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Impact of Managerial Environmental Concerns on Environmental Performance: Mediating Role of Green Entrepreneurship Orientation

Shoaib Zafar [1,*], Qifa Huang [1,*], Zuhaib Zafar [1] and Mirza Amin Ul Haq [2]

[1] School of Management, Jiangsu University, Zhenjiang 212013, China; 5103191204@stmail.ujs.edu.cn
[2] College of Management Sciences, Faculty of Engineering, Science, Technology & Management, Ziauddin University, Karachi 75600, Sindh, Pakistan; mirza.amin@zu.edu.pk
* Correspondence: shoaib.publication@gmail.com (S.Z.); qifa-h007@163.com (Q.H.)

Abstract

This study examines the impact of Green Entrepreneurial Orientation (GEO), Managerial Environmental Concerns (MECs), and Green Absorptive Capacity (GAC) on the environmental performance of Pakistani SMEs. The Dynamic Capabilities View (DCV) and Natural Resource-Based View (NRBV) demonstrate that innovation focused on sustainability and competitive advantage is enhanced by managerial engagement, knowledge capability, and environmental awareness. A cross-sectional survey involving 350 managers of SMEs in Pakistan utilized covariance-based structural equation modeling (CB-SEM). The MEC-to-GEO direction was insignificant, and this implies that the issue of managerial concern is not a driving force towards the initiation of green entrepreneurial endeavors. The confirmatory factor analysis model for the 350 SMEs demonstrates a satisfactory fit (CFI = 0.947; RMSEA = 0.073), along with reliability and validity. GEO and EP are positively influenced by GAC and MECs, with R^2 values of 0.204 and 0.526, respectively. The findings indicate that the absorptive and managerial capabilities of SMEs can integrate environmental responsibility into strategic decision-making, exceeding regulatory criteria to foster proactive environmental innovation. The study emphasizes ethical leadership, environmental competitiveness, and social responsibility through green information management and cooperative networks. The sustainability ideas and GEO are enhanced in developing nations by linking global green initiatives with local institutions and cultural contexts. Organizational management and policymakers should promote environmental education, ecological innovations, and sustainable practices within sectors. The limitations of the study include the use of self-reported data and cross-sectoral replication utilizing objective environmental indicators.

Keywords: green entrepreneurship orientation; green absorptive capacity; managerial environmental concerns; environmental performance; sustainability

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1. Introduction

The growing environmental crisis is shifting the world towards sustainable resources to ensure that small and medium-sized enterprises (SMEs) can promote economic sustainability and environmental responsibility. Despite being smaller and contributing to global resources, SMEs generate waste and pollution [1,2]. The lack of resources, the impracticability of accessing green financing, and the absence of integration of institutional support

also create challenges in developing countries, including Pakistan. SMEs are capable of adhering to the global sustainability criteria and are well-positioned to be innovative because of their entrepreneurial adaptability [3].

Green Entrepreneurial Orientation (GEO) is a firm's innovative and proactive commitment to environmental initiatives [4]. The current study focuses only on innovativeness and proactiveness, since the risk-taking dimension was excluded during measurement validation. GEO enables firms to create eco-innovations, develop cleaner technologies, and improve environmental performance through sustainable resource use [5].

Managerial Environmental Concerns (MECs) are also critical in influencing strategic priorities through the consciousness and dedication of leaders to environmental concerns. MECs affect the green market orientations, sustainability investments, and eco-innovation projects undertaken by firms [5]. However, the interaction between GAC, MECs, GEO, and EP has not been well researched in the SME sector of Pakistan. This is a major research gap, considering that economies in emerging markets have different economic, regulatory, and institutional environments than those in the developed nations [6].

This study advances sustainability knowledge by combining the Natural Resource-Based View (NRBV) and the Dynamic Capability View (DCV) in the context of Pakistan's developing market. NRBV is the process of firms gaining sustainable competitive advantage by using valuable, rare, and imitable green resources [6], and DCV identifies the abilities that enable firms to rearrange and reorganize competencies in rapidly changing environmental situations [7].

According to DCV, firms initially develop internal knowledge system and managerial perception frameworks. These are converted to strategic environmental activities embodied in GEO. Recent research has established that dynamic capacities, specifically absorptive capacity, are important prior to a company forming a strategic direction and achieving efficient establishment and management in green markets [7]. Likewise, recent studies indicate that the strategic environmental objectives of companies are predominantly shaped by managers responding to environmental issues, which subsequently leads to the development of innovative entrepreneurial thought [8]. Therefore, the rational connection between GAC, MECs, GEO, and environmental performance is, according to prior research, conceptually coherent.

Moreover, recent studies suggest that internal capabilities and managerial awareness contribute to how firms approach environmental initiatives. In this context, GAC is widely recognized as a capability-related antecedent of GEO, whereas MECs reflect a cognitive orientation that may shape managers' attention to sustainability issues [8]. However, while MECs are conceptually relevant, their empirical effect on GEO is not consistently supported in SME settings, indicating that managerial concern alone may not be sufficient to drive green entrepreneurial behavior. GAC and MECs represent two distinct strategic inputs—capability-based and cognition-based drivers—commonly discussed in sustainability and SME strategy research. GAC captures a firm's ability to acquire, assimilate, and apply green knowledge, thereby enabling the identification of environmental opportunities. MECs, by contrast, reflect managers' sensitivity to environmental issues, although the present findings indicate that cognitive stance does not significantly translate into GEO. Together, these constructs offer a theoretically grounded view of how internal capabilities and managerial orientations may support environmentally responsible strategies, consistent with NRBV and DCV perspectives [8].

Furthermore, this study advances the sustainability literature by examining the joint influence of GAC and MECs on GEO and EP in SMEs operating within Pakistan, a context characterized by resource limitations, institutional constraints, and culturally specific business practices. Distinct from prior research, the proposed model integrates capability-based

(GAC) and cognition-based (MEC) antecedents within a unified framework, facilitating an assessment of both their individual and combined effects on GEO and EP [9]. Furthermore, the study empirically demonstrates that GEO mediates the relationship between GAC and EP, elucidating the mechanisms through which SMEs can translate internal capabilities and managerial cognition into sustainable environmental and socio-economic outcomes.

Additionally, the emerging market conditions in Pakistan and the integration of the contemporary multidisciplinary perspectives render an opportunity to proceed with the theoretical premises and practical information on sustainability in SMEs. The study emphasizes how the collective efforts of GAC, MECs, and GEO lead to improved environmental performance through innovativeness and proactiveness, and it measures the need to achieve long-term environmental and social benefits. The examination of Pakistani SMEs makes a distinct contribution to the sustainability literature, since the literature typically focuses on large company entities in developed economies. Focusing on cultural plurality, the study identifies the importance of local managerial priorities, socio-economic realities, and institutional constraints that influence the development of green entrepreneurship in Pakistan [9]. Furthermore, the ethical aspect of the study is considered through the expression of how environmental justice and social equity can be advanced by SME green practices in areas where deprived populations experience the negative impact of pollution and resource wastage [10].

To maintain conceptual clarity, this study chooses to avoid other similar concepts like green human resource practices, green dynamic capabilities, and environmental leadership. Previous studies claimed that these elements tend to impact environmental strategy not directly but indirectly, either by absorptive capability or management cognition [10]. Their embedding may cause redundancy and multicollinearity, which is particularly critical for SMEs, where simplicity in models is needed.

2. Literature Review

2.1. Integration of the Natural Resource-Based View (NRBV) and the Dynamic Capability View (DCV)

Integrating the Natural Resource-Based View (NRBV) and the Dynamic Capability View (DCV) provides a more comprehensive explanation of how SMEs achieve environmental performance. NRBV highlights the strategic value of internal green resources such as environmental knowledge, green absorptive practices, and managerial environmental concern as sources of sustainability advantage. However, recent studies show that resource control alone does not lead to superior outcomes unless firms can actively utilize and renew those resources [3]. This limitation explains why NRBV must be complemented with a capability-based perspective.

Further, DCV fills this gap by explaining how firms mobilize, integrate, and reconfigure their green resources to respond to regulatory, technological, and ecological pressures. Dynamic capabilities such as identifying opportunities, absorbing external knowledge, and restructuring practices help convert environmental resources into green innovation and performance [4,7]. Therefore, DCV operationalizes the behavioral mechanisms that activate NRBV resources. Without NRBV and DCV, there is a lack of direction regarding what resources matters, and without DCV and NRBV, behavior becomes static and cannot explain adaptation, showing why both theories must be applied simultaneously.

In this study's model, NRBV identifies key green resource elements (GAC and MECs), while DCV explains how these resources are transformed into proactive environmental strategies through GEO and green innovation. This combined approach directly supports the study's argument that SMEs, especially in resource-constrained contexts, require both strong internal green resources and dynamic capabilities to achieve effective environmental

performance [11]. Thus, the integration of NRBV and DCV is theoretically coherent, mutually reinforcing, and essential for explaining the pathways proposed in this research.

2.2. Green Absorptive Capacity and Managerial Environmental Concerns as NRBV Capabilities

Green Absorptive Capacity (GAC) is the capability of a firm to learn, understand, adopt, and implement environmental knowledge. GAC is based on NRBV and views resources supporting sustainability as valuable, rare, and difficult to imitate [5]. Managerial Environmental Concerns (MECs) constitute the cognitive resources that illustrate the environmental consciousness of managers, their environmental risk awareness, and the strategic sustainability orientation of their decisions. GAC and MECs operate as joint sources of green strategy, serving as the internal drivers of such strategy. This is important for SMEs operating in emerging economies, where resource constraints and institutional hurdles are usually the norm [12].

2.3. Green Entrepreneurial Orientation as a Dynamic Capability

Green Entrepreneurial Orientation (GEO) is a dynamic competence that allows companies to translate environmental knowledge and management attention into innovative and proactive sustainability behavior. Based on DCV, GEO assists SMEs in identifying new opportunities and exploiting them using the approaches of creating eco-innovations and reorganizing internal processes to achieve improved environmental performance [7,8]. This concept aligns with the current literature that defines innovation-oriented and proactive entrepreneurial strategic approaches as critical in the attainment of sustainable competitive advantage in dynamic markets [12,13].

2.4. Integrating GAC, MECs, and GEO: Advancing the Model

The integration of GAC, MECs, and GEO provides theoretical insight by showing how GEO emerges primarily from capability-related drivers, while cognition plays a more context-sensitive role in influencing EP. The proposed model demonstrates an asymmetric pattern of mediation, highlighting the unique contribution of internal knowledge-processing capabilities and managerial cognitive orientations in shaping environmental outcomes [12,13]. Applying this framework to SMEs in Pakistan strengthens the contextual relevance of the model, as these firms operate under institutional weaknesses and resource limitations that restrict the implementation of sustainability strategies [14]. Considering these practical realities enhances understanding of how internal strategic factors function in constrained environments.

Within this framework, GAC and MECs are treated as internal factors that may influence a firm's ability to respond to environmental challenges. GAC represents knowledge-based capabilities, whereas MECs reflect managerial concern and cognition, and GEO acts as a dynamic capability translating these drivers into improved EP [7,14]. Although traditional EO includes innovativeness, proactiveness, and risk-taking, this study focuses on the first two dimensions, as risk-taking is less suitable in SME contexts [15]. Importantly, the findings show that MECs do not significantly predict GEO; rather, their influence on GEO appears to be limited and shaped by contextual constraints such as financial pressure, regulatory uncertainty, and cultural risk aversion. This nuance aligns with emerging evidence and clarifies how cognition-based drivers operate differently in developing-economy backgrounds [16].

2.5. Environmental Justice and SME Environmental Performance

The concept of environmental justice (EJ) highlights how SME environmental performance affects broader societal outcomes. EJ emphasizes that industrial activities often disproportionately impact vulnerable populations, particularly in emerging economies,

where SMEs are located near densely populated residential areas [17]. Recent research shows that improvements in corporate environmental practices can significantly reduce pollution and environmental risks in these vulnerable regions [18]. Enhancing internal capabilities, such as GAC, MECs, and GEO, not only strengthens corporate sustainability but also helps mitigate environmental inequalities at the community level [12,19].

Emerging studies further indicate that SMEs implementing proactive environmental solutions can reduce community exposure to industrial waste, pollutants, and resource depletion, thereby contributing to more equitable environmental outcomes [19]. Green innovations, cleaner production, and pollution-reduction technologies can improve environmental quality for marginalized populations residing near SMEs [20]. Although this study does not directly measure EJ, framing SME environmental performance within an EJ perspective strengthens the conceptual robustness of the model. Improvements in EP can serve both strategic sustainability objectives and societal processes, addressing environmental inequalities as recommended in contemporary research [16].

2.6. Green Absorptive Capacity and Green Entrepreneurship Orientation

Absorptive capacity can be defined as the ability of businesses to discover, absorb, and use external knowledge [14]. GAC is a sustainability concept that allows business entities to access information about the environment that can be leveraged to innovate and be aligned with strategic orientations [15]. GEO is a sustaining, creative, and risky sustainable principle. The greater their GAC, the more SMEs can relate to ecological possibilities, implement clean technologies, and concentrate on environmental concerns [16]. GEO is an enterprise strategy that helps to make sure that companies implement eco-friendly policies, invest in eco-friendly technologies, and implement and contribute to the overall rise in EP [17].

GAC assists businesses in exploring new and sustainable technology and promotes disseminating information on green and ecologically important activities [18]. The past literature demonstrates that absorptive capacity increases the performance of entrepreneurs by making it easier to realize and use opportunities in green markets [19]. It creates new knowledge that enhances the capacity of firms to react positively to environmental uncertainty and competitive forces [20,21].

The empirical evidence indicates that, together with knowledge sharing and big data analytics, GAC enhances green strategic orientation and entrepreneurial behavior in various institutional and cultural environments; therefore, GEO-GAC collaboration is a significant capability that fosters environmental, social, and economic performance, making its study an essential reference in various institutional contexts, including Pakistani SMEs [21]. Based on these insights, the following hypothesis is proposed:

H1. *GAC positively affects GEO.*

2.7. Effect of Managerial Environmental Concern on Green Entrepreneurship Orientation

MECs are also associated with green strategies, since environmentally conscious executives consider ecological factors when planning entrepreneurship [22].

Further, MECs are conceptually linked with shaping managers' environmental attention, yet their actual influence on GEO remains empirically weak and context-dependent [7]. While MECs may inform strategic awareness, our findings indicate that MECs do not significantly predict GEO, suggesting that managerial concern alone is insufficient to stimulate green entrepreneurial behavior in SMEs. Therefore, although the MEC–GEO relationship is theoretically relevant, the present study confirms that this link is not statistically supported in this context.

While GEO is aimed at enhancing environmental performance by leveraging green opportunities, management commitment will always be necessary to establish a culture of sustainability and avoid making decisions that contradict GEO goals [23]. Senior executives often find it challenging to assist GEO in unstable and unpredictable environments, negatively impacting their capacity to successfully locate and adjust to emerging environmental opportunities [24]. Despite the connection between MECs and the encouragement of green behavior and the dissemination of innovation, these are practices that require top management being involved in the strategic approach and not the use of individual environmental policies [25]. Based on the NRBV, MECs contribute to competitive advantage if they are converted into active green practices and entrepreneurial perspective [26].

Based on this reasoning, the following hypothesis is formulated:

H2. *MECs influence GEO.*

2.8. Green Absorptive Capacity and Environmental Performance

Following the NRBV framework, absorptive capacity is the unique and valuable characteristic that enhances EP [5,26]. Possessing strong GAC, companies are better positioned to engage in cleaner production processes, create sustainable supplier networks, and seek new developments that can facilitate environmental goals in businesses. The literature focuses on how absorptive ability helps in green innovation and enabling finding business opportunities in green markets [18].

Moreover, this study also seeks to fill the gap in the current literature and enhance environmental performance by examining the relationship between GAC and GEO. SMEs can utilize sustainability-driven opportunities through combining GAC and GEO [27]. This has also facilitated the implementation of the green supply chain and green environmental management practices, which are critical in improving EP [28].

According to [29], mediation can be supportive (where direct and indirect channels are consistent and significant) or competing (when direct and indirect paths are significant but point in opposite directions). GEO strengthens the effects of GAC and MECs on EP by translating managerial and absorptive inputs into proactive environmental strategies. This distinction defines mediation and aligns theory with the NRBV–DCV paradigm.

These relationships can be tested with the help of the hypotheses provided by the NRBV and the DCV on which the investigation is based.

H3. *GAC has a positive influence on EP.*

2.9. Managerial Environmental Concerns and Environmental Performance

Eco-conscious managers adopt strong proactive management techniques through pollution reduction, resource efficiency, and waste minimization that are directly linked to better EP [2]. Although the impact of MECs on GEO has not been precisely determined, MECs themselves enhance EP: they ensure the adoption of regulations and, consequently, increase the environmental credibility of firms [30]. MECs predict managers' consciousness of the environment and their intention to engage in environmentally friendly entrepreneurship and sustainable product development, which not only create innovation opportunities but can also guarantee the long-term survival of companies and their competitiveness [22].

Despite growing interest, the interaction between MECs and GEO has not gained much attention regarding the interaction of managerial priorities with green innovation to affect EP. This study thus looks at the combined effects of MECs and GEO in establishing green innovation capacity and enhancing organizational efficiency. Environmental awareness among managers plays a significant role in creating the corporate culture, practices, and

strategies that allow proactive responses to ecological issues [31]. GEO supports such initiatives by stimulating entrepreneurial strategies towards environmental concerns and improving EP [32].

Employing empirical studies demonstrates that leadership priorities regarding sustainability affect entrepreneurial orientation and the success of eco-innovation programs. By focusing on green values, managers enhance the probability that businesses will invest in sustainable operations, follow environmental rules, and produce superior EP results [33]. In light of this, the following hypothesis is proposed:

H4. *MECs have a positive influence on EP.*

2.10. Green Entrepreneurship Orientation and Environmental Performance

A company's strategic framework being proactive regarding environmental operations, such as GEO, positively influences EP through eco-innovation and the implementation of cleaner technology, and achieves higher levels of trust among its stakeholders [34]. GEO plays a vital role in providing green products, decreasing emissions, and ensuring wellness and safety due to growing environmental and social demands, which are supported by increasing consumer expectations and sustainability demands in the world [35].

GEO can also support sustainability by reducing the cost of resources, having advantages in green markets, and promoting investment in situations of uncertainty in relation to the environment. In accordance with the DCV, GEO also allows a business to redesign resources innovatively to deliver environmental value aligned with the DCV. In addition to assuring regulatory compliance, clean technologies can reduce emissions and save resources, also illustrating the usefulness of GEO to society and business [36]. GEO is a significant contributor to the enhancement of EP by promoting green innovation and increasing the number of stakeholders involved [27]. Considering the discussion above, the following hypothesis is proposed:

H5. *GEO has a positive impact on EP.*

2.11. Mediating Role of Green Entrepreneurship Orientation, Green Absorptive Capacity, and Environmental Performance

From the perspective of DCV, green entrepreneurship is a proactive strategy to address environmental issues and unexpected environmental fluctuations. GAC allows companies to learn, adopt, and apply environmental knowledge, and hence to improve processes, organizational competencies, and production systems to enhance the sustainability of processes [37]. This highlights the close relationship between GAC and entrepreneurial competence in promoting resource efficiency, minimization of pollution, and ecosystem health protection.

Regarding forecasting environmental opportunities by integrating GAC and GEO, this research fills a gap by theorizing the joint efforts of GAC and GEO, which should be undertaken to address environmental risks and capitalize on green opportunities so that firms can better predict sustainable business opportunities [38]. In this context, GEO becomes an intermediary that converts managerial commitment and absorptive capacities into better EP. Empirical research also confirms that GEO mediates the relationship between GAC and corporate EP [39].

Considering the discussion above, the following hypothesis is proposed:

H6. *GEO mediates the relationship between GAC and EP.*

2.12. Mediating Role of Green Entrepreneurship Orientation, MECs, and Environmental Performance

MECs play an important role in shaping green innovation and higher EP by guiding managerial attention toward internal challenges and environmental opportunities [40]. MECs may support GEO by fostering an eco-friendly mindset, although their influence on GEO is not always strong or direct, and depends heavily on contextual conditions such as resource constraints and institutional pressures—an observation consistent with the DCV. From the NRBV perspective, one crucial way of reducing environmental degradation is through stronger organizational alignment with the natural environment [27].

Leadership commitment remains particularly important for initiating and maintaining environmental initiatives that enable GEO where it emerges, but the results of this study show that MECs alone do not translate into proactive GEO behavior. Rather, MECs provide a cognitive foundation that may help managers identify sustainability-related opportunities, even if this concern does not always convert into entrepreneurial action [36]. Furthermore, managerial environmental concern contributes to an internal green orientation that may enhance EP, with GEO serving as a mediating mechanism when it is activated to translate leadership concern into stronger ecological performance [41,42]. Therefore, the following hypothesis is proposed:

H7. *GEO mediates the relationship between MECs and EP.*

According to the NRBV and the DCV, this research study describes how GAC with GEO stimulates green innovation as an environmental requirement (Figure 1). It answers the following questions: (1) Does GEO emphasize EP? (2) Regarding the indirect impact of GEO on GAC-EP and MEC-EP, how far is GEO able to mediate the relationship between GAC-EP and MEC-EP? (3) What are the impacts of MECs on GEO and EP?

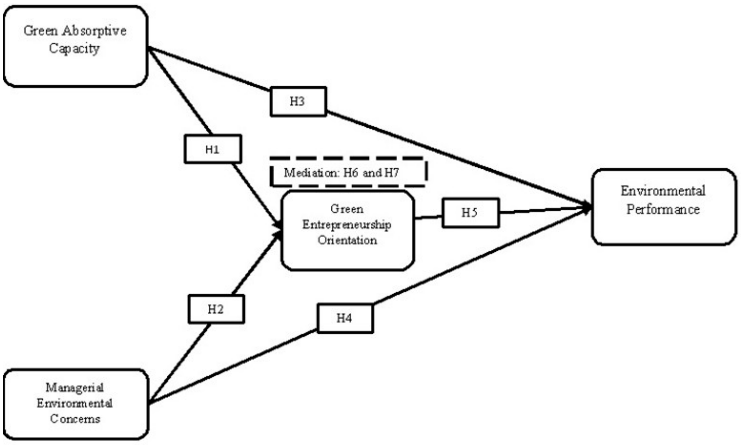

Figure 1. Theoretical framework.

2.13. Theoretical Framework

Based on the preliminary review of the literature, the study develops the theoretical framework shown in Figure 1.

3. Methods

This study investigates relationships among GAC, MECs, GEO, and EP across Pakistani manufacturing, assembling, and service SMEs. A cross-sectional survey targeted managerial informants (front-line supervisors to top managers) best positioned to report on firm capabilities, organizational attitudes, and environmental outcomes.

3.1. Sample and Data Survey

In this study, a non-probability sampling strategy was used. Although SMEs were initially identified from SMEDA directories (purposive frame), the participation of managers led to convenience-based participation. While this limits generalizability, it reflects common practice in SME research in Pakistan. Sample-size planning followed established practice: the table and conventional rules for SEMs (observations per estimated parameter) presented in [43] guided the target. We distributed questionnaires to 518 key informants (middle and top management); 350 completed questionnaires were returned (response rate = 67.6%). After data cleaning (removal of incomplete surveys and straight-lining), N = 350 valid cases were retained for analysis.

A sample size of 350 respondents was chosen for the research, based on the formula stated by Krejcie and Morgan [43].

The sample-to-parameter ratio was 12:1, slightly below the recommended 15:1 threshold for maximum-likelihood estimation. This limitation is acknowledged in the discussion.

$$s = \frac{x^2 NP(1-P)}{d^2(N-1) + x^2 P(1-P)}$$

s = substantial sample required;
x^2 = chi-square (1 degree of freedom [1.96 × 1.96]);
N = observed population;
P = population ratio (e.g., 50%);
d = degree accuracy proportion (5%).

Although non-probability sampling limits statistical generalizability, purposive access to knowledgeable informants is appropriate for theory-testing in SME contexts. Power and sample-size considerations for SEMs were checked against recent guidance on model complexity and parameter estimation [44].

All items used a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was in English and Urdu. Content validity was established through expert review: two industry practitioners and four academic/professional reviewers examined item clarity and relevance; their feedback was incorporated into the final instrument.

To address common-method bias, both procedural and statistical remedies were applied. Harman's single-factor test showed that no single factor accounted for most of the variance. A latent common-method factor test was also performed, confirming that CMB was not a major concern.

A pilot test (n = 16 firms; various managerial ranks) evaluated item clarity and preliminary reliability; Cronbach's α and composite reliability for constructs ranged from 0.79 to 0.83, exceeding conventional thresholds (>0.70).

A total of 350 participants with complete data were selected and followed throughout the study. Among them, 73% were male (256) and 27% were female (94). Age groups included 20–30 (36%), 31–40 (44.9%), 41–50 (12%), and 51+ (7.1%). Career levels represented were managers (29.6%), supervisors (56.3%), and representatives (14.2%). Participants worked in manufacturing (56.25%), assembling (19%), and other services. Experience varied: less than 5 years (24.57%), 6–10 years (35.42%), 11–20 years (31.14%), and over 20 years (8.87%). Figure 2 and Table 1 summarize these details.

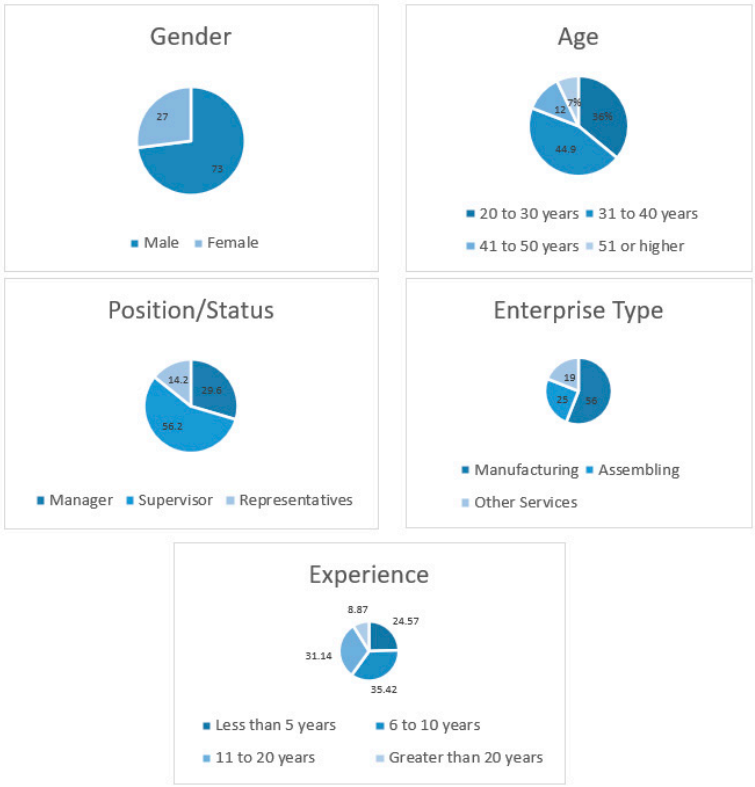

Figure 2. Details of the statistical demographics of the data.

Table 1. Details of the statistical demographics of the data.

Category	Subcategory	Frequency	Percent
Gender	Male	256	73
	Female	94	27
	Total	350	100
Age	20 to 30 years	126	36
	31 to 40 years	157	44.9
	41 to 50 years	42	12
	51 or higher	25	7.1
	Total	350	100
Position/Status	Manager	105	29.6
	Supervisor	96	56.2
	Representatives	52	14.2
	Total	350	100
Enterprise Type	Manufacturing	196	56
	Assembling	88	25
	Other Services	66	19
	Total	350	100
Experience	Less than 5 years	86	24.57
	6 to 10 years	124	35.42
	11 to 20 years	109	31.14
	Greater than 20 years	31	8.87
	Total	350	100

3.2. Measures

3.2.1. Green Absorptive Capacity

The GAC questionnaire developed by Gluch et al. [45] was used. On a five-point Likert scale, "one" denoted "strongly disagree" and "five" denoted "strongly agree".

3.2.2. Green Entrepreneurial Orientation

The GEO scale was developed by Jiang et al. [46]. On a five-point Likert scale, "one" denoted "strongly disagree" and "five" denoted "strongly agree".

3.2.3. Environmental Performance

The EP scale was developed by Jiang, Chai, Shao, and Feng [46]. On a five-point Likert-scale, "one" denoted "strongly disagree" and "five" denoted "strongly agree".

3.2.4. Managerial Environmental Concerns

The MEC scale was developed by Xue, Boadu, and Xie [12] and Saudi et al. [47]. On a five-point Likert-scale, "one" denoted "strongly disagree" and "five" denoted "strongly agree".

4. Data Analysis and Results

The researchers used AMOS (version 24) to conduct a confirmatory factor analysis (CFA). The CFA was estimated using the maximum-likelihood method based on the data that fit our model. This study expected the CMIN to be statistically insignificant at 5%; the minimum discrepancy per degree of freedom (CMIN/DF) to be less than 3; the Goodness-of-Fit Index (GFI) to be greater than 0.8; the Normed Fit Index (NFI), the Tucker–Lewis Index (TLI), and the Comparative Fit Index (CFI) to be greater than 0.9; and the RMSEA and RMR to be less than 0.08 [48]. RMSEA = 0.073, with PCLOSE = 0.104, such that a close fit was rejected; however, the model fit well, and modification indices showed no serious misspecifications.

Table 2 presents all achieved values with the thresholds and standardized coefficients; therefore, the study can proceed with further analysis.

Table 2 shows that all item loadings exceeded 0.70 [49]. AVE values were higher than 0.50 for all constructs [50], and the composite reliability was higher than 0.70 [51].

Confirmatory factor analysis (CFA) was conducted to assess measurement validity. While the Fornell and Larcker [52] criterion is traditionally used to evaluate discriminant validity, [53] the average variance extracted (AVE) can become unreliable when indicator loadings exceed 0.90, as observed for certain items in the Green Entrepreneurial Orientation (GEO) construct. To strengthen the assessment, this study employed the Heterotrait–Monotrait (HTMT) ratio of correlations, confirming discriminant validity across all latent variables.

Internal consistency was assessed using both composite reliability (CR) and coefficient omega (ω), in line with recent psychometric recommendations [54]. All constructs exceeded the 0.70 threshold for CR and ω, demonstrating reliability. To improve model fit and conceptual clarity, three items with low standardized loadings (<0.60) and high cross-loadings were deleted; specifically, two risk-taking indicators from the GEO construct and one redundant environmental concern item were removed. This process is reported transparently to comply with the TOP (Transparency and Openness Promotion) open-science guidelines [55].

Table 3 shows that in this research, the values in both the rows and columns had a higher value based on the diagonal value than their respective diagonal values, which indicates that the measures used in this study were discriminatory towards one another

based on the diagonal value, which shows that the measures employed were accurate (see Table 3).

Table 2. Confirmatory factor analysis (CFA), reliability and validity.

Variables: CMIN = 623.918; *p*-Value = 0.000; CMIN/DF = 2.862; SRMR = 0.072; GFI = 0.868; NFI = 0.921; TLI = 0.939; CFI = 0.947; RMSEA = 0.073; PCLOSE = 0.104;	**Factor Loadings**	**VIF**
Green Absorptive Capacity (GAC): CA = 0.959; CR = 0.957; AVE = 0.691		1.428
GAC1	0.814	
GAC2	0.798	
GAC3	0.833	
GAC4	0.775	
GAC5	0.876	
GAC6	0.824	
GAC7	0.831	
GAC8	0.837	
GAC9	0.829	
GAC10	0.887	
Managerial Environmental Concerns (MECs): CA = 0.862; CR = 0.864; AVE = 0.614		1.183
MEC1	0.743	
MEC2	0.811	
MEC3	0.789	
MEC4	0.791	
Green Entrepreneurial Orientation (GEO): CA = 0.937; CR = 0.939; AVE = 0.756		
GEO1	0.915	
GEO2	0.883	
GEO3	0.824	
GEO4	0.855	
GEO5	0.869	
Environmental Performance (EP): CA = 0.930; CR = 0.926; AVE = 0.757		
EP1	0.915	
EP2	0.883	
EP3	0.824	
EP4	0.855	
EP5	–	
EP6	–	

Note: – *indicates removed items due to low loading. VIF: variance inflation factor; CA: Cronbach's alpha; CR: composite reliability; AVE: average variance extracted*. CMIN/DF = chi-square divided by degrees of freedom; SRMR = root mean square residual; GFI = Goodness-of-Fit Index; NFI = Normed Fit Index; TLI = Tucker–Lewis index; CFI = Comparative Fit Index; RMSEA = root mean square error of approximation.

The summary in [56] lists many benefits of SEM techniques. It says, "SEM yields advantages that cannot be achieved with traditional statistical methods". When combined with CB-SEM (covariance-based structural equation modeling), SEM can analyze complicated structural models and determine interacting effects. As part of CB-SEM, a confirmatory factor analysis (CFA) quantifies all latent constructs' convergent and discriminant validity by assessing covariation simultaneously. The congener covariance model optimizes correla-

tions between each construct simultaneously, increasing correlation coefficients. Ref. [57] supports these thresholds.

Table 3. Discriminant validity.

Constructs	1	2	3	4
Green Absorptive Capacity	*0.831*	-	-	-
Managerial Environmental Concerns	0.347	*0.800*	-	-
Green Entrepreneurial Orientation	0.440	0.247	*0.869*	-
Environmental Performance	0.520	0.616	0.452	*0.870*

Note: $\sqrt{}$AVE indicates diagonal *italic* values.

The study reports the R^2 values for the endogenous constructs under a cumulus model: R^2 for GEO = 0.204 and R^2 for EP = 0.526 (shown in Figure 3, "Structural model"). Falk and Miller [58] proposed that, using the SEM technique, the R^2 value of 0.10 can be considered significant ($0 < R^2 < 1$); an interval defines the range for the determinant coefficient, 0 indicates no correlation, and 1 shows extreme correlation. The study achieved intermediate values for both endogenous constructs. Craney and Surles [59] recommended a VIF (variance inflation factor) value of less than 5 if the correlation is moderate and less than 10 if the correlation is substantial, indicating an acceptable range. Hence, all values in this research were lower than 5 (see Table 2). The research variables all met the requirements for positive and significant relationships, as shown in Table 4.

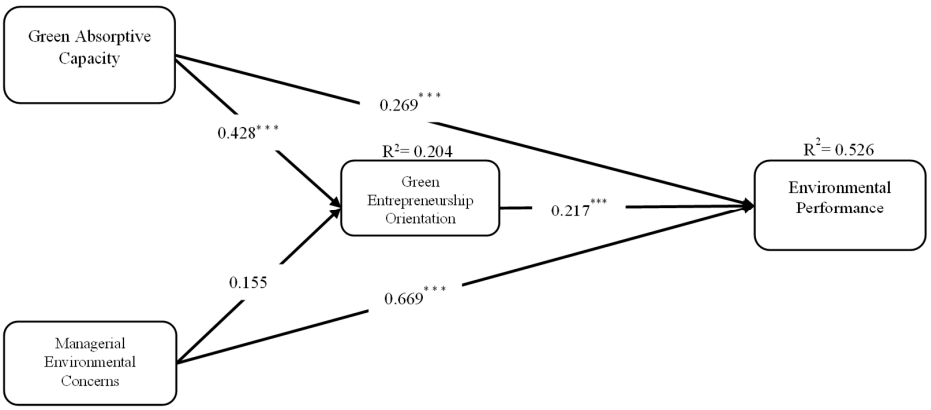

Figure 3. Structural model. Note: *** indicates $p < 0.001$, representing a highly significant result.

The structural path in Figure 3 and Table 4 showed a positive and significant relationship between GAC and GEO (β = 0.428, S.E. = 0.062, $p < 0.01$), indicating that H1 is supported. Next, the MEC path was positive but insignificant for GEO (β = 0.155, S.E. = 0.084, $p > 0.05$), indicating that hypothesis H2 is not supported. Moreover, GAC had a positive and significant effect on EP (β = 0.269, S.E. = 0.053, $p < 0.01$), supporting the validity of H3. Furthermore, the results showed that MECs positively and significantly influenced EP (β = 0.669, S.E. = 0.076, $p < 0.01$), supporting H4. Additionally, H5 was supported (β = 0.217, S.E. = 0.048, $p < 0.01$). See Table 4 for the results supporting the hypotheses and the significance levels.

The SEM path in Figure 4 and Table 4 tested Hypotheses 6 and 7, and bootstrapped bias-corrected confidence intervals with 5000 resamples tested mediation [60]. Mediation analysis was supported by the significant overall effect (c-path). GEO's indirect effects were significant, demonstrating complementary mediation. Indirect effects were significant when the 95% confidence range excluded zero. This decreased Type I error risk and improved the mediation analysis validity. In H6, GEO mediated the association between

GAC and EP (β = 0.093, S.E. = 0.027, $p < 0.01$). [60] It was advisable to use the significance level, e.g., *p*-value ($p = 0.001$), to test H6 and confirm mediation. Hypothesis 7 states that GEO mediates the relationship between MECs and EP. The direct path from MECs to GEO is not significant, but the indirect effect of MECs on EP through GEO is empirically supported (β = 0.034, S.E. = 0.023, $p < 0.01$). The findings (β = 0.034, S.E. = 0.023, $p < 0.01$) give empirical support. Ref. [60] suggests proving a significant link. The study's statistical inference *p*-value ($p = 0.001$) indicates that EP mediates GEO and MECs.

Table 4. Hypothesis testing.

Hypothesis	Relationship	Estimate (β)	S.E.	*p*-Value	Decision
H1	GAC ⟶ GEO	0.428 ***	0.062	0.000	Supported
H2	MEC ⟶ GEO	0.155	0.084	0.065	Not supported
H3	GAC ⟶ EP	0.269 ***	0.053	0.000	Supported
H4	MEC ⟶ EP	0.669 ***	0.076	0.000	Supported
H5	GEO ⟶ EP	0.217 ***	0.048	0.000	Supported
		Indirect Effects			
H6	GAC ⟶ GEO ⟶ EP	0.093 ***	0.027	0.001	Mediation exists
H7	MEC ⟶ GEO ⟶ EP	0.034 ***	0.023	0.001	Mediation exists

Note: *** ⟶ *0.01.*

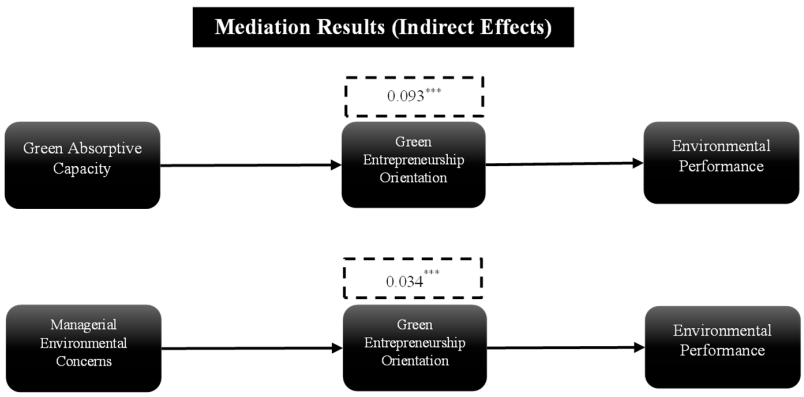

Figure 4. Mediation results. Note: *** indicates that the corresponding path is statistically significant at $p < 0.001$, reflecting a very strong mediation effect.

Moreover, GEO acts as a mediator between GAC, MECs, and EP, as illustrated in Figure 4. The data show that GAC significantly impacts EP through GEO (β = 0.093, *** $p < 0.001$), suggesting that firms with a strong ability to absorb green knowledge tend to adopt proactive entrepreneurial strategies that enhance sustainability. Likewise, MECs show a small indirect effect on EP through GEO (β = 0.034, $p < 0.001$), although the direct MEC ⟶ GEO path is not significant, suggesting that while managerial environmental concern may modestly relate to a green entrepreneurial mindset, its influence is limited.

5. Discussion and Conclusions

This research contributes to the SME and sustainability literature by demonstrating that GAC and MECs have an effect on EP. This relationship is mediated by GEO, which highlights the importance of strategic leadership and internal capabilities. Recently, there has been an analysis of GEO as a major source of green innovation and competitiveness, where leadership commitment and absorptive capacity are highlighted as the key catalysts for sustainable environmental development [61]. In this study, the perspectives of the

NRBV and DCV were integrated, and the role of GAC, MECs, and GEO in forming EP was explored, with an emphasis on GEO as a dynamic capability that converts environmental knowledge and managerial cognition into innovative and proactive behavior [27].

The combined model, including GEO, GAC, and EP, shows that SMEs are involved in green markets, secure the environment, and pursue eco-opportunities. The interplay between GAC, MECs, and GEO is particularly useful in terms of environmentally conscious SMEs and their orientation to corporate environmental management and enhancing the sustainable culture. The processes demonstrate that environmental leadership and green entrepreneurship training is needed because the capabilities of a firm influence the allocation of resources and decision-making. GAC supports the knowledge base; MECs lead issue identification and prioritization; and GEO facilitates the transfer of knowledge and concerns into practical outcomes in terms of environmental benefits in the structure [25,62].

Further, the concept of environmental justice (EJ) was not directly examined. In developing nations, SMEs are normally located in highly populated residential or industrial areas, subjecting vulnerable locals to increased environmental risks. The analysis indicates that internal strengths, i.e., GAC, MECs, and GEO, can indirectly reduce the damage to these populations through cleaner production, enhanced pollution management, and resource efficiency [63,64]. Although the practical effects of EJ are still on a purely theoretical level, the offered EP gains provide a platform on which more balanced environmental outcomes can be achieved [65,66].

Moreover, the non-significant MEC $\longrightarrow$ GEO relationship provides additional insight into Pakistani SMEs adopting environmental objectives in practice. Although managers are concerned about the environment, this concern does not necessarily translate into greater innovativeness or proactiveness in green entrepreneurship. Evidence from other low-income countries indicates that environmental awareness often results in compliance-based, low-effort behaviors rather than capability-enhancing actions [67]. This pattern can be attributed to context-specific factors: (1) severe financial and resource constraints that restrict investments in experimental green projects; (2) regulatory uncertainty and weak enforcement that limit proactive environmental entrepreneurship; and (3) risk aversion in family-owned SMEs, which discourages innovation-intensive or exploratory green entrepreneurial behavior. Therefore, MECs appear to function primarily as decision-level drivers of EP rather than as robust antecedents of dynamic green entrepreneurship [68].

In addition, the research did not include the risk-taking aspect of GEO, which is relevant to Pakistani SMEs. Although risk-taking plays a core role in EO, recent studies on green entrepreneurship suggest that SMEs in emerging markets are motivated by financial constraints, unstable institutions, and policy incentives to engage in risk-taking environmental strategies. From this perspective, GEO is a constructive, inventive approach, and the lack of policy incentives [69] to try and deal with the environment are contrary to risk-taking. GEO in this context is most appropriately viewed in terms of innovativeness and proactiveness, indicative of opportunity-seeking and adaptive environmental behavior rather than high-risk experimentation. This theoretical and empirical clarification confirms the construct validity of GEO in resource-limited contexts [7,25].

Also, the modest explanatory power for GEO in our model indicates that additional antecedents beyond GAC and MECs likely play a meaningful role, suggesting that future studies should explore broader organizational, strategic, and contextual drivers of GEO.

5.1. Theoretical Implications

This study contributes to the body of literature on sustainability because it provides a detailed theoretical model. It combines NRBV and DCV to explain which internal resources are transformed into greater environmental performance by SMEs. NRBV emphasizes

the strategic importance of green resources like GAC and MECs, which are rare, imitable, and may produce a sustainable competitive advantage when used properly. Further, DCV illustrates the transformation, renewal, and utilization of resources in changing and unpredictable environments to translate information and managerial objectives into tangible environmental responses of organizations [25,27].

Additionally, this study combines several theoretical approaches, which contributes to the better understanding of GEO as a dynamic capability. GEO connects internal resources to measurable environmental impacts. This study differentiates between capability-based drivers, e.g., GAC, and cognition-based drivers, e.g., MECs. The results indicate that GEO is the only mediator whereby absorptive capacity has an impact on environmental performance. This more explicit perspective defines the limits and causal processes of green strategies, eliminating the ambiguities that existed before and that were not proved properly [7,61].

Further, the study's findings are particularly relevant to SMEs in emerging economies, where resources are limited and institutional support is weak. These SMEs need to leverage internal capabilities and managerial cognition strategically. The results indicate that GAC and MECs jointly influence GEO, demonstrating that capability- and cognition-based factors simultaneously enhance proactive and innovative environmental behaviors. Consequently, this study strengthens the link between theoretical frameworks and empirical evidence, offering a robust foundation for understanding how SMEs can systematically deploy internal resources to achieve measurable environmental outcomes. This approach contributes to the literature on sustainable entrepreneurship and green management and provides managers and researchers with practical insights for improving sustainability strategies in resource-constrained organizations.

5.2. Practical Implications

The strategic development of absorptive capacity and knowledge-processing practices can help an SME to enhance its environmental performance. These functions facilitate the identification of green opportunities and creation of proactive entrepreneurship. Managers need to enhance the ability to gain environmental awareness and learning and align their thinking, focusing on making decisions that help in creating sustainability. Being environmentally conscious is not sufficient to initiate strategic entrepreneurship activities [16,21]. This highlights the importance of factors that not only enhance the skills capabilities of managers but also enhance managers' awareness of environmental considerations. Environmental practices may also be strengthened through sustainable approaches to business by SMEs [66], for instance, through the control of pollution, the creation of products that are environmentally friendly, and green growth. Collaborative networks are an important part of the cultural development of sustainability and the promotion of meaningful environmental initiatives.

Moreover, GEO is an environmental awareness initiative that equips firms to identify and exploit environmental opportunities to build expertise and foster green innovation. Investment in GAC allows SMEs to fully capitalize on environmental data by enabling scanning, sharing, and analysis of information. Both GAC and MECs are indirectly linked to GEO and environmental performance (EP). The direct connection between MECs and EP is relatively weak, highlighting that absorptive capacity must complement managerial commitment. Experimentation and GEO objectives further contribute to the development of green products and practices, leading to improved EP [67–69]. Green practices facilitated by GAC and GEO can prevent local pollution that disproportionately affects vulnerable populations, thereby promoting environmental justice [64,65]. By combining GAC, MECs, and GEO, SMEs can enhance societal welfare, expand the reach of sustainable innovation,

and optimize resource utilization. Although MECs alone may not trigger GEO, in combination with GAC, they can support innovative and proactive green strategies. SMEs can leverage environmental opportunities to facilitate cross-functional integration, disseminate sustainability knowledge, and promote green infrastructure innovation. Developing learning habits and knowledge acquisition processes enables SMEs to identify and respond to environmental opportunities, focusing on process and product improvement rather than high-risk initiatives. EP can also be enhanced through support from organizations and policymakers via green training, adoption of eco-friendly technologies, benchmarking and recognition systems, and structured reporting mechanisms. These frameworks transform managerial environmental foci into tangible results. This approach is particularly relevant for SMEs in resource-constrained emerging economies, where leveraging capability-based strategies such as GEO can effectively improve environmental performance and sustainability [16,21].

6. Directions for Future Research

To ensure that it is more reliable and generalizable, future research should take into consideration the limitations of the present study. Reduction of bias may be accomplished through the addition of self-reported survey information with external environmental performance indicators. It would be helpful to expand the sample to encompass more geographic regions and areas of service. Since the current study was cross-sectional, it would be appropriate to use a longitudinal design to elucidate the causes and effects between GAC, MECs, GEO and EP. The inclusion of contextual aspects like institutional forces, regulatory context, and cultural forces would provide more in-depth knowledge of the use of green strategies by SMEs, especially in resource-bound and developing markets.

Moreover, because GEO was measured without the risk-taking component in this study, future research should test whether incorporating risk-taking leads to different patterns of mediation or moderation within green innovation and sustainability models.

Further, this research study concerns SMEs in the context of a specific industry in Pakistan, which restricts generalization. Future studies should also expand sampling to different sectors and regions to increase applicability and reflect different institutional, infrastructural, and alliance impacts on green entrepreneurial practices and environmental performance. Specifically, industries other than the research field should be investigated since they have significant environmental effects.

Though the present study focuses on Pakistani SMEs, comparable linkages between leadership commitment, green capabilities, and GEOs and sustainability outcomes have been validated in China, MENA, and OECD economies. However, effect sizes are probably moderated by institutional pressures and stakeholder configurations, which necessitate local replication and a careful generalization across contexts [70,71]. Additionally, institutional pressures such as Pakistan's 2023 EPA amendments may influence firm-level environmental performance and should be considered as rival explanations.

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