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## Role of transformational leadership in shaping green innovation and organizational citizenship behavior: evidence from the pharmaceutical sector of Pakistan

### Abstract

**Research background and purpose:** Pharmaceutical industry has been severely impacted by environmental and economic crisis, and implementing green innovation within the pharmaceutical sector necessitates the adoption of novel technologies and practices to promote sustainable operations. Innovation allows businesses to stay ahead of the curve by developing new greener market offerings. However, employee involvement in the innovation and creative thinking process is a big challenge. The purpose of this study is to find the impact of green transformational leadership on green innovation and organizational citizenship behavior with the mediating role of green employee involvement.

**Design/methodology/approach:** A convenient sampling technique was used to collect the data from 408 respondents in the form of questionnaire, which was distributed online using a 5-point Likert scale. Partial Least Square structural equation modeling (PLS-SEM) was employed for the assessment of path analysis.

**Findings:** The results showed that transformational leadership is strongly associated with green innovation and organizational citizenship behavior. The results also confirmed partial mediating effect of green employee involvement.

**Value added and limitations:** The research highlights the mediating role of green employee involvement in the relationship between green transformational leadership and desired outcomes; organizational citizenship behavior and green innovation which contributes in the extent literature. This study employed a cross-sectional design, which may limit the ability to capture changes and variations over time. Conducting a longitudinal study instead could yield different outcomes and provide a greater comprehension of the variables that are important.

**Keywords:** *organizational citizenship behavior, employee involvement, green innovation, transformational leadership*

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## 1. Introduction

The global recognition of the depletion of natural resources has led to a heightened consciousness of environmental concerns. Consequently, organizations have redirected their efforts toward the creation of sustainable practices, and the provision of environment friendly services. Industries have recognized that businesses cannot survive and thrive in today's highly competitive marketplace unless concentrating on the concept of green innovation to increase efficiency and productivity in business operations (Baeshen et al., 2021). Due to popular environmental trends, green innovations have emerged as one of the most vital strategic tools for achieving sustainable development within industrial sectors. However, involvement of employees in the green innovation process is an arduous task. Studies suggest that organizations should focus on green employee behaviors to achieve desired organizational and environmental outcomes (Patwary et al., 2022; Shah & Soomro, 2023).

Studies show that transformational leadership sets the foundations for green innovations (Sidney et al., 2022). Green transformation leadership as defined by Perez et al. (2023), entails a proactive and strategic leadership style that prioritizes sustainability and environmental stewardship within organizational contexts. It encompasses the ability of leaders to inspire and motivate employees, and embrace their eco-friendly practices and fostering a culture centered on sustainability. Through guidance, these leaders drive the necessary organizational changes towards greener practices. Green transformational leadership sets itself apart from conventional leadership styles through its heightened emphasis on sustainability and environmental stewardship (Seema et al., 2025). While traditional leadership models primarily revolve around attaining organizational objectives and maximizing profitability, green transformational leadership transcends these customary aims. It prioritizes the integration of environmentally conscious practices, the advancement of sustainable behaviors, and the fostering of an organizational culture steeped in environmental responsibility (Ismail, 2025).

Transformational leadership approach encourages employees to exceed expectations in different ways; including employee performance and creativity, and therefore enhances their inner strength and outer attitudes. By developing a shared vision inside the organization, it is possible to create and foster a green culture at all levels. Therefore, leadership's dedication towards and endorsement of policies pertaining to environmental management has an impact on the development of a green culture (Rizvi & Garg, 2021). Green transformational leadership enhances employee involvement which not only supports employees to accomplish environmental objectives, and also enhances business performance (Alwali & Alwali, 2025; Du & Yan, 2022).

Green culture may encourage employees to act greener by enabling employees to connect socially (those who work with colleagues, staff, and leadership) with more

dedication as well as in ways that are compatible with protecting the environment behaviors. From a particular perspective, social connection will enhance employees' social development by means of their actions and behaviors and participation in green behaviors, like reducing waste, conserving energy, and motivating employees to safeguard the environment (Khan & Khan, 2022). From other perspective, the setting in which environmentally friendly practices are implemented might have an impact on employees' environmental relevance (Biswas et al., 2022). These can encourage the adoption of eco-friendly behaviors among employees by fostering green transformational leadership and shared environmental standpoint among employees (Tao, 2025).

The service industries face critical sustainability challenges due to resource constraints and material scarcity in production. The pharmaceutical sector, in particular, confronts resource constraints and scarcity of vital raw materials for drug production, resulting in rising costs and potential supply chain disruptions. These industries contribute to environmental degradation through waste generation and inefficient resource utilization, necessitating the adoption of circular economy practices (Chiappetta Jabbour et al., 2019). However, slow innovation and collaboration hinder the integration of sustainable alternatives. To secure the long-term viability of these sectors, pharmaceutical industries must take proactive measures such as promoting sustainable practices, fostering green innovation, and enhancing collaboration among stakeholders to minimize environmental impact while meeting societal needs (Chaturvedi et al., 2017). In developing countries such as Pakistan resources are limited and pharmaceutical sector strives for product and process innovation to remain competitive in market (Shehzad et al., 2023). Implementing sustainable practices, green innovation, and efficient resource management are essential for the industry's future.

This study aims to address the existing research gap through various approaches. Meidute-Kavaliauskiene et al., (2021) suggested investigating green innovation and organizational citizenship behavior in the presence of green transformational leadership style to mitigate future environmental hurdles in developing countries such as Pakistan, which is still lagging behind in addressing climate issues at different levels. Various studies have been conducted to foster green innovation, but they have not explored the mediating role of green employee involvement (Pham et al., 2019). Employees' participation in the green activities helps the organization to achieve its green goals, increase the possibilities for innovation. Khan et al. (2025) highlighted the importance of green involvement in fostering green innovation in the service sector, however its role in manufacturing sector needs to be explored. The research aims to examine the role of Green Transformational Leadership in shaping green innovation and organizational citizenship behavior in the pharmaceutical sector of Pakistan. Furthermore, this research investigated the role of green employee involvement as mediator between green transformational leadership, green innovation and organizational citizenship behavior to determine the relationship.

It examines the variables within a unique context of pharmaceutical industry, which were previously lacking in scholarly discourse. This research holds significant academic value by offering actionable guidance to pharmaceutical companies, industry associations, and policymakers in developing sustainable development strategies alignment with global standards.

## 2. Literature review

### 2.1. Green transformational leadership, green innovation and organizational citizenship behavior

Studies investigated the role of leadership styles and philosophies help in shaping positive employee behavioral outcomes (Haque et al., 2021). Traditional leadership styles often overlook or underestimate the significance of sustainability and environmental considerations. These styles tend to center on traditional business metrics, such as financial performance and market competitiveness, without explicitly integrating ecological concerns into the organization's agenda (Piwowar-Sulej & Iqbal, 2023). The concept of green transformational leadership builds upon the foundational framework of transformational leadership proposed by Bass (1985). Extending this perspective, Chen and Chang (2013) referred green transformational leadership as an expansion of transformational leadership to the area of environmental preservation that inspires employees to go above and beyond the required environmental standards. It is characterized by leaders articulating and motivating their followers to pursue eco-friendly goals and inspiring them to exceed their own expectations in environmental performance (Farrukh et al., 2022). It entails leaders taking proactive actions to promote and achieve sustainability objectives within the organization. Employees are more likely to take environmental action when leaders communicate in a democratic and open manner about environmental issues (Weber & Kassab, 2024).

Innovation has frequently been regarded as a crucial tactic for the competitiveness as well as achievements of goals. Green innovation (GI) is defined as “transformation that contains modified procedures, practices, infrastructures, and products that serve the environment as well as promote environmental sustainability (Meidute-Kavaliauskiene et al., 2021)”. According to Xie et al. (2019), innovation is the powers that enable industries to increase their competitive advantage. Furthermore, GI is an advancement that relates to environmentally friendly production methods, such as pollution control, energy conservation, waste utilization, environmental management, product design and development (Chen et al., 2006).

Chen et al. (2025) found that green transformational leadership plays a significant role in driving green innovation in the mega projects of construction industry. Leadership influences the green thinking process of the employees and encourages the creative

process engagement which ultimately leads towards innovative solutions (Begum et al., 2022). Anwar et al. (2020) claimed that organizational citizenship behavior among employees is significantly influenced by green transformational leadership. In services sector, leadership shapes the behavior of employees and motivates them to find environmental solutions (Priyadarshini et al., 2023). Similarly, it is found that GTL is also associated with green technology innovation in the hi-tech companies of China (Waqas et al., 2024). In textile industry of Pakistan, GTL is found to be linked with positive organizational outcomes including green innovation and green sustainable development. Surprisingly, role of GTL in the pharmaceutical sector is yet to be explored.

Organizational Citizenship Behavior (OCB) refers to “the performance that enhances the social and psychological climate within which task performance occurs” (Organ, 1988, p. 4). As the term “organizational citizenship” was subsequently proposed by organ, which observed three kinds of behaviors that are essential for attaining high levels of industrial effectiveness. First, individuals must enter and remain in the industry. Second, they must consistently fulfill the assigned role delegated to them. Finally, they must occasionally exhibit innovative and collaborative behavior beyond their designated responsibilities but also in support of industrial goals. According to Pham et al. (2021), OCB refers to voluntary behaviors exhibited by individuals that are not directly tied to monetary rewards but contribute to the whole performance and effectiveness of the organization. Studies found that transformational leadership positively influences the employees organizational citizenship behavior which leads towards better of performance and green creativity (Öğretmenoğlu et al., 2022; Shah & Shukla, 2025). Similarly, Priyadarshini et al. (2023) found that green transformational leadership promotes green empowerment and organizational citizenship behavior in IT of India. In the manufacturing sector, green organizational climate mediates the relationship between transformational leadership and green innovation (Liu & Yu, 2023). However, the role of transformational leadership is unexplored in the pharmaceutical sector particularly in the emerging economy such as Pakistan, and this study aims to fill this gap.

Considering the above literature, following hypotheses are suggested:

- H1. Green transformational leadership is positively related to green innovation.*
- H2. Green transformational leadership is positively related to organizational citizenship behavior.*

## 2.2. Mediating role of green employee involvement

The degree to which employees participate in sustainability initiatives, and are encouraged to offer their thoughts and feedback on the industry's green objectives and practices is referred to as green employee involvement (Shoaib et al., 2022). Green

employee engagement is a closely related concept but it emphasized on psychological state of employees and commitment to environmental goals, whereas green involvement is particularly related to behavioral and decision-making aspects (Tang et al., 2023). Beraldin et al. (2022) describe employee involvement as the extent to which employees spread wisdom, expertise, benefits, and authority within the firm. Green involvement helps in achieving job related favorable outcomes, such as green job satisfaction and green empowerment (Kaur & Mittal, n.d.). Employees are more likely to feel special and passionate about the organization when they participate in decision-making practices, which can enhance career progression, work performance, and organizational citizenship behavior.

According to Hwang and Choi (2017), in order to foster innovative behavior and successful innovation among organizational employees, organizational culture may encourage employees to acknowledge innovation and organizational modifications as components of the underlying principles of their organization. Pham et al. (2020) argued that green involvement not only enhances citizenship behavior but its interaction effect with green training helps in achieving environmental performance in the organizations.

Patwary et al. (2022) found that green involvement has a direct relationship with green citizenship behavior in hotel industry. Similarly, Malokani et al. (2023) investigated the mediating role of green involvement in the hospitality industry of Pakistan, and found that it is positively associated with the citizenship behavior of the employees. Studies found that green employee involvement helps in green performance management and organizational citizenship behavior (Patwary et al., 2022). Employees who are more involved in taking green initiatives also act more responsible towards other organizational citizenship initiatives (Malokani et al., 2023). Green involvement is relatively a new construct and often confused with green employee engagement. Above mentioned studies establish that green involvement is linked to green innovation and organizational citizenship behavior, but mediating role has been underexplored. Furthermore, leadership plays a critical role in creating an inductive environment where employees' involvement can be enhanced in green innovation process. It entails establishing a work environment where employees are motivated to contribute their suggestions, abilities, and expertise to the accomplishment of their objectives. Therefore, following hypotheses are suggested based on above mentioned literature:

*H3. Green transformational leadership is positively related to green employee involvement.*

*H4. Green employee involvement is positively related to green employee innovation.*

*H5. Green employee involvement is positively related to organizational citizenship behavior.*

*H6. Green employee involvement mediates the relationship between transformational leadership and (a) green innovation, and (b) organizational citizenship behavior.*

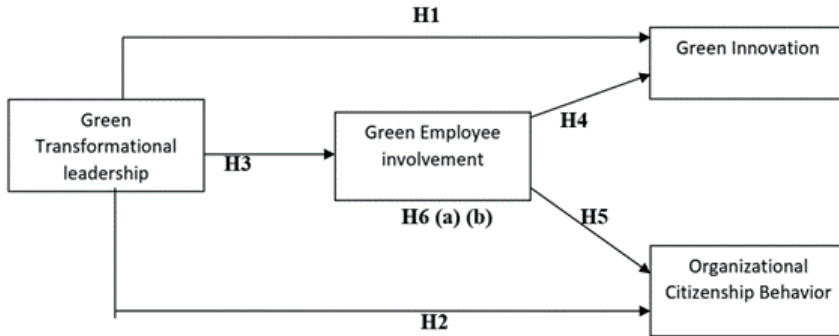


Figure 1. **Conceptual framework**

Source: own study

### 3. Methods

Research methodology includes the framework, strategy, and methodology used to compile and examine data, evaluate results, and make conclusions. In research, the term “population” is used to describe the overall assortment of people, organizations, or other factors that the researcher is interested in (Gall et al., 2021). The current research study population is the employees of pharmaceutical sector, which covers different companies inculcated in manufacturing, distribution, research and development of different pharmaceutical products.

Selecting the right sample size for statistical analyses is crucial, but agreement on the optimal size is lacking (Hair, 1998). A sample of 300 respondents is considered favorable for SEM analysis (Kline & Little, 2016). Hair (2019) advised that minimum 200 samples are recommended for SEM assessment, however a large sample size provides better results for generalizability. Considering the nature and complexity of the study, the questionnaire was sent to a cohort consisting of approximately 450 participants, and a total of 417 individuals provided their responses. Following a meticulous evaluation, it was established that only 408 of these responses satisfied the predetermined criteria for inclusion in the subsequent analysis.

This research utilized a convenience sampling technique, it includes individuals who were both willing to participate and readily accessible. Data was collected in the month of December, 2024 to February, 2025. A preamble was included at the beginning of the questionnaire, explicitly stating that participants’ involvement in the survey would be anonymous and voluntary, and emphasizing the strict maintenance of confidentiality regarding their data and responses.

The study used adapted measures from the previous studies (Table 1). Green Transformational Leadership Scale (GTLS) was developed by Podsakoff (1996), Green Innovation Scale (GIS) was developed by Chiou et al. (2011), Organizational Citizenship Behavior Scale (OCBS) was developed by Raineri and Paillé (2016), Green Employee Involvement Scale (GEIS) was developed by Tang et al. (2018). Respondents were asked to rate their level agreement with each item using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Measures and sources

Variable	Abbreviations	Source	Item	Scale
Green transformational leadership	GTL	Podsakoff, 1996	6	5-point Likert Scale
Green innovation	GI	Chiou., et al 2011	9	5-point Likert Scale
Organizational citizenship behavior	OCB	Rainere & Paille, 2016	7	5-point Likert Scale
Green employee involvement	GEI	Tang et al.,2018	5	5-point Likert Scale

Source: own study

#### 4. Analysis

Descriptive analysis (Table 2) of the sample shows that male respondents representing the majority at 81.1% (331 individuals), while the female respondents accounted for 18.9% (77 individuals). 47.1% of the respondents were below 26 years of age, while 51.0% fell within the age range of 26 to 40. Only 2.0% of the respondents were aged 41 and above. Notably, this study highlights a higher percentage of young respondents. Table 2 reveals that a small proportion, specifically 0.7% of the total sample, possessed a high school qualification. In contrast, a substantial majority, constituting 78.9% of the participants, held a bachelor's degree. Furthermore, a notable percentage of 20.3% of the respondents were qualified at the master's or doctoral level, indicating a significant representation of individuals with advanced academic credentials. 75.7% of the sample, reported having less than 3 years of experience. In contrast, 24.3% of the respondents indicated possessing 3 or more years of experience.

Table 2. Demographics

		Frequency	Valid percent	Cumulative percent
<b>Gender</b>	Male	331	81.1	81.1
	Female	77	18.9	100.0
	Total	408	100.0	
<b>Age</b>	Below 26	192	47.1	47.1
	26-40 years	208	51.0	98.0
	41 and above	8	2.0	100.0
	Total	408	100.0	
<b>Education</b>	High school	3	0.7	0.7
	Bachelor degree	322	78.9	79.7
	Masters/PhD	83	20.3	100.0
	Total	408	100.0	
<b>Experience</b>	Less than 3 years	309	75.7	75.7
	3 or more years	99	24.3	100.0
	Total	408	100.0	

Source: own study

#### 4.1. Measurement model analysis

Factor loadings indicate the strength and direction of the association between each observed variable and its corresponding latent construct. The interpretation of factor loadings involves examining their magnitude and statistical significance. Generally, factor loadings above 0.50 are considered acceptable, while loadings above 0.70 are considered strong.

The reliability of scales was assessed by Cronbach's Alpha, Composite reliability and Average Variance Extracted, indicate a favorable level of instrument consistency reliability (Table 3). All scale values surpass the threshold of 0.70, signifying the robustness of the factor scales for measurement purposes. Specifically, the values of Cronbach's Alpha range between 0.80 and 0.95, denoting the substantial strength of the scales. Moreover, the values of Average Variance Extracted exceed the threshold limit of

0.50, further establishing the reliability of the scales for utilization. Figure 2 showed the output of measurement model diagram.

Table 3. Item loadings and reliability analysis

Items	Factor loadings	Cronbach's alpha	Composite reliability	AVE
GE1: „My company has a clear developmental vision to guide my actions in environmental management.”	0.799	0.892	0.892	0.624
GEI2: „In my company, I am involved in a mutual learning climate among employees for green behavior and awareness (e.g., cleaning campaigns, environmental-based community projects).”	0.756			
GEI3: „In my company, I have observed a number of formal or informal communication channels to spread green culture (e.g., via email, posters, etc.).”	0.788			
GEI4: „In my company, I am encouraged to involve in quality improvement and problem solving on green issues.”	0.798			
GEI5: „In my company, I have opportunities to participate in environmental management such as suggestion schemes, community programs for environmental awareness, green initiatives).”	0.806			
GI1: „Using less or non-polluting/toxic materials (environmentally friendly material).”	0.684	0.901	0.901	0.503
GI2: „Designing or improving environmentally friendly packaging (i.e., less plastic materials) for existing and new product.”	0.712			
GI3: „Making efforts to recover company's end-of-life products and recycling.”	0.621			
GI4: „Using eco-labeling.”	0.796			
GI5: „Lower consumption of resources (e.g. water, electricity, gas and petrol) during production/use/ disposal.”	0.683			
GI6: „Use of recycled and remanufactured materials or part.”	0.672			
GI7: „Use of cleaner or renewable technology to save resources (i.e., energy, water, waste).”	0.693			

GI8: „Redesign of production and operation processes to improve environmental efficiency.”	0.745			
GI9: „Redesigning and improving products or services to meet new environmental criteria or directives.”	0.762			
GTL1: „The leader of the green product development project inspires the project members with the environmental plans.”	0.766	0.914	0.914	0.64
GTL2: „The leader of the green product development project provides a clear environmental vision for the project members to follow.”	0.814			
GTL3: „The leader of the green product development project gets the project members to work together for the same environmental goals.”	0.797			
GTL4: „The leader of the green product development project encourages the project members to achieve the environmental goals.”	0.833			
GTL5: „The leader of the green product development project acts with considering environmental beliefs of the project members.”	0.8			
GTL6: „The leader of the green product development project stimulates the project members to think about green ideas.”	0.79			
OCB1: „I suggest new practices that could improve the environmental performance of my company.”	0.774	0.91	0.91	0.591
OCB2: „I encourage my colleagues to adopt more pro-environmental behaviors.”	0.715			
OCB3: „I stay informed of my company’s environmental efforts.”	0.719			
OCB4: „I make suggestions about ways to protect the environment more effectively.”	0.767			
OCB5: „I volunteer for projects or activities that address environmental issues in my company.”	0.733			
OCB6: “I spontaneously give my time to help my colleagues take the environment into account.”	0.776			
OCB7: „I undertake environmental actions that contribute positively to my company’s image.”	0.886			

Source: own study

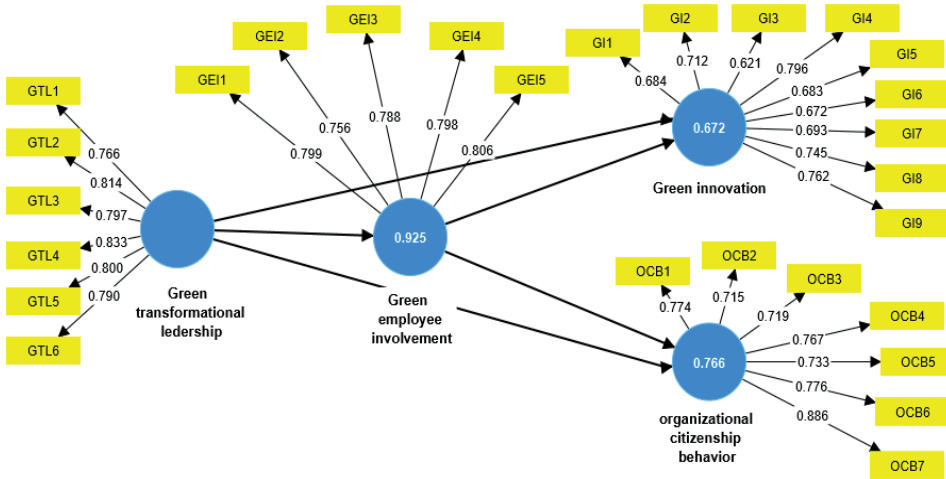


Figure 2. **Measurement model**

Source: own study

To assess the discriminant validity, the Hetrotrait-Monotrait (HTMT) ratio for correlation was employed on the variables. The HTMT tests calculate the average of Hetrotrait-Hetromethod correlations in relation to the relative average of Monotrait-Hetromethod correlations (Henseler et al., 2015). According to the authors' recommendation, the HTMT value should be less than 1. Other scholars propose even stricter thresholds, suggesting values below 0.85 (Kline, 2011) or 0.90 (Teo et al., 2008) for establishing discriminant validity. Table 4 represents that obtained HTMT values were significantly below the suggested thresholds in all categories. This provides strong evidence that the variables fulfill the criteria for discriminant validity, as they demonstrate clear distinctions from one another.

Table 4. **Validity Assessment HTMT**

	GEI	GI	GTL	OCB
GEI	1			
GI	0.783	1		
GTL	0.961	0.817	1	
OCB	0.839	0.804	0.874	1

Source: own study

Measurement scales in this study was self-reported, and it is recommended to assess common method bias (CMB) for cross-sectional data (P. M. Podsakoff et al., 2003). We applied Harman's single factor analysis on the variables data, and results showed that 38.4 percent variance is explained by the single factor which is acceptable and there is no evidence for CMB (P. M. Podsakoff et al., 2003). The collinearity among the reflective statistics was examined using the VIF (Variance Inflation Factor) values within the inner model. The test results, presented in the table below, indicate that the VIF values for collinearity fall within the desired range for the variables. Specifically, the collinearity values are all below 3, which aligns with the recommended threshold for assessing collinearity. Consequently, the collinearity values are deemed acceptable for testing purposes.

## 4.2. Structural model analysis

The hypothesis testing focuses on examining the direct and indirect effects of the variables on the dependent variables, green innovation and organizational citizenship behavior. The subsequent section presents a comprehensive discussion of the obtained results.

The direct-effect model examined the direct relationships between green transformational leadership, green innovation, and organizational citizenship behavior. In this model, green transformational leadership served as the independent variable, while green innovation and organizational citizenship behavior acted as dependent variables. By following these rigorous methodologies, the study aimed to provide robust evidence regarding the hypothesized relationships and their underlying mechanisms based on the existing literature and empirical findings.

The indirect paths involved the integration of green transformational leadership, green innovation, and green employee involvement as a mediating variable. Another mediating path was established by linking green transformational leadership to green employee involvement, which, in turn, influenced organizational citizenship behavior

Baron & Kenny (1986) proposed three primary types of mediation analysis: full mediation, partial mediation, and no mediation. However, Zhao et al. (2010) re-evaluated Baron and Kenny's research on mediation analysis and classified it into two main categories: mediation or non-mediation. Within mediation, Zhao et al. (2010) identified three patterns: complementary mediation, competitive mediation, and indirect-only mediation. Complementary mediation occurs when both the direct and mediation effects align in the same direction. Competitive mediation arises when both effects exist but point in opposite directions. Indirect-only mediation is observed when there is a mediating effect but no direct effect (Zhao et al., 2010).

Table 5. Path analysis

	Original sample (O) Beta	Standard deviation (STDEV)	T statistics ( O/STDEV )	Hypotheses
<b>Direct Analysis</b>				
Green transformational leadership -> green employee involvement	0.869	0.024	36.772	Accepted
Green transformational leadership -> green innovation	0.537	0.109	4.92	Accepted
Green transformational leadership -> organizational citizenship behavior	0.576	0.117	4.935	Accepted
green employee involvement -> green innovation	0.24	0.115	2.083	Accepted
green employee involvement -> organizational citizenship behavior	0.257	0.124	2.073	Accepted
<b>Indirect effect</b>				
Green transformational leadership -> green innovation	0.208	0.098	2.121	Accepted
Green transformational leadership -> organizational citizenship behavior	0.224	0.106	2.101	Accepted

Source: own study

Testing of hypothesis reveals that first hypothesis tested “H1: Green transformational leadership has positive influence on green innovation in pharmaceutical industry” was approved. The result indicated significant change in green innovation due to green transformational leadership ( $\beta = 0.537$ ,  $T = 4.92$ ,  $p = 0$ ). The second hypothesis tested “H2: There is positive association between green transformational leadership and organizational citizenship behavior in pharmaceutical industry”. The result indicates significant positive change in organizational citizenship behavior by green transformational leadership ( $\beta = 0.576$ ,  $T = 4.935$ ,  $p = 0$ ). Third hypothesis tested “H3: Green transformational leadership has significant positive impact on green employee involvement”. The result indicates significant positive change in green employee involvement by green transformational leadership ( $\beta = 0.869$ ,  $T = 36.772$ ,  $p = 0$ ). Forth hypothesis is also accepted ( $\beta = 0.24$ ,  $T = 2.083$ ,  $p = 0$ ). Similarly, fifth hypothesis was also assessed and it also supports the hypothesis ( $\beta = 0.257$ ,  $T = 2.073$ ,  $p = 0$ ).

Testing of overall indirect effect of green employee involvement mediates between green transformational leadership and green innovation and organizational citizenship behavior, H6a: Green employee involvement mediates the relationship between green transformational leadership and green innovation. The findings reveal a notable and statistically significant positive impact of green transformation leadership on green innovation due to green employee involvement ( $\beta = 0.208$ ,  $T = 2.121$ ,  $p = 0.034$ ). For the next hypothesis “H6b: The association between green transformational leadership and organizational citizenship behavior is mediated by green employee involvement in pharmaceutical industry”. The result reveals significant positive impact of green transformation leadership on organizational citizenship behavior due to green employee involvement ( $\beta = 0.224$ ,  $T = 2.121$ ,  $p = 0.036$ ). Therefore, a relationship was present between the variables and overall mediation was also present.

To evaluate the model’s goodness of fit, we utilized the coefficient of determination  $R^2$  to examine the linear regression among the variables. R-square statistics were employed to elucidate the amount of variance in the endogenous variables that can be accounted for by the exogenous variables, measuring the degree to which changes in the dependent variable are explained by the independent variable.

Table 6 Coefficient of determination ( $R^2$ )

	R square value	Adjusted R square value
Green innovation	0.672	0.569
Organizational citizenship behavior	0.766	0.656

Source: own study

Cohen (1988) suggested thresholds for assessing  $R^2$  values of endogenous latent variables: substantial (0.26 or above), moderate (0.13 – 0.25), and weak (0.02 – 0.12). In the realm of marketing research, Hair et al. (2011) and Hair et al. (2013) put forth guidelines where  $R^2$  values of greater than 0.75 is considered as substantial, 0.50-0.74 is considered moderate, and  $R^2$  values from 0.25-0.49 is weak. This study shows that  $R^2$  value for OCB (0.766) is substantial and for GI (0.672) is moderate.

Using the  $F^2$  distribution, we have tested the effect of green transformational leadership, green employee involvement on both the dependent variables green innovation and organizational citizenship behavior. According to Cohen (1988) effect size can be categorized on the basis of  $f^2$  value in small (0.02 – 0.14), medium (0.15 – 0.34) and large ( $\geq 0.35$ ). In this study transformational leadership has substantial effect on GI ( $f^2=0.537$ ) and OCB ( $f^2=0.536$ ), whereas employee involvement has medium effect size on GI ( $f^2=0.240$ ) and OCB ( $f^2=0.257$ ).

## 5. Discussion

Considering the social and environmental issues of the twenty-first century, green innovation has become a key strategy for sustainable business development. Manufacturing sector in particular seeking environment friendly product and process to stay competitive in the dynamic business environment. The pharmaceutical industry needs green transformational leadership which emphasis on environmental stewardship and sustainability rather than exploitation of the resources for profit. Green transformational leaders in the pharmaceutical sector can effect change by advancing ethical behavior, encouraging innovation in the creation of novel treatments, drugs and technologies, and promoting laws that uphold social and environmental responsibility.

Given the increasing emphasis of the Pakistani government on the sustainability of the country, this study aims to investigate a previously unexplored area in the pharmaceutical sector of Pakistan. This study's findings suggest a significant contribution to the existing body of knowledge on green transformational leadership, green innovation, organizational citizenship behavior, and employee involvement. Specifically, this study establishes the positive influence of green transformational leadership on both green innovation and organizational citizenship behavior. Although few studies supported the argument that green transformational leadership is linked with organizational citizenship behavior (Öğretmenoğlu et al., 2022; Shah & Shukla, 2025) and green innovation (Abbasi et al., 2025; Begum et al., 2022; X. Chen et al., 2025; Waqas et al., 2024). However there were limited studies in manufacturing sector. The study findings are important in the context of pharmaceutical industry and aligned with the previous studies (Chen et al., 2025; Shah & Shukla, 2025; Waqas et al., 2024).

Furthermore, the research highlights the mediating role of green employee involvement in the relationship between green transformational leadership and desired outcomes; organizational citizenship behavior and green innovation which contributes in the extent literature. Here it is important for organizational leaders and strategic managers to understand the difference between employee engagement and employee involvement (Tang et al., 2023). Employee engagement focuses more on psychological development of employees which is also important for green initiatives, however employee involvement emphasize more on behavioral and decision-making aspects (Carmeli et al., 2017). Employee involvement in green initiatives can be observed and rewarded. Organizations can leverage this insight by providing opportunities for employee participation, fostering a sense of ownership and commitment to environmental sustainability. By embracing sustainability principles and cultivating leadership that drives positive change, the pharmaceutical sector can position itself as a responsible global player and contribute significantly

to a more sustainable future. By demonstrating commitment to environmental stewardship, organizations can gain the trust of stakeholders. Employees involvement in sustainable initiatives acts as a system through which the positive effects of green transformational leadership are realized.

This research emphasizes that green innovation leads to the development of environmentally friendly products, processes, and technologies. This opens up new opportunities for research and development, allowing pharmaceutical companies to differentiate themselves in the market and contribute to sustainable solutions for societal and environmental challenges. To encourage a culture of innovation, organizations can implement training programs that empower employees to openly share their ideas, recognizing that even seemingly random ideas may have the potential to significantly benefit organizational performance. Some employees may hesitate to participate due to a perceived lack of usefulness in their ideas. However, organizations should emphasize the importance of green innovation and create an environment where they feel comfortable expressing their unique ideas.

The researchers also identified certain limitations associated with this specific study. One primary limitation of this study is its limited geographic coverage within the pharma sector, which was constrained by resource limitations and time constraints. Other significant limitation of the research was encountered during the data collection process, specifically in accessing and engaging with organizations' human resource departments. Despite multiple attempts, including reminders via phone calls, email and WhatsApp, many organizations displayed resistance and did not respond to the researcher's requests for data collection. This limitation hindered the ability to gather comprehensive data from a wider range of organizations. Furthermore, this study employed a cross-sectional design, which may limit the ability to capture changes and variations over time. Conducting a longitudinal study instead could yield different outcomes and provide a greater comprehension of the variables that are important.

Future research can delve deeper into the concepts of green transformational leadership, green innovation, and organizational citizenship behavior, focusing on other industries within Pakistan. By considering additional factors such as organizational culture and demographic variables, future studies may provide a more comprehensive understanding of the relationships at play. Qualitative research or mixed-method approaches can be employed to obtain more nuanced and accurate results. Future research can investigate other mediating or moderating variables that may influence the connection between green transformational leadership and its outcomes, such as green organizational culture, green creativity, talent management, turnover intention, or change management.

## 6. Conclusion

The study contributes to the existing body of knowledge by highlighting the significance of green transformational leadership in driving green innovation and promoting organizational citizenship behavior. Leadership should emphasize on employee involvement by offering initiatives and organizational support. For organizations in the pharmaceutical sector, emphasizing the need to adopt sustainable practices, nurture employee involvement, and align with global sustainability standards. The study highlights the complementary advantage of green employee involvement in realizing these positive outcomes. By recognizing the significance of the factors, organizations can create a sustainable and responsible work environment that contributes to their overall success.

## Authors' contribution

**A.H.:** article conception, theoretical content of the article, research methods applied, conducting the research, data collection, analysis and interpretation of results, draft manuscript preparation. **Z.N:** theoretical content of the article, research methods applied, analysis and interpretation of results, draft manuscript preparation. **Z.R.M.:** research methods applied, analysis and interpretation of results, draft manuscript preparation

## Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors did not use Generative AI and AI-assisted technologies in the writing process.

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