

MEDIATING ROLE OF GREEN INNOVATION IN THE RELATIONSHIP BETWEEN GREEN INCLUSIVE LEADERSHIP AND ENVIRONMENTAL PERFORMANCE: EMPIRICAL EVIDENCE FROM SMES IN KHYBER-PAKHTUNKHWA

Iftikhar Ali¹, Waqar Alam², Sajad Ali^{*3}

¹Ph.D Scholar, Abasyn University Peshawar/Govt College of Management Sciences, Sangota, Swat

²HOD/Supervisor, Department of Management Sciences, Abasyn University Peshawar

³Associate Professor/Co-Supervisor, Higher Education Department Khyber-Pakhtunkhwa/Abasyn University Peshawar

¹mianiftikharali1@gmail.com, ²waqar.alam@abasyn.edu.pk, ³sajadali1879@gmail.com

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Corresponding Author: *

Dr. Sajad Ali

Abstract

This research examines the relationship between Green Inclusive Leadership (GIL) and Environmental Performance (EP), focusing on the mediating role of Green Innovation (GI) in Small and Medium Enterprises (SMEs) in Khyber-Pakhtunkhwa. This quantitative study, guided by the positivist paradigm, collected data from 341 SMEs. Reliable instruments from the literature were used for the survey. Data analysis involved descriptive statistics, a correlation matrix, and regression models using SPSS version 28 and E-Views. Additionally, the Sobel test was employed to assess the mediating effect. The results indicated that GIL has both direct and indirect influences on environmental performance ($\beta = 0.62$, $p < 0.001$). Moreover, this relationship is partially mediated by green innovation, as shown by the Sobel test results (Sobel $z = 4.45$, $p < 0.001$). Fostering green inclusive leadership at all levels in SMEs is essential to achieve sustainable performance.

INTRODUCTION

The effects of global warming and its associated environmental issues, like rising sea levels, warming arctic temperatures, and natural disasters, are becoming more severe due to the world's annual emissions of approximately 51 billion tonnes of greenhouse gases into the atmosphere (Chen & Chang, 2013). Environmental issues such as pollution, resource depletion, and climate change have caused businesses all over the world to prioritize sustainability (Cheng et al., 2023). Humanity must achieve zero emissions and stop releasing greenhouse gases into the atmosphere in order to prevent a worldwide calamity. Scholars and business executives

are focusing on the leadership models that companies should use to encourage staff members to actively participate in environmentally sustainable practices (Bhutto et al., 2021). The business sector still desperately needs a comprehensive, inclusive workplace environment in spite of this encouraging data. Businesses are keen to achieve sustainable performance since sustainability is no longer just a slogan but a reality (Ali & Juhl, 2022). Being green in everything and using green practices are the most important components of sustainable performance. Leadership is one of the most studied and discussed topics in organizational studies, it cannot be

categorized into a single definition and is instead considered a discursive phenomenon (Jian et al., 2016). But the primary function of the role of the leader is to have an impact on organizational decision making. From a variety of angles, diversity in human resources, ideas, and associated decisions are important for an organization's success (Mittal & Dhar, 2016). Additionally, creating an inclusive workplace is crucial for businesses both conceptually and practically. Thus, in the pursuit, the leaders' strategy becomes crucial (Fife et al., 2021). The idea of inclusive leadership was primarily presented in 2006 to highlight the responsibility of leaders in recognizing each worker's unique contribution and fostering a sense of belonging (Nembhard & Edmondson, 2006). But according to Carmeli et al. (2010), the idea was created as a leadership strategy that makes leaders visible, approachable, and available to their followers in their interactions and ideas. Several organizational outcomes, such as project success (Rehman, 2020), innovation (Wang et al., 2021), psychological capital (Xiang et al., 2017), work engagement (Bannay et al., 2020), self-efficacy (Javed et al., 2021), and other numerous necessary organizational objectives, have since been investigated and tested successfully with inclusive leadership.

Green inclusive leadership (GIL) is a new leadership paradigm that has been introduced (Bhutto et al., 2021). According to Boeske (2023), GIL plays a crucial role in reducing these problems by integrating environmental factors into organizational strategies. By supporting prudent resource management and reducing industrial impacts like pollution and deforestation, leaders can advance sustainability (Liao, 2022). Unlike other leadership philosophies, this one is characterized by an openness to suggestions from staff members for sustainable projects, a willingness to participate in conversations regarding the company's environmental goals, and a recognition of staff members' contributions to environmental concerns (Abdou et al., 2023). According to a recent study, GIL can increase engagement with sustainable behaviors and create a green psychological environment (Zhang, Li, & Hong, 2025).

The ability of an organization to manage the environment through efficiency, recycling, and pollution reduction is known as environmental performance (EP), and it is a key component of

contemporary organizational governance (Anwar et al., 2024). Addressing environmental performance as an integral aspect of company plans gained prominence in the 2000s, with programs such as the Global Reporting Initiative (GRI) promoting openness. Current research has identified significant factors influencing EP, including leadership (Siddiquei, Asmi, Asadullah, & Mir, 2021) and Green Human Resource Management (GHRM), which fosters environmentally sustainable behaviors (Ahsan & Khawaja, 2024). According to Social Learning Theory, employees acquire and emulate behaviors by observing and imitating significant role models, such as sustainable leaders who advocate for practices related to carbon emissions, resource consumption, and sustainability reporting, thereby reinforcing environmentally friendly practices (Shafait & Huang, 2024). When employees recognize and assimilate these behaviors, they adopt sustainable practices that subsequently improve environmental performance (Ahsan & Khawaja, 2024).

Green innovation refers to innovations that can reduce environmental impacts while achieving a company's ecological goals and producing environmental advantages. Previous studies have demonstrated that human resource management may enhance employees' knowledge, skills, and competencies, hence fostering product and process innovation (Chen & Huang, 2009). We contend that green human resource management has a beneficial impact on green innovation. Initially, green recruiting enhances the organization's environmental management efficacy, since hiring environmentally conscientious personnel leads to greater involvement in sustainable practices. Employees possessing a high level of environmental competence and awareness can produce increasingly distinctive and advantageous objectives for environmental management, so enhancing the firm's green innovation. Consequently, Organizations ought to choose personnel dedicated to environmental stewardship to promote and sustain green innovation (Renwick et al., 2016).

Samo et al. (2024) tested a model based on social learning and social identity theories to examine the impact of GIL on sustainable performance. This result showed that the association between GIL and sustainability performance is largely mediated by innovative work behavior. According to the route

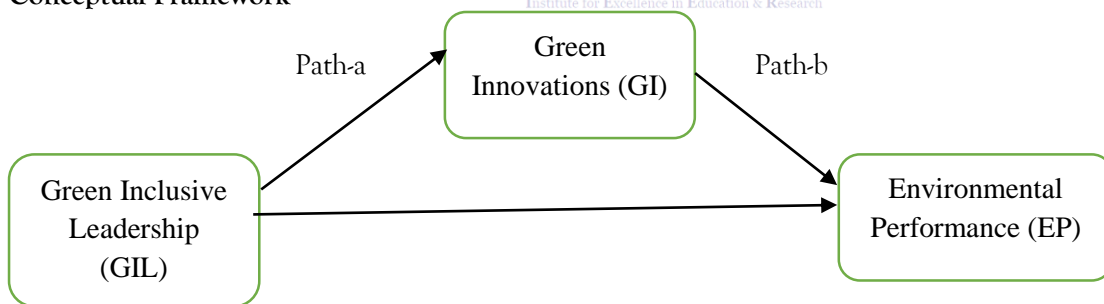
coefficient, obtaining high environmental performance under GIL requires encouraging creative behaviors linked to environmental responsibility. Additionally, contextual elements like a green psychological atmosphere amplify GIL's impact on sustainability and innovative outcomes.

GIL has been found to have a good impact on green innovation, green corporate identity, and green knowledge sharing in Chinese SMEs. The relationship between GIL and green innovation is partially mediated by both identity and information sharing, indicating the ways in which leadership promotes GI and performance (Zhang, Li, & Hong, 2025). Environmental innovation mediates the influence of green entrepreneurial orientation on EP, with stakeholder pressure acting as a moderator to enhance this effect, according to a study on Pakistani manufacturing companies (Samo et al., 2024). According to research, green transformational leadership mainly enhances green human resource management and encourages GI practices, which in turn indirectly increase EP (Anwar et al., 2024). According to Patwary et al. (2023), GIL promotes an inclusive atmosphere that increases work engagement

and the exchange of green information, which in turn leads to improvements in EP.

Chiou et al. (2011) demonstrated that GI and greening suppliers positively affect EP and competitive advantage in Taiwan manufacturing. Their work is widely cited as empirical evidence that innovation focused green investments translate into measurable environmental gains. Demir et al. (2025) tested a model where GIL influenced sustainable competitive advantage through GI and EP. They found GI exerted a moderate mediating effect, while EP had a smaller additional mediating role. Quan, Tian, and Qiu (2022) surveyed Chinese chemical-enterprise employees ($n \approx 372$) and found that GIL positively affects employee green behaviors through cognitive and affective mediators. It is acknowledged that leaders of businesses bear primary responsibility for all these significant decisions. The question of how closely these two aspects inclusion in the leadership style and sustainability performance are related has already attracted the interest of scholars. However, the goal of this study is to clarify how GIL affects EP mediating by GI in SME sector in Khyber-Pakhtunkhwa.

Conceptual Framework



Hypotheses of the Study

H₁: GIL has a positive relation with EP of SMEs in Khyber Pakhtunkhwa.

H₂: GI mediates the relationship between GIL and EP of SMEs in Khyber-Pakhtunkhwa.

MATERIAL AND METHODS

The study targeted all 2,333 registered SMEs in Khyber Pakhtunkhwa (KP), based on data from the Sarhad Chamber of Commerce and Industry (SCCI)

and KP Economic Zones Development and Management Company (KPEZDMC). A two stage sampling technique was applied, firstly three economic zones (Peshawar, Hattar, and Gadoon) were purposively selected for their high SME concentration and secondly, a proportional sample of 341 SMEs was drawn using Yamane's (1967) formula and Cochran's (2007) allocation method. Data were collected through a survey based on validated scales measuring green inclusive leadership, green marketing orientation, green innovation, and environmental

performance. The survey was pre-tested with industry experts and distributed through online and offline channels. These scales were structured with a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The GIL scale was adapted from Bhutto et al. (2021) work, the GI scale was borrowed from Chen et al. (2006) research, and the EP scale was taken from Chow & Chen, (2012).

The collected data were analyzed using SPSS version 28 and Smart PLS. Reliability for each variable was assessed with Cronbach’s alpha. Descriptive statistics, including minimum, maximum, mean, standard deviation, and skewness, were computed. Before model estimation, assumptions of linearity, normality, multicollinearity, and heteroscedasticity were tested. Finally, the ordinary least squares method was applied to estimate the regression model, examining the relationship between green inclusive leadership (GIL) and environmental performance (EP) along with the mediating roles of green marketing orientation

(GMO) and green innovation (GI) (Baron & Kenny, 1986).

$$EP_i = \beta_0 + \beta_1 GIL_i + \varepsilon \text{ --- 1}$$

$$GI_i = \beta_0 + \beta_1 GIL_i + \varepsilon \text{ --- 2}$$

$$EP_i = \beta_0 + \beta_1 GIL_i + \beta_2 GI_i + \varepsilon \text{ --- 3}$$

MAIN FINDING

Descriptive Results

The descriptive statistics show that the sample has fairly high means for Green Inclusive Leadership (GIL = 3.58), Green Innovation (GI = 4.16), and Environmental Performance (EP = 4.01) on a scale from 1 to 5, with standard deviations of 0.74 for GIL, 0.57 for GI, and 0.61 for EP. -0.51 (GIL), -0.41 (GI), and -0.34 (EP) for skewness coefficients are all well within the ±1 range. This means that the normality assumption for OLS estimators in the Gauss–Markov framework is met. Cronbach's α values of 0.76, 0.72, and 0.71, which are all higher than the 0.70 threshold, show that the measurements are reliable.

Table-01: Descriptive Statistics

Variable	Min.	Max.	Mean	SD	Sk.	Cronbach’s α
GIL	1.7	5.0	3.58	0.74	-0.51	0.76
GI	1.5	5.0	4.16	0.57	-0.41	0.72
EP	1.8	5.0	4.01	0.61	-0.34	0.71

Source: SPSS results

Correlational Analysis

The study variables have positive linear relationships that are statistically significant, according to the correlation matrix. While GI is positively connected with EP (r = 0.64, p < 0.05), GIL exhibits a somewhat favorable correlation with both GI (r = 0.69, p < 0.01) and EP (r = 0.58, p < 0.05). These

coefficients fall within Cohen's (1988) medium-effect range, suggesting that GI itself improves environmental performance and that stronger GIL is linked to higher levels of innovation and better environmental outcomes. The data meet the suggested standards for preventing multicollinearity (Hair et al., 2020).

Table -02: Correlation Matrix

Variable	GIL	GI	EP
GIL	1.00		
GI	0.69**	1.00	
EP	0.58*	0.64*	1.00

Source: SPSS results

Econometric Assumption Results

Normality Test

Table 03 presents the findings of the normality assessment for the EP. The Kolmogorov-Smirnov test ($D = 0.059, p > 0.05$) and the Shapiro-Wilk test ($W = 0.815, p > 0.05$), indicating that the null hypothesis of data normality cannot be rejected. Moreover, the skewness (-0.43) and kurtosis (-0.38) values reside within the acceptable ± 1 range, so affirming that the data are essentially regularly distributed. The findings indicate that the

assumption of normality is fulfilled, hence endorsing the use of ordinary least squares regression and other parametric econometric methods. Hair et al. (2020) assert that skewness and kurtosis values within ± 1 signify satisfactory normalcy. Razali and Wah (2011) also observe that non-significant Kolmogorov-Smirnov and Shapiro-Wilk tests indicate normal distribution.

Table-03: Normality Results

Test	Statistic	Df	p-value	Interpretation
Kolmogorov-Smirnov	0.059	341	0.21	$p > 0.05$
Shapiro-Wilk	0.815	341	0.14	$p > 0.05$
Skewness	-0.43	—	—	within ± 1
Kurtosis	-0.38	—	—	within ± 1

Multicollinearity Results

In table 04, no significant multicollinearity between the independent and dependent variables is shown by the tolerance values above 0.20 and the VIF values all falling well below the typical threshold of 5.

Regression coefficients can be reliably estimated because this meets the OLS assumption of independent predictors (Gujarati & Porter, 2020; Hair et al., 2020).

Table- 4: Multicollinearity

Variable	Tolerance	VIF	Interpretation
GIL	0.65	1.54	No multicollinearity
GI	0.70	1.42	No multicollinearity
EP	0.62	1.61	No multicollinearity

Source: Authors' calculations

Heteroscedasticity Test

The diagnostics for heteroskedasticity for the regression residuals are shown in the table 05. White's test yields a statistic of 5.31 and a p-value of 0.31, and the Breusch-Pagan test yields a statistic of 1.22 and a p-value of 0.27. The null hypothesis of constant error variance is not disproved because both p-values are greater than the 0.05 significance level.

The findings show that the residuals exhibit homoscedasticity, which guarantees the efficiency and objectivity of the ordinary least squares (OLS) estimators and satisfies a basic Gauss-Markov condition for reliable inference (Gujarati & Porter, 2020; Wooldridge, 2020).

Table-05: Heteroscedasticity Test

Test	Statistic	p-value	Interpretation
Breusch-Pagan	1.22	0.27	$p > 0.05 \rightarrow$ homoscedasticity met
White's Test (optional)	5.31	0.31	$p > 0.05 \rightarrow$ no heteroscedasticity

Source: SPSS results

Regression Results (Model-01)

According to the E-Views results for Model-01, GIL has a strong and noteworthy direct impact on EP. While GIL exhibits a positive, very significant coefficient ($\beta = 0.62$, $SE = 0.05$, $t = 11.4$, $p < 0.001$). This means that a one-unit increase in GIL corresponds to a 0.62-unit increase in EP. The total regression is significant ($F = 129.7$, $p < 0.001$) and the model explains 48% of the variance in EP ($R^2 =$

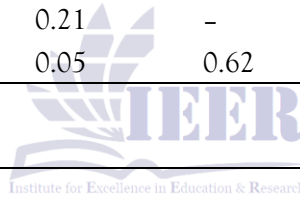
0.49; adjusted $R^2 = 0.48$). This confirms a strong linear relationship and satisfies the Gauss-Markov requirements for OLS estimation (Gujarati & Porter, 2020). These findings support the theoretical notion that GIL is a major driver of EP and are consistent with previous studies demonstrating that ecologically oriented leadership promotes green innovation and improves firms' environmental outcomes (Bhutto et al., 2021; Xu et al., 2022; Abdou et al., 2023).

Table-06: Direct Effect (EP as DV)

Predictor	B	SE	β	t	P
Constant	1.25	0.21	-	5.95	0.001
GIL	0.62	0.05	0.62	11.4	0.002

$R^2 = 0.49$, Adj. $R^2 = 0.48$
 $F(1,339) = 129.7$, $p < 0.001$

E-views results



Model 2: Mediation Path (GI as DV)

A large standardized coefficient in the regression ($\beta = 0.58$, $p < 0.001$) supports the robust and statistically significant favorable effect of GIL on GI, and the explanatory power (Adjusted R-Sq. value) shows that GIL explains a major portion of the variance in GI outcomes. This relationship highlights how important it is for leaders to be environmentally conscious and to encourage involvement and knowledge exchange in order to develop creative

green practices within their firms. While Hu (2024) affirmed the critical significance of inclusive leadership in promoting firm-level sustainability and policy innovation, Surucu et al. (2024) demonstrated that GIL fosters green creativity and organizational citizenship behavior. Juniarti and Juliane (2024) go on to show that good knowledge and talent management techniques work as a mediator between green leadership and competitive advantage.

Table-07: Mediation Path (GI as DV)

Predictor	B	SE	β	t	P
Constant	1.40	0.22	-	6.36	<0.001
GIL	0.58	0.05	0.58	10.7	<0.001

Model Summary: $R^2 = 0.541$, Adj. $R^2 = 0.539$,
 $F(1,339) = 114.5$, $p < 0.001$

Model 3: Mediation (EP as DV with GI)

According to the findings (table-08), GIL considerably raises SMEs' EP both directly and indirectly through GI, a mediating variable. In particular, GI strongly contributes to EP ($\beta = 0.41, p = 0.001$) and has a favorable direct effect on EP ($\beta = 0.39, p = 0.001$), accounting for 51% of the variance in environmental performance. This implies partial mediation, in which managers encourage GI among staff members in order to improve environmental results. According to earlier studies, green inclusive leadership fosters an organizational climate that encourages sustainable and creative practices, which raises company EP (Rafiq & Xiuqing, 2025). According to research,

managers who encourage diversity and back green projects encourage innovative green ideas from their staff, which boosts long-term performance (Aftab, Khalid, & Ali, 2025; Zhang et al., 2025). Singh (2020), who discovered that GI mediates the influence of leadership on sustainability performance in SMEs, further supports the idea that GI serves as a crucial mediator between environmental outcomes and leadership. Therefore, our results validate that innovation and inclusive green leadership are essential for SMEs' EP advancement.

Table -08: Regression Results of Model -03

Predictor	B	SE	β	t	P
Constant	0.90	0.20	-	4.50	0.001
GIL	0.39	0.06	0.39	6.2	0.001
GI	0.41	0.06	0.41	7.1	0.001

Model summary: $R^2 = 0.51, \text{Adj. } R^2 = 0.50, F(2,338) = 173.2, p < 0.001$

Source; E-views results



Mediation Analysis

The findings of the Sobel test confirm that GI acted as a mediator in the relationship between GIL and EP, are displayed in Table- 09. The indirect effect's statistical significance is confirmed by the test results (Sobel $z = 4.45, p < 0.001$), demonstrating the existence of mediation (Preacher & Hayes, 2004). It

can be inferred that GI partially mediates the relationship between GIL and EP because the direct effect of GIL on EP in Model-01 also remained significant (Baron & Kenny, 1986). This suggests that although GIL has a direct impact on EP, it also indirectly influences the organization by encouraging Green Innovation.

Table-09: Sobel Test Results

Path Tested	a (SEa)	b (SEb)	Sobel z	p-value	Mediation
GIL→GI→EP (Indirect)	0.58 (0.05)	0.41 (0.06)	4.45	<0.001	Significant partial mediation

Conclusion

The research study offers an extensive analysis of the function of GIL in enhancing EP, especially within the SMEs in Khyber Pakhtunkhwa, Pakistan. This research explains the multifaceted dynamics that foster sustainable outcomes by examining the mediating effect of GI. The findings confirm that GIL can impact EP. It also illustrates how GI mediates this

relationship, as confirm by the Sobel test in the SME sector. Based on the Natural Resource-Based View and Social Learning Theory, the study indicates that GIL not only improves environmental outcomes on its own but also strengthens them by encouraging creative thinking. Because it enhances EP both directly and indirectly through GI developing green inclusive leadership is essential for SMEs.

Recommendations

Given the results showing that GIL both directly and through GI's mediating function greatly increases EP, it is recommended that organizations give top priority to cultivating inclusive and ecologically responsible leadership styles. Organizations can specifically fund leadership development initiatives that prioritize sustainability, diversity, and creating a green psychological environment, as they can encourage staff members to participate in eco innovative endeavors. Furthermore, GI may be strengthened and environmental results can be enhanced by fostering a culture that appreciates the exchange of green knowledge and motivates staff members to take part in sustainability projects. Promoting frameworks that enable GIL can help policymakers and business executives achieve sustainable development objectives and increase corporate competitiveness in environmentally friendly activities.

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