By actively reducing the organization's ecological footprint and modeling environmentally conscious conduct, these leaders serve as role models and encourage others to adopt sustainability [19].

Organizations can benefit greatly from responsible leadership. Responsible leadership has been linked to several positive effects on employees' pro-environmental behavior by emphasizing intellectual stimulation, personalized attention, inspirational motivation, and idealized influence. Thus, responsible leaders can inspire staff by imparting a vision for sustainability, elevating their trust and confidence to take environment-friendly initiatives, and going beyond what they previously believed was possible [77]. Responsible leaders convey their vision and mission with clarity and passion. They are motivated by a strong sense of purpose, actively listen to their staff members, and have outstanding communication skills, which foster an atmosphere of open communication, respect, and trust. Such leaders encourage their team members to grow emotionally and professionally by offering support, direction, and mentorship [78]. Moreover, responsible leaders establish a culture of continuous improvement and enable their staff to take ownership of their jobs by encouraging creativity, innovation, and critical thinking. The results of H1 align with these features of responsible leadership where pro-environmental behavior is encouraged in employees.

Results of H2 indicate that green shared vision plays a pivotal intermediary role in the relationship between responsible leadership and the pro-environmental behavior of construction employees. Regarding green shared vision, responsible leadership entails taking proactive measures toward environmental protection and encouraging environmentally friendly and sustainable activities. It involves leading by example, outlining precise standards for environment-friendly conduct, and motivating others to do the same. A responsible leader recognizes the significance of tackling ecological issues and endeavors to integrate sustainability into routine business activities [79]. Some relevant examples include encouraging energy efficiency, cutting back on waste production, and switching to renewable energy sources whenever feasible. Responsible leaders ensure that their firms minimize their negative ecological impact and make a constructive contribution to the global battle against climate change by cultivating a culture of sustainability. In the modern era, this helps organizations align with the UN-SDGs.

H3 results suggest that green management plays a pivotal intermediary role in the relationship between responsible leadership and the pro-environmental behavior of construction employees. Green management practices and responsible leadership for construction employees emphasize the leaders' critical role in advancing sustainability in their organizations. It entails encouraging an environment-conscious culture and following up with employees to ensure they actively engage in eco-friendly activities [80]. Responsible leaders prioritize the overall health of the business and its stakeholders, including the employees. They understand and value that the effective implementation of sustainable programs relies on the active participation of the employees. Therefore, to achieve sustainable goals in line with UN-SDGs, responsible leaders harness the collective strength of their staff by fostering an inclusive workplace where ideas, feedback, and concerns are valued. Additionally, they fund training initiatives to enlighten employees about environment-friendly behaviors. A more sustainable future for organizations can be steered by responsible executives setting an example for their staff by cutting back on waste, using less energy, and promoting eco-friendly suppliers [81].

H4 results imply that environmental consciousness plays a pivotal intermediary role in the relationship between responsible leadership and the pro-environmental behavior of construction employees. This finding substantiates that an increased environmental consciousness level is obtained through responsible leadership and pro-environmental behavior. This is because responsible leadership generates a sense of consciousness among the employees through their actions toward sustainability and the environment. Similarly, when an employee sees the leader as enthusiastic about improving the environment, they try to replicate the same at their level. Such actions are contagious and usually trickle down the organization. Human behavior, known for its intricacy, is largely influenced by the learning process. This involves various modes, including direct empirical and indirect learning, where individuals acquire knowledge by observing the behavior of role models or responsible leaders [82]. Given the frequent interaction between leaders and employees, leaders' conduct significantly influences employee attitude. This study highlights that responsible leadership contributes to promoting organizational citizenship behavior toward the environment by exemplifying moral conduct and cultivating an ethical atmosphere. The same has been concluded by [83].

6.2. Theoretical and practical implications

By identifying environmental consciousness as a key mediator, this study significantly advances the literature on pro-environmental behavior, highlighting its essential role in linking responsible leadership to the pro-environmental actions of construction employees [20]. The research extends beyond prior studies by illustrating how environmental consciousness shapes employees' attitudes and behaviors, effectively bridging the connection between leadership practices and sustainable actions in the construction industry. Additionally, the study introduces green management and a green shared vision as additional mediators, offering new insights into how these factors amplify the positive impact of responsible leadership on employees' pro-environmental behavior [12].This study has implications for both internal and external stakeholders and management of construction organizations. Responsible leadership has a substantial influence on the pro-environmental behaviors of its workforce, which has huge ramifications for businesses and society at large. Pro-environmental behavior among construction employees can be greatly aided by responsible leadership. Such behavior is demonstrated by leaders who place a high value on moral decision-making and show concern for the social and environmental effects of their actions. The same, if adopted at the organizational level, helps achieve sustainability goals in line with UN-SDGs. Our findings indicate that responsible leadership can significantly drive pro-environmental behavior in construction employees. Therefore, construction organizations can benefit from this study by enhancing their processes for selecting, assessing, and developing leaders who foster responsible characteristics. Such responsible leaders serve as communicators within the construction organization, communicating their environmental standards and values, thereby heightening awareness of responsibility among subordinates. A manager's responsible leadership level and the reinforcement of their interactions with employees contribute significantly to fostering environmentally protective practices at the construction sites. Additionally, the construction organization's human resources practices should indicate a commitment to recruiting individuals who embody the values and traits associated with responsible leadership.

To reinforce responsible leadership within construction organizations, the core values indicated in this study should be integrated into decisions regarding promotions, training programs, and leadership development initiatives. Simultaneously, efforts should be directed toward fostering an organizational culture that embraces a shared green vision among construction employees. Cultivating a green shared vision involves implementing environment-related policies and practices, such as energy conservation, carbon emissions reduction, and resource reuse, to motivate pro-environmental behavior among construction employees for sustainable buldings and cities [84–86]. Similarly, green management plays a pivotal role in promoting environment-friendly practices in the construction sector. It involves adopting new organizational structures or management systems prioritizing sustainability, thereby enhancing production and management processes to minimize negative environmental impacts affiliated with construction projects. Such management styles will facilitate transform construction organizations and help them enable sustainability in their core operations and practices in the future.

7. Conclusions and future directions

The current study investigated the relationship between responsible leadership and environmentally conscious conduct among employees using Pakistan's construction industry as an example. The results revealed that responsible leadership practices significantly impact construction employees' pro-environmental behaviors. This suggests that leaders who prioritize sustainability and environmental responsibility are essentially encouraging their workforce to act in an environmentally responsible manner. Further, green management, green shared vision, and environmental consciousness positively mediated the relationship between responsible leadership and the pro-environmental behavior of construction employees in the current study. Accordingly, responsible leaders can encourage their staff to embrace more sustainable behaviors at construction sites and in their personal lives by supporting green initiatives, providing sustainability-oriented training, sharing green ideas, establishing clear standards, and offering incentives for eco-friendly conduct.

By providing insights into the significance of responsible leadership in promoting environmental consciousness inside construction firms functioning in developing economies, this research makes humble contributions to the body of literature. The role of considered mediators between responsible leadership and the pro-environmental behavior of construction employees adds to the normative literature on pro-environmental behavior in service industry.

The current research has certain limitations that merit consideration for future research. The sample size was limited to construction employees, suggesting the need for replication with a more diverse sample across various settings. The study did not account for all potential factors influencing the relationship between responsible leadership and pro-environmental behavior. Factors such as motivation, commitment, and behavioral intentions might also play a key role. Future research could explore these aspects and investigate other factors at the organizational level that will help present more holistic frameworks.

CRediT authorship contribution statement

Ahsen Maqsoom: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Lapyote Prasittisopin:** Writing – review & editing, Validation, Resources, Project administration, Funding acquisition. **Fahim Ullah:** Writing – review & editing, Visualization, Validation, Conceptualization.

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.

Data availability

Data will be made available on request.

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