



The influence of renewable energy, humanistic culture, and green knowledge on corporate social responsibility and corporate environmental performance

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Abstract

The environmental performance of modern corporations faces compromise due to administrative practices, resulting in insufficient attention to corporate social responsibility (CSR). This lack of consideration within organizational frameworks underscores the imperative for a heightened commitment to CSR initiatives, as they play a pivotal role in fostering sustainability and responsible business practices. The purpose of this research is to determine the relationship among renewable energy (RE), humanistic culture (HC), green knowledge (GK), CSR, and corporate environmental performance (CEP) in the Pakistani retail sector. The research aspires to unravel the moderating influence of environmental sustainability (ES) and explore the plausible mediating function of CSR. This study's research design was quantitative. The sample consisted of a diverse range of organizations operating in Pakistan's industrial, services, retail, and information technology sectors. A purposive sampling technique was employed to pick a representative sample of organizations. In this research, the participants consisted of senior managers, executives, and personnel who held positions of responsibility for environmental management and CSR efforts inside their respective organizations. The selected organizations were given standardized questionnaires to collect data. The hypothesis was examined by the application of the structural equation modeling approach (SEM) using IBM, SPSS, and AMOS software. The research findings show that there are statistically significant and robust relationships between RE, HC, GK, CSR, and CEP. The study also concludes that CSR serves as a positive mediator in the connections between RE and CEP, HC and CEP, and GK and CEP. Further, the results of the study underscore the need for integrating sustainability practices into CSR programs. The environmental sustainability plays a crucial role in enhancing the relationship

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between CSR and CEP. This paper provides helpful advice for businesses looking to incorporate CSR, RE, and sustainable development into their operations.

Graphical abstract



Keywords Renewable energy · Humanistic culture · Green knowledge · Environmental sustainability · Corporate social responsibility · Corporate environmental performance · Pakistan

Introduction

The significance of corporate social responsibility (CSR) and its effects on environmental sustainability gained increasing attention from scholars in recent years (Dhar et al. 2022). Organizations are increasingly compelled to adopt sustainable practices and mitigate their environmental impact due to the global challenges of climate change and resource depletion. Therefore, businesses are embracing green technologies, fostering humanistic cultures, and using renewable energy sources. In line with this, Pakistan must embrace sustainable practices across all sectors addressing issues such as air and water pollution, deforestation, and energy constraints. Furthermore, Pakistan's rapid industrialization and expanding service sector underscore the importance of considering the interplay between corporate social responsibility, renewable energy, and environmental performance in the retail, IT, manufacturing, and services sectors of the country. (Abbas 2020).

To address its energy issues and reduce dependence on fossil fuels, Pakistan has made tremendous progress in the promotion of renewable energy sources, including wind and solar power. Adopting renewable energy is in line with Pakistan's commitment to the United Nations' Sustainable Development Goals (SDGs) and demonstrates a proactive

approach toward environmental sustainability. (Javeed et al. 2021). In practice, the firms have failed to adopt CSR practices for environmental issue management.

However, as indicated by Raza and Khan (2022), the focus is on the impact of green knowledge and renewable energy on corporate environmental performance in Pakistan. Organizations investing in renewable energy sources and employing green knowledge are expected to play a crucial role in enhancing environmental performance, especially given the country's susceptibility to climate change and environmental degradation. Utilizing renewable energy solutions not only aids in reducing Pakistan's carbon footprint but also supports sustainable energy demands. Additionally, providing employees with green knowledge empowers them to make environmentally beneficial decisions (Sahoo et al. 2023). This study aims to illuminate the effectiveness of adopting renewable energy and green knowledge within Pakistani organizations to improve their environmental performance.

This study significantly contributes to the understanding of the interplay between corporate social responsibility (CSR), renewable energy adoption, humanistic culture, green knowledge, and environmental performance within Pakistani organizations (Khan et al. 2021). To solve the theoretical and practical problem, the influence of renewable

energy, humanistic culture, and green knowledge on corporate social responsibility in Pakistan is an important area of research. Furthermore, the study also examines how corporate social responsibility mediates the relationship between renewable energy, humanistic culture, green knowledge, and corporate environmental performance in Pakistan. In this way, the implementation of corporate social responsibility initiatives within Pakistani organizations may also be facilitated by establishing a humanistic culture that prioritizes social and environmental issues (Sun and Hong 2022). In the context of Pakistani organizations, the study aims to investigate how these factors influence corporate socially responsible practices.

Corporate social responsibility (CSR) initiatives may serve as a link between the adoption of renewable energy, the spread of green knowledge, and improved environmental performance as organizations across the nation attempt to strike a balance between economic growth and environmental sustainability. Pakistani organizations may improve their environmental performance through sustainable practices and stakeholder involvement by incorporating corporate social responsibility into their daily operations (Ahmad et al. 2021). In this context, organizations seeking to maximize their sustainability efforts can benefit from understanding the mediating role of corporate social responsibility. The study findings will have useful implications for Pakistani retail, IT, manufacturing, and services organizations, helping them create sustainable business plans. This research provides a platform for future studies and policy initiatives in Pakistan by examining the relationships among these variables. It also advances the major objective of attaining environmental sustainability in Pakistan. This study is divided into sections on literature review, methodology, findings, discussion, conclusion, implications, and future directions.

Literature review

The study's theoretical framework is supported by the resource-based view (RBV) paradigm, particularly in the areas of corporate environmental performance, renewable energy, humanistic culture, and green knowledge (Lockett et al. 2009). The RBV paradigm holds that firms can gain a competitive edge and improve performance by using their unique and valuable resources (Madhani 2010). This research suggests that solar, wind, and hydroelectric electricity are vital, scarce, and irreplaceable. Companies may stand out from competitors and meet growing social and legal demands for sustainability by using renewable energy (Mahoney and Pandian 1992). An organization's humanistic culture may also increase environmental performance. Companies that value employee well-being, ethics, and social responsibility can promote sustainable practices and

environmental stewardship. Environmental technology, sustainability, and eco-innovation, or green knowledge, are important professional skills (Wernerfelt 1984). Thus, companies that are conscious of environmentally friendly activities are more adept at finding and using environmental advances. The examination of RBV further emphasizes that a company's distinctive assets and competencies, especially in renewable energy and green knowledge, can be harnessed to enhance overall business environmental performance. Therefore, the current study uses the RBV theory to hypothesize that companies with renewable energy, a humanistic culture, and green knowledge are more likely to have excellent corporate environmental performance.

The resource-based view (RBV) makes it possible to examine the connections between renewable energy, environmental awareness, and business environmental performance. The resource-based view (RBV) contends that a company's unique assets and competencies are essential in determining both its competitive advantage and overall performance (Rehman Khan and Yu 2021). When taking into account renewable energy and green knowledge as independent variables, the RBV framework suggests that companies with these special resources might employ them to improve their corporate environmental performance (Singh et al. 2019). In addition to being ecologically beneficial, renewable energy sources, including solar, wind, and hydroelectric electricity, can also be helpful strategically. Businesses that invest in and effectively employ renewable energy sources can reduce their reliance on fossil fuels, reduce greenhouse gas emissions, and increase operational efficiency. When a corporation uses these energy resources in its operations. It can reduce costs, improve energy security, and win over stakeholders that care about the environment. Green expertise, which comprises eco-friendly methods, tools, and experience, also emerges as a distinctive talent.

Therefore, the businesses can achieve greater success by adopting environmentally friendly practices and producing sustainable goods through advanced green knowledge. These efforts collectively contribute to an enhanced environmental performance. This knowledge-driven competitive advantage may allow companies to manage legislative changes, satisfy consumer demand for greener products, and establish themselves as market leaders in environmentally responsible business operations. The resource-based view, in its conclusion, emphasizes the significance of green expertise and renewable energy as distinct and priceless resources that could aid firms in improving their corporate environmental performance (Rehman et al. 2021a, b). By aligning their plans with these resources, businesses can gain a competitive vantage, enhance their environmental stewardship, and contribute to a more sustainable future.

While the literature extensively supports the positive impact of renewable energy and green knowledge on

corporate environmental performance, there is a noticeable gap in understanding the specific mechanisms through which these factors contribute and interact within the context of a humanistic culture. This study aims to address this gap by providing a nuanced analysis of the synergistic effects of renewable energy, humanistic culture, and green knowledge on corporate environmental performance, thereby contributing to a more comprehensive understanding of sustainable business practices. In order to provide publication a thorough knowledge of the relationships among these variables, this section analyses pertinent research and establishes the theoretical underpinnings for developing hypotheses. The proposed research model is shown in Fig. 1.

Renewable energy (RE) and corporate social responsibility (CSR)

Energy sources that can be used without depleting their resources and are regenerated naturally are referred to as renewable energy sources (Yi et al. 2023). These energy sources are regarded as sustainable because they have lesser adverse environmental effect than conventional fossil fuels, which emit greenhouse gases and cause climate change. In the corporate social responsibility (CSR) plans of several companies throughout the world, renewable energy has become an essential element. The organizations are realizing the tremendous influence they can have by switching to renewable energy sources as concerns about environmental sustainability and climate change continue to rise (Mutezo and Mulopo 2021). This transformation provides several rewards that are consistent with the fundamental ideas of corporate social responsibility, such as lowering environmental impact, promoting sustainable development,

and increasing stakeholder participation. Through its role in preventing climate change, renewable energy has substantial influence on corporate social responsibility. (Osman et al. 2023) stated that the organizations may drastically lower their greenhouse gas emissions by switching from fossil fuels to sustainable energy sources like hydroelectric, solar, and wind power. According to Omisore (2018), this reduction not only aligns with global efforts to combat climate change, but also aids organizations in attaining their sustainability objectives and showcasing their commitment to environmental stewardship. Amran et al. (2014) pointed out that organizations possess the potential to assume a pivotal role in the process of decarbonizing the economy and safeguarding the planet for forthcoming generations through their active involvement in the adoption of renewable energy sources.

Additionally, companies may reduce their environmental impact by using renewable energy sources. Renewable energy methods generate little to no hazardous waste, contaminated water, or air pollution, in contrast to fossil fuel-based power generation (Chew et al. 2021). This change is consistent with sustainable development principles as it lessens adverse effects on ecosystems and public health. The organizations that place a high priority on renewable energy demonstrate their dedication to protecting the environment, fostering biodiversity, and safeguarding natural resources. Stakeholder engagement is another CSR component that is favorably impacted by renewable energy. People and communities are becoming more ecologically aware, and they are expecting firms to use sustainable practices. Additionally, the switch to renewable energy provides business opportunities that support principles of CSR (Daú et al. 2019). The development of new jobs is stimulated by

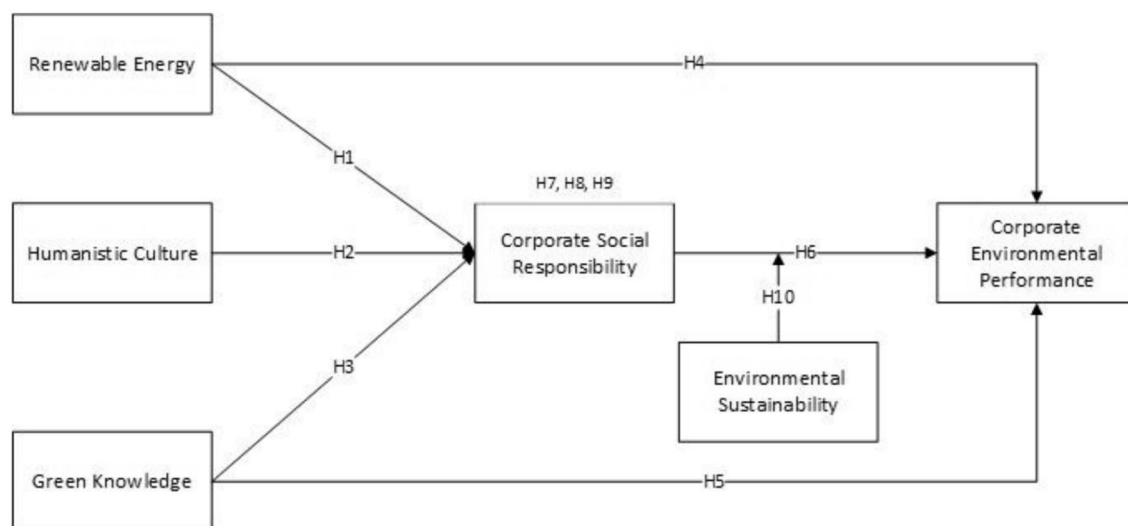


Fig. 1 Proposed research model

investments in renewable energy technology, particularly in the sector's rapidly expanding renewable energy market. By promoting local economies and creating opportunities for employment, this helps in socioeconomic growth. Thus, the following hypothesis is formulated.

H1 Renewable energy has significant impact on corporate social responsibility.

Humanistic culture (HC) and corporate social responsibility (CSR)

A culture that places a high priority on an individual's growth and well-being as well as their ability for self-realization, creativity, and personal evolution is referred to be humanistic (Watts 2022). It places a strong emphasis on the value of human dignity, freedom, and autonomy as well as the quest of meaning and purpose in life. The beliefs, ethics, and behaviors of corporations may be greatly influenced by humanistic culture which in turn can have a significant effect on corporate social responsibility. A humanistic culture puts people's welfare and dignity first while promoting empathy, social justice, and inclusion. Humanistic culture may motivate organizations to participate in ethical behavior that goes beyond simply conforming to legal requirements and aims for positive societal impact when it is incorporated into CSR strategy (Sharma et al. 2023). The emphasis on the well-being of employees is encouraged in humanistic cultures. It encourages righteous behavior and upholds moral standards, providing secure workplaces, just pay, and chances for progression. The organizations may boost employee happiness, productivity, and loyalty by respecting their workers as unique individuals and creating a positive work environment. Moreover, by promoting a culture of respect and dignity at work, businesses that invest in the well-being of their workers strengthen the social fabric as a whole (Alrawadieh et al. 2021).

Ethical business conduct and thoughtful decision-making are prioritized in humanistic cultures. The organizations with humanistic cultures aim to provide long-term benefit for all parties involved, not just shareholders (Chou and Cheng 2020). They make decisions that support larger society interests after considering the environmental, social, and economic effects of their choices. Furthermore, firms may embrace environment friendly practices because of a humanistic culture. According to Chew et al. (2021), environmental sustainability is an integral aspect of CSR, and organizations that prioritize humanistic values recognize the paramount need of safeguarding the environment for the well-being of future generations. Shah and Ivascu (2023) pointed out that the individuals in question employ proactive measures to mitigate their environmental footprint, minimize waste generation, and promote the efficient utilization of resources.

The organizations could showcase their efforts to the planet's well-being and support global efforts to combat climate change and ecological degradation by incorporating sustainability concerns into their operations (Han et al. 2023). Therefore, the following hypothesis is proposed.

H2 Humanistic culture has significant impact on corporate social responsibility.

Green knowledge (GK) and corporate social responsibility (CSR)

Green knowledge is the understanding and knowledge of sustainable and environmentally friendly concepts, technologies, and practices (Rubel et al. 2021). It covers a broad spectrum of subjects and disciplines with the common goals of advancing environmental protection, minimizing ecological harm, and achieving a more sustainable society. Green knowledge influences the corporate social responsibility. Incorporating green knowledge into CSR initiatives enables organizations to take educated decisions and engage in endeavors that support favorable environmental outcomes as they become more conscious of the value of environmental sustainability. The ability of firms to properly measure and manage their environmental impact is one of the primary effects of green knowledge on CSR. The organizations may find ways to minimize their environmental impact, save resources, and generate less waste by understanding the effects of their operations on the environment (Javaid et al. 2022). The organizations may implement green technology and renewable energy sources by using green knowledge. The organizations may lower their greenhouse gas emissions and supports a low-carbon economy by making investments in renewable energy technology. By combating climate change and encouraging sustainable development, this transition to clean energy is consistent with the principles of CSR (Zahoor et al. 2022).

Green knowledge also enables businesses to manage their supply chains ethically. The organizations may find opportunities for improvement by analyzing how their supply chains affect the environment. This can entail obtaining raw materials from eco-friendly vendors, cutting down on transportation emissions, or encouraging fair trade and moral labor standards (Abbate et al. 2023). Businesses can ensure that their CSR initiatives go beyond their own operations and positively impact their whole value chain by considering the environmental and social effect of their supplier networks. Moreover, Çop et al. (2021) pointed out that acquiring a more comprehensive comprehension of environmental concerns enables organizations to effectively include their stakeholders and meet evolving customer expectations. As environmental awareness continues to grow, there is a rising trend among customers to seek out products and services

that align with their personal ideals and contribute to sustainability efforts (Rehman et al. 2021a, b). Organizations can cultivate trust, loyalty, and enduring relationships with environmentally conscious customers by the demonstration of a comprehensive comprehension of environmental issues and the implementation of sustainable practices. According to Alyahya et al. (2023), the acquisition of green knowledge fosters effective communication and collaboration among diverse stakeholders. This interaction may result in the creation of innovative ideas, collaborative efforts, and partnerships that achieve sustainable development goals (Kong et al. 2020). Thus, the following hypothesis is formulated.

H3 Green knowledge has significant impact on corporate social responsibility.

Renewable energy (RE) and corporate environmental performance (CEP)

Corporate environmental performance is significantly impacted using renewable energy sources. Businesses may reduce their environmental impact and support sustainable development by switching from energy based on fossil fuels to energy based on renewable resources (Malik 2020). Numerous factors, such as reduced emissions of greenhouse gases, preserving resources, pollution prevention, and preservation of ecosystems, are impacted by renewable energy on corporate environmental performance. Reducing greenhouse gas emissions is one of the key effects of renewable energy on company environmental performance. By using these sustainable energy sources, organizations may drastically lower their carbon footprint, reduce climate change, and support global efforts for reducing greenhouse gas emissions (Raihan 2023b). Furthermore, the use of renewable energy helps in resource preservation. Extraction and usage of fossil fuels degrade the environment significantly and consume scarce resources. The organizations may promote the preservation of natural resources like coal, oil, and natural gas by switching to renewable energy sources and reducing their dependency on non-renewable resources. In addition, compared to traditional power generation, renewable energy solutions frequently use less water, protecting this priceless resource. The organizations can ensure that natural resources are used more sustainably and effectively by preserving resources via the use of renewable energy (Nathaniel et al. 2021).

Additionally, the use of renewable energy is essential for reducing pollution. The burning of fossil fuels for energy production is a major cause of air pollution and a factor in smog, acid rain, and a number of respiratory and cardiovascular diseases (Munsif et al. 2021). The organizations may considerably reduce air pollution and enhance air quality by switching to renewable energy sources from fossil

fuels. According to Sampantamit et al. (2020), this alteration assists to the safeguarding of human health and the environment by diminishing the quantity of harmful pollutants and particulate matter emitted into the atmosphere. In addition, Zhang et al. (2021) pointed out that the use of renewable energy sources significantly reduces the potential for land and water contamination, as these sources generate minimal or negligible amounts of hazardous waste. The use of renewable energy also promotes ecological preservation (Raihan 2023a). Ecosystem preservation is also necessary to preserve crucial ecological functions including carbon sequestration and water filtration. The organizations may help preserve ecosystems and save biodiversity by switching to renewable energy. Therefore, the following hypothesis is proposed.

H4 Renewable energy has significant impact on corporate environmental performance.

Green knowledge (GK) and corporate environmental performance (CEP)

Green knowledge helps organizations make rational decisions and implement initiatives that promote environmental sustainability and reduce ecological damage (Vakili et al. 2022). Improved resource management, less environmental impact, better compliance, and sustainable practice innovations are all benefits of green knowledge. Green knowledge boosts business environmental performance by improving resource management (Roscoe et al. 2019). Considering energy, water, and raw material utilization can help organizations decrease waste and optimize use. According to Chien et al. (2022), using green knowledge, organizations can adopt sustainable procurement, energy efficiency, recycling, and waste reduction programs. Green knowledge also helps companies reduce their environmental impact. Furthermore, Ulucak and Kassouri (2020) highlighted that understanding how their actions affect the environment helps organizations implement sustainable practices. According to Sun et al. (2022), develop pollution control measures, embrace cleaner production practices, and reduce waste and emissions. The organizations may significantly reduce their ecological footprint by using green knowledge to help them make rational decisions about the technology, materials, and procedures they use (Ghosh et al. 2022).

According to (Chen et al. 2020), green knowledge also improves a company's compliance with environmental laws and norms. According to Forés (2019), by being abreast of environmental rules and regulations, companies can avoid fines and legal issues. Amankwah-Amoah and Syllias (2020) pointed out that with green information, organizations can monitor and report their environmental performance, establish efficient environmental management systems, and proactively close compliance gaps.

Meanwhile, Khatter (2023) asserted that green knowledge drives sustainable technology and practice innovation. Companies with a greater environmental awareness can recognize innovation opportunities. Green knowledge stimulates innovation and the creation of new eco-friendly goods, methods, and technology (Shehzad et al. 2022). Thus, the following hypothesis is formulated.

H5 The acquisition of green knowledge has a substantial influence on the environmental performance of corporations.

Corporate social responsibility (CSR) and corporate environmental performance (CEP)

Corporate environmental performance, which is an important element of corporate social responsibility, is particularly concerned with the impact that an organization's operations have on the environment (Ahmad et al. 2021). According to Xue et al. (2022), the achievement of superior environmental performance can be attributed to the reduction in resource consumption, mitigation of pollution, implementation of efficient waste management practices, and the minimization of environmental dangers. Nureen et al. (2023) pointed out that enhancing the environmental performance of a corporation has been found to have positive effects on various aspects, including the company's reputation, stakeholder trust, adherence to regulatory requirements, and long-term financial viability. It conforms with the principles of sustainable development and demonstrates an organization's commitment to environmental protection (Liu et al. 2021). According to Suliman et al. (2023), the importance of corporate environmental performance in upholding social responsibility has become increasingly significant, as it strengthens the alignment between environmental performance and societal norms. By incorporating sustainability into their daily operations, the organizations demonstrate their commitment to environmental responsibility and improve corporate environmental performance (Haldorai et al. 2022).

The organizations may lessen their ecological footprints, increase resource efficiency, increase environmental awareness, and promote sustainable practices by prioritizing corporate social responsibility and incorporating environmental issues into their plans (Nureen et al. 2023). Initiatives that promote corporate social responsibility not only help the environment but also improve productivity, cut costs, and long-term sustainability (Barauskaite and Streimikiene 2021). The organizations have the power to transform entire industries by their actions and help the environment in the future. Hence, the following hypothesis is proposed.

H6 The influence of corporate social responsibility on company environmental performance is substantial.

Corporate social responsibility (CSR) as a mediator

Integrating the adoption of renewable energy with more general sustainability goals, promoting successful implementation, and encouraging stakeholder participation, corporate social responsibility acts as a mediator between renewable energy and corporate environmental performance (Huan and Hong 2021). The organizations may improve their environmental performance, show their dedication to sustainability, and encourage a more sustainable future by incorporating renewable energy into corporate socially responsible initiatives. The organizations may achieve significant and long-lasting environmental advantages while enacting positive change both within their operations and externally by combining renewable energy with social responsibility initiatives (Gawusu et al. 2022).

By encouraging a sense of responsibility, including sustainable practices, and empowering employees, humanistic cultures serve as a mediator between corporate social responsibility and corporate environmental performance (Liedong et al. 2022). Corporate socially responsible initiatives are likely to support environmental goals and affect positive change when organizations place a high priority on humanistic culture. The organizations may improve their environmental performance, promote sustainability, and have a positive influence on the environment and society as a whole by integrating a humanistic culture with corporate socially responsible initiatives (Raza et al. 2021).

Corporate social responsibility mediates the relationship between green knowledge and corporate environmental performance by establishing a framework for practical implementation, promoting the involvement of stakeholders, and strengthening accountability (Zhou et al. 2023). The organizations may successfully utilize environmental knowledge, influence positive change, and enhance their environmental performance by incorporating green knowledge into corporate social responsibility strategy. The organizations engage stakeholders, promote transparency, and apply green knowledge into practice through corporate socially responsible programs, all of which eventually lead to a more sustainable future (Cezarino et al. 2022).

H7 Corporate social responsibility mediates the relationship between renewable energy and corporate environmental performance.

H8 Corporate social responsibility mediates the relationship between humanistic culture and corporate environmental performance.

H9 Corporate social responsibility mediates the relationship between green knowledge and corporate environmental performance.

Environmental sustainability (ES) as a moderator

Environmental sustainability is the process of managing resources in a way that safeguards the environment for both current and future generations (Oláh et al. 2020). The ability of future generations to satisfy their own requirements must be preserved while continuing to address the demands of the present. Environmental sustainability moderates the relationship between corporate social responsibility and corporate environmental performance. According to (Kraus et al. 2020), corporate social responsibility initiatives significantly improve corporate environmental performance when environmental sustainability is high. However, it is important to note that the influence of corporate social responsibility on corporate environmental performance may be limited in cases when environmental sustainability is lacking (Ha et al. 2023). The extent to which corporate socially responsible efforts are integrated into core business operations is contingent upon the level of environmental sustainability (Yasin et al. 2023). According to Juma et al. (2023), organizations have the potential to enhance the beneficial influence of corporate social responsibility on corporate environmental performance and drive substantial progress toward a more sustainable future via the reinforcement of their dedication to environmental sustainability.

H10 Environmental sustainability moderates the relationship corporate social responsibility and corporate environmental performance.

Methodology

This study employed a quantitative research design centered on gathering data and conducting statistical analysis to make inferences and generalizations about the target population. This design is best suitable to measure variables, examine relationships among variables, and test hypotheses. Analyzing employee perspectives across diverse sectors such as Pakistani retail, IT, manufacturing, and service industries serves as an illustrative case, employing a systematic and rigorous methodology to comprehend the research issues in question. Total twenty-seven scale items were used to measure the responses related to renewable energy, humanistic culture, green knowledge, corporate social responsibility, corporate environmental performance, and environmental sustainability. The data collection in this study was conducted using a five-point Likert scale.

Some of the scale items of the constructs were adopted and adapted from the previous existing studies but some of the scale items were developed after discussion with the knowledge experts in the subject. The study adopted the six-scale items of green knowledge from (He et al. 2022).

Three-scale items of corporate environmental performance adopted from (He et al. 2022) and two-scale items was adapted from (Latan et al. 2018). Four items of humanistic culture were adapted from (Kalyar et al. 2013). The study adapted the four items of corporate social responsibility from (Tien-Shang Lee 2012). Four items of renewable energy and four items of environmental sustainability were developed after in-depth focus group discussion. It was important to engage in collaborative approach that included the ideas and viewpoints of competent people in the relevant field to assure the content validity of the scale items.

This cohort of assistant professors was meticulously chosen based on their qualifications, research experience, and professional achievements. The focus group session entailed a structured and facilitated dialogue among the individuals who possess expertise in the relevant topic matter. The objective was to obtain the participants' perceptions, viewpoints, and ideas regarding the design of the scale items. Engaging in a structured dialogue regarding various major aspects and factors was crucial in accurately capturing the construct items. The experts were encouraged to share their expertise, provide constructive feedback, and suggest potential additions. The recommendations and insights provided by the experts were carefully analyzed after the focus group deliberation. For this, the operationalization of the variables was considered. The acquired data from the experts were meticulously analyzed and summarized by the researchers, who subsequently formulated the scale items. A pool of scale items was developed, and external set of reviewers were contacted to determine the face and content validity of the items. The content validity is confirmed with little modification, and finally the scale is considered for a pilot study. A subset of population based on 61 responses was contacted to collect the data. Subsequently, the researchers proceeded to perform an exploratory factor analysis to identify any potential concerns pertaining to the scale items. Hence, the reliability of the scale is achieved, and the scale items with low factor loadings were removed. Furthermore, the data was collected from a subset of 66 respondents to determine the validity of scale items with confirmatory factor analysis. The results indicated that the scale items demonstrated significant validity, leading to their finalization for the conclusive data collection. Before proceeding with further investigation, three items were deemed inappropriate and subsequently excluded.

The researchers employed the purposive sampling strategy in conducting this investigation. Importantly, the main goal of purposive sampling is to identify the cases, individuals, or communities' best suited to helping you answer your research question. Hence, the participants are selected for inclusion in the study using a non-probability sampling method, whereby individuals are picked based on their level of acquaintance with or relevance to the topic under

investigation. The survey included 430 Pakistani retail, IT, manufacturing, and service organizations. The respondents of the study were senior managers, executives, and staff members who oversaw environmental management and CSR initiatives with their own organizations. The selected participants were contacted using a multistage method to collect data. A list of Pakistani organizations engaged in retail, IT, manufacturing, and service was initially compiled. Once the organizations had been selected, the researchers contacted the human resources department to ask for permission to collect data from the employees. Following organizational approval, the researchers visited the chosen organizations and provided the employees with a survey form. To collect relevant information on employee perceptions, the survey questionnaire was carefully designed based on prior research and expert guidance. The completed surveys were collected on-site ensuring a high response rate.

The demographic characteristics are given in Table 1. The survey encompassed a diverse range of organizations from various industry sectors, including retail, IT, manufacturing, and service. The distribution of organizations based on size indicated a mix of medium, small, and large enterprises, all located in Pakistan. The study specifically targeted individuals holding different positions within these organizations, with a focus on senior managers in retail, executives in IT, and staff members in manufacturing and service sectors. In total, the survey garnered responses from 430 individuals across these organizations. The education level of the respondents was varied, with a significant portion holding master's degrees, including 40 respondents in retail, 46 in IT, 65 in manufacturing, and 25 in service. Additionally, individuals with bachelor's degrees constituted a substantial portion of the respondents, with 70 in retail, 54 in IT, 95 in manufacturing, and 20 in Service. Notably, in the service sector, a segment of respondents held college degrees (15 individuals). This diverse educational background provides a comprehensive view of the perceptions and insights of individuals across different levels of educational attainment within the surveyed organizations.

The data were analyzed using IBM SPSS AMOS software. The structural equation modeling (SEM) technique was used to analyze the study's direct and indirect effects. The covariance-based structural equation modeling (CB-SEM) technique provide researchers the opportunity to assess the model's overall fit, investigate relationships among the variables, and assess the measurement features of the survey items. According to (Hair et al. 2014), "the widespread application of CB-SEM has led to numerous advances that extend the method's capabilities. Several of these advances include approaches that enable more complex and comprehensive analysis than with first generation methods (Shah et al. 2024). Included in these advances is assessment of mediating effects, moderation, invariance/equivalence of constructs across multiple groups, and higher order modeling of constructs." Furthermore, the number of variables used, and the variables used for the purpose of AMOS SEM analysis can be studied using the text output variable summary. Hence, this study has considered AMOS for its data analysis.

Results

The study evaluated the measurement model and determined if the variables accurately reflected the theoretical components using these metrics. To confirm research hypothesis, the study also evaluated the overall goodness-of-fit of the suggested research model.

Assessment of the measurement model

The AMOS software was used to conduct a confirmatory factor analysis (CFA) to assess the measurement model. It was determined whether the factor loadings for each item in this study were significant. Table 3 shows that all the item's factor loadings are greater than the 0.6 cutoff value (Hair et al. 2016). The metrics CMIN/DF, CFI, NFI, GFI, RMR, SRMR, and RMSEA were used to evaluate the model's

Table 1 Demographic characteristics

Industry sector	Organization size	Geographic location	Respondent position	Number of respondents	Education level
Retail	Medium	Pakistan	Senior manager	110	Master's Degree (40 respondents) Bachelor's Degree (70 respondents)
IT	Small	Pakistan	Executive	100	Master's Degree (46 respondents) Bachelor's Degree (54 respondents)
Manufacturing	Large	Pakistan	Staff member	160	Master's Degree (65 respondents) Bachelor's Degree (95 respondents)
Service	Large	Pakistan	Senior manager	60	Master's Degree (25 respondents) Bachelor's Degree (20 respondents) College (15 respondents)

overall goodness-of-fit. All the values of these metrics remained in the recommended range (Bentler 1990; Hu and Bentler 1998). All the model-fit measure values are shown in Table 2. Figure 2 displays the measurement model.

Reliability

Cronbach's alpha (α) and composite reliability (CR) were used to evaluate the constructs' reliability. Table 3 shows that Cronbach's alpha values for all of the study's constructs were greater than the acceptable range of 0.70 (Nunnally and Bernstein 1994). The composite reliability (CR) values, which ranged from 0.785 to 0.889, were higher than the recommended threshold of 0.70 (Hair et al. 2013). The items used to measure each construct were therefore said to be reliable and accurate indicators of the underlying construct.

Convergent validity

The average variance extracted (AVE) was used to assess the convergent validity of the scale items. As indicated in Table 3, all AVE values were more than the 0.50 cutoff value (Fornell and Larcker 1981). As a result, the current study establishes the convergent validity.

Discriminant validity

The Fornell and Larcker Criterion (FLC) (Fornell and Larcker 1981) and the Heterotrait–Monotrait (HTMT) Ratio (Henseler et al. 2015) were used to evaluate the discriminant

validity. When a construct's square root of AVE is larger than its correlation with the other constructs in the research, the Fornell and Larcker criteria for discriminant validity are accomplished. The results show that FLC has been developed for each construct. Recent criticism of the Fornell and Larcker criterion has led to an increase in the usage of the HTMT ratio, a unique technique for evaluating discriminant validity. The HTMT matrix values, according to the findings, were all under the recommended value of 0.90 (Gold et al. 2001). HTMT is therefore established for each construct. Table 4 shows the HTMT matrix.

Assessment of the structural model

The AMOS structural model was used to test the study hypotheses. According to Hair et al. (2013), the structural model has a satisfactory match if the metrics' values—CMIN/DF, CFI, NFI, GFI, RMR, SRMR, and RMSEA—are below the recommended range. Each metric value fits within the specified range, as indicated in Table 5. The R² was 63% for corporate social responsibility and 67% for corporate environmental performance.

SEM was used in AMOS to evaluate all ten hypotheses. Table 6 shows that renewable energy has positive impact on corporate social responsibility ($b=0.831$, $t=6.595$, $p<0.001$), thus H1 is supported. The humanistic culture positively influences the corporate social responsibility ($b=0.464$, $t=5.658$, $p<0.001$), therefore H2 is accepted. H3 is supported because the results indicate that there is a positive relationship between green knowledge and corporate social responsibility ($b=0.339$, $t=4.774$, $p<0.001$). The findings show that renewable energy positively impacts the corporate environmental performance ($b=0.328$, $t=7.130$, $p<0.001$). The green knowledge has positive association with corporate environmental performance ($b=0.562$, $t=3.697$, $p<0.001$). The results also reveal that corporate social responsibility positively influences the corporate environmental performance ($b=0.483$, $t=2.824$, $p<0.001$). By analyzing all the values in acceptable range, the results interpret a fair relationship among variables.

Mediation analysis

The study analyzes the mediation effect of corporate social responsibility between renewable energy and corporate environmental performance, humanistic culture and corporate environmental performance, and green knowledge and corporate environmental performance. The findings of the study reveal that corporate social responsibility positively mediates the relationship between renewable energy and corporate environmental performance ($\beta=0.124$, $t=5.116$, $p<0.05$), and therefore H7 is accepted. Furthermore, the direct effect of renewable energy on corporate

Table 2 CFA model Fit indices

Measure	Recommended values	Scores
X ² /df	< 3.0*	2.464
CFI	> 0.90*	0.944
NFI	> 0.90*	0.936
GFI	> 0.90*	0.904
RMR	< 0.08*	0.040
SRMR	< 0.08*	0.036
RMSEA	< 0.08*	0.058

X²/df: Chi-square/df (CMIN/DF), CFI: Comparative Fit Index, NFI: The Normed Fit Index, GFI: Goodness of fit, RMR: Root Mean Square Residual, SRMR: Standardized Root Mean Square Residual, RMSEA: Root Mean-Square Error of Approximation

*, ** and *** indicate the level of significance at 10%, 5% and 1% level respectively

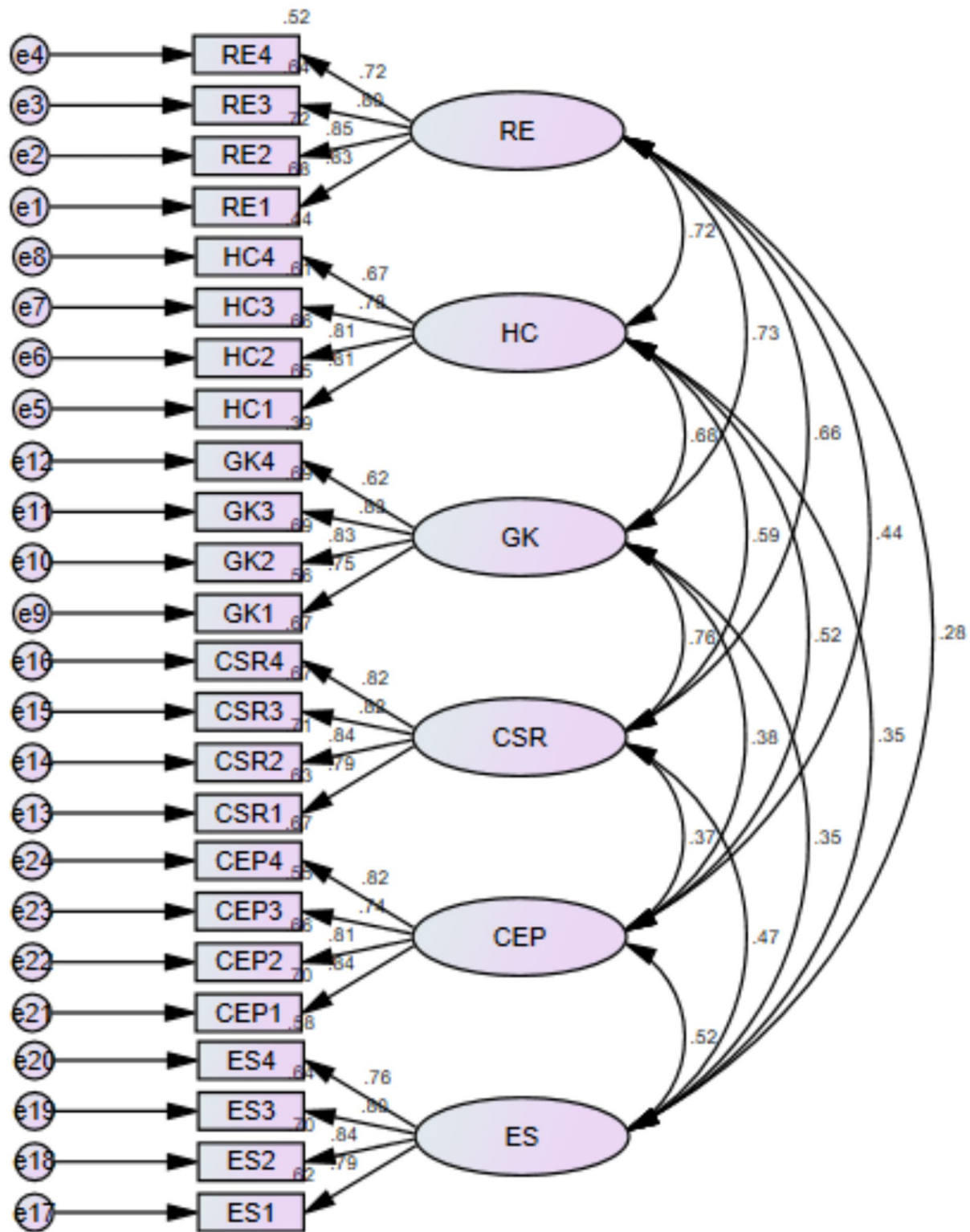


Fig. 2 The measurement model

environmental performance in the presence of mediator was also found significant ($b=0.328$, $t=7.130$, $p<0.001$). Thus, the corporate social responsibility partially mediates the

relationship between renewable energy and corporate environmental performance. The results also demonstrate the positive mediating effects of corporate social responsibility

Table 3 Scale Items, Loadings, Cronbach's Alpha, AVE, and CR

Constructs	Items	Loadings	AVE (>0.5)	CR (>0.7)
Renewable energy (RE) ($\alpha=0.801$)	My organization invests in the research and development of cutting-edge renewable energy technologies	0.826	0.639	0.876
	My organization works with regional stakeholders and local communities to promote and support renewable energy initiatives	0.849		
	My organization actively endorses and participates in community based renewable energy projects	0.797		
	My organization works with other organizations to exchange best practices and jointly promote the use of renewable energy sources in the sector	0.720		
Humanistic culture (HC) ($\alpha=0.782$)	My organization shows concern for the needs of others	0.805	0.591	0.852
	My organization resolves conflicts constructively	0.813		
	My organization involves others in decisions affecting them	0.783		
	My organization gives positive rewards to others	0.666		
Green knowledge (GK) ($\alpha=0.791$)	"I know green products and services can reduce negative impact on the environment"	0.751	0.583	0.847
	"I know how to implement green practices and strategies"	0.833		
	"I collect information about environmental issues"	0.830		
	"I appreciate green marketing practices adopted by business entities"	0.622		
Corporate social responsibility (CSR) ($\alpha=0.824$)	My organization understands that the economy operates within, and is limited by, finite ecosystems	0.792	0.666	0.889
	My organization takes full responsibility for its environmental impacts and liabilities	0.840		
	My organization encourages and rewards a corporate culture that fosters environmental values	0.818		
	My organization encourages to become a socially responsible organization	0.816		
Corporate environmental performance (CEP) ($\alpha=0.818$)	"My organization is focused to reduce hazardous waste"	0.836	0.642	0.878
	"My organization is focused to consume fewer natural resources (such as water and gas)"	0.812		
	"My organization is interested to comply with environmental regulation"	0.740		
	"My organization is generating societal benefits"	0.816		
Environmental sustainability (ES) ($\alpha=0.812$)	My organization makes sure that all operations comply with environmental standards and regulations	0.790	0.635	0.785
	My organization frequently performs environmental audits and evaluations	0.838		
	My organization follows sustainable design concepts and procedures for the development of new products and services	0.800		
	My organization focus on waste reduction and new recycling programs	0.764		

between humanistic culture and corporate environmental performance ($\beta=0.131$, $t=7.277$, $p<0.05$), and hence H8 is supported. The relationship between green knowledge and

corporate environmental performance is positively mediated by corporate social responsibility ($\beta=0.129$, $t=4.607$, $p<0.05$), thus H9 is accepted. Moreover, the direct effect

Table 4 HTMT

	Renewable energy	Humanistic culture	Green KNOWLEDGE	Corporate social responsibility	Corporate environmental performance	Environmental sustainability
Renewable energy						
Humanistic culture	0.26					
Green knowledge	0.41	0.39				
Corporate social responsibility	0.33	0.21	0.22			
Corporate environmental performance	0.51	0.28	0.36	0.35		
Environmental sustainability	0.31	0.32	0.43	0.47	0.29	

Table 5 Structural model fit indices

Measure	Recommended values	Scores
χ^2/df	< 3.0*	2.889
CFI	> 0.90*	0.971
NFI	> 0.90*	0.948
GFI	> 0.90*	0.902
RMR	< 0.08*	0.056
SRMR	< 0.08*	0.053
RMSEA	< 0.08*	0.062

χ^2/df : Chi-square/df (CMIN/DF), CFI: Comparative Fit Index, NFI: The Normed Fit Index, GFI: Goodness of fit, RMR: Root Mean Square Residual, SRMR: Standardized Root Mean Square Residual, RMSEA: Root Mean-Square Error of Approximation

*, ** and *** indicate the level of significance at 10%, 5% and 1% level respectively

Table 6 Hypotheses results

Hypothesis	Estimate	S.E	C.R	P
RE → CSR	0.831	0.126	6.595	***
HC → CSR	0.464	0.082	5.658	***
GK → CEP	0.339	0.071	4.774	***
RE → CEP	0.328	0.046	7.130	***
GK → CEP	0.562	0.152	3.697	***
CSR → CEP	0.483	0.171	2.824	***
RE → CSR → CEP	0.124	0.024	5.116	***
HC → CSR → CEP	0.131	0.018	7.277	***
GK → CSR → CEP	0.129	0.028	4.607	***

*** $p < 0.001$

of green knowledge on corporate environmental performance in the presence of mediator was also found significant ($b = 0.562$, $t = 3.697$, $p < 0.001$). Hence, the corporate social responsibility partially mediates the relationship between green knowledge and corporate environmental performance. The mediation results are presented in Table 6.

Moderation analysis

The study also assessed how environmental sustainability moderates the relationship between corporate social responsibility and corporate environmental performance. The results demonstrated that environmental sustainability had positively and significantly moderating effect on the relationship between corporate social responsibility and corporate environmental performance ($b = 0.081$, $t = 2.562$, $p = 0.002$), supporting H10. The moderating hypothesis results are highlighted in Fig. 3.

Discussion

In this research, data are collected from different industries (retail, IT, manufacturing, and services organizations) that have diverse operational methodologies. Hence, the results are based on diverse data, not keenly addressing each industry. In this way, the findings of this research are generalized for these industries. The results of hypothesis 1 suggest that there is strong positive relationship between renewable energy and corporate social responsibility. This would have important implications for Pakistani organizations striving to improve their corporate social responsibility initiatives. The findings of this hypothesis align with the results from previous studies. First, organizations may demonstrate their dedication to sustainability, enhance environmental performance, involve stakeholders, and perhaps even save energy costs by incorporating renewable energy programs (Naz et al. 2022). Additionally, Stocker et al. (2020) demonstrated that by coordinating with national agendas and regulatory frameworks, organizations may improve their

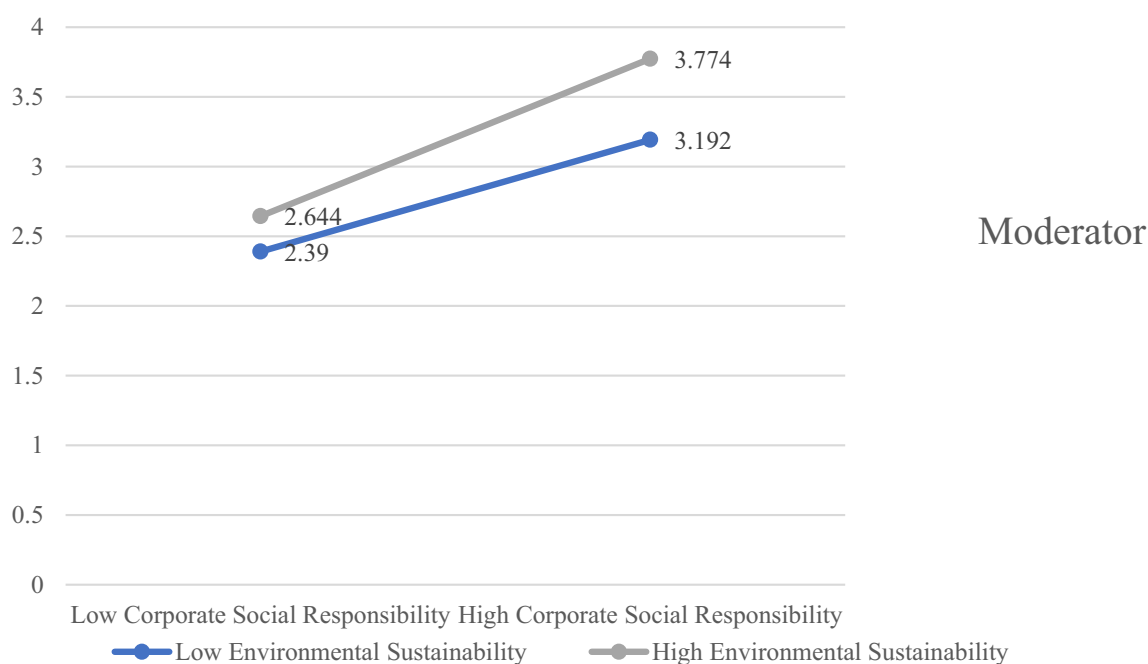


Fig. 3 Moderation of environmental sustainability

standing and connections with key stakeholders including consumers, workers, communities, and government agencies. Meanwhile, Khatter (2023) reported the organizations can promote ecological preservation and show their commitment to sustainable practices by embracing renewable energy options, which will ultimately result in cost savings and enhanced stakeholder relations. The findings of hypothesis 2 confirm that humanistic culture positively impacts the corporate social responsibility. Pakistani retail, IT, manufacturing, and services organizations may promote the beliefs and behaviors that support ethical business practices, worker well-being, stakeholder involvement, and societal welfare by building a humanistic culture. The findings of this hypothesis are also supported by the discussion of existing studies. According to Rasoolimanesh et al. (2021), this increases stakeholder trust, loyalty, and support because these organizations are more likely to be seen as ethical, compassionate, and socially responsible. Furthermore, incorporating CSR practices successfully and promoting a humanistic culture may be accomplished by organizations with the help of these results, which will eventually encourage sustainable development and have a positive effect on society (Liedong et al. 2022). The findings of hypothesis 3 support the relationship between green knowledge and corporate social responsibility. The organizations in Pakistan may enhance their environmental performance, develop innovative sustainable practices, maintain regulatory compliance, and satisfy stakeholder expectations by obtaining and using green knowledge. The findings of existing studies also support this

hypothesis. According to Islam et al. (2021), it improves reputation and increases stakeholder satisfaction, all of which have an advantageous impact on the environment. The effective execution of CSR initiatives may be facilitated by organizations' developing an environmental awareness culture, investing in sustainable practices, and utilizing green knowledge (Shah et al. 2021).

The findings of hypothesis 4 affirm that renewable energy has significant positive impact on corporate environmental performance. Pakistani organizations may lower their greenhouse gas emissions, improve energy efficiency, save resources, maintain biodiversity, and comply with stakeholder demands for environmental responsibility by investing in renewable energy approaches. The findings of existing studies also support this hypothesis. In accordance, scholars highlighted that by incorporating renewable energy sources, enhancing energy management procedures, and constantly enhancing their environmental performance, organizations may help create a more sustainable future (Khan et al. 2020). The results of hypothesis 5 suggest that green knowledge has direct and positive impact on corporate environmental performance. Understanding these results may help organizations create an atmosphere where people care about the environment, engage in training and education on sustainable practices, and use green knowledge to improve environmental performance and promote sustainable growth (Biswas et al. 2022). The findings of existing studies also support this hypothesis. Shahzad et al. (2021) demonstrated that green knowledge-driven strategy is in line with the ultimate

objective of sustainable development as it promotes environmental preservation while also enhancing stakeholder satisfaction and organizational reputation. The findings of hypothesis 6 confirm that corporate social responsibility positively influences the corporate environmental performance. The findings of existing studies also support this hypothesis. According to Ashraf et al. (2022), it is crucial to remember that this hypothesis' acceptability is predicated on empirical data that is particular to Pakistani retail, IT, manufacturing, and services organizations. Due to varying social, economic, and regulatory circumstances, the context of each nation or area may differ (Breuer et al. 2019). However, the fact that this hypothesis has been accepted shows that Pakistani organizations are able to prosper by using CSR practices to enhance their environmental performance.

Hypothesis 7 validates that the positive mediation of corporate social responsibility exists in the relationship between renewable energy and corporate environmental performance. The findings of existing studies also support this hypothesis. Hussain et al. (2022) discussed that Pakistani organizations may improve their environmental performance, engage stakeholders, and support sustainable development in Pakistan by putting a strong emphasis on CSR and successfully communicating renewable energy initiatives. The results demonstrate that hypothesis 8 corporates social responsibility mediates the relationship between humanistic culture and corporate environmental performance is accepted. Understanding these results may help businesses create complete CSR plans, foster a humanistic culture, and use that culture to maximize the environmental advantages of their projects (Cheema et al. 2020). The findings of Liedong et al. (2022) also support this hypothesis. The findings of hypothesis 9 affirms that the link between green knowledge, CSR, and environmental performance in this context may have been impacted by the unique sociocultural, economic, and institutional aspects prevalent in Pakistan. The findings of Abbas (2020) also support this hypothesis. The organizations that actively participate in CSR programs are more likely to use their green knowledge wisely and produce favorable environmental results (Long et al. 2023). The results of hypothesis 10 suggest that the impacts of CSR on environmental performance are more likely to be stronger for organizations that priorities and incorporate environmental sustainability into their operations. The results underline how crucial it is to take environmental sustainability into account as a moderating variable while analyzing the relationship between CSR and environmental performance in Pakistani organizations. The findings of existing studies also support this hypothesis. According to Qalati et al. (2021), when the organizations that priorities CSR programs and actively engage stakeholders in their use of renewable energy and humanistic culture are likely to see improvements in their environmental performance. This finding supports the idea that

social responsibility acts as a link between environmentally responsible behavior and sustainable practices (Murad et al. 2022a, b; Murad et al. 2022a, b). The study concludes that renewable energy, humanistic culture, and green knowledge are important factors to influence corporate social responsibility and corporate environmental performance in the context of Pakistani retail, IT, manufacturing, and services organizations.

Conclusion

This study addresses both practical and theoretical challenges by examining the complex interrelationships among renewable energy, humanistic culture, green knowledge, corporate social responsibility (CSR), and corporate environmental performance within the specific context of Pakistani retail, IT, manufacturing, and services organizations. The research not only provides solutions to practical issues but also contributes to theoretical advancements.

Moreover, the conducted research has yielded significant findings that are poised to profoundly impact the future initiatives of these organizations in terms of sustainability, stakeholder engagement, and social impact. Importantly, the study acknowledges the influence of unique social, economic, and institutional factors on the interplay between these variables within the specific setting of Pakistani organizations.

The findings underscore the importance of adopting tailored strategies and interventions that consider the distinctive attributes of the region. Additionally, the research emphasizes the role of environmental sustainability as a moderating factor, illustrating how organizations incorporating sustainability into their routine activities can enhance the positive effects of CSR on environmental performance.

The findings of this study carry substantial ramifications for organizations in Pakistan. The interconnections seen between renewable energy, humanistic culture, green knowledge, CSR, and environmental performance offer a customized trajectory for development within a nation characterized by unique sociocultural and legal contexts. The findings of this study underscore the potential for businesses to leverage renewable energy sources to achieve cost-effectiveness in a sustainable manner. Additionally, it emphasizes the importance of fostering humanistic cultures inside organizations to promote moral behavior and establish trust among stakeholders. Furthermore, it suggests that businesses can harness green expertise to drive the development and implementation of sustainable practices. The study's results provide valuable insights for Pakistani organizations aiming to achieve long-term sustainability. These insights can help organizations align their strategies with national priorities and meet the expectations of stakeholders. Additionally, the findings highlight the importance of accountability, reputation

management, and minimizing ecological effect in pursuing sustainability goals.

Implications

Theoretical implications

The findings of this research have several theoretical implications that contribute to the current body of knowledge on renewable energy, humanistic culture, green knowledge, corporate social responsibility, and corporate environmental performance. First, this study contributed to knowledge that organizations ought to actively participate in information dissemination and training initiatives aimed at enhancing the knowledge and consciousness of environmentally sustainable practices among their staff members. Furthermore, this study contributed to the literature that firms should prioritize the adoption and integration of renewable energy technologies within their operations. Enhanced corporate environmental performance can be expected when organizations cultivate their internal sustainability capabilities and competence. Third, this study reported CSR serves as a mechanism for facilitating the transformation of sustainability initiatives undertaken by firms into tangible environmental enhancements. In accordance, this study highlighted CSR practices serve as a crucial connection between the acquisition of green information, implementation of renewable energy projects, and the subsequent enhancement of environmental performance. Meanwhile, this linkage significantly reinforces their collective impact on sustainability. This study examines the impact of environmental sustainability on the relationship between CSR and environmental performance. This implies that for optimal environmental outcomes, firms should align their CSR initiatives with overarching sustainability objectives.

Meanwhile, this study provides insights into the specific setting of manufacturing, services, retail, and IT organizations in Pakistan. To facilitate the integration of renewable energy, green knowledge, CSR, and environmental sustainability practices, it is imperative to comprehend the distinct characteristics and challenges associated with these sectors. Importantly, the research contributes to the existing literature on sustainability in developing nations and offers theoretical insights that may inform future inquiries in related disciplines. The research underscores the significance of comprehending environmental concerns to foster sustainable behaviors. To enhance employees' understanding and proficiency in green technologies and practices, it is recommended that organizations prioritize the acquisition of knowledge. The findings of this study have significant implications for HR policy and training programs. Specifically, it is recommended that these programs focus on the cultivation

of employee sustainability competencies to promote environmentally friendly behaviors inside organizations.

Practical implications

In accordance with its theoretical implications, this study has some practical implications for organizations operating within Pakistan's retail, IT, manufacturing, and services sectors can enhance their sustainability practices and environmental performance. First, the organizations should prioritize investments in renewable energy sources such as solar, wind, and hydropower. To accomplish this objective, it is imperative to conduct comprehensive feasibility studies aimed at identifying feasible options for renewable energy sources and subsequently incorporating them into current operational frameworks. Moreover, the organizations have the potential to reduce their reliance on fossil fuels, decrease their carbon emissions, and make a positive contribution toward a cleaner and more sustainable energy portfolio by transitioning to renewable energy sources. Meanwhile, the organizations ought to foster a corporate environment that promotes the cultivation of ecological knowledge and consciousness among their workforces. Accordingly, the training programs, workshops, and seminars focused on eco-friendly technologies, energy efficiency, waste management, and sustainability practices have the potential to contribute toward the attainment of this objective. Also, the organizations can foster environmentally conscious behaviors and cultivate a collective dedication to sustainability through the enhancement of employees' understanding of eco-friendly practices. Organizations have the potential to effectively translate their sustainability commitments into quantifiable environmental advantages through the integration of CSR practices into their routine operations.

In accordance, it is imperative for Pakistani organizations to establish robust monitoring systems to effectively oversee their environmental performance and progress toward sustainability objectives. This involves regular monitoring of significant environmental indicators, such as energy consumption, waste generation, and carbon emissions. Organizations can identify specific areas in need of improvement, set objectives, and develop strategies to mitigate environmental impacts through the collection of accurate data. It is recommended that organizations develop comprehensive sustainability frameworks that integrate these various components into a cohesive and integrated plan. The implementation of sustainability initiatives necessitates the formulation of well-defined sustainability objectives, the development of strategic action plans, and the allocation of financial resources to facilitate the execution of sustainability projects within the organizational framework. Finally, this study highlighted that organizations should prioritize

the assurance of compliance with environmental laws and regulations set forth by competent authorities.

Limitations and future research

This study has several important findings; however, there are certain limitations that should be noticed. The study's initial focus was on particular sectors in Pakistan, including retail, IT, manufacturing, and services. As a result, the findings' applicability to other sectors or geographical areas can be restricted. To increase the external validity of the findings, future research should consider a more varied sample that covers a larger range of sectors and geographical regions. Second, the self-reported data used in this study was obtained using structured questionnaires. Social desirability bias and common method bias are potential risks of this approach. Future studies might use objective metrics or mixed-methods approaches to collect more thorough and trustworthy information on the use of renewable energy, humanistic culture, green knowledge, CSR practices, and environmental performance. The study used a quantitative study; however, to learn more about the processes through which green knowledge, CSR practices, and renewable energy affect environmental performance, qualitative research methods like focus groups and interviews can be used. The study employed a cross-sectional design; however, the long-term impacts of the adoption of renewable energy, green awareness, and CSR on environmental performance may be investigated through longitudinal research.

Author contributions Muhammad Farhan Basheer, Saira Ghulam Hassan, Afshan Ali, and Saeed Ahmad Sabir contributed equally to the conceptualization, data collection, analysis, and manuscript preparation. They played vital roles in designing the research framework and conducting the empirical analysis. Waeibrorheem Waemustafa provided valuable insights and expertise in data interpretation, statistical analysis, and critical revisions of the manuscript.

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Data availability Data will be made available on reasonable request to the corresponding author.

Declarations

Conflict of interest The authors declare no competing interests.

References

Abbas J (2020) Impact of total quality management on corporate green performance through the mediating role of corporate social responsibility. *J Clean Prod* 242:118458

- Abbate S, Centobelli P, Cerchione R (2023) From fast to slow: an exploratory analysis of circular business models in the Italian apparel industry. *Int J Prod Econ* 260:108824
- Ahmad N, Ullah Z, Arshad MZ, Waqas Kamran H, Scholz M, Han H (2021) Relationship between corporate social responsibility at the micro-level and environmental performance: the mediating role of employee pro-environmental behavior and the moderating role of gender. *Sustain Prod Consum* 27:1138–1148
- Alrawadieh Z, Altinay L, Cetin G, Şimşek D (2021) The interface between hospitality and tourism entrepreneurship, integration and well-being: a study of refugee entrepreneurs. *Int J Hosp Manag* 97:103013
- Alyahya M, Aliedan M, Agag G, Abdelmoety ZH (2023) The Antecedents of hotels' green creativity: the role of green HRM, environmentally specific servant leadership, and psychological green climate. *Sustainability* 15(3):2629
- Amankwah-Amoah J, Syllias J (2020) Can adopting ambitious environmental sustainability initiatives lead to business failures? An analytical framework. *Bus Strateg Environ* 29(1):240–249
- Amran A, Periasamy V, Zulkafli AH (2014) Determinants of climate change disclosure by developed and emerging countries in Asia Pacific. *Sustain Dev* 22(3):188–204
- Ashraf M, Hafeez R, Sajid AN (2022) Factors affecting the adoption of Fin-tech in Pakistan based on the Unified Theory of Acceptance and Use of Technology Model: an empirical study on financial inclusion in Pakistan. *J Financ Technol Fintech Incl Sustain* 1(1):9–26
- Barauskaite G, Streimikiene D (2021) Corporate social responsibility and financial performance of companies: the puzzle of concepts, definitions and assessment methods. *Corp Soc Responsib Environ Manag* 28(1):278–287
- Bentler PM (1990) Comparative fit indexes in structural models. *Psychol Bull* 107(2):238
- Biswas SR, Uddin MA, Bhattacharjee S, Dey M, Rana T (2022) Eco-centric leadership and voluntary environmental behavior for promoting sustainability strategy: the role of psychological green climate. *Bus Strateg Environ* 31(4):1705–1718
- Breuer A, Janetschek H, Malerba D (2019) Translating sustainable development goal (SDG) interdependencies into policy advice. *Sustainability* 11(7):2092
- Cezarino LO, Liboni LB, Hunter T, Pacheco LM, Martins FP (2022) Corporate social responsibility in emerging markets: opportunities and challenges for sustainability integration. *J Clean Prod* 362:132224
- Cheema S, Afsar B, Al-Ghazali BM, Maqsoom A (2020) Retracted: how employee's perceived corporate social responsibility affects employee's pro-environmental behaviour? The influence of organizational identification, corporate entrepreneurship, and environmental consciousness. *Corp Soc Responsib Environ Manag* 27(2):616–629
- Chen YS, Lin SH, Lin CY, Hung ST, Chang CW, Huang CW (2020) Improving green product development performance from green vision and organizational culture perspectives. *Corp Soc Responsib Environ Manag* 27(1):222–231
- Chew KW, Chia SR, Chia WY, Cheah WY, Munawaroh HSH, Ong W-J (2021) Abatement of hazardous materials and biomass waste via pyrolysis and co-pyrolysis for environmental sustainability and circular economy. *Environ Pollut* 278:116836
- Chien F, Kamran HW, Nawaz MA, Thach NN, Long PD, Baloch ZA (2022) Assessing the prioritization of barriers toward green innovation: small and medium enterprises Nexus. *Environ Dev Sustain* 24(2):1897–1927. <https://doi.org/10.1007/s10668-021-01513-x>
- Chou W-J, Cheng B-S (2020) Humanistic paradigm in leadership practice—a case study of a Confucian entrepreneur. *Cross Cultural Strategic Manag* 27(4):567–587

- Çop S, Olorunsola VO, Alola UV (2021) Achieving environmental sustainability through green transformational leadership policy: can green team resilience help? *Bus Strateg Environ* 30(1):671–682
- Daú G, Scavarda A, Scavarda LF, Portugal VJ (2019) The healthcare sustainable supply chain 4.0: the circular economy transition conceptual framework with the corporate social responsibility mirror. *Sustainability* 11(12):3259
- Dhar BK, Harymawan I, Sarkar SM (2022) Impact of corporate social responsibility on financial expert CEOs' turnover in heavily polluting companies in Bangladesh. *Corp Soc Responsib Environ Manag* 29(3):701–711
- Forés B (2019) Beyond gathering the 'low-hanging fruit' of green technology for improved environmental performance: an empirical examination of the moderating effects of proactive environmental management and business strategies. *Sustainability* 11(22):6299
- Fornell C, Larcker DF (1981) Structural equation models with unobservable variables and measurement error: Algebra and statistics. In: Sage publications Sage CA: Los Angeles, CA.
- Gawusu S, Zhang X, Jamatutu SA, Ahmed A, Amadu AA, Djam Mien-sah E (2022) The dynamics of green supply chain management within the framework of renewable energy. *Int J Energy Res* 46(2):684–711
- Ghosh S, Mandal MC, Ray A (2022) Strategic sourcing model for green supply chain management: an insight into automobile manufacturing units in India. *Benchmarking Int J* 29(10):3097–3132
- Gold AH, Malhotra A, Segars AH (2001) Knowledge management: an organizational capabilities perspective. *J Manag Inf Syst* 18(1):185–214
- Ha NM, Nguyen PA, Luan NV, Tam NM (2023) Impact of green innovation on environmental performance and financial performance. *Environ Dev Sustain*. <https://doi.org/10.1007/s10668-023-03328-4>
- Hair JF, Ringle CM, Sarstedt M (2013) Partial least squares structural equation modeling: rigorous applications, better results and higher acceptance. *Long Range Plan* 46(1–2):1–12
- Hair JF, Gabriel M, Patel V (2014) AMOS covariance-based structural equation modeling (CB-SEM): guidelines on its application as a marketing research tool. *Braz J Mark* 13(2):44
- Hair JF Jr, Sarstedt M, Matthews LM, Ringle CM (2016) Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I—method. *Eur Bus Rev* 28(1):63–76
- Haldorai K, Kim WG, Garcia RF (2022) Top management green commitment and green intellectual capital as enablers of hotel environmental performance: the mediating role of green human resource management. *Tour Manag* 88:104431
- Han D, Yu D, Qiu J (2023) Assessing coupling interactions in a safe and just operating space for regional sustainability. *Nat Commun* 14(1):1369
- He D, Raza A, Chen M, Xu Y, Morake O (2022) Examining the green factors affecting environmental performance in small and medium-sized enterprises: a mediating essence of green creativity. *Front Psychol*. <https://doi.org/10.3389/fpsyg.2022.1078203>
- Henseler J, Ringle CM, Sarstedt M (2015) A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J Acad Mark Sci* 43:115–135
- Hu L-T, Bentler PM (1998) Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification. *Psychol Methods* 3(4):424
- Huan NQ, Hong TTT (2021) Role of corporate social responsibility in sustainable energy development in emerging economy. *Int J Energy Econ Policy* 11:172–186
- Hussain S, Xuotong W, Maqbool R, Hussain M, Shah Nawaz M (2022) The influence of government support, organizational innovativeness and community participation in renewable energy project success: a case of Pakistan. *Energy* 239:122172
- Islam T, Islam R, Pitafi AH, Xiaobei L, Rehmani M, Irfan M, Mubarak MS (2021) The impact of corporate social responsibility on customer loyalty: the mediating role of corporate reputation, customer satisfaction, and trust. *Sustain Prod Consum* 25:123–135
- Javaid M, Haleem A, Singh RP, Suman R, Gonzalez ES (2022) Understanding the adoption of Industry 4.0 technologies in improving environmental sustainability. *Sustain Oper Comput* 3:203
- Javeed A, Khan MY, Rehman M, Khurshid A (2021) Tracking sustainable development goals—a case study of Pakistan. *J Cult Herit Manag Sustain Dev* 12:478
- Juma N, Olabisi J, Griffin-EL E (2023) External enablers and entrepreneurial ecosystems: the brokering role of the anchor tenant in capacitating grassroots ecopreneurs. *Strateg Entrep J* 17(2):372–407. <https://doi.org/10.1002/sej.1462>
- Kalyar MN, Rafi N, Kalyar AN (2013) Factors affecting corporate social responsibility: an empirical study. *Syst Res Behav Sci* 30(4):495–505
- Khan SAR, Zhang Y, Kumar A, Zavadskas E, Streimikiene D (2020) Measuring the impact of renewable energy, public health expenditure, logistics, and environmental performance on sustainable economic growth. *Sustain Dev* 28(4):833–843
- Khan M, Wang C, Lee G (2021) A framework for developing green building rating tools based on Pakistan's local context. *Buildings* 2021, 11, 202. In: s Note: MDPI stays neutral with regard to jurisdictional claims in published...
- Khatter A (2023) Challenges and solutions for environmental sustainability in the hospitality sector. *Sustainability* 15(15):11491
- Kong T, Feng T, Huang Y, Cai J (2020) How to convert green supply chain integration efforts into green innovation: a perspective of knowledge-based view. *Sustain Dev* 28(5):1106–1121
- Kraus S, Rehman SU, García FJS (2020) Corporate social responsibility and environmental performance: the mediating role of environmental strategy and green innovation. *Technol Forecast Soc Chang* 160:120262
- Latan H, Jabbour CJC, de Sousa Jabbour ABL, Wamba SF, Shahbaz M (2018) Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: the role of environmental management accounting. *J Clean Prod* 180:297–306
- Liedong TA, Taticchi P, Rajwani T, Pisani N (2022) Gracious growth: how to manage the trade-off between corporate greening and corporate growth. *Organ Dyn* 51(3):100895
- Liu Z, Mei S, Guo Y (2021) Green human resource management, green organization identity and organizational citizenship behavior for the environment: the moderating effect of environmental values. *Chin Manag Stud* 15(2):290–304
- Lockett A, Thompson S, Morgenstern U (2009) The development of the resource-based view of the firm: a critical appraisal. *Int J Manag Rev* 11(1):9–28
- Long W, Luo L, Sun H, Zhong Q (2023) Does going abroad lead to going green? Firm outward foreign direct investment and domestic environmental performance. *Bus Strateg Environ* 32(1):484–498
- Madhani PM (2010) Resource based view (RBV) of competitive advantage: an overview. *Resource Based View Concepts Pract Pankaj Madhani ed*, pp 3–22
- Mahoney JT, Pandian JR (1992) The resource-based view within the conversation of strategic management. *Strateg Manag J* 13(5):363–380
- Malik MI (2020) Renewable energy products and customer's purchase intentions having environmental concern. *Int J Energy Econ Policy*. <https://doi.org/10.32479/ijeep.10427>
- Munsif R, Zubair M, Aziz A, Zafar MN (2021) Industrial air emission pollution: potential sources and sustainable mitigation. In: *Environmental emissions*. IntechOpen

- Murad M, Ali M, Akhtar M (2022a) Consumer's environmental knowledge: green washing and brand hate. *Compet Soc Sci Res J* 3(2):754–769
- Murad M, Bhatti A, Bakar A, Ahmad R, Khan AJ (2022b) Exploring the relationship between effective management and social equity: a CSR perspective. *J South Asian Stud* 10(1):103–111
- Mutezo G, Mulopo J (2021) A review of Africa's transition from fossil fuels to renewable energy using circular economy principles. *Renew Sustain Energy Rev* 137:110609
- Nathaniel SP, Yalçiner K, Bekun FV (2021) Assessing the environmental sustainability corridor: linking natural resources, renewable energy, human capital, and ecological footprint in BRICS. *Resour Policy* 70:101924
- Naz S, Jamshed S, Nisar QA, Nasir N (2022) Green HRM, psychological green climate and pro-environmental behaviors: an efficacious drive towards environmental performance in China. In: *Key topics in health, nature, and behavior*. Springer, Berlin, pp 95–110
- Nunnally JC, Bernstein IH (1994) The assessment of reliability. *Psychom Theory* 3(1):248–292
- Nureen N, Liu D, Irfan M, Malik M, Awan U (2023) Nexuses among green supply chain management, green human capital, managerial environmental knowledge, and firm performance: evidence from a developing country. *Sustainability* 15(6):5597
- Oláh J, Aburumman N, Popp J, Khan MA, Haddad H, Kitukutha N (2020) Impact of Industry 4.0 on environmental sustainability. *Sustainability* 12(11):4674
- Omisore AG (2018) Attaining sustainable development goals in sub-Saharan Africa; the need to address environmental challenges. *Environ Dev* 25:138–145
- Osman AI, Chen L, Yang M, Msigwa G, Farghali M, Fawzy S, Yap P-S (2023) Cost, environmental impact, and resilience of renewable energy under a changing climate: a review. *Environ Chem Lett* 21(2):741–764
- Qalati SA, Yuan LW, Khan MAS, Anwar F (2021) A mediated model on the adoption of social media and SMEs' performance in developing countries. *Technol Soc* 64:101513
- Raihan A (2023a) The dynamic nexus between economic growth, renewable energy use, urbanization, industrialization, tourism, agricultural productivity, forest area, and carbon dioxide emissions in the Philippines. *Energy Nexus* 9:100180
- Raihan A (2023b) Toward sustainable and green development in Chile: dynamic influences of carbon emission reduction variables. *Innov Green Dev* 2(2):100038
- Rasoolimanesh SM, Tan PL, Nejati M, Shafaei A (2021) Corporate social responsibility and brand loyalty in private higher education: mediation assessment of brand reputation and trust. *J Mark High Educ*. <https://doi.org/10.1080/08841241.2021.1973645>
- Raza SA, Khan KA (2022) Impact of green human resource practices on hotel environmental performance: the moderating effect of environmental knowledge and individual green values. *Int J Contemp Hosp Manag*. <https://doi.org/10.1108/IJCHM-05-2021-0553>
- Raza A, Farrukh M, Iqbal MK, Farhan M, Wu Y (2021) Corporate social responsibility and employees' voluntary pro-environmental behavior: the role of organizational pride and employee engagement. *Corp Soc Responsib Environ Manag* 28(3):1104–1116
- Rehman SU, Kraus S, Shah SA, Khanin D, Mahto RV (2021b) Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. *Technol Forecast Soc Chang* 163:120481
- Rehman A, Ullah I, Afridi FE, Ullah Z, Zeeshan M, Hussain A, Rahman HU (2021) Adoption of green banking practices and environmental performance in Pakistan: a demonstration of structural equation modelling. *Environ Dev Sustain* 1–21
- Rehman Khan SA, Yu Z (2021) Assessing the eco-environmental performance: an PLS-SEM approach with practice-based view. *Int J Log Res Appl* 24(3):303–321
- Roscoe S, Subramanian N, Jabbour CJ, Chong T (2019) Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. *Bus Strateg Environ* 28(5):737–749
- Rubel MRB, Kee DMH, Rimi NN (2021) The influence of green HRM practices on green service behaviors: the mediating effect of green knowledge sharing. *Empl Relat Int J* 43(5):996–1015
- Sahoo S, Kumar A, Upadhyay A (2023) How do green knowledge management and green technology innovation impact corporate environmental performance? Understanding the role of green knowledge acquisition. *Bus Strateg Environ* 32(1):551–569
- Sampantamit T, Ho L, Lachat C, Sutumwong N, Sorgeloos P, Goethals P (2020) Aquaculture production and its environmental sustainability in Thailand: challenges and potential solutions. *Sustainability* 12(5):2010
- Shah SGM, Ivascu L (2023) Accentuating the moderating influence of green innovation, environmental disclosure, environmental performance, and innovation output between vigorous board and Romanian manufacturing firms' performance. *Environ Dev Sustain* 26:10569–10589
- Shah SMA, Jiang Y, Wu H, Ahmed Z, Ullah I, Adebayo TS (2021) Linking green human resource practices and environmental economics performance: the role of green economic organizational culture and green psychological climate. *Int J Environ Res Public Health* 18(20):10953
- Shah SKA, Ali Z, Rais K (2024) Green HRM for enhanced environmental performance: a circular economy perspective aligned with SDGs. *Asian Bull Green Manag Circ Econ* 4(1):4–1
- Shahzad M, Qu Y, Zafar AU, Appolloni A (2021) Does the interaction between the knowledge management process and sustainable development practices boost corporate green innovation? *Bus Strateg Environ* 30(8):4206–4222
- Sharma A, Choudhury M, Agarwal S, Sharma R, Sharma R (2023) Corporate social responsibility and roles of developers for sustainability in companies. In: *The route towards global sustainability: challenges and management practices*. Springer, Berlin, pp 313–332
- Shehzad MU, Zhang J, Dost M, Ahmad MS, Alam S (2022) Knowledge management enablers and knowledge management processes: a direct and configurational approach to stimulate green innovation. *Eur J Innov Manag* 27:123
- Singh SK, Chen J, Del Giudice M, El-Kassar A-N (2019) Environmental ethics, environmental performance, and competitive advantage: role of environmental training. *Technol Forecast Soc Chang* 146:203–211
- Stocker F, de Arruda MP, de Mascena KM, Boaventura JM (2020) Stakeholder engagement in sustainability reporting: a classification model. *Corp Soc Responsib Environ Manag* 27(5):2071–2080
- Suliman MA, Abdou AH, Ibrahim MF, Al-Khaldy DAW, Anas AM, Alrefae WMM, Salama W (2023) Impact of green transformational leadership on employees' environmental performance in the hotel industry context: does green work engagement matter? *Sustainability* 15(3):2690
- Sun Y, Hong J (2022) Developing a sustainability-driven learning organization through expatriate knowledge transfer: the case of Haier. *Learn Organ* 29:485. <https://doi.org/10.1108/TLO-01-2022-0010>
- Sun Y, Anwar A, Razzaq A, Liang X, Siddique M (2022) Asymmetric role of renewable energy, green innovation, and globalization in deriving environmental sustainability: evidence from top-10 polluted countries. *Renewable Energy* 185:280–290

- Tien-Shang Lee L (2012) The pivotal roles of corporate environment responsibility. *Ind Manag Data Syst* 112(3):466–483
- Ulucak R, Kassouri Y (2020) An assessment of the environmental sustainability corridor: investigating the non-linear effects of environmental taxation on CO2 emissions. *Sustain Dev* 28(4):1010–1018
- Vakili S, Ölçer AI, Schönborn A, Ballini F, Hoang AT (2022) Energy-related clean and green framework for shipbuilding community towards zero-emissions: a strategic analysis from concept to case study. *Int J Energy Res* 46(14):20624–20649
- Watts G (2022) Spirituality, self-help, and subjective wellbeing culture. In: *New spiritualities and the cultures of well-being*. Springer, Berlin, pp 35–49
- Wernerfelt B (1984) A resource-based view of the firm. *Strateg Manag J* 5(2):171–180
- Xue C, Shahbaz M, Ahmed Z, Ahmad M, Sinha A (2022) Clean energy consumption, economic growth, and environmental sustainability: what is the role of economic policy uncertainty? *Renew Energy* 184:899–907
- Yasin R, Huseynova A, Atif M (2023) Green human resource management, a gateway to employer branding: mediating role of corporate environmental sustainability and corporate social sustainability. *Corp Soc Responsib Environ Manag* 30(1):369–383
- Yi S, Abbasi KR, Hussain K, Albaker A, Alvarado R (2023) Environmental concerns in the United States: can renewable energy, fossil fuel energy, and natural resources depletion help? *Gondwana Res* 117:41–55
- Zahoor Z, Khan I, Hou F (2022) Clean energy investment and financial development as determinants of environment and sustainable economic growth: evidence from China. *Environ Sci Pollut Res*. <https://doi.org/10.1007/s11356-021-16832-9>
- Zhang J, Zhang N, Bai S (2021) Assessing the carbon emission changing for sustainability and high-quality economic development. *Environ Technol Innov* 22:101464
- Zhou S, Tiruneh WA, Legese MA (2023) The effect of corporate social responsibility on environmental performance: the mediating role of green innovation and green human resource management. *Int J Emerg Mark*. <https://doi.org/10.1108/IJOEM-02-2022-0211>

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