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Open Access Organization and Management Review

Original Article

Towards Green Innovation: Impact of Green Entrepreneurial Orientation on Green Product Development with a Mediating Role of Green Creative Behaviour

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Received: 29 October 2026
Accepted: 07 November 2026
Published: 10 November 2026

DOI Prefix 10.59644

Quick Response Code:

ISSN (p): 2959-6211
ISSN (e): 2959-622X
Website: mdpip.com
Publisher: MDPIP

ABSTRACT

Recently, Green Product Development (GPD) has gained broad acceptance in academia, business, and the research community and has become an important part of a company's growth in the era of environmentalism. This study aimed to explored new dimensions that will improve Green Product Development by exploiting certain important variables such as Green Entrepreneurial Orientation (GEO) and Green Creative Behaviour (GCB). The research framework is based on the Natural Resource-Based View (NRBV) theory to examine the relationships among the GEO, GPD, and GCB constructs. Data was obtained from a sample of employees working in manufacturing SMEs (ISO 14001 certified), using a structured survey questionnaire. The results confirmed that GEO significantly influences GPD both directly and through the GCB, thereby validating the role of creative behaviour as a mediator. Model fit indices demonstrated strong reliability and validity, ensuring robustness of the findings. The outcomes provide empirical evidence that GEO-driven practices foster innovative green product initiatives, reinforcing the strategic importance of creativity in sustainable entrepreneurship. The results provide a substantial theoretical contribution to current literature. This study will help researchers to understand the variation in GEO and GPD from different aspects. The proposed study also suggests new insights for SMEs to reinforce green entrepreneurial orientation practices as a part of their firm's strategies to attain a highly competitive advantage.

Keywords: Green Entrepreneurial Orientation (GEO), Green Creative Behaviors (GCB), Green Product Development (GPD), Natural Resource-Based View (NRBV) Theory.

How to cite this article: Usman, M., Khalil, S.H., & Shah, S.M.A. (2026). Towards Green Innovation: Impact of Green Entrepreneurial Orientation on Green Product Development with a Mediating Role of Green Creative Behaviour. *Open Access Organization and Management Review*, 5(1), 51-69. https://doi.org/10.59644/oagmr.5(1).313

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INTRODUCTION

Global warming has emerged as a significant cause of environmental concerns; many organizations are now facing environmental issues as well as corporate social responsibility and are thus enormously willing to exercise green initiatives (Le *et al*., 2022). Consequently, designing appropriate environmental policies has become a major requirement for improving corporate sustainability in an eco-friendly world. The adverse implications of industrial activities on environmental sustainability have become an international issue due to increasing industrial evolution and growth (Khan *et al*., 2023). The importance of environmental conservation has received prominence in the business management agenda for alleviating environmental pressure. Day-by-day, consumers are continuously recognizing the importance of environmental sustainability and their effects on the consumption patterns, and hence, they are fostering businesses to adopt environmentally friendly practices. Because of the shared responsibility for a clean environment, all stakeholders, including businesses, communities, government agencies, and researchers, are focusing on the creation of green products (Nureen *et al*., 2023). Therefore, many companies have shifted their focus from traditional production to the new way of eco-friendly green production.

The term "Green Product Development " can be illustrated as the implementation of innovative notions for green products, services and practices that are regarded as creative, novel and valuable (Huang & Li, 2017). Green products have a smaller effect on society, as they are less harmful to human health because they are made of recyclable materials, manufactured with lower energy consumption, or delivered to the market with green packaging (Liu *et al*., 2021). The adoption of green products offers businesses a variety of positive outcomes, such as increased consumer demand, positive branding, regulatory compliance, cost savings, innovation opportunities and market differentiation. As environmental awareness continues to grow, green products have become valuable competitive tools in the market (Zameer *et al*., 2022). Entrepreneurs and businesses with GEO emphasize the importance of environmental sustainability in their overall business strategy. This orientation drives them to develop products that align with their commitment to sustainability (Appiah *et al*., 2023). GEO encourages innovative thinking and creativity in the development of products that address environmental challenges. Entrepreneurs strive to find new and innovative ways to create products that are more energy efficient, use eco-friendly materials, or have less impact on the environment. GEO possesses cultural dispersion and leadership, resulting in a more dynamic corporate green innovation process (Feng & Li, 2022). However, few researchers have used GEO as a predecessor for investigating its impact on GPD. From an entrepreneurial point of view, those organizations which focused on environmental concerns, characterized by innovativeness, proactiveness and risk-taking provide their members with the essential resources they need to engage in the creative activities (Aurellia & Nuringsih, 2023). Thus, to begin green initiatives and stimulate green creativity in the environmental era, enterprises must integrate the philosophy of sustainability with an innovative mindset (Rahim *et al*., 2023). Therefore, one aspect of this study is focused on exploring how the GEO is contributing to the sustainable development of green products.

GEO provides organizations with a strategic orientation for recognizing and undertaking sustainable business opportunities, the implementation of green strategies does not automatically ensure improved green product development outcomes. The successful conversion of such strategic objectives into tangible results also depends on the participation and innovative contributions of employees within the organization. Employees' ability to develop, produce and implement environmentally focused ideas assist firms to transform their ecological commitments into tangible improvements in product development, manufacturing processes, efficient resource utilization, and

sustainable performance. This differentiation underscores the significance of exploring the relationship between organizational-level strategic orientation and employee-level creative behaviour.

In recent years, the idea of green creative behaviour has received greater attention from the research community and enterprises for sustainable green product development. Employees' GCB plays a significant role in the context of GEO and GPD. These behaviors involve the generation of innovative and environmentally sustainable ideas and actions that contribute to a company's commitment to environmental responsibility (Zhang *et al*., 2023). GCB drives innovation, aligns the organization's strategies with environmental goals, fosters a culture of sustainability, and enhances the company's ability to develop and offer environmentally friendly products. By valuing and encouraging these behaviors, businesses can strengthen their commitment to sustainability and position themselves as leaders in eco-friendly entrepreneurship and product innovation (Rahim *et al*., 2023). Hence, additional studies are needed to gain sufficient knowledge regarding effective and efficient GPD. To achieve this objective, this study also investigated the impact of GEO on GPD, with the mediating role of GCB.

Despite extensive literature on the relationship between GEO and GPD (Wu & Yu, 2023), little attention has been paid to the role of other variables in strengthening this relationship. Furthermore, it is suggested that more in-depth research is required to understand the role of other variables (such as Environmental Regulation, Green Innovation, and Green Creative Behaviors) that are attributed to GPD (Moslehpour *et al*., 2023). In the context of these arguments, it is hypothesized that GCB should be considered with greater importance. To address the existing gaps, the current study has developed a theoretical framework asserting the relationship between GEO and GPD and the indirect mediation path of GCB. The proposed model has been presented in figure 1.

The role of GCB as a mediator justifies additional investigation as it presents behavioral explanation of how organizational level strategic orientation can be transformed into the results of green product development. While GEO signifies the organization's strategic commitment to sustainability performance, GCB demonstrates the creative efforts by means of which employees contribute to achieving sustainable oriented goals. So therefore, the investigation of GCB as a mediator helps to explain the mechanism by which GEO may influence GPD. This study addresses this research gap through the integration of integrating firm-level strategic orientation and employee-level creative behaviour to give a more holistic understanding of the relationship between GEO and GPD, specifically in the context of manufacturing SMEs.

The findings of this study will help SMEs' managers to develop green products by cultivating GCB, competing in a dynamic business environment, and achieving sustainable company performance. The main contributions of this study include shedding light on the relationship between GEO and GPD through the mediating role of GCB, recognizing the importance of environmentally friendly practices and products in modern business, and suggesting potential areas for further research and practical applications.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Green Entrepreneurial Orientation

Green Entrepreneurial Orientation represents a strategic approach embedded within a company's culture, acting as a dynamic capability that helps organizations identify, support, and implement environmental initiatives (Makhloufi *et al*., 2022). The term "Green Entrepreneurial Orientation" comprises three core elements based on organizational capabilities: Innovativeness, Proactiveness, and Risk-Taking (Chung *et al*., 2020). Innovativeness and

Proactiveness involve the exploitation of new ideas and resources and recombine them for effective utilization of entrepreneurial opportunities to develop new products (Shafique *et al*., 2021). On the other hand, Risk-Taking reflects an organization's capability to effectively hold the risk inherent in new products and processes through the utilization of resources obtained via Environmental Corporate Social Responsibility (ECSR) practices (Rehman *et al*., 2022).

GEO plays a significant role in advancing both environmental sustainability and social welfare, including two distinct characteristics: social orientation and environmental orientation (Guo *et al*., 2020). GEO is considered as a significant catalyst for sustainable development and environmental protection because of its extensive benefits for the organization. It empowers socially and environmentally responsible firms to acquire the resources necessary for driving technological innovation (Zhang *et al*., 2020). Several authors have suggested that GEO represents an organization's tendency to actively seek out opportunities for both economic and ecological advantages through green practices.

Green Creative Behaviour

Green Creative Behaviour refers to an individual's ability to generate environmentally friendly ideas for environmental sustainability and can be transformed into environmentally friendly processes, products, or services (Li *et al*., 2020). GCB refers to employee behaviour within an organization that involves employees' proactive engagement with their peers and organization, in which employees are engaged in discussions and exchange ideas related to environmental issues. Employees share their thoughts and suggestions that lead to the overall improvement of environmental practices. Employees with GCB tend to be more likely to adjust their work activities and behaviour to comply with environmental concerns. Employees who exhibit GCB will not only adapt their own behaviour but also serve as a source of inspiration, motivating their colleagues to adopt similar behaviour for the enhancement of environmental sustainability (Hameed *et al*., 2022). Individuals with creative behaviour are more capable of carrying out their responsibilities in particular situations, and this makes them able to come up with innovative ideas or solutions for problem solving and task completion. However, to enhance green performance, individuals must utilize their assets, such as "mindfulness, "which serves as a key component of green creative behaviour (Zhao *et al*., 2023).

Green Product Development

Green product is defined as a product with less environmental impact, designed in a way to minimize the potential risk to human health, composed of recyclable materials, manufactured energy-efficient methods and require less packaging in market delivery (Ahmad *et al*., 202). Compared to traditional product, GPD emphasize on more environmental concern, product life cycles, and the influence of the whole supply chain on the social environment (Wang & Su, 2022). These factors significantly contribute to firm's strategies in addressing environmental challenges. Recent studies indicate a growing number of consumers are willing to pay more for eco-friendly products (Katare *et al*., 2023).

Therefore, green products serve as a dual-purpose strategy for firms. It not only satisfies customer's increased environmental awareness but also gets higher performance from them to uphold competitiveness. Due to the increasing utilization of green products and the benefits of adopting green management practices, several companies are now directing their focus towards GPD and eco-friendly production strategies, therefore the integrations of green products significantly contribute to achieving the sustainability goals of the companies (Noor

et al., 2023). The concept of GPD is generally linked with the advancement of various environmentally friendly elements, including green products, services, and processes, and it is considered as a valuable and innovative business indicator that focuses on sustainability (Chang *et al*., 2019).

Green Entrepreneurial Orientation and Green Product Development

Some prior studies argue that GEO is entrenched in a firm's progressive strategies, enhancing its ability to begin green initiatives and increase business performance (Jiang *et al*., 2018; Ali, 2023). The Resource-Based View theory proposes that GEO provides businesses with a sustainable competitive advantage by developing green products, whereas it also affects the firm's performance (Asadi *et al*., 2020). As a result, GEO's primary objective is to promote eco-friendly manufacturing techniques, as well as green goods and services. Firms with GEO demonstrate creative strategies aimed at establishing an eco-friendly workplace and creating sustainable products and services (Jiang *et al*., 2018). These practices not only allow workers to participate in addressing environmental issues and developing green outcomes but also give them confidence in generating innovative green ideas or solutions (Sarfraz *et al*., 2023). Thus, consistent with the above discussion, the following hypothesis is proposed:

H_1: Green entrepreneurial orientation has a significant impact on green product development.

Green Entrepreneurial Orientation and Green Creative Behaviour

Green Creative Behaviour is defined as the imaginative ideas or strategies of an individual for the enhancement of environmental performance that may be applied as green processes, goods, or services. Frare and Beuren (2022) suggested that GEO promotes workers to engage in green creative processes, which might help to minimize paper and water consumption as well as improve hygiene practices, all of which would help to save the environment. The empirical findings cited above support the notion that different green strategies can be used to foster green creative behaviour. Employees' GCB is important for GPD, which leads to green and sustainable environmental performance (Alyahya *et al*., 2023). To generate green projects and activate green creativity in the environmental era, enterprises must integrate a sustainability philosophy with a creative approach (Ghazali *et al*., 2022). Thus, it is argued that employees' GCB plays an important role in organizational green strategies, and for this reason, various studies from various disciplines have focused more on GCB or eco-initiatives for the betterment of the environment (Luu, 2021). These findings lead to the following hypothesis:

H_2: Green entrepreneurial orientation has a significant impact on employee green creative behaviour.

Green Creative Behaviour and Green Product Development

Green creativity plays a significant role in the realm of eco-innovation, enabling organizations to implement sustainable practices through the development of eco-efficient services, the resolution of environmental issues, and reducing their overall environmental effect (Huo *et al*., 2020). GCB is defined as imaginative ideas or strategies of an individual to enhance environmental performance that may be applied as green processes, goods, or services (Rahim *et al*., 2023). To create innovative solutions, businesses must encourage managerial creativity, which is a major source of creativity (Ghazali *et al*., 2022). Research suggests that employees' Creative Behaviour plays a crucial role in the success and development of new products by utilizing useful and unique resources. Organizational concepts that can lead to higher product development are referred to as creativity (Hunt & Morgan, 1995). Furthermore, a creative product development team with extraordinary imagination can successfully fulfil consumer demands and provide high-quality products. Therefore, in accordance with the above discussion, the subsequent hypothesis is formulated:

H3: Green Creative Behaviour has a significant impact on Green Product Development.

Mediating Role of Green Creative Behaviour

As a specific type of creative behaviour, GCB is regarded as an individual's ability to create ideas and solutions aimed at supporting environmental protection and improvements, which can be subsequently translated into practical applications such as green services, products or processes. (Chen & Chang, 2013). Individuals can generate green outcomes when they possess both affective resources, such as motivation for environmental sustainability and Intellectual resources, including understanding of the utilization of environmental preservation, harmful factors for environmental sustainability like plastic waste and gas emissions, along with the knowledge of environmentally friendly practices including the conservation of natural resources and energy (Luu, 2023). According to Jiang *et al*. (2018) GEO is an organizational orientation to pursue opportunities that generate both economic and environmental benefits through green initiatives". Organizations that *seek* environmental oriented strategies provide support for the proactive creation of green ideas and solutions and anticipating in such initiatives that yield a positive impact on the environment. Firms exhibiting high GEO allocate high level of resources for enhancing green entrepreneurial skills and behaviors of their staff; such organizations further enhance creative skills among their employees (Stevenson & Jarillo, 1990).

The influence of GCB on GPD is a significant factor in advancing environmentally conscious innovation. GCB involves generating novel ideas and solutions with a focus on environmental conservation and improvement. When this kind of creative thinking is determined into GPD, it can lead to the creation of innovative, sustainable, and eco-friendly products (Ghazali *et al*., 2022). Individuals who exhibit GCB are more likely to propose inventive ways to reduce environmental impact, enhance energy efficiency, and incorporate recyclable or biodegradable materials. These creative insights can boost the design and conceptualization of products that align with sustainability goals (Rahim *et al*., 2023).

In summary, the impact of GCB on GPD is substantial. It enriches the ideation process, encourages collaboration, drives experimentation, and ultimately contributes to the creation of innovative, sustainable, and marketable products that align with environmental goals and consumer preferences (Shahzad *et al*., 2023). Thus, consistent with the preceding discussion, the study developed the following hypothesis:

H4: Employee green creative behaviour mediates the relationship between green entrepreneurial orientation and green product development.

Theoretical Foundation

Natural Resource-Based View Theory

This study is based on the Natural Resource-Based View (NRBV) theory, which expands the established Resource-Based View (RBV) by highlighting the significance of eco-friendly resources and capabilities in obtaining sustainable competitive advantage. While RBV emphasizes the long-term value of firm resources, NRBV illustrates how environmentally oriented capabilities allow firms to deal with ecological challenges while simultaneously achieving long-term competitive advantages (Kraus *et al*., 2020).

This study is based on the Natural Resource-Based View (NRBV establishes) theory, that expands the established Resource-Based View (RBV) by highlighting the significance of eco-friendly resources and capabilities in obtaining

sustainable competitive advantage. While RBV focuses on the strategic value of firm resources, NRBV explains how environmentally oriented capabilities enable firms to address ecological challenges while achieving long-term competitive benefits (Kraus *et al*., 2020).It provides a theoretical foundation for illustrating how the three dimensions of Green Entrepreneurial Orientation, namely green innovativeness, green proactiveness, and green risk-taking, enhance Green Product Development.

Green innovativeness stimulates the creation of eco-friendly product ideas, green proactiveness allows firms to predict environmental opportunities and customer demands, while green risk-taking represents the propensity to invest in risky but potentially beneficial environmental initiatives. Additionally, the present study broadens the implementation of NRBV theory by introducing Green Creative Behaviour (GCB) as a mediating process between GEO and GPD. GEO determines an organizational strategic environmental orientation. In contrast to prior GEO-related studies that mainly focus on green innovation as an underlying mechanism, the study highlights the behavioral contribution of GCB in transforming green entrepreneurial strategies into green product development outcomes. Consequently, NRBV explains how firms can employ their sustainability orientation and innovative competencies to develop eco-friendly products, efficient resource utilization and attain sustainable competitive advantages (Shahzad *et al*., 2020; Tan *et al*., 2023).

Conceptual Framework

Figure 1 shows the recommended conceptual framework that is comprised of three main latent constructs that are; Green Entrepreneurial Orientation (GEO), Green Creative Behaviour (GCB) and Green Product Development (GPD). The proposed framework represents four main hypotheses of this research. The first hypothesis shows a significant relationship between GEO and GPD. Then, in H2 the relationship between GEO and GCB is explored which states that GEO plays a vital role in shaping Employee's GCB. The relationship in H3 shows that the level of GCB positively correlates with GPD. Finally, from the model it is indicated that GCB act as a mediator through which GEO is influencing green product development.

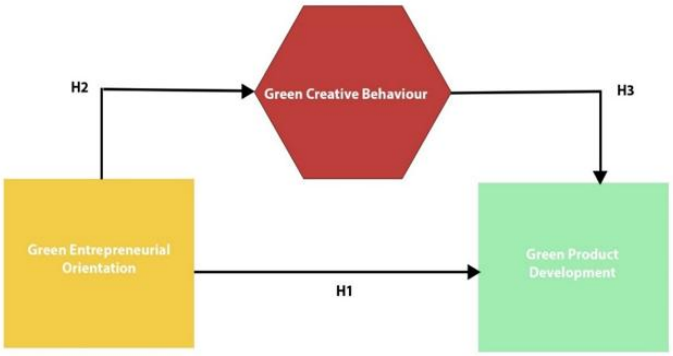


Figure 1
Proposed Model

METHODS AND MATERIALS

Sample and Data Collection

SMEs play a substantial role in employing a significant portion of a country's workforce, making a notable contribution to its economic landscape (Asghar *et al*., 2023), demonstrating their potential to improve social, economic and environmental growth. In recent years, SMEs have demonstrated a significant evolution in the

growing economy of Pakistan, contributing to a large portion of employment, fostering innovation, and overall economic development. According to (SMEDA), more than 5.2 million SMEs are operating in Pakistan (SMEDA, 2020), SMEs are facing substantial environmental pressure from the regulatory authorities, which encourages them to adopt such type of environmental practices that results in green innovation strategies. Thus, keeping in mind these considerations, the data collected from manufacturing SMEs (ISO certified 14001) in the major cities of Khyber Pakhtunkhwa to conduct an in-depth performance evaluation of the proposed conceptual framework. In alignment with ISO 14001 standards, organizations typically strive to enforce the implementation of green management initiatives throughout all functional areas (Ghazali & Afsar, 2021). The research was executed through the involvement of CEOs, owners and managerial level employees of the SMEs registered with Security and Exchange Commission of Pakistan (SECP), (SMEDA) and Small Industrial Development Board (SIDB).

The current study employed a purposive sampling technique within the realm of non-probability sampling. This method was chosen due to its distinctive capability of enabling researchers to define specific criteria and prerequisites for selecting samples that align with the study's objectives. This approach facilitates a holistic comprehension of a given phenomenon. Data collection occurred both physically and through the online survey conducted via (Google docs), from March 2026 to May 2026. To conduct the online survey, the initial step involved was gathering email addresses of potential respondents from various sources such as websites, directories, and other relevant platforms. Data was collected from more than 500 respondents, out of which a total of 326 complete questionnaires were collected for analysis, while excluding a few responses with incomplete information and the remaining 311 responses were used finally representing a response rate of 60%. The demographic profiles for respondents can be shown in Table 1.

Table 1

Demographic and Firm Characteristics of the Sample

Variables	Category	Frequency	Valid %
Age of respondents			
	20-35	77	24.8%
	36-45	54	17.4%
	46-55	77	24.8%
	56 & above	103	33.1%
Education of respondents			
	High School Degree or Lower	118	37.9%
	Bachelor's Degree or Equivalent	108	34.7%
	Master's degree or higher	85	27.3%
Designation of respondents			
	Low-Level Manager	82	26.4%
	Mid-Level Manager	125	40.2%
	Upper-Level Manager	83	26.7%
	CEO	21	6.8%
Respondents experience			
	0-10	119	38.3%
	11-20	141	45.3%

	21-30	38	12.2%
	31 and above	13	4.2%
Firm type			
	Small-size Enterprise	160	51.4%
	Medium-size Enterprise	151	48.6%
Years of Operation			
	01-05 Years	112	36.0%
	05-10 Years	138	44.4%
	Above 10 years	61	19.6%
No. of Employee			
	10-50	157	50.5%
	50-100	66	21.2%
	100-150	47	15.1%
	150-200	27	8.7%
	200-250	14	4.5%
SMEs Location			
	Peshawar	95	30.5%
	Mardan	57	18.3%
	Haripur	33	10.6%
	Kohat	37	11.9%
	Swat	49	15.8%
	Swabi	40	12.9%

Measurement

The questionnaire employed in the current study consists of previously established scales from the prior studies. Table 2 delineates the reliability of the questionnaire used for the performance evaluation of the proposed constructs. The measurement scale utilized in the study is based on a "7-point Likert scale" whereby respondents are presented with a range of 1 to 7. In this case, "1" represents "strongly disagree" and "7" represents "strongly agree." There are three measurement scales in the current study; firstly, to assess "Green Entrepreneurial Orientation" an eight-item scale was modified and employed, the reliability of this scale was evaluated through Cronbach's alpha value, which was 0.891 as shown in Table 2. This value indicating a high level of internal consistency and reliability for the adapted scale (Luu *et al*., 2023).

Subsequently, for the assessment of "Green Creative Behaviour" a six-item scale was adapted (Chen & Cheng, 2013). The Cronbach's alpha value was of 0.902, which shows a strong level of reliability and internal consistency for the "Green Creative Behaviour" scale signifying its robustness in measuring the proposed construct. Finally, a five-item scale was utilized to measure "Green Product Development" (Zhou *et al*., 2018). The value of Cronbach's alpha for this scale was 0.879, indicating a high degree of reliability for the measurement of the Green Product Development.

Table 1
Measurement (Questionnaire and Scaling)

Constructs	Indicators	Industry type	Source	Cronbach's alpha
Green Entrepreneurial Orientation	8	Manufacturing	(Luu *et al*., 2021)	0.891
Green Creative Behaviour	6	Manufacturing	(Chen & Chang, 2013)	0.902
Green Product Development	5	Manufacturing	(Zhou *et al*., 2018)	0.879

RESULTS AND FINDINGS

For measuring and analyzing the research hypotheses, this study has used two statistical benchmark tools that are; first, various statistical tests were performed through SPSS to find missing values and evaluate the distribution of data, then Smart PLS tool was used to show the internal consistency of all latent variables. In Smart PLS, the PLS-SEM algorithm is used for accurate estimations of reliability measures, including "Cronbach's alpha and composite reliability (CR)," and Validity measures, which include "convergent validity and Discriminant Validity" (Sarstedt *et al*., 2023). In the analysis phase, a two-stage model was employed (Sarstedt *et al*., 2023); in the first stage, the reliability and validity of the study items were evaluated through the measurement model. After the assessment of Measurement model, a structural model was executed to test the implication of relationships among the constructs and to verify the empirical validity of the proposed hypotheses.

The main objective of the study is to investigate the association between GEO and GPD along with the mediating role of GCB. For this purpose, the study used SPSS and Smart PLS tools for data coding and analysis, Smart PLS consists of two models in which the construct validity and reliability are checked through measurement model assessment based on some parameters such as Cronbach's alpha, composite reliability and AVE, after that Discriminant validity is then tested though HTMT and Fornell & Larker criterion After the assessment of measurement model, the hypotheses were evaluated through the structure model based on several measurements (i.e., path coefficient, explanatory power (R2), Effect size (F2) and predictive capability of the model through Q2 value). The obtained results are interpreted and discussed in the next session.

Measurement Model Assessment

The initial step in examining the measurement model is to assess the indicators' loadings. Table 3 plots the loading values for each individual items where all the values are greater than 0.05 which is the minimum acceptable threshold value, which determines that all the items are fit with the underlying constructs (Hair *et al*., 2010). Before eliminating the indicators with low factor loadings, it should be checked if the deletion of these items results in increasing the value of composite reliability and AVE or not. The items could be removed in that case if its removal results in increasing the composite reliability and AVE (Hair *et al*., 2021). Thus, in the present study, eliminating the items GEO5 with outer loading = 0. 609 and GCB2 with outer loading = 0. 697 does not bring any substantial increase in rho_a and AVE because the values for these constructs were already above the recommended threshold. Hence, no items were removed in our study for further analysis.

The threshold values for Cronbach's alpha and rho_a for measurement model evaluation should be > 0.70 (Bernstein & Teng, 1989; Hair *et al*., 2019). As shown in Table 3, the internal consistency values for all the constructs are above

0.70. Furthermore, to validate the constructs, the assessment of composite reliability was conducted through AVE. From Table 3, it is observed that the AVE values for all the latent variables are above the threshold value of 0.50. This means that these items are converging to underlying constructs; hence, the convergent validity is established, as higher AVE indicates better Convergent validity (Hair *et al*., 2019). Table 3 shows the results for validity and reliability assessment.

Table 2

Reliability and Validity Analysis

Constructs	Items	Loadings	Cronbach's Alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
GEO						
	GEO1	0.742	0.890	0.900	0.912	0.567
	GEO2	0.777				
	GEO3	0.745				
	GEO4	0.796				
	GEO5	0.609				
	GEO6	0.723				
	GEO7	0.784				
	GEO8	0.829				
GCB						
	GCB1	0.803	0.901	0.911	0.924	0.672
	GCB2	0.697				
	GCB3	0.793				
	GCB4	0.846				
	GCB5	0.881				
	GCB6	0.883				
GPD						
	GPD1	0.831	0.879	0.885	0.912	0.674
	GPD2	0.786				
	GPD3	0.819				
	GPD4	0.831				
	GPD5	0.835				

Discriminant Validity

Discriminant Validity is checked to establish distinctiveness of different constructs in the study. It shows that up to what extent one construct is different from other constructs in the research model. Discriminant Validity is examined through two main criteria, the first one is Heterotrait-Monotrait correlation ratio (HTMT), and the second one is Fornell & Larcker. Fornell (1981) proposes that the square root of AVE of each individual construct should be compared to the inter-construct correlation of the same construct and with all other constructs that are reflectively measured in the structural model.

Now, variance within the constructs should be greater than the variance explained jointly, as reflected in the results of Table 4. This means that Discriminant Validity is established.

Table 3

Discriminant Validity (Fornell and Larcker Criterion)

	GEO	GCB	GPD
GEO	0.753		
GCB	0.546	0.820	
GPD	0.531	0.418	0.821

Another standard method to evaluate the discriminant validity used in many studies is the HTMT which is more robust component available in PLS-SEM (Henseler *et al*., 2; Hair *et al*., 2021). In the table all the HTMT values are below threshold value of 0.85, which confirmed the strong Discriminant validity for the proposed measurement model.

Table 4

Discriminant Validity (HTMT (0.85) Criterion)

	GCB	**GEO**	**GPD**
GCB			
GEO	0. 581		
GPD	0.469	0.580	

Structural Model Assessment

The structural model illustrates the hypothesized relationship in the research framework by evaluating the significance and relevance of path coefficients, followed by R-squared (R2), effect size (F2) and predictive relevance (Q2). The path coefficient assessment examines the relationship among constructs based on which the proposed hypothesis is accepted or rejected. Four hypotheses were investigated in the study: H_1, H_2, H_3 and H_4. The association between dependent and independent variables was evaluated through P-value, Path-Coefficient (β) and t-statistics. The t-statistic value should be above 1.96 with a 95% confidence interval and P-value < 0.05.

Furthermore, Gotz *et al*. (2010) emphasized that the PLS-SEM bootstrapping technique is well-suited for mediation analysis. Consequently, the study also examined the mediation role of GCB by using the technique of PLS (SEM) bootstrapping for determining the t-value. Table 6 shows that there is a direct and substantial impact of GEO on the GPD (β = 0.493, SD = 0.077, t-value = 6.380, P-value < 0.05).

Similarly, after analyzing the results (β = 0.603, SD = 0.058, t-value = 10.474, P-value < 0.05), it is concluded that GEO has a relatively positive impact on GCB. The third hypothesis H_3 is also confirmed by founding a significant relationship between GCB and GPD (β = 0.169, SD = 0.085, t-value = 1.99, P-value < 0.05). Finally, from the results in Table 6, it is concluded that GCB plays a vital mediating role in strengthening the association between GEO and GPD (β = 0.102, SD = 0.056, P-value < 0.05, t-value = 1.827). From all this discussion it is determined that all proposed hypotheses are accepted.

Table 5

Path Coefficients

Hypotheses	Paths	Beta-value	SD	t-statistics	P-value	Results
H_1	GEO -> GPD	0.493	0.077	6.380	0.000	Supported
H_2	GEO -> GCB	0.603	0.058	10.474	0.000	Supported
H_3	GCB -> GPD	0.169	0.085	1.978	0.024	Supported
H_4	GEO -> GCB -> GPD	0.102	0.056	1.827	0.034	Supported

The R^2 value is an important component of the structure model assessment. R^2 value shows how much variance comes in the endogenous constructs due to the exogenous constructs. As a rule of thumb, it ranges from 0 to 1, and the value closer to 1 indicates a great explanatory power (Henseler *et al*., 2009). Hair *et al*. (2019) proposed three assumptions about R2 values; R2 with value 0.75 is considered as strong, value of 0.05 is considered as moderate and a value of 0.25 or less is considered as weak explanatory power. In the current study, the R^2 values for GCB are 0.364 and GPD is 0.372 respectively, these values represent moderate explanatory power. Another criterion for the evaluation of structural model is the PLS path model's predicative accuracy which is obtained by calculating the Q2 value (Hair *et al*., 2019). The value of Q2 greater than zero indicates a high level of predictive capability for the endogenous construct. This is a standard approach for examining the predictive relevancy of the model (Stone in 1974). As a rule of thumb, Q2 values less than 0.25 indicate small, greater than 0.25 up to 0.50 shows medium and a value greater than 0.50 represents large predictive capability. Now as shown in Table 7, the Q2 value for GCB is 0.289 and for GPD is 0.268, these values indicate that a model has a moderate predictive capability for the constructs. The results are shown in Table 7.

Table 6

Coefficient of Determination (R2) and Predictive Relevance (Q2)

Endogenous constructs	R2	Adjusted R^2	Q2
GCB	0.364	0.362	0.289
GPD	0.372	0.368	0.268

The practical significance of the outcomes should be explored by evaluating the effects of the relationship among the constructs. The effect size is the statistical measurement showing us a degree of an effect that is not influenced by the sample size used in the study (Cohen, 1998). The effect size (F2) is categorized into different levels of strength accordingly; F2 values within the range of (0.020 to 0.1500) indicate a weak effect, range of (0.150 to 0.350) indicates a medium effect and a value of equal or greater than 0.350 is considered as high effect (Haque et al., 2023). In the current scenario, F2 values for hypothesized relationships are 0.187, 0.424 and 0.033 respectively as shown in Table 8.

Table 7

Effect Size (F2)

Variables	F2 values
GEO -> GPD	0.187
GEO -> GCB	0.424
GCB -> GPD	0.033

DISCUSSION

GPD has gained a lot of interest in the literature for the researcher, academia, government and businesses. Business is now shifting their environmental strategies from cleaner processes towards a more holistic and sustainable approach to Green Products accounting for their whole life cycle and examining a broader range of environmental, social, and economic factors. The main aim of the current study is to examine the relationships between the GEO and GPD. We also endeavored to examine whether GCB plays a potential mediating role in the relationship between GEO and GPD.

The research findings suggest that GEO positively influences GPD, which means that GEO is an important predictor to initiate green product development in SMEs. In the second hypothesis, the relationship between GEO and GCB was investigated, and the result of this analysis demonstrated that yes, there is a significant relationship between GEO and GCB. Then the third hypothesis was formulated to examine the relationship between GCB and GPD, which was also supported and concluded that there is small but positive relationship between GCB and GPD. Finally, the mediating role of GCB was investigated, which leads to the conclusion that there is a significant mediating role of GCB between the relationship of GEO and GPD.

The findings are aligned with previous studies that have examined the relationship between GEO and GCB (Luu, 2023); similarly, the results are aligned with the previous studies focusing on GPD (Luan *et al*., 2022; Rasool *et al*., 2023). The study results provide a notable theoretical contribution to existing literature because very few studies show the relationship between GEO and GPD. The findings are in line with the previous work done by Sarfraz *et al*. (2023), who also identified a substantial impact of GEO on the green products and services. As indicated by earlier studies, the GPD aspect is still in the preliminary phase (Asadi *et al*., 2020); however, the current study holds the potential to make a significant theoretical contribution and provide essential insights to SMEs to help them attain sustainable business performance by integrating GCB and GPD.

Theoretical Implications

The current study adds a significant contribution to the prior literature in various aspects. First, these findings provide empirical support for hypothesis H1, showing the relationship between GEO and GPD. Which means that entrepreneurially oriented organizations need to adopt a strategic approach that prioritize environmental consideration in their operations and practices that can assist the GPD to attain environmental sustainability in their overall growth. The results of the study are also in line with the prior research that has highlighted the significance of GEO in influencing several aspects of organizational performance in general and GPD in particular (Asyraf *et al*., 2022). Secondly, the findings of the study supports all the proposed hypotheses, which are in tune with the previous work done by different authors in GEO and GPD context such as (Luu, 2021; Sahoo *et al*., 2023).However, the study differentiates itself from previous studies that has primarily focused on contextual mediating mechanisms, such as green adaptive capability, technological capabilities and green value co-creation (Chang, 2019) in the domain of sustainable strategy and green product development. Specifically, the findings highlight the significance of GCB as an individual mediating mechanism that facilitates the impact of GEO on GPD. The findings of the study suggest that by implementing a specific strategic orientation such as GEO, companies could stimulate a culture of green innovation and play a significant role in transforming employee behaviour into eco-friendly product development. These practices could involve conducting training, resources, and motivational rewards to encourage employees to promote sustainability by coming up with new ideas and developing green products within the organization. The

study will open new avenues for future research to predict consumer behaviour, identify barriers to implementation, and design strategies to promote sustainable consumption patterns.

Practical Implications

The research findings provide a couple of helpful suggestions for businesses seeking to enhance GPD as a part of their goals for environmental sustainability. First this study demonstrates the contribution that GEO had in promoting GPD in businesses throughout the manufacturing sectors. The findings reveal that the firms with the aim of promoting GPD ought to establish and implement such practices which can incorporate GEO in their firms. This integration can serve as a valuable framework providing guidance and support for green practices in terms of product designs, environmental sustainability and efficient management of waste recycling (Khan *et al*., 2021). To go ahead of the competitor, managers should motivate and support employee to investigate their green practices, particularly in terms of green products. To make their operations environmentally friendly, organizations must monitor and capture technological and market opportunities and engage their employee in such ventures that encourage green technology and generate new ways to develop eco-friendly products. Second, the results show that GCB can interpret GEO into GPD. When such practices are implemented in the organization which builds GEO, then it could happen that employee may engage in GCB to generate innovative ideas or solutions relating to green product designs or packaging, or the adoption of sustainable technology or environmentally friendly supplies in the production. Hence, apart from incorporating GEO, it is essential to strengthen GCB among employees. Acknowledging, evaluating, and rewarding employees' creative contributions to GPD is crucial to foster and enhance their GCB (Bhatia & Jakhar, 2021). Companies should also provide employees with up-to-date information about green materials and technologies, along with fostering divergent thinking skills. This will facilitate and encourage their creativity in generating novel green product ideas.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The study incorporates GEO, GCB, and GPD. Even though most of the assumptions have been strained, still the study lacks some deficiencies due to constraints in human capital, operational resources and limited time. First, as a survey-based cross-sectional study, the methodology used in the research has limitations and may not show a causal relationship between constructs. A more thorough and comprehensive understanding of relationships may be provided through a longitudinal or experimental approach. Integrating both quantitative and qualitative techniques might result in a deeper comprehension of the mechanisms for GPD. Second, this study examined the manufacturing sector for SMEs in only one province of Pakistan; further studies may confirm and test the findings in different sectors across different provinces or nations. It may be very helpful for organizations to test the model with a range of cultures and business contexts. Thirdly, the current study investigated only one mediator (GCB), however literature shows that there could be several variables which act as a mediator underlying the relationship between GEO and GPD (Moslehpour *et al*., 2023). It is therefore suggested to conduct more research to examine the effects of several variables, including the psychological climate, green identity, and green vision etc.

CONCLUSION

The paper started by emphasizing many challenges faced by global environment, including resource scarcity and climate change. This led to the emergence of “Green” concept compelling global organizations and researchers to address fundamental research questions about GPD practices. However, very few studies have been found that explore the evaluation and execution of GPD using a comprehensive framework. Furthermore, to comprehend the

role of extra variables comprehensive research is needed (like Environmental Regulation, Green Innovation, Green self-efficacy, etc.) that are attributing towards GPD. The current research enhances the existing body of knowledge regarding the determinants of GPD by finding the predictive role of GEO and its indirect and positive effects through GCB. Additionally, our study identifies the GCB as a key mechanism that enables GEO to be more effective in the development of Green Products in an organization. Therefore, our study is an attempt to provide a basis for future research determining possible practices that will increase green products development and will serve as a foundation for those future studies. In future work, we will consider the social parameters and their impact on the GPD.

DECLARATION

Ethical Considerations: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. All procedures performed in this study were consistent with the ethical standards of the Declaration of Helsinki. The study was conducted according to ethical and clinical standards for research.

Conflict of Interest: The authors have no conflicts of interest.

Consent for Publication: Consent was obtained according to the aims and process of the research.

Funding Source: Not Applicable.

Acknowledgements: The authors thank to the supervisor, teachers and feloows for valuable support and guidance.

Authors' Contributions: Authors declare equal contributions.

Data Availability: The data supporting the findings could be provided by the corresponding author subject to institutional and ethical restrictions.

Use of Artificial Intelligence (AI)- Assisted Technology for Manuscript Preparation: No AI tools were used for data extraction, statistical analysis, result interpretation, or the generation of original scientific content. All analyses were conducted by the authors, and they take full responsibility for the integrity and accuracy of the manuscript; however, we used AI for our questionnaire alignments, yet no AI was involved in conducting the test for the analysis.

Similarity Index/ Plagiarism: The similarity index was checked, and it is well below the threshold value of 19%, whereas each source is less > 5%.

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