



Research article

Green leadership in manufacturing industry: Unveiling the green Revolution's impact on organizational performance

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ABSTRACT

This study aims to analyze the role of green transformational leadership and human resource management in organizational performance with the mediating effect of green innovation. The study also proposes the moderating role of commitment to management change. The study used a quantitative research method with a random sampling technique and surveyed 235 managers from the Cement industry across Pakistan. The statistical techniques used to assess the study's hypotheses were partial least squares structural equation modeling (PLS-SEM) and SPSS. The findings show that green transformational leadership and HRM positively impact organizational performance, with green innovation partially mediating effect. Furthermore, affective commitment to management change strongly moderates the relationship between green innovation and organizational performance. In addition, the proposed relationship is based on the resource-based view (RBV) theory. Therefore, Managers and executives should adopt green principles and practices and build an environmentally friendly culture that encourages employees to engage in green behaviors and activities to improve organizational performance. To successfully implement green practices in a developing country like Pakistan, the Cement sector must understand how the cement industry improves its performance and whether employees demonstrate green innovation.

1. Introduction

In recent decades, scholars have recognized the significance of Green HRM and green leadership in shaping the operational practices in modern firms [1]. In this regard, and for the efficient and effective management of operations, technology advancements, and rising stakeholder pressure have motivated firms to discover and implement cost-effective and long-term methods to improve organizational performance [2,3]. Enhancing performance has emerged as a primary problem for businesses, requiring the effective utilization of organizational resources and adopting environmentally sustainable practices in Green HRM and eco-friendly activities [4]. The significant rise in globalization and social responsibilities demands justifications for adopting optimal Green HRM practices and integrating data analytics to enhance decision-making [5,6]. To ensure the sustainability and advancement of green business activities, dominant policies encompassing Green HRM, innovation, leadership, environmental quality, and social well-being are essential. Businesses can mitigate their adverse environmental and societal impacts by implementing GHRM, green leadership, and

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innovative practices [7]. Green HRM comprises three crucial components: motivating employees to enhance their engagement, providing them with green opportunities, and assisting in developing their green skills, which are essential abilities [8]. The underlined components of Green HRM address staff recruitment, selection, development, and training with an environmentally conscious focus; the potential for adopting green practices encompasses employee involvement and green leadership [9].

According to Robertson & Barling [10], green transformational leadership can be described as an interpretation of transformational leadership that explicitly emphasizes the promotion of environmental initiatives through the content of leadership behaviors. Singh et al. [11] conducted a recent study that highlights the primary objective of a green transformational leader. This objective entails offering employees inspiration, motivation, and a well-defined vision while simultaneously addressing their developmental requirements to achieve the organization's environmental goals. Chen et al. [12] posit that implementing green transformational leadership in Taiwan has enhanced self-efficacy, awareness, and performance. A research study in Pakistan discovered that green transformational leadership significantly boosts green performance [13]. Green HRM and leadership are essential in enhancing employee engagement through green awards, performance management, and appraisal systems [9]. The psychological characteristics, employee opinions, and organizational culture significantly impact an organization's overall effectiveness [14,15]. Hence, Green HRM and leadership are important to effectively managing people in various manufacturing firms [14,15]. According to Chen & Chang [16], a leader demonstrating green transformational leadership (GTL) is someone who inspires and motivates coworkers/colleagues to exceed environmental expectations.

On the other hand, green innovation refers to developing or modifying processes, technologies, systems, and products to mitigate or prevent environmental issues [17]. Green innovation comprises both process and product innovation [18]. It involves enhancing the design of products and implementing manufacturing processes aimed at pollution reduction. This approach consists of monitoring a company's environmental footprint, including pollution levels, and striving for energy efficiency [19]. For instance, Begum et al. [20] conducted research in China and argued that green innovation is hugely affected by green transformational leadership. Furthermore, studies by Begum et al. [20], Chen et al. [12], and Hanif [13] emphasized the importance of green innovation in the growing economies, as well as related concepts such as eco-innovation, sustainable innovation, and ecological innovation [21]. Besides that, affective commitment is characterized as a heartfelt, emotional attachment to an organization's goals and values, as well as to one's role in achieving these goals and upholding the organization's values. It goes beyond mere instrumental worth and extends to valuing the organization for its intrinsic worth [22]. Anyone who is committed must fulfill the actions specified in the agreement's terms. These behaviors include various assistance that an organization expects from its employees [23].

Employees' commitment is primarily influenced by the perceived costs of not supporting change. This situation promotes resistance to change and a lack of engagement in green activities, as well as when commitment is solely based on avoiding immediate costs; employees may prioritize short-term gains over long-term benefits [24]. As a result, employees who fear the costs of change may be less likely to propose new ideas or take calculated risks. This can stifle innovation and hinder the development of a culture of continuous improvement. Moreover, the commitment driven by the fear of negative consequences can lead to a hostile work environment, low morale, and increased turnover as employees seek more positive and empowering workplaces. Given that, the current study addresses some fundamental research questions:

- (a) How does green transformational leadership contribute to organizational performance?
- (b) How does green HRM contribute to organizational performance?
- (c) Does organizational performance depend on adopting and applying leadership and HRM practices?
- (d) To what extent does green innovation mediate the interaction between green transformational leadership and human resource management to influence organizational performance?
- (e) How does commitment to management change moderate the relationship between green innovation and organizational performance?

This research contributes to the literature on green transformational leadership, HRM, innovation, affective commitment to change management, and organizational performance. The study has revealed that to attain corporate performance, an organization's top management must embrace Green HRM and transformational leadership approaches while fostering the enduring internal competencies necessary for green innovation [1]. The study adopts the RBV theory to clarify the roles of green transformational leadership and HRM in enhancing businesses' capacity to maximize green innovation and improve overall performance. The RBV as a model provides a comprehensive understanding of human resources within a company, offering improved insight, predictive capabilities, and enhanced management.

In the initial phase of this study, we thoroughly examine the significance of the Resource-Based View (RBV) theory in the unique context of the Cement manufacturing business. This examination shows how green transformational leadership, HRM, and innovation foster fundamental organizational performance with the moderating impact of affective commitment to management change, particularly in Pakistan's distinctive cement industry setting.

Furthermore, this study unfolds in an emerging economy, Pakistan, specifically within the Cement industry, which has a significant role in the country's GDP. These Cement industries operate in diverse locations of the country; the Northern area includes the provinces of Punjab, Khyber Pakhtunkhwa (KPK), and Azad Jammu and Kashmir (AJK), while the Southern region comprises the provinces of Sindh and Baluchistan. Each varies in employee numbers and daily production rates. The research provides empirical evidence of how green transformational leadership, HRM, and affective commitment to change empower cement companies to enhance their green innovation and overall performance.

2. Theoretical background

The resource-based view theory developed by Barney [25] is a highly utilized managerial framework in current research. He explains the application of business strategy and strategic management as the foundations of the resource-based view (RBV), an economic tool for analyzing organizational performance. The theory uses strategic internal resources, capabilities, and core competencies among organizations to attain long-term market competitiveness. It assesses the strategic fit of competencies and essential resources: value, rarity, imperfect imitability, and lack of substitutability to obtain desirable market competitiveness [26]. RBV is sometimes referred to as resource-based theory and resource-based approach. This study explores the correlation between the current study and relevant previous research. An organization's performance has become more connected with its business operations, leadership, human resource management, and innovation. Organizations often have sustainable growth by maintaining high levels of performance and competition. Companies typically find a version by sharing their productive resources to achieve common goals. Three business-related factors were considered: return on investment, shareholder value, and the success of the product or service in the market [27]. According to Karakiliç [27], organizational performance refers to a company's ability to achieve goals and objectives while utilizing adequate and sufficient means. Theories related to RM (resource management) recommend that resources are valuable, infrequent, as well as unique [28]. Due to these assertions that resources are scarce and constrained, businesses maintain excellent and viable competitive positions founded on their resources [29]. Therefore, the research study concludes the recent investigation on the relationship among green transformational leadership, HRM approaches, green innovation, affective commitment to management change, and organizational performance sustained by resource base view (RBV) theory [30]. Obstacles to successfully implementing green innovation can be overcome if the RBV of human resource management and environmental management collaborate [31].

The concept of organizational performance and human capital is ancient enough, and the recent literature review on HRM has a history and methodology. According to Nishii et al. [32], performance and competitive advantage depend on how businesses use their priceless strategic resources, which are authoritative, scarce, and challenging for rivals to duplicate in the marketplaces. Conferring to the RBV theory, organizational performance is a collection of resources, capabilities, and commitments to achieve targets [33]. Several recruitment, selection, training, and development programs ensure staff members possess the knowledge and abilities to do specific work. At the same time, people are motivated to meet their performance goals through performance appraisal and financial and non-financial incentives.

Lastly, the strategies encourage employee contribution in numerous actions over increased participation, information argument, and personal freedom. Increasing employee capacity for green training is critical to fostering engagement with consumers and sellers [33,34]. Leadership and employees are as crucial to a firm's resources as any other. To give businesses a competitive edge and maximize performance, Green HRM practices encourage, incentivize, and offer possibilities for longer job performances [33,35]. Therefore, we argue that human resources indulge the fundamental RBV typical for creating enhanced secondary efficiency and clear benefits. Human capital, which represents the business's key feature to employ in an organization best positioned to compete in the marketplace, is deeply ingrained in the multilayered social structure of a firm [36,37].

3. Hypothesis development

3.1. Direct impact

3.1.1. Green transformational leadership (GTL) with organizational performance

According to Kılıç & Uludağ [38], Transformational leadership can increase motivation, trust, cohesion, commitment, and performance in the workplace by creating a sense of belonging and community among individuals. They do this by setting an example through their behavior and inspiring others to higher levels of effort and commitment. Peng, Yin, Hou, Zou, & Nie [39], developing green transformational leadership is essential for improving corporate performance. Green transformational leadership strongly emphasizes the team's performance and prompts followers to think about adopting greener methods in their daily work. To inspire their followers to contribute their suggestions for enhancing environmental business performance and achieving longstanding success, the leader keeps lines of communication with them open. Similarly, two scholarly articles were written by Shan et al. [40] on Turkey's four and five-star hotels and [41] on the Dalian IT industry; China's studies argued that green transformative leadership motivates and inspires supporters of active engagement in work, and they need to do job duties to reduce the negative ecological influences of corporate actions through green creativity.

Green transformational leadership significantly impacts the organization and personifies the thoughts and principles of the top management. We hypothesize that green transformational leadership in organizations will be crucial in developing Green HRM policies and practices, helping businesses carry out their approaches and visualizations to attain green performance. This will help firms achieve green innovation and performance [42]. As a result, we anticipate that green transformational leadership has a significant impact on organizational performance due to the green mindset and attitude of the leadership [43]. As a result, the RBV theory posits that green transformational leadership increases employee productivity and engagement while creating chances for environmental management measures [44] concerning environmental performance and green innovation [45].

H1a. Organizational performance is significantly impacted by green transformational leadership.

3.1.2. Green HRM with organizational performance

Organizations can maintain distinct and competitive positions despite limited and insufficient resources [29]. Green HRM includes

integrating ecological management objectives into the organization's HR processes: staffing, development, training, and performance management, as well as reward and recognition [46]. These actions greatly impact productivity, growth, and organizational performance [47]. Green staffing, i.e., green recruitment and selection, allows organizations to find candidates with a green attitude to carry out their fundamental duties and be socially liable for protecting the environment and natural resources [48]. There is a growing trend among organizations to actively include environmental values in their recruiting and selection processes by adopting green practices [49].

To improve performance at the workplace, Green HRM implements green training programs that teach workers about environmental issues and how to solve them [50]. Additionally, Green HRM practices training and development assistance in creating procedures for leading, managing, and motivating teams [51]. Employees are supported through green training and development as they comprehend and create a process to improve organizational performance. Performance evaluation based on green goals and responsibilities is fundamental to green performance management [52]. Arulrajah & Opatha [53] define green performance management as a method for increasing productivity in pursuing environmentally friendly objectives at all company levels. Green compensation and rewards are employed inside firms to strengthen employee determination and enthusiasm, ultimately leading to enhanced production [54].

Similarly, Obeidat et al. [55] stated that, from a Green HRM perspective, rewards and remuneration are vital tools for handling firms' environmental concerns and activities. In addition, implementing a compensation package that motivates environmentally friendly performance requires integrating a comprehensive system for evaluating employee performance and determining compensation aligned with green-oriented goals and standards [56]. According to RBV theory, organizations using Green HRM practices can obtain a competitive edge, resulting in increased organizational performance. The distinct set of environmentally friendly HRM practices becomes a source of long-term competitive advantage, favorably influencing the organization's financial, operational, and reputational outcomes [57]. So, based on the above arguments, we can say that:

H1b. Green HRM has a significant influence on organizational performance

3.1.3. Green innovation with organizational performance

Businesses initiate green programs when they perceive that implementing these efforts will enhance their profitability, optimize their organizational operations, and provide them with a competitive advantage [58]. Therefore, companies currently give greater importance to long-term performance rather than traditional financial performance objectives [59]. Green Innovation refers to an organizational approach that involves developing new technologies and products to minimize environmental damage and mitigate the negative consequences of resource extraction. Businesses are motivated to implement green innovation due to external pressure, which includes factors such as company resources, organizational structure, and core competencies [60].

Green innovation has the potential to impact the performance of organizations [61,62]. Businesses that prioritize environmental sustainability can save resources and energy through green innovation. Adopting green innovation not only brings economic advantages to companies but also contributes to the overall well-being of society. Strategies for increasing sustainable competitiveness include green innovation, quality improvement, cost reduction, and brand image [63,64]. Several empirical research has demonstrated that green innovation enhances organizational performance [32,36,65]. The influence of green innovation on financial success is still unclear, despite the advantages it has for the environment [66]. According to Palmer et al. [67] green innovation can lead to inefficiencies and reduced output, negatively impacting business performance. Similarly, Przychodzen & Przychodzen [68] argued that the correlation between green innovation and performance could have either a positive or negative impact. RBV theory argues that the resources and capabilities of an organization play a crucial role in determining its competitive advantage and performance. Within the context of green innovation, this theory can be applied to examine how certain resources and abilities enhance organizational performance through implementing environmentally friendly practices. Therefore, we hypothesized the following:

H1c. Green innovation is positively linked with organizational performance.

3.2. Mediating role of green innovation

3.2.1. The mediating role of green innovation between GT leadership and organizational performance

The study by Jin & Drozdenko [69] suggests that several approaches are available to evaluate the accomplishment of distinct organizational goals. Sun et al. [70] provide evidence that green transformational leadership positively impacts employees' environmental consciousness, green innovation, and the establishment of sustainable organizations. Prior research suggests that GTL boosts GI and OP; however, investigating how firms engage their key stakeholders in eco-friendly management practices needs a comprehensive and practical strategy [71]. Employees' environmental activities should receive high-level support, encouragement, and endorsement while creating an ecological product that uses fewer resources and less pollution [46]. When businesses feel that implementing green practices would result in financial gain, operational improvement, and an increase in their competitive advantage, they undertake green programs [58]. A green program would probably enhance the company's overall environmental performance [72,73]. Green innovation combines green product and process innovation and entails trash recycling, lower energy consumption, and environmentally friendly product designs [74]. Green processes and product innovations mitigate negative corporate impacts by lowering costs, waste, and other assets [75]. Using RBV theory, Barney [30] predicts that through the mediation of green product innovation and process innovation, green transformational leadership indirectly improves the company's performance.

H2a. The relationship between green transformational leadership and organizational performance is mediated by green innovation.

3.2.2. *The green innovation mediating role between GHRM and organizational performance*

As we know, Corporate social responsibility (CSR) is a growing trend, and it is widely acknowledged that Green HRM and Green Innovations are crucial parts of CSR for businesses. According to Allen et al. [61], the term "corporate social responsibility" (CSR) refers to the policies and activities of the corporation. However, various actors affect and implement these policies at the institutional, organizational, and individual levels. Green HRM improves employee environmental awareness, green innovation, and firm performance [47]. Existing research suggests hiring people based on their environmental knowledge, beliefs, and preferences through environmentally conscious employment practices to guarantee recruits comprehend and support the firm's environmental aims [14].

HRM systems or bundles impact innovation, claim [9]. According to our research, these systems or bundles have an impression on organizational, process, and product innovation. A corporation can use green innovation as a valuable resource to influence environmental performance and meet environmental management goals [5,66]. Product innovation and Green processes reduce a business's harmful environmental impact. Cutting expenses and waste and saving resources, time, and money improve the company's social, environmental, and financial performance. Therefore, based on the (RBV) resource-based view approach theory proposed by Ref. [30]. We suggest that by promoting green products and process innovation, GHRM indirectly influences business performance. So, we made the following hypothesis:

H2b. Green innovation's mediating role between GHRM and organizational performance.

3.3. *The moderating role of affective commitment to management change*

The responsibility for initiating changes in an organization's values, norms, and culture lies with the management, as they facilitate the process of individuals adapting to new realities. According to earlier research, management commitment, appropriate HR procedures, and utilizing large-scale data may be necessary to improve company performance and competitive advantage through green practices [63]. These elements are essential for overcoming the technological obstacles facing green innovation. The responsibility for making strategic decisions for company development lies with top management. Therefore, it is imperative to foster the development of teamwork, sharing, flexibility, efficient communication, the generation of good ideas, and innovation to enhance performance [64]. The inclusion of senior managers' perspectives is crucial in improving employees' motivation toward the adoption of environmentally sustainable practices [69,70]. The environmental interests of managers determine how green innovation strategies affect business performance and competitive capabilities [76]. Effectively committed individuals are more likely to see the value in what they do and be willing to do whatever it takes to further that goal, including implementing organizational change or transformation [23]. The study showed the affective commitment to management change to modify the association between green innovation and organizational performance [33].

People who are more affectively committed tend to identify with the organization and work to develop and uphold their organizational identities by identifying themselves according to the same criteria as the organization [77,78]. RBV theory suggests that affective commitment to management change acts as a valuable, rare, difficult to imitate, and non-substitutable resource, enhancing the value and effectiveness of green innovation practices. Organizations that effectively cultivate and leverage affective commitment are more likely to achieve improved organizational performance by implementing green innovation initiatives. Thus, we can say that:

H3. Affective commitment to management change moderates the relationship between green innovation and organizational performance.

Research model. The study aims to develop a model of how Green transformational leadership and HRM affect organizational performance in the Cement sector. It was proposed that green innovation, as illustrated in Fig. 1, would mediate between the links above.

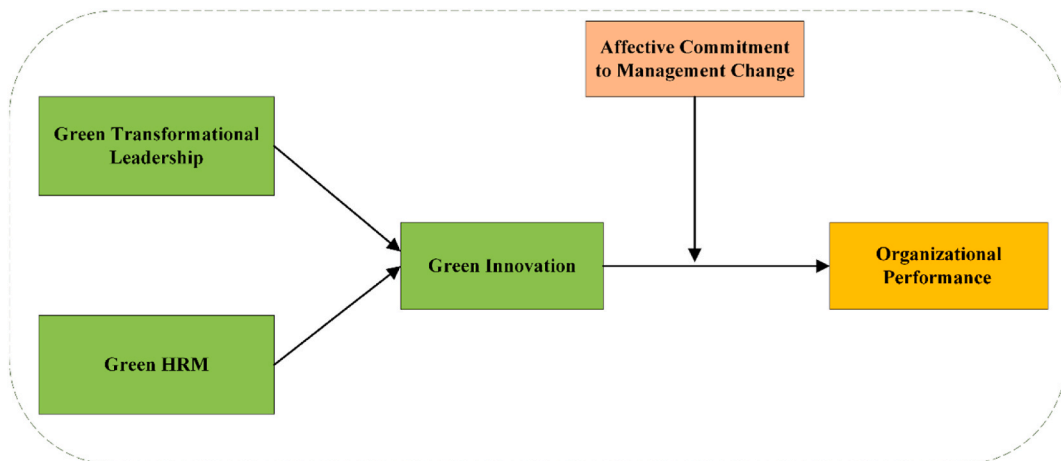


Fig. 1. Research framework.

4. Research methodology

4.1. Data collection and sample size

We used a quantitative research method with a random sampling technique. Similarly, this study employed a cross-sectional investigation design, gathering data within one month. Respondents were made aware of the scope and purpose of the research and assured of strict confidentiality. Three hundred questionnaires were distributed online to managers employed in various Cement companies through WhatsApp, Facebook, and email links. Two hundred fifty responses were received, of which 235 were accurate and valuable across Pakistan's cement industry. Statistical software packages were used for the social science (SPSS) and SmartPLS software. The sample comprised respondents from the top level to first-line managers and HR managers, ensuring that different departments were considered as part of the sample collection.

The data was obtained mainly from the cement companies, specifically from top-level managers to first-line managers. We have adopted an English questionnaire. The survey was translated into Urdu and retranslated into English by two bilingual academics, who also addressed any remaining inquiries through further interactions.

4.2. Measurements

To measure all these variables, we have taken an adapted questionnaire. We utilized a 5-point Likert scale for all study variables, ranging from 1 = strongly disagree to 5 = strongly agree.

4.3. Green HRM

We measure nine items from the Singh et al. [11] scale for Green HRM. These nine components include recruiting and selection, training and development, and administration of performance appraisals. As an illustration, "the green hiring process is accorded a high emphasis." The range of factor loadings for GHRM is between 0.690 and 0.842. Similarly, the Cronbach alpha and average variance extracted (AVE) values are 0.896 and 0.589, respectively.

4.4. Green transformational leadership (GTFL)

The study employed six items of green transformational leadership [79]. The sample item comprises, 'the leadership in my organization stresses the achievement of environmental goals.' A sample item is "I provide subordinates with a clear sustainable business vision." The range of factor loadings for GTFL is between 0.706 and 0.885. Also, the average variance extracted (AVE) is 0.687 and Cronbach's alpha is 0.908.

4.5. Green innovation

We adopted a seven-item green innovation scale from Zailani et al. [80] with the example, "My company uses materials that produce the least pollution." The scale consists of 4 items for green product innovation and three for green process innovation. The range of factor loadings for green innovation is between 0.692 and 0.841. The Cronbach's alpha and average variance extracted (AVE) have values of 0.851 and 0.580, respectively.

4.6. Organizational performance

A seven-item scale was used for this study; it was developed by Williams & Anderson [81], such as "adequately completes assigned duties." The range of factor loadings for organizational performance is between 0.675 and 0.881. The value of Cronbach's alpha and the average variance extracted (AVE) are 0.720 and 0.618, respectively.

4.7. Affective commitment to management change

Employees believe that environmental management is a vital part of fostering trust. This is one of the six items adapted from Herscovitch & Meyer [82] affective commitment to change scale is used to measure it. The range of factor loadings for affective commitment to management change is between 0.732 and 0.899. Cronbach's alpha has a value of 0.734, whereas the average variance extracted (AVE) is 0.678.

For all the above values of factors loadings, AVE, and Cronbach's alpha please refer to [Appendix Table II](#).

4.8. Control variables

We incorporated various control factors in our study to verify that our findings were robust and valid. To account for their potential influence on the relationship, we adjusted for firm size, firm age, top management team expertise, and managers' ages [32,82]. Only the organization's size was significant. The other factors played an insignificant role in validating results. In the structural model, the control variables were further discussed.

Table 1
Descriptive statistics and Correlations.

Variables	Mean	SD.	1	2	3	4	5	6	7	8	9	10
1. Age of firm	–	–	1									
2. Size of firm	–	–	0.430**	1								
3. Manager's Qualification	–	–	0.155*	0.258**	1							
4. Manager's Age	–	–	0.105	0.060	0.624**	1						
5. Manager's experience	–	–	0.245**	0.078	0.338**	0.614**	1					
6. Green Human Resource Management	4.0676	0.70804	0.046	0.034	0.012	0.060	0.067	1				
7. Green Innovation	4.0219	0.76262	0.149*	0.004	0.002	0.125	0.225**	0.635**	1			
8. Green Transformational Leadership	4.2709	0.78847	0.094	0.008	0.001	0.086	0.172**	0.757**	0.734**	1		
9. Organizational Performance	3.5052	0.66105	0.041	0.021	0.156*	0.155*	0.169**	0.214**	0.091	0.169**	1	
10. Affective commitment to change	3.3794	0.69534	0.132*	0.055	0.096	0.160*	0.159*	0.260**	0.158*	0.178**	0.740**	1

Note: *p value less than 0.05, **p value less than 0.01, GTL = Green transformational leadership, AFC = Affective commitment to change.

5. Data analyses and results

5.1. Frequency analysis

It indicates that 22 firms started their operation in the last ten years, 36 started their process during 11–20 years, 85 started their operation during 21–30 years, 69 firms during 31–40, and only 23 have started their operation for more than 41 years. There are 14 firms with less than 500 employees; 100 firms have 501–1000 employees, 82 firms have 1001–1500, and 39 firms have 1501–2000 employees. In the survey, there are only ten managers who have bachelor’s or below qualification, 109 were master qualified, 103 have MPhil/MS, while only 12 have Ph.D. There were 15 young managers (18–25 years), 156 managers aged 26–35 years, 54 managers aged 36–45, and only 10 managers aged 46–55. We found that 78 managers have less than ten years of experience, 110 have 11–20 years, and 47 have above 21 years of experience. For more complete details about the demographic characteristics of the respondents, refer to [Appendix in Table I](#).

5.2. Descriptive statistics and correlations

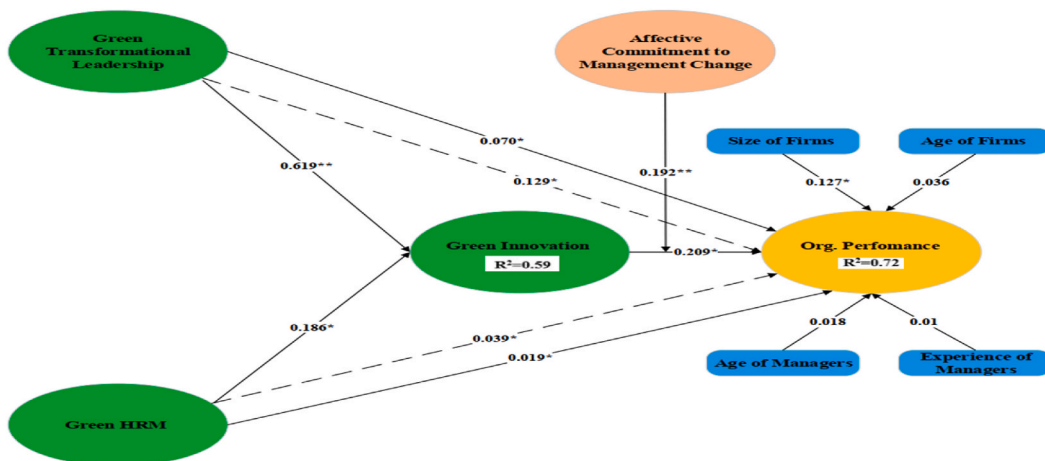
The correlation analysis among the variables is stated in [Table 1](#). The results indicate positive correlations among the variables. For instance, green transformation leadership significantly correlates to organizational performance ($r = 0.169, p < 0.01$). Similarly, GHRM is positively and significantly related to organizational performance ($r = 0.214, p < 0.01$). There is no multicollinearity issue because the correlation values in the variables are not above 0.80.

5.3. Confirmatory factor analysis

We used confirmatory factor analysis (CFA) in SmartPLS. All the items provided satisfactory factors loading (0.70), except a few things, such as ghrm1. We checked the validity and reliability of the variables, as shown in [Appendix Table II](#). Overall, the items provided a desirable (minimum 0.50) Average Variance Extracted (AVE) value. Discriminant validity presented as \sqrt{AVE} is also satisfactory (above 0.70), as suggested by Hair et al. [83]. Finally, the items’ internal consistency was calculated using Cronbach’s Alpha. We calculated the internal consistency of the items using Cronbach’s Alpha. We found an acceptable value (above 0.70) of the Cronbach Alpha as per the suggestion of Kilic [84].

5.4. Multicollinearity issue and common method bias

Variance inflation factors (VIFs) are more effective for measuring collinearity than simple correlation values [85]. As demonstrated by Michael and colleagues Akinwande et al. [86], VIFs have a significant advantage in that they identify which coefficients are influenced by collinearity. The VIF value of GHRM (2.430), green transformational leadership (1.000), affective commitment to management change (1.036), and Green Innovation (1.006). This suggests that the study’s variables are relatively independent and that regression analysis can accurately assess their correlations. The potential concern of common method variance (CMV) may arise due to a single measurement of all variables. Common method variance (CMV) refers to the potential introduction of bias when



Note: *p value less than 0.05, ** p-value less than 0.01

Fig. 2. Structural Model

Note: *p value less than 0.05, ** p-value less than 0.01.

employing a single measurement method for multiple variables. This can result in an inflated relationship between variables, which may not be statistically significant. The study's variance inflation factors (VIFs) values were below the 3.0 threshold level suggested by Kock [87], indicating that there was no common method bias and no collinearity problem [88]. For complete details about VIF values please refer to [Appendix Table III](#).

5.5. Structural model

To test the hypothesized model, we performed bootstrapping methods of 2000 resampling in SmartPLS (see [Fig. 2](#)). The results indicate that green transformational leadership significantly influences organizational performance ($\beta = 0.070$, p below 0.05) that accepted [H1a](#). Green HRM also significantly and positively influences operational performance ($\beta = 0.070$, p below 0.05), thus supporting [H1b](#) and [H1c](#) in which green innovation has a positive impact on organizational performance ($\beta = 0.209$, p below 0.05). The indirect impact of green transformational leadership (through green innovation) on organizational performance is significantly positive ($\beta = 0.129$, p below 0.05), and the indirect effect also remained significant, partially supporting [H2a](#). It indicates that green innovation is a partial and considerable mediator between GTL and organizational performance. Similarly, the indirect influence of green HRM (through green innovation) on organizational performance is significantly positive ($\beta = 0.039$, p below 0.05), partially supporting [H2b](#). Finally, affective commitment to management change substantially moderates the association amid green innovation and organizational performance ($\beta = 0.192$, p below 0.05) that supported [H3](#).

6. Discussion

Our empirical work has examined the interactions among variables such as green transformational leadership, HRM, innovation, affective commitment to management change, and organizational performance of the cement industry in Pakistan using theoretical insights from RBV theory. Our study has thoroughly explained all three hypotheses and their sub-hypotheses, showing that the performance of an organization can be improved through green transformational leadership and HRM. This improvement is achieved through the mediating role of green innovation and the moderating role of affective commitment to management change. There is a strong and positive association between all three hypotheses.

Our study found that green transformational leadership influences firm performance by establishing a clear environmental vision, motivating individuals to adopt green practices, increasing employee commitment to achieving environmental goals, and encouraging staff to create and disseminate new green practices; these results are similar to past findings [41]. The results demonstrate that transformational leaders who foster their employees' green practices to motivate them have excellent potential to execute green prospects effectively.

This study found a positive correlation between Green HRM and Organizational Performance. Bose & Gupta [89] argue that by promoting a green mindset and skill set among employees responsible for business processes, green HRM practices (such as green recruitment and selection, green training and development, green performance evaluation, and green compensation and rewards) enable an organization to enhance its business performance.

The study suggests that green innovation mediates green transformational leadership and organizational performance. Green innovation also works as a mediator between Green HRM and organizational performance. Our finding revealed that organizations intending to adopt green transformational leadership and HRM practices should give priority to integrating green innovation into the Cement industry processes and products. Green innovation (strategy and product innovation) is essential in supporting employees' adoption of green approaches and plans to achieve high organizational performance. The findings of our study align with the argument by Iqbal [90] that enhanced innovative arrangement, a culture of green innovation, and environmental effectiveness are all important for attaining tangible and long-term organizational performance.

The degree of affective commitment to management change moderated the association between organizational success and green innovation [33]. Green innovation will likely positively influence organizational performance in companies where workers have a high degree of affective engagement to management change. Our study shows that affective commitment to management change moderates the connection amid green innovation and organizational performance. Effectively dedicated employees trust the difference and want to contribute to the organization's success. Employees with affective commitment are more likely to recognize the value of their course of action and be willing to do what is necessary to benefit the target of their activity, such as organizational change [23]. This establishes good connections between stress or strain outcomes and their commitment to change.

6.1. Theoretical implications

Many scholars have made organizational performance a significant and influential topic, carrying out various forms of research to determine the multiple aspects that affect it. First, the current study enhances past research and knowledge by examining the relationship between green transformational leadership and green HRM in the cement industry. It also investigates the role of green innovation as an intervening factor and the influence of affective commitment as a moderating factor. This study contributes to a better understanding of these concepts by filling the research gaps. The researcher suggests that integrating green innovation might enhance organizational performance without affective engagement.

Secondly, the study supported the mediating role of green innovation by showing that process and product innovation can significantly reduce an organization's adverse effects and boost performance through cost savings, reduced waste, and the use of other resources [75].

Thirdly, the current research focuses on the effect of affective commitment as a moderator to strengthen green innovation's role as a mediator and determine the measures taken to maximize organizational performance. This study is an extension and expansion of Barney [30] RBV theory, in which we suggest that companies should devise and implement policies to recruit, train, and incentivize green employees. This will help to increase organizational performance and green innovation and foster an affective commitment to management change due to continuous green transformational leadership and a GHRM monitoring role.

Regarding capabilities, various techniques, including recruitment and selection processes and training and development programs, confirm that employees have the knowledge and skills to carry out a particular task. The same applies to encouragement after a performance evaluation; monetary and non-monetary rewards inspire individuals to fulfill their performance goals. Finally, the policies encourage employee participation in various operations and activities through greater commitment, information sharing, and freedom of choice.

Moreover, our research contributes to the RBV theory by employing green transformational leadership and GHRM as organizational capabilities that spur innovation and performance. We found that abilities such as leadership and HRM give a competitive advantage to organizations in terms of innovation and performance.

6.2. Practical implications

This paper discusses the implications for senior management as well as academia. Green transformational leadership and HRM approaches are being applied by organizational management, which includes HR managers, executives, top managers, and decision-makers, to encourage environmentally friendly behavior and boost organizational performance.

Our study reveals that green HRM and transformational leadership are key factors in organizational success and green innovation. Managers and leaders should adopt green principles and practices to encourage employees to engage in green behaviors and initiatives to enhance the organization's performance. The study suggests that commitment to management change significantly moderates the association between green transformational leadership, green HRM, green innovation, and organizational performance. To increase employees' commitment and participation in the change process, managers and leaders should effectively convey the vision and benefits of a green change. According to the study, green transformational leadership and HRM practices can improve organizational performance and innovation. Therefore, businesses should invest in developing green leaders and employees and equip them with the tools, rewards, and recognition they need to succeed in going green. Some variable's practical implications are given below:

1. Importance of adopting green transformational leadership: Practical implications include the need for leaders to motivate and guide employees toward environmental sustainability goals and to build a climate of innovation and change.
2. By implementing green HRM practices: Our findings support the benefits of incorporating green human resource management (HRM) practices. Adopting environmentally friendly recruitment, training, and performance evaluation procedures are the practical implications, as they encourage employee engagement and involvement in sustainable activities.
3. Green Innovation: Increasing a company's capacity for green innovation requires a strong digital transformation. Businesses can create novel green solutions, lessen environmental impact, and enhance sustainability by implementing digital transformation strategies, cutting-edge technologies, and data analytics. Furthermore, digital transformation can help businesses improve employee collaboration and communication, streamline internal operations, allocate resources more efficiently, and innovate green technology even more.
3. Affective commitment to management change: Practical implications highlight the need to create an environment where employees are dedicated to accepting and implementing environmental improvements.
4. Enhancing organizational performance: Practical implications of our research emphasis on enhancing organizational performance through green innovation. This entails creating methods to support advancing environmentally friendly products, processes, resource efficiency, and waste reduction.

6.3. Limitations and future research directions

This research has a few limitations that are opportunistic for future scholars in the same areas. For example, we focused on firms located in Pakistan, especially from the Cement industry, which is not the best sample for other countries. We encourage researchers from other countries, such as India, China, and Malaysia, to expand and test the model in these regions. It will be better to get data from Asian and European economies and run a comparative model for the conceptualized framework. Standard method bias may exist in our data because we primarily used closed-ended questions to collect it. Future researchers should consider in-depth interviews and longitudinal data to avoid biases and get more valid results. We assessed green transformational leadership (GTL) and Green HRM in the model. However, it will be interesting to evaluate other types of leadership, such as self-leadership, transaction leadership, and superior leadership, if these styles enhance green innovation and organizational performance in the context of emerging companies. Evaluating factors at the firm and managerial levels, such as age, gender, education, income, and industry, can reveal if they make a difference in performance.

Also, firm-level and managerial-level factors such as age, gender, education, income, and industry types might be checked to know if these factors bring any difference in performance.

6.4. Conclusion

This research aims to understand the importance of green transformational leadership (GTL) and green HRM in organizational performance through an intervening role of green innovation and the moderating influence of affective commitment to management change. We used a structured questionnaire and surveyed 235 managers in the Cement industry in various areas of Pakistan. We used quantitative techniques and employed SPSS and SmartPLS for data analysis and results. We found that green transformational leadership and green HRM significantly influence the organizational performance of Cement companies. Moreover, green innovation partially mediates between green transformational leadership, green HRM, and organizational performance. Furthermore, affective commitment to management change significantly moderates the association between green innovation and organizational performance. We have discussed several policy implications for companies and managers.

Ethics statement

All of the experimental procedures performed in this study involving human participants were per the ethical standards of the Institutional Review Board (IRB) in the School of Management at Harbin Institute of Technology, approval number 2023–28. Participation in this online survey is entirely voluntary. All participants provided informed consent to take part in the study voluntarily.

Declaration of generative AI

During the preparation of this work the author used BaiAI to improve the language and readability of the article. After using this tool, the author reviewed and edited the content as needed and took full responsibility for the content of the publication.

Data availability statement

Data sharing does not apply to this article. The dataset associated with this research is not publicly available due to the privacy and confidentiality commitments made to the study participants. Ensuring the protection of respondent privacy was of utmost importance in this research, and as such, the raw data cannot be made openly accessible. Although it can be requested from the corresponding author on a reasonable request.

CRedit authorship contribution statement

Yang Yang: Writing – review & editing, Supervision, Funding acquisition. **Azhar Ud Din:** Writing – original draft, Visualization, Validation, Resources, Project administration, Investigation, Data curation. **Qaiser Mohi Ud Din:** Formal analysis, Conceptualization. **Imran Ullah Khan:** Writing – review & editing.

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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Appendix

Table 1)
Demographic Characteristics of the Respondents

Age of Firm	Frequency	Percent
1. Less than ten years	22	9.4
2. 11–20 years	36	15.3
3. 21–30 years	85	36.2
4. 31–40 years	69	29.4
5. 41 and above years	23	9.8

(continued on next page)

Table I) (continued)

Age of Firm	Frequency	Percent
Size of Firm		
1. Less than 500	14	6.0
2. 501-1000	100	42.6
3. 1001-1500	82	34.9
4. 1501-2000	39	16.6
Manager's Qualification		
1. Bachelor and below	10	4.3
2. MA, M.Sc	109	46.4
3. MS and MPhil	103	43.8
4. PhD	12	5.1
Missing	1	0.4
Manager's Age		
6. 18-25 years	15	6.4
7. 26-35 years	156	66.4
8. 36-45 years	54	23.0
9. 46-55 years	10	4.3
10. 56 and above years	0	0
Manager's Experience		
1. Less than ten years	78	33.2
2. 11-20 Years	110	46.8
3. 21 and above years	47	20.0
Total	235	100

Table II)
Loadings, Validity, and Reliability

Items and Variables	Loadings	AVE	$\sqrt{\text{AVE}}$	Cronbach Alpha
Affective commitment to management change		0.678	0.823	0.734
afc1	0.732			
afc3	0.882			
afc4	0.793			
afc5	0.899			
afc6	0.798			
GHRM		0.589	0.768	0.896
ghrm1	0.690			
ghrm2	0.692			
ghrm3	0.765			
ghrm4	0.780			
ghrm5	0.830			
ghrm6	0.736			
ghrm7	0.842			
ghrm8	0.824			
ghrm9	0.732			
Green Innovation		0.580	0.762	0.851
gi1	0.841			
gi2	0.813			
gi3	0.809			
gi4	0.696			
gi5	0.692			
gi6	0.759			
gi7	0.706			
Green Transformational Leadership		0.687	0.829	0.908
gtfl1	0.836			
gtfl2	0.877			
gtfl3	0.846			
gtfl4	0.885			
gtfl5	0.706			
gtfl6	0.812			
Organizational Performance		0.618	0.786	0.720
op1	0.788			
op2	0.691			
op3	0.792			
op4	0.675			
op5	0.916			
op6	0.73			
op7	0.881			

Table III
Variance Inflation Factor

Variables	Green HRM	Green Innovation	Organizational Performance
Green HRM	–	2.430	–
Affective commitment to management change	–	–	1.036
Green Innovation	–	–	1.006
Organizational Performance	–	–	–
Transformational leadership	1.000	2.410	–

References

- [1] A.U. Din, Y. Yang, K. Khan, Q.M.U. Din, M.M.A. Golo, I.U. Khan, Role of employee commitment and individual value in green HRM practices and sustainable firm performance, in: *Second International Conference on Sustainable Technology and Management (ICSTM 2023)*, 2023, pp. 404–413, <https://doi.org/10.1117/12.3004029>. SPIE.
- [2] A.-N. El-Kassar, S.K. Singh, Green innovation and organizational performance: the influence of big data and the moderating role of management commitment and HR practices, *Technol. Forecast. Soc. Change* 144 (2019) 483–498, <https://doi.org/10.1016/j.techfore.2017.12.016>.
- [3] M.A. Golo, D. Han, M. Ibrar, Q.M.U. Din, An experimental pursuit of sustainable economic growth, in: *Second International Conference on Sustainable Technology and Management (ICSTM 2023)*, 2023, pp. 385–395, <https://doi.org/10.1117/12.3002778>. SPIE.
- [4] S. Shayegan, A. Bazrkar, R. Yadegari, Realization of Sustainable Organizational Performance Using New Technologies and Green Human Resource Management Practices, 2023, <https://doi.org/10.17323/2500-2597.2023.2.95.105>.
- [5] S.K. Mousa, M. Othman, The impact of green human resource management practices on sustainable performance in healthcare organisations: a conceptual framework, *J. Clean. Prod.* 243 (2020), <https://doi.org/10.1016/j.jclepro.2019.118595>.
- [6] A.A. Zaid, T. Talib Bon, A.A.M. Jaaron, Green human resource management bundle practices and manufacturing organizations for performance optimization: a conceptual model, *Int. J. Eng. Technol.* 7 (3.20) (Sep. 2018) 87, <https://doi.org/10.14419/ijet.v7i3.20.18986>.
- [7] E. Rossi, A.C. Bertassini, C. dos S. Ferreira, W.A. Neves do Amaral, A.R. Ometto, Circular economy indicators for organizations considering sustainability and business models: plastic, textile and electro-electronic cases, *J. Clean. Prod.* 247 (Feb) (2020), <https://doi.org/10.1016/j.jclepro.2019.119137>.
- [8] A. Longoni, D. Luzzini, M. Guerci, Deploying environmental management across functions: the relationship between green human resource management and green supply chain management, *J. Bus. Ethics* 151 (2018) 1081–1095, <https://doi.org/10.1007/s10551-016-3228-1>.
- [9] P. Paillé, P. Valéau, D.W. Renwick, Leveraging green human resource practices to achieve environmental sustainability, *J. Clean. Prod.* 260 (Jul) (2020), <https://doi.org/10.1016/j.jclepro.2020.121137>.
- [10] J.L. Robertson, J. Barling, Greening organizations through leaders' influence on employees' pro-environmental behaviors, *J. Organ. Behav.* 34 (2) (2013) 176–194, <https://doi.org/10.1002/job.1820>.
- [11] S.K. Singh, M. Del Giudice, R. Chierici, D. Graziano, Green innovation and environmental performance: the role of green transformational leadership and green human resource management, *Technol. Forecast. Soc. Change* 150 (September 2019) (2020) 119762, <https://doi.org/10.1016/j.techfore.2019.119762>.
- [12] Y.-S. Chen, C.-H. Chang, Y.-H. Lin, The determinants of green radical and incremental innovation performance: green shared vision, green absorptive capacity, and green organizational ambidexterity, *Sustainability* 6 (11) (2014) 7787–7806, <https://doi.org/10.3390/su6117787>.
- [13] S. Hanif, A. Ahmed, N. Younas, Examining the impact of environmental management accounting practices and green transformational leadership on corporate environmental performance: the mediating role of green process innovation, *J. Clean. Prod.* 414 (2023) 137584, <https://doi.org/10.1016/j.jclepro.2023.137584>.
- [14] F.G. Gilal, Z. Ashraf, N.G. Gilal, R.G. Gilal, N.A. Channa, Promoting environmental performance through green human resource management practices in higher education institutions: a moderated mediation model, *Corp. Soc. Responsib. Environ. Manag.* 26 (6) (Nov. 2019) 1579–1590, <https://doi.org/10.1002/csr.1835>.
- [15] Y.J. Kim, W.G. Kim, H.M. Choi, K. Phetvaroon, The effect of green human resource management on hotel employees' eco-friendly behavior and environmental performance, *Int. J. Hospit. Manag.* 76 (Jan. 2019) 83–93, <https://doi.org/10.1016/j.ijhm.2018.04.007>.
- [16] Y.-S. Chen, C.-H. Chang, Enhance environmental commitments and green intangible assets toward green competitive advantages: an analysis of structural equation modeling (SEM), *Qual. Quantity* 47 (2013) 529–543, <https://doi.org/10.1007/s11135-011-9535-9>.
- [17] Q.M.U. Din, L. Zhang, S. Karim, M.A. Golo, A.U. Din, Ethical leadership as a catalyst for sustainable training and green performance, in: *Second International Conference on Sustainable Technology and Management (ICSTM 2023)*, 2023, pp. 442–452, <https://doi.org/10.1117/12.3004393>. SPIE.
- [18] Y.-S. Chen, The driver of green innovation and green image–green core competence, *J. Bus. Ethics* 81 (2008) 531–543, <https://doi.org/10.1007/s10551-007-9522-1>.
- [19] S. Asadi, et al., Investigating influence of green innovation on sustainability performance: a case on Malaysian hotel industry, *J. Clean. Prod.* 258 (2020) 120860, <https://doi.org/10.1016/j.jclepro.2020.120860>.
- [20] S. Begum, M. Ashfaq, E. Xia, U. Awan, Does green transformational leadership lead to green innovation? The role of green thinking and creative process engagement, *Bus. Strat. Environ.* 31 (1) (Jan. 2022) 580–597, <https://doi.org/10.1002/bse.2911>.
- [21] F. Zhang, X. Deng, F. Phillips, C. Fang, C. Wang, Impacts of industrial structure and technical progress on carbon emission intensity: evidence from 281 cities in China, *Technol. Forecast. Soc. Change* 154 (2020) 119949, <https://doi.org/10.1016/j.techfore.2020.119949>.
- [22] B. B. II, Building organizational commitment: the socialization of managers in work organizations, *Adm. Sci. Q.* 19 (4) (Dec. 1974) 533, <https://doi.org/10.2307/2391809>.
- [23] J.P. Meyer, E.S. Srinivas, J.B. Lal, L. Topolnysky, Employee commitment and support for an organizational change: test of the three-component model in two cultures, *J. Occup. Organ. Psychol.* 80 (2) (2007) 185–211, <https://doi.org/10.1348/096317906X118685>.
- [24] M. Santana-Martins, M.I. Sanchez-Hernandez, J.L. Nascimento, Dual commitment to leader and organization: alternative models based on the employees' emotional awareness, *Sustainability* 14 (15) (2022) 9421, <https://doi.org/10.3390/su14159421>.
- [25] J. Barney, Firm resources and sustained competitive advantage, *J. Manag.* 17 (1) (1991) 99–120, <https://doi.org/10.1177/014920639101700108>.
- [26] N. Kshetri, The rapidly transforming Chinese high-technology industry and market: institutions, ingredients. Mechanisms and Modus Operandi, Elsevier, 2008. Available online: <https://www.sciencedirect.com/book/9781843344643/the-rapidly-transforming-chinese-high-technology-industry-and-market#book-info>.
- [27] N.Y. Karakılıç, Impacts of leadership styles on organizational performance, *New Trends Manag. Stud.* 2018 (2019) 99–114, <https://doi.org/10.5171/2018.687849>.
- [28] E. Baía, J.J. Ferreira, R. Rodrigues, Value and rareness of resources and capabilities as sources of competitive advantage and superior performance, *Knowl. Manag. Res. Pract.* 18 (3) (2020) 249–262, <https://doi.org/10.1080/14778238.2019.1599308>.
- [29] J.A.J.-B. Miles, "A Jossey-Bass Reader. Hoboken, NJ, USA: John Wiley & Sons, 2012. ProQuest Ebrary. Web. 12 December 2014. Upphovsrätt © 2012. John Wiley & Sons Alla Rättig," in *Management and Organization Theory*, San Francisco: Jossey Bass Reader, 2002. Available online: <https://www.wiley.com/en-fr/Management+and+Organization+Theory:+A+Jossey+Bass+Reader-p-9781118008959>.
- [30] J.B. Barney, Is the resource-based 'view' a useful perspective for strategic management research? Yes, *Acad. Manag. Rev.* 26 (1) (2001) 41–56, <https://doi.org/10.5465/amr.2001.4011938>.

- [31] J. Sarkis, P. Gonzalez-Torre, B. Adenso-Diaz, Stakeholder pressure and the adoption of environmental practices: the mediating effect of training, *J. Oper. Manag.* 28 (2) (2010) 163–176, <https://doi.org/10.1016/j.jom.2009.10.001>.
- [32] L.H. Nishii, D.P. Lepak, B. Schneider, Employee attributions of the 'why' of HR practices: their effects on employee attitudes and behaviors, and customer satisfaction, *Person. Psychol.* 61 (3) (Sep. 2008) 503–545, <https://doi.org/10.1111/j.1744-6570.2008.00121.x>.
- [33] E.R. Lestari, N.M.S. Sunyoto, Fostering green innovation in achieving sustainable performance, in: *Natural Resources Forum*, Wiley Online Library, 2023, pp. 413–434, <https://doi.org/10.1111/1477-8947.12293>.
- [34] S. Hussain, M. Shahzad, A. Appolloni, W. Xuetong, The impact of public infrastructure project delays on sustainable community development, *Environ. Sci. Pollut. Res.* 30 (14) (2023) 40519–40533, <https://doi.org/10.1007/s11356-022-24739-2>.
- [35] W. Yu, R. Chavez, M. Feng, C.Y. Wong, B. Fynes, Green human resource management and environmental cooperation: an ability-motivation-opportunity and contingency perspective, *Int. J. Prod. Econ.* 219 (2020) 224–235, <https://doi.org/10.1016/j.ijpe.2019.06.013>.
- [36] P. Boxall, M. Steeneveld, Human resource strategy and competitive advantage: a longitudinal study of engineering consultancies, *J. Manag. Stud.* 36 (4) (1999) 443–463, <https://doi.org/10.1111/1467-6486.00144>.
- [37] S.A.R. Khan, A. Razzaq, Z. Yu, S. Miller, Industry 4.0 and circular economy practices: a new era business strategies for environmental sustainability, *Bus. Strat. Environ.* 30 (8) (Dec. 2021) 4001–4014, <https://doi.org/10.1002/bse.2853>.
- [38] M. Kılıç, O. Uludağ, The effects of transformational leadership on organizational performance: testing the mediating effects of knowledge management, *Sustainability* 13 (14) (2021) 7981, <https://doi.org/10.3390/su13147981>.
- [39] J. Peng, K. Yin, N. Hou, Y. Zou, Q. Nie, How to facilitate employee green behavior: the joint role of green transformational leadership and green human resource management practice, *Acta Psychol. Sin.* 52 (9) (Sep. 2020) 1105, <https://doi.org/10.3724/SP.J.1041.2020.01105>.
- [40] S. Shan, S.Y. Genç, H.W. Kamran, G. Dinca, Role of green technology innovation and renewable energy in carbon neutrality: a sustainable investigation from Turkey, *J. Environ. Manag.* 294 (Sep. 2021) 113004, <https://doi.org/10.1016/J.JENVMAN.2021.113004>.
- [41] W. Li, T.A. Bhutto, W. Xuhui, Q. Maitlo, A.U. Zafar, N. Ahmed Bhutto, Unlocking employees' green creativity: the effects of green transformational leadership, green intrinsic, and extrinsic motivation, *J. Clean. Prod.* 255 (2020) 120229, <https://doi.org/10.1016/j.jclepro.2020.120229>.
- [42] J. Jia, H. Liu, T. Chin, D. Hu, The continuous mediating effects of GHRM on employees' green passion via transformational leadership and green creativity, *Sustain. Times* 10 (9) (2018), <https://doi.org/10.3390/su10093237>.
- [43] C. Koeber, E. Appelbaum, T. Bailey, P. Berg, A.L. Kalleberg, Manufacturing advantage: why high-performance work systems pay off, *Contemp. Sociol.* 30 (3) (2001) 250, <https://doi.org/10.2307/3089250>.
- [44] J. Haddock-Millar, C. Sanyal, M. Müller-Camen, Green human resource management: a comparative qualitative case study of a United States multinational corporation, *Int. J. Hum. Resour. Manag.* 27 (2) (2016) 192–211, <https://doi.org/10.1080/09585192.2015.1052087>.
- [45] K.W. Mui, W.T. Chan, Application of the building environmental performance model (BEPM) in Hong Kong, *Energy Build.* 37 (8) (Aug. 2005) 897–909, <https://doi.org/10.1016/J.ENBUILD.2004.12.002>.
- [46] D.W.S. Renwick, T. Redman, S. Maguire, Green human resource management: a review and research agenda, *Int. J. Manag. Rev.* 15 (1) (2013) 1–14, <https://doi.org/10.1111/j.1468-2370.2011.00328.x>.
- [47] Y.M. Yusoff, M. Nejadi, D.M.H. Kee, A. Amran, Linking green human resource management practices to environmental performance in hotel industry, 10.1177/0972150918779294 21 (3) (Jul. 2018) 663–680, <https://doi.org/10.1177/0972150918779294>.
- [48] H. Ahmad, M. Öztürk, W. Ahmad, S.M. Khan, Status of natural resources in the uplands of the swat valley Pakistan, *Clim. Chang. Impacts High-Altitude Ecosyst* (Jan. 2015) 49–98, https://doi.org/10.1007/978-3-319-12859-7_2/TABLES/17.
- [49] S. Yozgat, S. Erol, Sustainable closed-loop supply chain network design and optimization, in: *International Conference on Management Science and Engineering Management*, Springer, 2022, pp. 705–726, https://doi.org/10.1007/978-3-031-10388-9_52.
- [50] E. Fernández, B. Junquera, M. Ordiz, Organizational culture and human resources in the environmental issue: a review of the literature, *Int. J. Hum. Resour. Manag.* 14 (4) (2003) 634–656, <https://doi.org/10.1080/0958519032000057628>.
- [51] F. Rahmanniyay, A.J. Yu, A multi-objective stochastic programming model for project-oriented human-resource management optimization, *Int. J. Manag. Sci. Eng. Manag.* 14 (4) (2019) 231–239, <https://doi.org/10.1080/17509653.2018.1534220>.
- [52] K. Mehta, P.K. Chugan, Green HRM in pursuit of environmentally sustainable business, *Purs. Environ. Sustain. Bus.* (June 1, 2015). *Univers. J. Ind. Bus. Manag.* 3 (3) (2015) 74–81, <https://doi.org/10.1080/17509653.2018.1534220>.
- [53] A.A. Arulrajah, H. Opatha, Analytical and Theoretical Perspectives on Green Human Resource Management: A Simplified Underpinning, 2016, <https://doi.org/10.5539/ibr.v9n12p153>.
- [54] B. Nalini, F.A.P. Durai, Emerging trends of HR practices in green initiatives, *Int. J. Res. Eng. IT Soc. Sci.* 9 (3) (2019) 1–3. Available online: <http://indusedu.org>.
- [55] S.M. Obaidat, A.A. Al Bakri, S. Elbanna, Leveraging 'green' human resource practices to enable environmental and organizational performance: evidence from the Qatari oil and gas industry, *J. Bus. Ethics* 164 (2) (Jun. 2020) 371–388, <https://doi.org/10.1007/S10551-018-4075-Z/TABLES/5>.
- [56] M.M. Uddin, R. Islam, Green HRM: goal attainment through environmental sustainability, *J. Nepal. Bus. Stud.* 9 (1) (2015) 14–19.
- [57] J.Y. Yong, M. Ysliza, T. Ramayah, C.J. Chiappetta Jabbour, S. Sehnem, V. Mani, Pathways towards sustainability in manufacturing organizations: empirical evidence on the role of green human resource management, *Bus. Strat. Environ.* 29 (1) (2020) 212–228, <https://doi.org/10.1002/bse.2359>.
- [58] T.-Y. Chiou, H.K. Chan, F. Lettice, S.H. Chung, The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan, *Transp. Res. Part E Logist. Transp. Rev.* 47 (6) (2011) 822–836, <https://doi.org/10.1016/j.tre.2011.05.016>.
- [59] M. Zhang, W. Zeng, Y.K. Tse, Y. Wang, P. Smart, Examining the antecedents and consequences of green product innovation, *Ind. Mark. Manag.* 93 (2021) 413–427, <https://doi.org/10.1016/j.indmarman.2020.03.028>.
- [60] W. Cai, G. Li, The drivers of eco-innovation and its impact on performance: evidence from China, *J. Clean. Prod.* 176 (2018) 110–118, <https://doi.org/10.1016/j.jclepro.2017.12.109>.
- [61] G.W. Allen, P.A. Attoh, T. Gong, Transformational leadership and affective organizational commitment: mediating roles of perceived social responsibility and organizational identification, *Soc. Responsib. J.* 13 (3) (2017) 585–600, <https://doi.org/10.1108/SRJ-11-2016-0193>.
- [62] S. Pal, I. Mandal, Impacts of stone mining and crushing on environmental health in Dwarka river basin, *Geocarto Int.* 36 (4) (2021) 392–420, <https://doi.org/10.1080/10106049.2019.1597390>.
- [63] A. Gunasekaran, et al., Big data and predictive analytics for supply chain and organizational performance, *J. Bus. Res.* 70 (2017) 308–317, <https://doi.org/10.1016/j.jbusres.2016.08.004>.
- [64] D. Chatterjee, R. Grewal, V. Sambamurthy, Shaping up for e-commerce: institutional enablers of the organizational assimilation of web technologies, *MIS Q.* (2002) 65–89, <https://doi.org/10.2307/4132321>.
- [65] A.O. Ojo, M.A. Fauzi, Environmental awareness and leadership commitment as determinants of IT professionals engagement in Green IT practices for environmental performance, *Sustain. Prod. Consum.* 24 (2020) 298–307, <https://doi.org/10.1016/j.spc.2020.07.017>.
- [66] M. Tang, G. Walsh, D. Lerner, M.A. Fitza, Q. Li, Green innovation, managerial concern and firm performance: an empirical study, *Bus. Strat. Environ.* 27 (1) (2018) 39–51, <https://doi.org/10.1002/bse.1981>.
- [67] K. Palmer, W.E. Oates, P.R. Portney, Tightening environmental standards: the benefit-cost or the no-cost paradigm? *J. Econ. Perspect.* 9 (4) (1995) 119–132, <https://doi.org/10.1257/jep.9.4.119>.
- [68] J. Przychodzen, W. Przychodzen, Relationships between eco-innovation and financial performance—evidence from publicly traded companies in Poland and Hungary, *J. Clean. Prod.* 90 (2015) 253–263, <https://doi.org/10.1016/j.jclepro.2014.11.034>.
- [69] K.G. Jin, R.G. Drozdenko, Relationships among perceived organizational core values, corporate social responsibility, ethics, and organizational performance outcomes: an empirical study of information technology professionals, *J. Bus. Ethics* 92 (2010) 341–359, <https://doi.org/10.1002/bse.2359>, 10.1080/1331677X.2021.2025127.
- [70] X. Sun, A. El Askary, M.S. Meo, B. Hussain, Green transformational leadership and environmental performance in small and medium enterprises, *Econ. Res. Istrazivanja* 35 (1) (2022) 5273–5291.

- [71] G. Tang, Y. Chen, Y. Jiang, P. Paillé, J. Jia, Green human resource management practices: scale development and validity, *Asia Pac. J. Hum. Resour.* 56 (1) (2018) 31–55, <https://doi.org/10.1111/1744-7941.12147>.
- [72] M. Palmer, Y. Truong, The impact of technological green new product introductions on firm profitability, *Ecol. Econ.* 136 (2017) 86–93, <https://doi.org/10.1016/j.ecolecon.2017.01.025>.
- [73] J.C.F. De Guimarães, E.A. Severo, E.C.H. Dorion, F. Coalier, P.M. Olea, The use of organisational resources for product innovation and organisational performance: a survey of the Brazilian furniture industry, *Int. J. Prod. Econ.* 180 (2016) 135–147, <https://doi.org/10.1016/j.ijpe.2016.07.018>.
- [74] Y.-S. Chen, S.-B. Lai, C.-T. Wen, The influence of green innovation performance on corporate advantage in Taiwan, *J. Bus. Ethics* 67 (2006) 331–339, <https://doi.org/10.1007/s10551-006-9025-5>.
- [75] G. Del Giudice, R. Rappuoli, A.M. Didierlaurent, Correlates of adjuvanticity: a review on adjuvants in licensed vaccines, *Semin. Immunol.* 39 (May) (2018) 14–21, <https://doi.org/10.1016/j.smim.2018.05.001>.
- [76] I.M. Ar, The impact of green product innovation on firm performance and competitive capability: the moderating role of managerial environmental concern, *Procedia-Social Behav. Sci.* 62 (2012) 854–864, <https://doi.org/10.1016/j.sbspro.2012.09.144>.
- [77] P. Chithambaranathan, N. Subramanian, A. Gunasekaran, P.L.K. Palaniappan, Service supply chain environmental performance evaluation using grey based hybrid MCDM approach, *Int. J. Prod. Econ.* 166 (2015) 163–176, <https://doi.org/10.1016/j.ijpe.2015.01.002>.
- [78] S.-B. Tsai, et al., Using the fuzzy DEMATEL to determine environmental performance: a case of printed circuit board industry in Taiwan, *PLoS One* 10 (6) (2015) e0129153, <https://doi.org/10.1371/journal.pone.0129153>.
- [79] S.K. Singh, M. Del Giudice, R. Chierici, D. Graziano, Green innovation and environmental performance: the role of green transformational leadership and green human resource management, *Technol. Forecast. Soc. Change* 150 (May 2019) (2020) 119762, <https://doi.org/10.1016/j.techfore.2019.119762>.
- [80] S. Zailani, K. Govindan, M. Iranmanesh, M.R. Shaharudin, Y.S. Chong, Green innovation adoption in automotive supply chain: the Malaysian case, *J. Clean. Prod.* 108 (2015) 1115–1122, <https://doi.org/10.1016/j.jclepro.2015.06.039>.
- [81] L.J. Williams, S.E. Anderson, Job satisfaction, *J. Manag.* 17 (3) (1991) 601–617, <https://doi.org/10.1177/014920639101700305>.
- [82] L. Herscovitch, J.P. Meyer, Commitment to organizational change: extension of a three-component model, *J. Appl. Psychol.* 87 (3) (2002) 474, <https://psycnet.apa.org/doi/10.1037/0021-9010.87.3.474>.
- [83] J.F. Hair, G.T.M. Hult, C.M. Ringle, M. Sarstedt, K.O. Thiele, Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods, *J. Acad. Market. Sci.* 45 (2017) 616–632, <https://doi.org/10.1007/s11747-017-0517-x>.
- [84] S. Kilic, Cronbach's alpha reliability coefficient, *J. Mood Disord.* 6 (1) (2016) 47, <https://doi.org/10.5455/jmood.20160307122823>.
- [85] M.R. Lavery, P. Acharya, S.A. Sivo, L. Xu, Number of predictors and multicollinearity: what are their effects on error and bias in regression? *Commun. Stat. Comput.* 48 (1) (2019) 27–38, <https://doi.org/10.1080/03610918.2017.1371750>.
- [86] M.O. Akinwande, H.G. Dikko, A. Samson, Variance inflation factor: as a condition for the inclusion of suppressor variable(s) in regression analysis, *Open J. Stat.* 5 (7) (2015) 754–767, <https://doi.org/10.4236/ojs.2015.57075>.
- [87] N. Kock, Common method bias in PLS-SEM: a full collinearity assessment approach, *Int. J. e-Collaboration* 11 (4) (2015) 1–10, <https://doi.org/10.4018/ijec.2015100101>.
- [88] A. Diamantopoulos, J.A. Siguaw, Formative versus reflective indicators in organizational measure development: a comparison and empirical illustration, *Br. J. Manag.* 17 (4) (2006) 263–282, <https://doi.org/10.1111/j.1467-8551.2006.00500.x>.
- [89] I. Bose, V. Gupta, Green HRM practices in private health care & banking sectors in India, *Indian J. Ind. Relat.* 53 (1) (2017) 48–58. Available online: <https://www.jstor.org/stable/26536436>.
- [90] Q. Iqbal, The era of environmental sustainability: ensuring that sustainability stands on human resource management, *Global Bus. Rev.* 21 (2) (2020) 377–391, <https://doi.org/10.1177/0972150918778967>.