



Employee green behavior: a study on the impact of corporate social responsibility (CSR) on employee green behavior, green culture: the moderating role of green innovation

Cai Li¹ · Fazeelat Aziz¹ · Shoaib Asim² · Asim Shahzad¹ · Asad Khan¹

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Abstract

This study adopts the natural resource-based view (NRBV) of the firm to investigate the relationships between corporate social responsibility (CSR), employees' green behavior (EGB), green culture, environmental performance (EP), and green innovation (GI) in China's automobile manufacturing industry. A survey of 465 employees was conducted. The data were analyzed using partial least squares structural equation modeling. The results showed that CSR positively influences EGB and GC, which in turn improves EP. CSR also directly impacts EP. Furthermore, GI enhances the positive effect of CSR on EP through the mediators EGB and GC. The findings contribute to the literature by elucidating the mechanisms linking CSR and EP. They provide an integrated framework incorporating direct, mediated, and moderated effects. For practice, the study highlights the importance of CSR, EGB, and GC for manufacturers aiming to improve environmental sustainability. It suggests managers should promote green values, foster eco-innovation, and encourage employees' discretionary green actions. The moderating effect of GI implies embedding sustainability in corporate culture and operations to magnify the gains from CSR. Overall, the research offers insights into translating green strategic intent into performance outcomes through cultural and behavioral transformation.

Keywords Corporate social responsibility · Environmental performance · Employee's green behavior · Green culture · Green innovation

Introduction

Sustainable development now focuses on how a company manages its environmental impact. The increasing significance of environmental concerns has attracted heightened academic investigation, especially in developed nations and emerging economies (Shi et al. 2021). The escalating significance of this phenomenon can be attributed to its adverse impact on the affected countries' economic standing and national policies, as noted (Hayes 2015). In recent times, the conservation of ecosystems has emerged as a

significant concern. The growing environmental concerns necessitate that automobile manufacturing companies follow ecologically beneficial procedures. CSR refers to a set of cost-effective and integrated techniques employed to minimize or eliminate all forms of waste flows associated with the production, layout, and disposal of goods and supplies (Andaregie and Astatkie 2022).

By the fundamental principles of less polluted production, corporations can mitigate environmental degradation and achieve financial benefits by proactively avoiding pollution. In connection to this matter, several companies across various countries have implemented CSR or indicated their intention to do so, as stated by Wassan et al. (2023). Manufacturers are implementing CSR practices such as "reduce, reuse, recover, remake, remanufacturing, and recycling" (6R) and lean manufacturing methods into their operations (Karuppiyah et al. 2020). According to the existing body of research on environmental performance, companies adopt CSR in reaction to social and regulatory limitations (Suganthi 2019). A body of literature indicates

Responsible Editor: Arshian Sharif

✉ Fazeelat Aziz
fazeelataziz448@gmail.com

¹ School of Management Science, Jiangsu University, Zhenjiang, Jiangsu, People's Republic of China

² School of Business Administration, NFC & IET University, Multan, Pakistan

that pro-environmental behavior produces numerous benefits (Zameer et al. 2021). These advantages include enhancing productivity, reducing expenses, protecting the environment, encouraging the goodwill of the organization (Qu et al. 2022), and enhancing long-term environmental performance.

This study aims to determine the mediating effect of employees' green behavior and green culture on the relationship between CSR and environmental performance within the automobile industry of the State of China. According to Afum et al. (2020a, b), adopting environmentally sustainable practices such as CSR can establish a competitive advantage for a company from a NRBV, leading to enhanced EP. CSR can effectively mitigate the environmental impact of manufacturing practices and activities while maintaining good reliability and quality without incurring additional manufacturing expenses, thereby ensuring general economic viability. Although CSR is crucial for achieving environmentally sustainable manufacturing of products, certain companies encounter significant challenges in implementing green practices across diverse industries to achieve sustainability. Previous literature has examined CSR as a crucial component in promoting sustainability through diverse innovation-driven abilities aimed at improving EP (Sezen and Cankaya 2013). Some researchers have suggested that GI serves as the mechanism through which the impact of CSR on EP is realized (Waheed et al. 2020).

The present study examines the influence of CSR on the EP of automobile manufacturing companies operating in an emerging economy, specifically China. To effectively shift toward EGB and GC through the implementation of CSR, companies must establish a GI, which is a time-intensive undertaking. This value is integrated into the company's mission statement to foster a sense of environmental responsibility among every workforce member. The effective implementation of CSR and attainment of high levels of innovation can be facilitated by increasing awareness of GI among employees.

Although prior studies have emphasized the crucial significance of GI in the effective execution of CSR, there appears to be an absence of research on the influence of GI in augmenting the effect of CSR on EGB and GC, and ultimately, EP, as far as our knowledge is concerned. The variability of organizational culture among industrial firms has been noted in previous literature (Morris et al. 1998). To better understand the potential reasons for differences in success or failure in achieving sustainability goals through CSR, EGB practices, and GC, it may be useful to investigate the moderating influence of GI. Such an investigation might result in more specific and widely applicable findings. Therefore, the present investigation aims to fill the existing research body gap.

However, the impact of organizational factors such as GI has not received enough consideration in previous research (Maghazei and Netland 2020). The present investigation aims to examine the potential moderating role of GI in the indirect association between CSR and EP, which EGB and GC mediate. Investigating a moderated mediation effect, which has not been explored previously, is crucial for improving our conceptual understanding of the relationship between CSR and EP (Aman-Ullah et al. 2023). The present study depends on manufacturing firms within the framework of an emerging economy, such as China, in evaluating the correlation between CSR and EP. Although rising environmental concerns, there is still a need for additional academic research on the environmental effects of manufacturing firms in CSR (Oloyede et al. (2022)), with most earlier studies concentrating on CSR about big corporations. This research is noteworthy as the automotive industry in China remains underdeveloped. The rationale behind the selection of China as a subject of study was driven by the significant increase in CO₂ emissions and the strong economic expansion, which were supported by recognized structural transformations and diversifying the economy. This study makes several novel empirical contributions. First, it offers among the earliest large-sample investigations on CSR in the under-researched Chinese automobile industry. With rising sustainability pressures, findings from this emerging economy context are valuable. Second, it provides empirical evidence that CSR's impact on environmental performance is mediated by employee green behavior and green culture. This elucidates important drivers through which CSR strategies translate into tangible performance gains. Third, the study reveals green innovation does not significantly moderate CSR effects, contradicting common assumptions of its amplifying role. This surprising result warrants further investigation and opens up avenues for future research.

Against this background, and informed by the NRBV, this study seeks to answer the following research questions: Four research issues are covered in this paper.

RQ1: What are the significant factors that influence the environmental performance of the manufacturing industry in China?

RQ2: What are the identified corporate social responsibility factors that can affect the environmental performance of the manufacturing industry in China?

RQ3: How does the relationship between employees' green behavior and green culture affect the environmental performance of the manufacturing industry in China?

RQ4: What relationship exists between green innovation and the environmental performance of China's manufacturing industry?

Theoretical foundations

Natural resource-based view of firms

This study makes several important theoretical contributions. First, it applies the natural resource-based view (NRBV) of the firm to investigate CSR's impact on environmental performance. The NRBV argues firms can gain competitive advantage by leveraging environmental resources and capabilities (Hart 1995). Prior literature lacks NRBV models examining how CSR drives sustainability through cultural and behavioral factors. By incorporating employee green behavior and green culture as mediators, this study addresses a gap in understanding the mechanisms linking CSR and environmental outcomes. Second, the research tests a moderated mediation model which explores how green innovation enhances the indirect CSR-environmental performance relationship. Existing research overlooks the role organizational factors like innovation play in strengthening CSR effects. Examining this contingency addresses a gap in knowledge on variables shaping the CSR-performance link. Third, the integrated theoretical framework provides a more comprehensive perspective than past studies focused solely on direct effects or specific CSR tools. This responds to calls for greater theorization on the complex interplay between CSR strategic orientation, organizational culture/behavior, and environmental performance.

As per the argument presented, companies that adopt CSR initiatives, including environmentally sustainable practices, can establish a distinct market position, boosting their EP (Bhattarai 2023). In contrast, extant literature suggests that prominent firms operating in manufacturing firm of environmentally-friendly goods and green chemicals can attain a competitive edge using product differentiation, such as establishing a reputable and eco-friendly image, and by engaging in cost-effective manufacturing practices, such as reducing pollution prevention costs and enhancing resource productivity. Additionally, the NRBV perspective advocates for integrating GI within organizations, asserting that incorporating environmental considerations into a company's ethos can improve its environmental performance and discuss competitive benefits. According to Qu et al. (2022), implementing GI can facilitate a company in making environmentally friendly modifications to its operations. According to Jabbour and Santos (2008), employees are likely to exhibit a heightened sense of accountability toward the environment, which may show in various forms, such as product stewardship, pollution prevention, or sustainable growth initiatives.

Literature review and hypothetical model

Corporate social responsibility and environmental performance

CSR is a voluntary framework adopted by businesses, encompassing economic, social, and environmental aspects, enabling them to take responsibility for their actions and demonstrate accountability (Aragón-Correa et al. 2020). Incorporating CSR and EP into the NRBV framework strengthens the link between environmental sustainability and competitive advantage. CSR practices, including eco-efficient initiatives, positively influence a firm's EP, so the study proposes a significant relationship between CSR and EP (Zhou et al. 2023).

In this study, CSR is conceptualized through the environmental dimension, representing organizations' commitment to minimizing their ecological footprints. A company's market behavior is viewed as a sign of how well it has incorporated economic responsibility considerations into its fundamental business operations and decision-making processes. Economically motivated CSR adds value by encouraging the creation of innovative items that customers want, reducing the cost of inputs, and enhancing production effectiveness. The social dimension of CSR actively recognizes "the health, safety, and general well-being of employees; motivates the workforce by offering training and development opportunities; and enables firms to act as good citizens in the local community" with the workplace and the community as its two positions of focus to consider social and ethical issues and take into account the interests of all parties involved in the decision-making process, such CSR also entails the establishment of a formal social dialogue.

By doing this, the company and its stakeholders may end up with mutually acceptable outcomes (Delgado-Ceballos et al. 2023). CSR's environmental component emphasizes innovation, eco-efficiency, pollution control, and environmental performance (Aragón-Correa et al. 2020). CSR is frequently characterized by adopting globally accepted environmental management systems (or a total quality management approach) to ensure the environmental impacts from a firm's activities are monitored and managed methodically. This helps a firm gain the trust of external stakeholders and ensure the adoption of the company's environmental policies (Kumar et al. 2021; Zhou et al. 2023). Environmental performance refers to the measurable ecological impacts of an organization's operations, processes, and products. It encompasses the environmental burdens imposed by business activities as well as the outcomes of environmental policies and initiatives. In this study, EP is conceptualized through eco-efficient procedures, waste and emissions reduction goals, regulatory compliance, and cost savings.

EP measurement provides an objective assessment of the effects of a company's environmental strategies. Evaluating the efficacy of an organization's sustainability goals or environmental management system is imperative to ascertain its intended effect. This study defines environmental performance as the ability to decrease environmental pollutants, such as water, air, and solid waste, as well as the quantity and the use of hazardous items and the extent of economic and environmental accidents (García Alcaraz et al. 2022). It considers how business practices, goods, and resource consumption affect the environment through applicable laws and regulations (Altaf et al. 2020). Prior studies have shown that green practices and environmental action enhance overall ecological performance, particularly by lowering contaminants (Afum et al. 2020a, b). Based on their study methods and linkages discovered in the academic literature, the researchers forecast a significant relationship between CSR and environmental performance. Thus, the following hypothesis is proposed:

H1: CSR positively affects the EP of manufacturing firms.

Corporate social responsibility, employees' green behavior, and green culture

Expanding the NRBV framework by embracing CSR, the firm demonstrates its dedication to environmental responsibility, which influences the EGB and contributes to the development of a GC. As employees adopt environment friendly behaviors and the organizational culture prioritizes sustainability, the firm is better equipped to implement environmentally innovative practices, thus reinforcing its competitive advantage through a greener and more socially responsible image.

EGB, which arises from environmental conduct and serves as the key construction element for organizational environmental sustainability, is the most crucial stage in translating a corporate sustainability strategy into tangible outcomes (Tian et al. 2020). Environmental behavior, which is activities that safeguard and even improve the environment, is where EGB originated (Farrukh et al. 2023). Environmental behavior becomes EGB when relevant to workers and focused on the workplace. EGB refers to the pro-environmental actions and initiatives undertaken by organizational members in the workplace context (De Roeck and Farooq 2018). It encompasses employee behaviors that collectively benefit environmental sustainability. This study conceptualizes employees' green behavior through green competencies and skills, green human capital development, and contributions to sustainability. Together, these elements characterize EGB as the discretionary and prescribed environmentally responsible actions and contributions of human

capital within an organization. It is conceptualized as a key driver of enterprise-level sustainability flowing from individual employees' green capacities and initiatives.

Unlike organizational citizenship behavior, EGB refers to individual green behavior that goes above and beyond what the organization expects. For instance, a typical manufacturing factory worker's EGB might include double-sided printing, turning off lights when leaving, and encouraging co-workers to go green (Unsworth et al. 2021). Khattak et al. (2021) defined EGB as an "employee's activities to accomplish work-related duties in an environmentally friendly way (e.g., rational resource usage, recycling, adopting more environmentally friendly policies, active engagement in environmental projects)." Thus, EGB includes practices like recycling, conserving energy by turning off additional lights, using resources effectively, and maintaining papers electronically to save waste rather than printing (Ramdhan et al. 2022). Previous research has demonstrated the importance of CSR in fostering employee engagement in environmentally friendly behavior (Ertuna et al. 2019). Manufacture firm CSR initiatives are one of these informative signals that workers take in. Workers are encouraged to adopt green practices due to their attitudes and actions, which are influenced by their firm's CSR efforts (Ozkan et al. 2023). Su and Swanson (2019) discovered a substantial correlation between EGB and CSR, which is consistent with this assumption.

A "green culture" is a set of shared ideals that management teams create to influence workplace behavior and attitude toward accomplishing common business goals (Al-Swidi et al. 2021). An organization's GC can be characterized as one in which environmental preservation is valued highly. So, the company's mission statement incorporates an employee core value, making each team member feel accountable for preserving the environment (Bhattarai 2023). Employees are more concerned about environmental concerns due to green culture, which benefits their job (Lee et al. 2022). Managers need to care more about the environment if green culture is to grow (Azhar and Yang 2022). Also, a strong green culture encourages workers to critically consider environmental challenges (Azhar and Yang 2022). Eco-environmental principles, the cornerstone of a formal framework for green culture, may aid a company in implementing changes to its operations that are more environmentally friendly (Wang et al. 2022).

This was accomplished by incorporating environmental culture into the company strategy (Piwowar-Sulej 2020). So, the development of EP must be driven by an awareness of GC. Managers must understand the company culture to communicate their staff's values, standards, and guiding principles. Employees that adhere to and share the organization's norms, values, habits, and beliefs perform better due to the organization's culture (Shahbaz et al. 2021). Employees'

knowledge of green innovation is influenced by GC when they demonstrate a dedication to sustainability and ecology to lessen environmental harm (Zhang et al. 2022). In general, culture is a collection of norms and values that are upheld by everyone in the organization and can take on many shapes depending on the particulars of the business. High-tech businesses support cutting-edge technology, while others customize it to suit their needs to reinforce their cultures (Zheng et al. 2021). Also, a company's EP will improve if it regards green standards of conduct as an integral component of its business strategy and its workers' ecological ethic.

Adopting an adaptability culture enables firms to develop the flexibility needed to respond to environmental challenges and deliver value to their customers. Mission culture also highlights the importance of having a defined purpose when establishing corporate objectives and strategic goals. Thus, the following hypotheses are proposed:

H2: CSR positively affects the EGB of manufacturing firms.

H3: CSR positively affects the GC of manufacturing firms.

Employees' green behavior and environmental performance

Environmental behavior, defined as activities that protect or enhance the environment, gives rise to EGB (Eby et al. 2019). Environmental conduct becomes EGB when it is relevant to employees and focused on the workplace (Tian et al. 2020). This idea was initially put out by Ones and Dilchert, who defined EGB as a behavior that workers engage in inside an enterprise (Hossain et al. 2022). EGB is classified into the following five categories: (i) working sustainably, (ii) resource conservation, (iii) influencing others, (iv) taking the initiative, and (v) avoiding damage. As the criteria are ambiguous and difficult to identify, these five categories are not mutually exclusive, and one activity may concurrently fall under two different categories (Bashirun and Noranee 2020).

Tang et al. (2023) researchers can have a general understanding of behavioral predictions thanks to earlier studies that explicitly linked attitudes with behavior prediction. This has significant theoretical as well as practical implications. EGB believes they can carry out environmentally friendly duties and engage in environmental performance actions with vigor and persistence. EGB helps businesses remain competitive and sustainable worldwide, where business rivalry is always increasing. This is because it favors the organization's production and results and the company's financial success and environmental outcomes (Wang et al. 2021). Nonetheless, actual data supports the idea that an innovative culture improves employee performance. Also,

a company's EP will improve if it regards green standards of conduct as an integral component of its business strategy and its workers' ecological attitude (Woo and Kang 2021). Thus, the following hypotheses are proposed:

H4: EGB positively affects the EP of manufacturing firms.

H5: EGB mediates the relationship between CSR and EP.

Green culture and environmental performance

NRBV focus on GC and EP underscores the importance of a green organizational culture in fostering and supporting environmental performance. When a firm embraces a green culture and integrates environmental considerations into its core ethos, it encourages employees to engage in environment friendly behaviors and seek out opportunities for green culture. Based on science, politics, and aesthetics, GC is a modern environmental philosophy that encourages sustainable economic and ecological growth. Companies started considering this strategy a few years ago when adopting CSR. Businesses understood that this paradigm shift would change consumer behavior, changing sales and enhancing profits (Albort-Morant et al. 2019). According to the literature on ecological management, companies must set up strategic initiatives that go beyond agreed-upon pledges if they want to embrace sustainable behavior.

Promoting a shift to a green culture by companies is crucial for developing sustainability (Aggarwal and Agarwala 2023). According to theory, GC is an important intangible resource for advancing an organization's sustainable growth and EP (Zhang et al. 2022). Generally speaking, culture is a collection of norms and values that permeate the whole firm and can take on many shapes depending on the specifics of the business. High-tech businesses support cutting-edge technology, while others customize it to suit their needs to reinforce their cultures (Xu and Li 2022). García-Machado and Martínez-Ávila (2019) state that GC is a collection of ideas, notions, attitudes, and values that may guide an organization's choices and activities throughout time.

The cultural fabric of an organization, encompassing its predominant norms, beliefs, values, and mindsets, plays a crucial role in driving sustainability behaviors and performance. GC represents the degree to which environmental consciousness is embedded into this organizational culture through four key attributes: First, pervasive eco-education whereby employees at all levels are systematically educated on sustainability issues as a core competency; second, universal prioritization of green goals into every department's operations, strategy, and objectives; third, formal institutionalization of explicit policies and statements codifying sustainability into governance; and fourth, a shared value system where environmentalism is enacted as a pivotal

ethos across the organization. In aggregate, these hallmarks signify GC as the extent to which concern for the natural environment is collectivized into the preeminent shared assumptions steering organizational actions. It denotes sustainability as a defining cultural characteristic. Managers must care more for environmental preservation if they want the green culture to grow (Azhar and Yang 2022). According to academics, businesses must adopt GC ideals to generate eco-friendly products (Banerjee et al. 2003). Thus, the following hypotheses are proposed:

H6: GC positively affects EP.

H7: GC mediates the relationship between CSR and EP.

Green innovation

NRBV with GI and EP emphasizes the role of innovative environmental practices in shaping a firm's competitive edge. Embracing green innovation initiatives allows the company to improve its environmental performance by implementing cleaner technologies, eco-friendly products, and sustainable production processes. Environmental friendly, clean energy, ecological preservation, and the fight against climate change are all priorities in the technical innovation described as "green innovation (Sun and Razzaq 2022)." Researchers have studied the following areas of GI. The existing literature mostly focused on and characterized GI (Dangelico and Pujari 2010). First, Braun and Wield (1994) defined green innovation. They emphasized that it is a term for innovations that reduce environmental pollution, material inputs, energy use, and process or product improvements. Generally, GI is also referred to as eco-innovations, environment friendly technologies, energy-efficient technologies, and technologies utilizing renewable energy sources.

Green innovation is a crucial aspect of technical advancement that emphasizes environmental preservation, clean energy, and combating climate change (Sun and Razzaq 2022). Scholars have extensively studied different facets of green innovation, often referred to as eco-innovations, environment-friendly technologies, energy-efficient technologies, and renewable energy sources (Dangelico and Pujari 2010). Braun and Wield (1994) defined GI as innovations aimed at reducing environmental pollution, material inputs, energy consumption, and improving processes or products. Similarly, Rennings (2000) highlighted that green innovations encompass new goods, services, technologies, and methods designed to protect the environment. Chang (2011) expanded the definition to include the entire process from conceptualizing new products to their market implementation.

Government agencies also recognize green innovation as the development and application of products, processes, technologies, and initiatives with the goal of minimizing

environmental impacts (Wang 2019; Xie et al. 2019). In essence, green innovation involves integrating sustainability principles into business practices, preventing pollution, waste, and resource depletion throughout operations. In the modern business landscape, ecological practices have gained popularity due to growing environmental concerns. Implementing GI allows businesses to protect the environment and reduce pollution (Alhadid and As' ad 2014). Green innovation can be applied to improve energy efficiency, product design, processes, and technologies, resulting in industry sustainability and better environmental conditions (Chang 2011).'

This study focuses on GI, specifically green product innovation and green process innovation, as indicators of EP (Denison and Mishra (1995)). Green product innovation involves creating new or improved products with environmentally friendly attributes, benefiting consumers and manufacturers alike (Pujari 2006). On the other hand, green process innovation aims to modify manufacturing systems to achieve environmental goals like energy conservation and waste recycling (Abdullah et al. 2016). GI is strongly associated with CSR and eco-target attainment, contributing to improved EP (Chen et al. 2006). Previous research has shown that green goods and green process innovation lead to significant environmental benefits (Lin et al. 2014), making it a reliable approach for businesses to enhance CSR by improving EP (Lin et al. 2013). Based on this, the study proposes the following hypothesis:

H8: Green innovation positively affects CSR and EP.

Research framework

This study examines the impact of CSR, defined as organizations' commitment to minimize their ecological footprints through environmental management practices (Dahlsrud 2008), on the environmental performance of firms, conceptualized as the measurable ecological impacts of their operations, and sustainability initiatives (Daily et al. 2007; Melnyk et al. 2003). It tests employee green behavior, the discretionary eco-friendly actions of employees (De Roeck and Farooq (2018)), and green culture, the embedded organizational values and norms that prioritize environmentalism (Wang 2019), as mediators of this relationship. Furthermore, it explores how green innovation, the introduction of sustainability-oriented products, processes, and technologies (Song and Yu (2018); (Xie et al. 2019)) enhance these mediation effects. Together, this framework provides an integrated perspective on how organizational green strategic orientation and culture translate into ecological performance gains (Fig. 1).

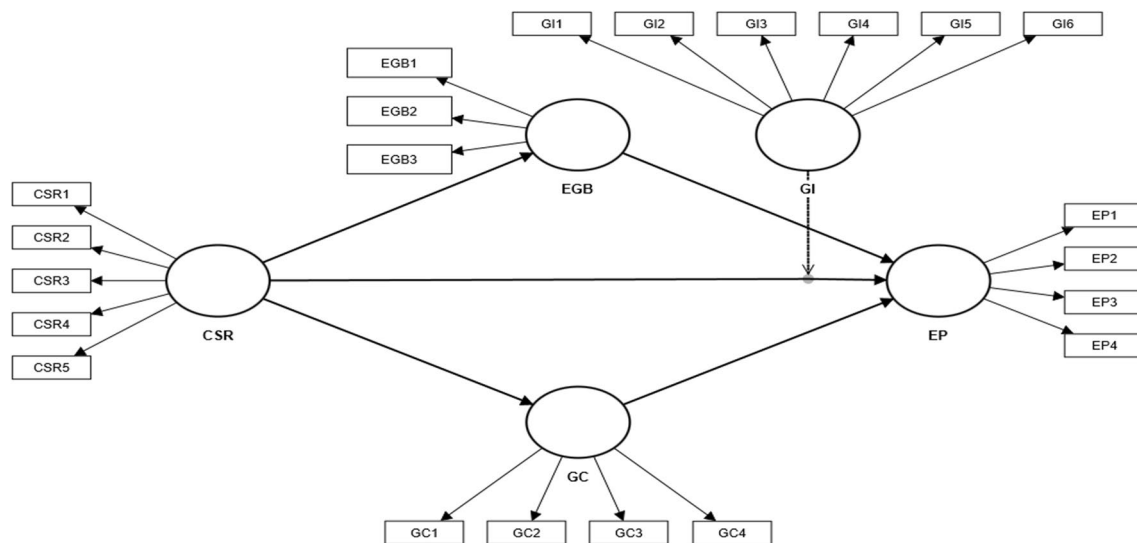


Fig. 1 Research framework

Methodology and data collection survey

The main objective of this study is to investigate the relationships between various constructs, namely corporate social responsibility, green culture, employees' green behavior, environmental performance, and green innovation, and their impact on sustainable performance. CSR comprises five items and assessed using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). GC is composed of four items, and its assessment also employed a 5-point Likert scale. EGB includes three items and was evaluated using a 5-point Likert scale. EP was operationalized using four items, while GI, a high-order construct was assessed with six items, both utilizing the 5-point Likert scale.

Employees from Chinese manufacturing companies participated in the study and selected for their role in acquiring and disseminating knowledge and involvement in strategic decision-making (Yusr et al. 2017). A questionnaire with two components was developed to gather data, focusing on general characteristics and measuring the constructs. Content validity was ensured through expert evaluations and indexes, indicating the appropriateness of the questionnaire items (Almanasreh et al. 2019). To improve response quantity and quality and reduce ambiguity, a Likert five-point scale was used (Buttle 1996). Participants received no financial incentives, reducing bias (Sax et al. 2003). All items were created using trustworthy published research and a thorough examination of the literature on technological acceptability (see Table 1).

To measure these constructs, a survey tool was adapted from prior research. The survey underwent content validation by a panel of 10 post-doctoral professionals to ensure construct validity and reliability. The questionnaire was

translated from English to Chinese, and a back-translation process was undertaken to ensure consistency. Participants were employed in automobile manufacturing companies in China, and 465 questionnaires were collected, representing a 37.8% response rate.

To reduce biases, incomplete and missing answer questionnaires were eliminated, leaving 465 questionnaires included in the final analysis. The data was gathered during the first 3 months of 2023 and analyzed in January, February, and March of the same year. Table 2 shows all the demographic information. To analyze the data and assess the relationships between the constructs, the study employed the structural equation modeling technique with Smart-PLS software. SEM enables the examination of complex relationships between variables and provides a comprehensive assessment of the proposed conceptual framework.

Common method bias (CMB)

Evaluation of the CMB resulting from biases or errors in measurement methodology is the first stage in SEM. The same respondents were used to gather data on the research constructs so that CMB may exist. The inner VIF created by Kock (2015), which uses a complete collinearity test, is a reliable tool for testing CMB. Each dependent variable is only considered once when calculating the inner VIF and the recommended threshold (Kock 2015) value is 3.3. CMB is a serious issue that could compromise the findings of any research. Accordingly, researchers (Harman 1976; Kock 2015), have employed a variety of techniques to handle CMB, including, Harman's single factor test and Kock's inner VIF technique. Since all of the inner VIF values in

Table 1 Constructs' measurement sources

Constructs	Items	Sample of measurement item	Sources
Corporate social responsibility	CSR1	Our firm complies with environmental legislation	(Su and Swanson 2017, 2019) (Dahlsrud 2008)
	CSR2	Our firm uses clean technologies	
	CSR3	Our firm ensures the sustainable use of natural resources	
	CSR4	Our firm has a waste management policy	
	CSR5	Our firm conforms requirements of environmental management	
Environmental performance	EP1	Environmental protection has been taken into consideration during the redesign of our company's production and operational procedures	(Chen et al. 2015) (Daily et al. 2007; Melnyk et al. 2003)
	EP2	Our organization has created environmental care goals to reduce hazardous waste and harmful emissions	
	EP3	To eliminate dangerous emissions from procedures, our business adheres to environmental regulations	
	EP4	We reduced overall costs	
Employees green behavior	EGB1	The sustainability of our healthy environment is dependent on the competencies and skills of the organization's employees	(De Roeck and Farooq 2018)
	EGB2	Our firm includes green human capital in its working environments to enhance long-term sustainability	
	EGB3	Green human capital contributes to the sustainability of the firm	
Green innovation	GI1	Our company employs less or less toxic/polluting materials	(Song and Yu 2018) (Xie et al. 2019)
	GI2	Our company uses eco-labeling	
	GI3	Our company employs materials that have been recycled, reused, and manufactured afterward	
	GI4	Our company employs more eco-friendly technologies to save costs and stop pollution (from electricity, water, and waste)	
	GI5	Throughout industrial operations, our organization reduces hazardous emissions and waste	
	GI6	We encourage a culture of green technology in our organization	
Green culture	GC1	My organization teaches all of its employees about the significance of environmental sustainability	(Wang 2019)
	GC2	Every department in my organization has social sustainability as one of its top priorities	
	GC3	My organization's explicit policy statement encourages social sustainability in every aspect of operations	
	GC4	In my company, social sustainability is a key corporate value	

Table 3 are within acceptable limits, CMB is not a significant problem in this research.

Evaluation of the measurement model

The evaluation of the measurement model was conducted through the utilization of content validity, convergent validity, and discriminant validity (Fig. 2) (Aman-Ullah and Mehmood 2022). By making sure that the correlational pattern of the constructs corresponds to the relationships predicted by the theory currently in use, it is possible to assess the nomological validity of each construct. All constructs and their interactions employed in the current study are based on earlier validated investigations, as described in part under the “Literature review and hypothetical model” section. The constructions’

nomological validity is therefore proven. The loadings and importance of the indicators were evaluated before the measurement model was evaluated (Henseler et al. 2009). According to Hair et al. (2017), the exterior weight of the index should be greater than 0.7. Loading between 0.4 and 0.7 should be removed only if it improves the construct's uniformity and dependability (Hult et al. 2018). As a result, Table 3 shows structures and their recognized signs. Following that, the reliability of the mirrored assessment model was evaluated using Cronbach's alpha, composite reliability (CR), Rho-a, and the commonality of each construct. The average variance extracted (AVE) and the contrast of CR and AVE were used to assess concurrent validity. Subsequently, the HTMT criterion technique was employed to evaluate the discriminant validity (Salameh et al. 2023). Finally,

Table 2 Respondent demographic information

Respondent Profile		(n = 465)	
Attributes	Distribution	Frequency	%
Gender	Male	285	61.2%
	Female	180	38.7%
	Total	465	100%
Age (year)	20 to 29	120	25.8%
	30 to 39	185	39.7%
	40 to 49	100	21.5%
	More than 50	60	12.9%
	Total	465	100%
Education	Undergraduate	137	29.4%
	Graduate	165	35.4%
	Postgraduate	163	35%
	Total	465	100%
Managerial level	Low level	100	21.5%
	Middle level	220	47.3%
	Top-level	145	31.1%
	Total	465	100%
Job experience	Less than 5	140	30.1%
	6 to 10	170	36.5%
	11 to 15	100	21.5%
	More than 15	55	11.8%
	Total	465	100%

the Q^2 index was used to evaluate the forecast validity of the measurement model.

Assessment of the indicator's loadings

Hair et al. (2020) recommends that (Khan et al. (2019)) the indicator's external loadings be greater than 0.7 limits. Indicators with external loadings between 0.4 and 0.7 should be evaluated for elimination only if doing so improves CR and build content validity. Cronbach's alpha numbers greater than 0.7 are appropriate, according to Tenenhaus et al. (2005). As shown in Table 3, all Cronbach's alpha values are higher than 0.7, confirming the internal consistency dependability of the measurement model based on this criterion. Since of the constraints of Cronbach's alpha, it is suggested to use another parameter, such as CR, which is evaluated for various exterior loadings of the markers (Hair et al. 2011). For CR, values higher than 0.7 are suggested (Hair et al. 2011).

This measure is close to the CR but examines each component's weight rather than its related indicator's exterior weighting. This variable accepts values higher than 0.7 (Henseler 2017). Cross-loadings and the Fornell-Larcker criterion support the categories' discriminative validity (Hult et al. 2018). Each indicator's outer loadings should be larger

than its cross-loadings or association with other categories (Hair et al. 2011).

Fornell-Larcker measure has also been used to assess concurrent validity (Jenatabadi and Ismail 2014). The results of this indicator for various forms are shown in Table 4. Convergent validity is verified because all numbers and relationships between various categories are less than 0.9.

The AVE is the sum of the cubed loadings of each measure (Sarstedt et al. 2021). AVE should have a minimally acceptable number of 0.5 (Hult et al. 2018). As shown in Table 3, the AVE for all structures is greater than 0.5. As a result, the accuracy of the assessment model based on this indicator is verified. Another method for convergent validity is comparing CR with AVE, where CR should be greater than AVE for each concept (Ringle et al. 2012). This is acceptable for all constructions.

Assessment of the structural model

The following phase included evaluating the results of the structural model to ascertain the predictive relevance, linkages between the constructs, strength, and quality of the structural model and to validate the research's assumptions. Specifically, the coefficient of determination (R^2), path coefficient (β value), and T -statistic value, effect size (f^2), and the model's predictive usefulness were measured (Q^2). An analysis using bootstrapping was performed. However, R^2 values of 0.75, 0.50, and 0.25 might be regarded as high, moderate, and low, respectively (Henseler et al. 2015). As a result, this study's R^2 value was only modest. A measurement of the predictive significance of the model is the Q^2 value. According to the advice of Henseler et al. (2015), the findings of Q^2 values should be bigger than zero as a sign that the external structure has predictive significance to the endogenous structure under examination. Table 5 shows that the EGB, EP, and GC satisfaction achieved cross-validated redundancy values were reported as 0.195, 0.332, and 0.211, respectively.

The extent to which each exogenous latent construct influences the endogenous latent construct is measured by the f^2 . A researcher may use this metric to examine how the structural model relates to the selected endogenous latent variables. According to Gim et al. (2015), the predictive variables' respective f^2 values of 0.02, 0.15, and 0.35 were considered small, medium, and high impact sizes, respectively. Employees' green behavior, EP, and GC construct with medium impact sizes, with f^2 values of 0.301, 0.251, and 0.160, respectively. The outcomes of every test were acceptable and satisfying.

In addition, the path coefficients test was run to validate the predicted correlations. We are using the bootstrapping approach, as suggested by Hult et al. (2018), and Table 6 displays the results of the presented hypotheses. The results of

Table 3 Reliability and validity of constructs

Construct	Items	Loading	CA	(rho_a)	AVE	VIF
Corporate social responsibility	CSR1	0.700	0.783	0.785	0.533	1.319
	CSR2	0.730				1.602
	CSR3	0.743				1.606
	CSR4	0.748				1.607
	CSR5	0.729				1.381
Employees green behavior	EGB		0.825	0.837	0.740	1.926
	EGB1	0.847				1.848
	EGB2	0.857				1.836
	EGB3	0.876				1.729
Environmental performance	EP		0.778	0.779	0.600	1.692
	EP1	0.814				1.371
	EP2	0.790				1.472
	EP3	0.722				2.403
	EP4	0.771				2.242
Green culture	GC		0.897	0.899	0.765	2.729
	GC1	0.868				2.783
	GC2	0.848				1.547
	GC3	0.891				1.668
	GC4	0.890				2.146
Green innovation	GI		0.853	0.857	0.578	2.123
	GI1	0.700				1.837
	GI2	0.739				1.691
	GI3	0.808				1.000
	GI4	0.807				1.319
	GI5	0.777				1.602
	GI6	0.722				1.606

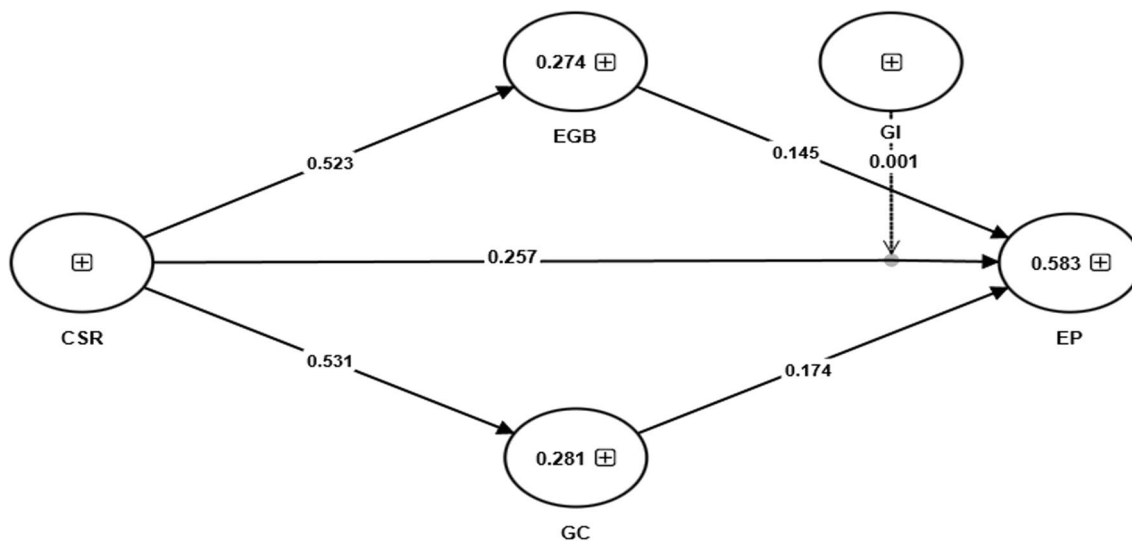


Fig. 2 Measurement assessment model

this technique contain the numerical information about the β , standard error, accompanying T -values, and P -value that is considered significant by the two-tailed T -test. As shown

in Table 6 and Fig. 2, a correlation between CSR and EP supports H1, H2, and H3. The first hypothesis was validated by the findings in H1, which showed that the predicted

Table 4 Fornell-Larcker criterion and heterotrait-monotrait ratio (HTMT)

Construct	CSR	EGB	EP	GC	GI
CSR	0.730	<i>0.660</i>	<i>0.689</i>	<i>0.679</i>	<i>0.620</i>
EGB	0.523	0.860	<i>0.828</i>	<i>0.555</i>	<i>0.804</i>
EP	0.634	0.549	0.775	<i>0.624</i>	<i>0.613</i>
GC	0.531	0.482	0.583	0.875	<i>0.716</i>
GI	0.596	0.528	0.681	0.578	0.760

Diagonal elements (in Bold) are the Fornell–Larcker criterion and in Italics are the Hetero trait Mono trait ratio

association between CSR and EP was significant ($\beta=0.257$, $T=3.667$, $P\text{-value}=0.000$). The second hypothesis was confirmed by the significant link between CSR and EGB ($\beta=0.523$, $T=10.303$, $P\text{-value}=0.000$). H3 is supported by the fact that CSR had a discernible impact on GC ($\beta=0.531$, $T=10.208$, $P=0.000$). The influence of an external latent construct on the endogenous latent construct is larger the higher the β coefficient. Compared to various β values in the model, CSR has the highest T path coefficient of β 0.523. CSR, on the other hand, had the least effect on GI, with 0.001.

Conclusion and discussion

The present quantitative study concentrates on a survey-based analysis that primarily indicates the factors that influence the adoption of CSR and EP in manufacturing firms in China. We analyze how CSR enhances environmental performance by encouraging green culture and employees' green behavior, relying on the natural resource-based perspective. This research aims to advance the existing body of literature regarding the effects of CSR on EP by investigating the specific circumstances and mechanisms through which CSR influences EP. In general, our research has revealed that the effects of CSR on EP can be partly mediation by EGB and GC. Moreover, scholarly research verifies the passive effects of corporate social responsibility on EGB and GC and environmental performance. The significance of GC is positively correlated with the level of GI. Additionally, it has been discovered that the moderating impacts of GI are entirely insignificant among employees.

Table 5 R^2 , Q^2 , f^2

Construct	R^2	R^2 adjusted	f^2	EGB	EP	GC	Q^2
EGB	0.274	0.270	CSR	0.377	0.088	0.392	0.195
EP	0.583	0.572	EGB		0.032		0.332
GC	0.281	0.278	EP				0.211
			GC		0.043		
			GI		0.150		
			GI x CSR		0.000		

Theoretical implication

This research adds several new ideas to the body of knowledge. First, this research offers a theoretical framework for analyzing the beneficial correlation between CSR and environmental performance using NRBV (Hart 1995). Higher CSR is confirmed to be likely to boost performance (Han et al. 2019). Since NRBV maintains that corporate resources go beyond just assets, capabilities, information, and knowledge to include valuable green culture, Barney (1991) explains why CSR, including managers' attention to environmental issues, is a significant internal cultural resource for the organization. CSR may include environmental awareness in strategic decision-making, environmental performance, and environmental policy as an organizational culture resource (Weaver et al. 1999).

This research supports previous findings and paves the way for the automobile industry to promote a GC within their organizations. This (Shahzad et al. (2012)) study empirically proved that a research model of environmental performance is useful for environmental protection in the State of China automobile industry. This is the GC in which staff members are dedicated to safeguarding their health and the environment, not just an environmental performance meant to conform to existing government rules and codes of practice. It should not be overlooked that internal corporate rules include a variety of topics in addition to environmental protection. Instead, they are linked to organizational performance, which may include outgrowth development in

Table 6 Hypothesis testing

Hypothesized paths	B	T statistics	P values	Result
CSR → EGB	0.523	10.303	0.000	Supported
CSR → EP	0.257	3.667	0.000	Supported
CSR → GC	0.531	10.208	0.000	Supported
EGB → EP	0.145	2.223	0.026	Supported
GC → EP	0.174	2.368	0.018	Supported
GI → EP	0.350	4.691	0.000	Supported
GI x CSR → EP	0.001	0.010	0.992	Not supported

a more fierce market. The findings of this study have been experimentally supported and are consistent with earlier studies. They add to the small but growing body of information on environmental performance, green innovation, green culture, and employees' green behavior. The significance of our empirical findings and their scientific contribution to the field is widely acknowledged.

Practical implications

The findings of our study hold significant practical implications for managers. Thus, automobile sector managers and executives should encourage a corporate social responsibility built on innovation and excellent environmental performance. The present research has significant practical implications for CSR, as it highlights the potential benefits of integrating EGB and GC principles to enhance EP. This is particularly relevant in rising societal, productive, and regulatory requirements to adopt ethical procedures that effectively address economic, environmental, and social concerns. The results represent the significance of CSR, EGB factors, and GC in the manufacturing sector to attain EP goals. CSR advocates for business executives to be mindful of the amount of energy and resources utilized in their companies' production processes and disposal of waste, causing improved EP. Our research suggests managers should adopt CSR practices, as they may encounter substantial obstacles due to the current green environmental standards and immediate technological advancements. This research advocates for incorporating CSR by manufacturing firms to enhance their capacity for EGB practices. This is a crucial aspect for businesses to consider in the current competitive environment, as it emphasizes the importance of maintaining a delicate balance with the environment (Song et al. 2020).

Additionally, the present findings indicate that CSR holds equal significance for the manufacturing sector as it does for large corporations. This suggests that manufacturing firms successfully implement CSR are more inclined to attain EP objectives, irrespective of their scale of operation. Consequently, our research assures manufacturing executives that they are also entitled to the advantages of CSR similar to those experienced by larger corporations. The study's findings indicate that CSR benefits are not exclusive to developed nations, as companies operating in underdeveloped or developing regions can also attain comparable outcomes by implementing CSR practices effectively. The significance of the finding concerning the full mediating effect of EGB and GC strategy depends on the fact that prior research has largely overlooked mediation. This finding is significant as it carries implications for the EGB and GC approach. The results suggest that managers of firms can influence innovation by promoting practices that reduce environmental

damage, leading to the production of superior EGB and GC. To achieve this, managers must demonstrate an ethical, environmental management model.

Additionally, as it is a major contributor to EGB and GC and enhances EP, it is critical to foster innovative thinking throughout the company (Awan et al. 2019). The present study provides evidence that the construct of GI serves as a negative moderator in the relationship between CSR and EP. Based on our findings, if a causal relationship occurs between CSR and GI, then the implications for management are insignificant (Harvey et al. 2013). In the context of the current strict environmental rules and enhanced environmental consciousness, managers must adopt eco-friendly practices to enhance their firms' market opportunities and improve their environmental performance.

Limitations and future research

There are several restrictions on this study. First, cross-sectional research was conducted, which implies that the information was gathered during a particular period. Increasing the sample size and repeating the research in different industrial sectors and states nationwide (or even in other countries) are crucial for more reliable findings. To enhance the generalizability of the findings, future investigations may consider augmenting the sample size while accounting for potential variances related to the implementation of CSR, EGB, GC principles, and EP and GI practices across firms, dependent upon their distinctive attributes. Moreover, future research endeavors may consider micro, small, medium-sized, and large enterprises. Furthermore, it could prove advantageous to evaluate the present study framework via a case study or concentrate on particular industries to determine if any variance exists in the inferences drawn. Moreover, it is suggested that future research endeavors could look into the potential impact of CSR environment initiatives on firms' cost reduction and brand promotion through the lens of a case study. The present study was conducted in China. Subsequent research endeavors may consider replicating comparative investigations in less developed and other emerging economies or across multiple countries to achieve generalizable outcomes.

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Declarations

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