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Impact of Green Transformation Leadership on Environmental Knowledge Learning and Work Pro-environmental Behaviors: The Mediating Role of Green Self-efficacy and Green Creativity

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Abstract

The purpose of this study is to investigate the Impact of GTL (Green Transformation Leadership) on Environmental Knowledge Learning and WPB (Work pro-environmental Behaviors) through the mediating role of green self-efficacy and green creativity. The study has adopted a survey-based approach where data were collected from 279 employees working in hotel industry of Saudi Arabia using structured questionnaires and validated scales. Results show that GTL directly impacts EKL and WPB, suggesting it promotes the acquisition of environmental knowledge and skills, and GTL encourages employees to participate in friendly environmental behaviors in the workplace. This result also found, GSE and GC mediate the relationship between GTL and both EKL and WPB. This suggests that GTL not only directly influences EKL and WPB but also indirectly through its impact on GSE and GC. Future studies could discover the long-term effects of leadership on environmental sustainability, examine the role of leadership in fostering innovation and adaptation to environmental challenges, and examine the influence of different leadership styles on specific environmental behavior.

Keywords: *Green Transformation Leadership, Green Self-efficacy, Green Creativity, Environmental Knowledge Learning, Work Pro-environmental Behaviors.*

Introduction

Organizations have been motivated to implement innovative leadership styles that prioritize sustainability due to the growing urgency of confronting environmental challenges. One of these approaches is GTL (Green Transformational Leadership), which is different from other leaders who, encourage, motivate, and inspire their followers to prioritize the goal of environment. in addition to organizational objectives. GTL not only cultivates a culture of sustainability but also improves the green self-efficacy and creativity of its employees, which are essential for the effective acquisition of environmental knowledge and the adoption of PEBs (pro-environmental behaviors) in the work area. GSE (Green self-efficacy) is the term used to describe the confidence that individuals have in their capacity to take actions that promote environmental sustainability. Research suggests that GTL substantially improves employees' GSE (green self-efficacy), thus enabling them to participate in PEBs (pro-environmental behaviors). For example, Kura (2016) emphasizes that there is a positive impact between environmentally specific transformational leadership and the environmental concerns of employees, which in turn predicts their green behaviors in the workplace. This relationship emphasizes the significance of leadership in influencing the confidence and dedication of employees to sustainability initiatives (Kura,2016; Khan et al., 2021).

Additionally, GTL has a role in the facilitation of the acquisition of environmental knowledge within organizations. GTL fosters an environment of perpetual learning and development, which motivates workers to learn the requisite skills, information knowledge, and abilities to effectively confront environmental challenges (Bhatti et al, 2022a; Bhatti et al, 2022b). Çöp et al. (2020) have identified that the successful GTL implementation enhances employees' comprehension of ecological issues and fosters their commitment to environmental sustainability. Employees must possess this knowledge to implement effective sustainability practices and innovate. The link between pro-environmental behaviors and GTL, green creativity, which is the capacity to generate novel and useful ideas related to environmental sustainability, functions as a critical mediator. As per Zhang et al. (2020), GTL has an important impact on

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green creativity, which can increase the level of engagement of employees in sustainable practices. This inventive process is essential for organizations that are trying to develop innovative solutions to environmental challenges, as it allows employees to think outside the box and contribute to sustainability initiatives. The culmination of the relationship among green creativity, green self-efficacy, and GTL is the improvement of pro-environmental behaviors within organizations. Leaders who exemplify GTL not only motivate their followers but also offer the requisite resources and support to encourage employees to enhance their creativity and capabilities (Zhang et al. 2020). The significant role of leaders in cultivating a supportive environment is essential for the improvement of workers' environmental citizenship behaviors, as emphasized by (Liu & Yu, 2023). This results in a positive feedback cycle, in which the engagement in pro-environmental actions is primarily driven by increased self-efficacy and creativity.

In Saudi Arabia, the need for effective leadership in promoting environmental sustainability is particularly pressing. The country might faces significant environmental issues, including water scarcity, air pollution, and waste management challenges, exacerbated by rapid economic growth and urbanization contempt the growing acknowledgment of the importance of environmental sustainability in Saudi Arabia, there remains a significant gap in understanding how leadership styles, particularly Green Transformational Leadership, influence employees' environmental knowledge learning and pro-environmental behaviors. organizational culture, industry characteristics, and individual differences among employees may all play a role in shaping how leadership practices are perceived and enacted (Zhao,2023). There is limited understanding of how GTL can be effectively leveraged to enhance workers' self-assurance in their skills and ability to contribute to environmental initiatives and foster innovative solutions to ecological problems. As organizations in Saudi Arabia seek to navigate the complexities of environmental sustainability, it is crucial to explore the mechanisms through which GTL impacts environmental knowledge learning and pro-environmental behaviors. Addressing this gap will provide valuable insights for organizational leaders and policymakers aiming to cultivate values of sustainability and responsibility for the environment in the region.

Literature

The Theory of Planned Behavior or TPB

According to Ajzen's Theory of Planned Behavior, intentions are the primary motive force behind individual behavior, and these intentions are influenced by subjective norms, attitudes, and perceived behavioral control. In the context of GTL, executives can influence employees' perspectives on environmental sustainability by fostering a positive green psychological climate and encouraging green creativity. Zhou et al. (2018) underscore the importance of aligning individual green values with organizational objectives, which enhances employees' intentions to engage in pro-environmental activities. The mediating function of green creativity is essential, as it enables employees to convert their intentions into actionable behaviors by developing innovative solutions to environmental challenges.

GTL (Green transformational leadership) Workplace pro -Environmental behaviors

GTL (Green transformational leadership is crucial in promoting pro-environmental attitudes in the workplace, which are vital for firms seeking sustainability. TL (Transformational leadership), defined by its capacity to encourage, motivate, and inspire the employees toward a mutual mission and vision, has been demonstrated to dramatically impact employees' PEB. By Robertson and Barling leaders demonstrating PEB (pro-environmental behaviors) can cultivate a harmonious enthusiasm for the environment among employees, thereby augmenting their own pro-environmental acts in the workplace (Robertson & Barling, 2012). This link shows the implication of leadership in fostering an organizational climate that not only supports but also actively promotes environmentally sustainable actions. Moreover, the amalgamation of GTL with organizational methods can enhance performance in sustainability activities. Zhuravleva and Poliak emphasize that transformational leadership is significantly associated with the success of green growth initiatives, indicating that organizations that strategically adopt environmental development programs can improve their competitiveness and operational efficiency (Zhuravleva & Poliak, 2022). The congruence between leadership and organizational strategy is essential, as it establishes a framework for

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integrating sustainability into the fundamental operations of a corporation. The literature also discloses that the PEB (pro-environmental behaviors) of workers are influenced by the leaders' commitment to sustainability. Hussain's research indicates that sustainable leadership correlates with improved organizational performance, and the importance of the necessity for leaders to integrate green policies into their strategic planning (Hussain, 2023).

This integration promotes a sustainability culture and encourages workers to embrace PEB activities as integral to their business identity. The empirical evidence provided by Zainab et al. further substantiates this concept, illustrating that sustainable leadership enhances Social economic, social & environmental performance (Zainab et al., 2021). Chi et al. (2023) contends that, within the realm of hospitality and tourism, although customer behavior regarding eco-friendly practices has been thoroughly examined, there remains a deficiency in comprehending the formation of employees' intentions and behaviors related to pro-environmental behavior. This disparity underscores the imperative for executives to actively include employees in fostering a culture of sustainability, thus reconciling consumer expectations with staff behaviors. Kafetzopoulos and Gotzamani assert that some leadership styles can improve a firm's sustainable performance by addressing environmental, social, and economic aspects. Fatoki's research emphasizes the significance of leadership in the development of pro-environmental behaviors, as it demonstrates that sustainable leaders are essential for the advancement of long-term sustainable performance and generate value for all stakeholders (Fatoki, 2021). This viewpoint corresponds with the comprehensive notion of sustainable leadership as a complex framework that includes ethical accountability, stakeholder involvement, and dedication to environmental conservation. Moreover, Sengur's bibliometric analysis reveals an increasing acknowledgment of the necessity for educational leaders to implement sustainable methods, which may serve as a paradigm for other sectors (Sengur, 2023). The relationship among leadership & pro-environmental conduct is examined via the perspective of organizational citizenship behavior. Althnayan et al. (2022) suggest a model that establishes a connection among environmental transformational leadership and organizational sustainability performance, emphasizing the mediating role of environmental organizational citizenship behavior. This model demonstrates how leaders may cultivate a sustainability culture that motivates people to exceed their defined duties and participate in environmentally responsible behaviors.

GTL (Green transformational leadership) green creativity, & workplace pro -Environmental behaviors

GTL (Green transformational leadership) is vital for cultivating green creativity and encouraging PEBs (pro-environmental behaviors) in the work area. This leadership style pushes people to approve environmentally supportable practices and boosts their advanced talents in tackling sustainability concerns. The connection among GTL, green creativity, and workplace PEBs is substantiated by an expanding corpus of scholarship that elucidates the mechanisms by which GTL affects these outcomes. GTL is defined by leaders who prioritize environmental ideals and motivate their employees to be involved in PEBs. Research demonstrates that GTL is favorably associated with employees' environmental concerns, which subsequently predicts their participation in green behaviors at work (Kura, 2016; Robertson & Barling, 2012). Leaders who exemplify environmentally focused transformational leadership can foster a supportive corporate atmosphere that motivates people to engage in environmentally responsible behaviors (Robertson & Barling, 2012; Yue et al., 2022). This supportive environment is crucial as it cultivates a sense of collective responsibility and inspires staffs to engage in the sustainability of the organization's objectives (Kim & Lee, 2022; Du & Yan, 2022). Furthermore, GTL fosters environmental innovation by granting staff the independence and motivation necessary to better their ecological practices. Research indicates that when leaders convey a distinct environmental vision and exhibit dedication to sustainability, employees are more inclined to participate in innovative problem-solving about environmental challenges (Crucke et al., 2021; Öğretmenoğlu et al., 2021). Additionally, the relationship between green creativity and GTL is influenced by factors such as organizational identity and green self-efficacy, which empower employees to initiate and participate in pro-environmental initiatives (Du & Yan, 2022; Faraz et al., 2021).

Besides promoting eco-friendly innovation, GTL considerably influences workplace dynamics. Workers are more inclined to demonstrate PEBs when they view their leaders as exemplars who emphasize environmental sustainability (Liu & Yu, 2023; Soni, 2022). The alignment of leaders' values with those of

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their employees, referred to as value congruence, improves the efficacy of GTL in fostering PEBs. (Priyadarshini et al., 2023). Moreover, firms that adopt GHRM techniques alongside (GTL) green transformational leadership can provide a holistic framework that encourages and rewards employees' environmentally friendly actions (Esponda-Pérez et al., 2023; Elshaer et al., 2021). GHRM activities, including training, performance assessments, and acknowledgment of eco-friendly behaviors, might enhance the beneficial impact of GTL on employee involvement in sustainability initiatives (Esponda-Pérez et al., 2023; Elshaer et al., 2021).

GTL (Green transformational leadership), green self-efficacy, & Workplace pro -Environmental behaviors

GTL (Green transformational leadership) is recognized as a crucial catalyst for PEBs in the office, primarily via enhancing employees' GSE. GSE (Green self-efficacy) denotes a person's confidence in their capacity to execute activities that promote environmental sustainability. The relationship of GTL, GSC (green self-efficacy), and PEBs is essential for firms seeking to improve their environmental performance. Research demonstrates that GTL enhances employees' green self-efficacy by fostering an empowering and supportive atmosphere that promotes pro-environmental behaviors. Leaders who display environmentally specific transformational behaviors, such as articulating a clear environmental vision and demonstrating a commitment to sustainability, can encourage and motivate employees to adopt these values and bolster their confidence in attractive PEBs (Zong-bo et al., 2020; Robertson & Barling, 2012). Zong-Bo et al. state that GTL (green transformational leadership) centered on environmental sustainability is crucial for motivating and encouraging workers' eco-friendly actions in the work area, as it cultivates a feeling of environmental enthusiasm and intrinsic drive (Zong-Bo et al., 2020). The relationship between GTL and PEBs is facilitated by green self-efficacy. Employees who view their leaders as supportive and dedicated to environmental objectives are more inclined to cultivate a robust sense of self-efficacy around their capacity to engage in sustainability projects (Chen & Wu, 2022). This self-efficacy therefore increases their propensity to participate in PEBs (pro-environmental behaviors), as they observe themselves as more capable of effecting good environmental change through their activities (Chen et al., 2014). Chen and Wu underscore the importance of both GTL (Green Transformational Leadership) and GSE(green self-efficacy) in promoting employees' environmentally friendly behaviors, indicating that leaders who cultivate a culture of environmental dedication can substantially bolster their employees' self-confidence in their capacity to engage in pro-environmental actions (Chen & Wu, 2022).

Furthermore, the importance of GSC green self-efficacy is corroborated by evidence connecting it to diverse organizational outcomes. Employees with elevated green self-efficacy are more inclined to participate in voluntary pro-environmental actions, like recycling and energy conservation, which are essential for attaining organizational sustainability objectives (Robertson & Barling, 2012; Jiang et al., 2019). This association highlights the significance of fostering green self-efficacy via GTL, as it improves individual employee behaviors and aids in a collective organizational commitment to sustainability (Robertson & Barling, 2012; Jiang et al., 2019).

Green transformational leadership & environmental knowledge learning

GTL (Green transformational leadership) is essential in cultivating environmental understanding among employees, hence increasing their proactive involvement in sustainable activities. GTL is defined by leaders who engage motivate and inspire their workers to prioritize environmental objectives in conjunction with organizational goals, therefore fostering a culture of environmental accountability. This leadership style positively impacts employee behaviors, including initiative and engagement in environmentally sustainable practices, as demonstrated by Du and Yan's research, which underscores personal initiative as mediation in the connection between GTL (Green Transformational Leadership) and employees' proactive behaviors toward organizational environmental objectives (Du & Yan, 2022). Imam and Astini assert that GTL enhances performance responsibility in firms by fostering a clear vision and facilitating staff growth in accordance with environmental goals (Imam & Astini, 2022). The incorporation of environmental knowledge acquisition is essential for the efficacy of GTL. Suryani et al. contend that a fundamental comprehension of ecological principles is crucial for humans to evaluate environmental issues and participate in significant activities (Suryani et al., 2021). Su et al. substantiate this concept by demonstrating

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that the acquisition of environmental knowledge significantly impacts the relationship between environmental leadership and green innovation practices. This suggests that employees who are knowledgeable are more likely to contribute to innovative environmental solutions (Su et al., 2020). The research conducted by Zhang et al. highlights the importance of information acquisition in the development of a proactive environmental culture by demonstrating that efficient environmental knowledge management can improve employee green behavior (Zhang et al., 2021).

Furthermore, experiential learning methodologies, as articulated by Mashfufah et al., augment environmental literacy by prompting students to critically assess the interaction between ecological and social elements (Mashfufah et al., 2020). This corresponds with the research of Kim et al., which emphasizes the significance of leader behaviors in fostering workplace green advocacy, indicating that leaders who emphasize environmental education can profoundly impact their followers' participation in sustainable practices (Kim et al., 2014). The connection between knowledge acquisition and environmental attitudes is also supported by Shutaleva, who claims that experiential learning creates a sense of responsibility and commitment to sustainability among learners (Shutaleva, 2023).

GTL (Green transformational leadership), green creativity & Environmental knowledge learning

GTL (Green transformational leadership) is increasingly acknowledged as an essential factor in fostering green creativity and enhancing environmental knowledge acquisition inside enterprises. This leadership style pushes followers to adopt ecologically friendly activities and cultivates an environment that promotes inventive thinking and problem-solving about ecological concerns. Sidney et al. indicate that GTL is directly associated with green creativity, implying that leaders ought to embrace this approach to enhance innovation among staff (Sidney et al., 2022). Mauledy underscores the significance of GHRM as a mediator in the link between GTL and GC, suggesting that proficient HR practices might enhance the beneficial impacts of GTL on creativity in the hospitality industry (Mauledy, 2023). Moreover, Shah et al. contend that GTL affects green creativity and performance, underscoring the role of leadership is essential for fostering sustainable innovation (Shah et al., 2021). Acquiring environmental knowledge is crucial for fostering green innovation, since it delivers employees with the necessary information to develop proficiently. Safari et al. assert that the knowledge of environmental and awareness substantially influences employees' eco-friendly behavior, indicating that firms ought to conduct frequent training to augment this understanding (Safari et al., 2018). This is consistent with the findings of Riva et al., who assert that green creativity serves as a mediator between green knowledge and environmental performance, thereby underscoring the importance of information acquisition in the development of creativity (Riva et al., 2021). Kura's research illustrates that ecologically pertinent transformational leadership has a positive impact on green behavior in the workplace, thereby linking leadership style to the advancement of environmental knowledge and practices (Kura, 2016).

The interaction between GTL and environmental knowledge acquisition produces a synergistic impact that improves organizational sustainability. Banahene illustrates that GTL fosters innovation and motivates people to design creative solutions that correspond with environmental goals (Banahene, 2024). The study by Hameed et al. indicates that the integration of GHRM practices with GTL substantially improves green creativity, implying that a conducive corporate culture is essential for promoting innovation (Hameed et al., 2021). Ding's research underscores that employees' green creativity is essential for attaining innovation in green products and processes, emphasizing the importance of integrating leadership, knowledge, and creativity for sustainable results (Ding, 2023).

GTL (Green transformational leadership), GSC (Green self-efficacy) & Environmental knowledge learning

GTL (Green transformational leadership) is essential for improving GSC (green self-efficacy) and promoting environmental knowledge acquisition in businesses. This leadership style not only bolsters employees' belief in their capacity to achieve environmental objectives (green self-efficacy) but also facilitates the acquisition of essential environmental knowledge for effective pro-environmental activities. Research demonstrates that GTL substantially affects employees' green self-efficacy. Zhang et al. discovered that GTL positively influences green self-efficacy, subsequently augmenting employees'

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commitment to environmental objectives. Zhang et al. (2020). This corresponds with the conclusions of Chen et al., who assert that GTL is an important element prompting green performance, with self-efficacy acting as a mediating variable in this association (Chen et al., 2014). Nisar et al. substantiate this concept by illustrating that GSC mediates the connection between GTL and green performance, emphasizing the significance of self-efficacy in converting leadership into tangible environmental results (Nisar et al., 2017).

Besides enhancing green self-efficacy, GTL is also important in advancing environmental knowledge acquisition. Çöp et al. assert that effective GTL procedures promote employee participation in training and development concerning environmental issues, hence improving their comprehension of sustainability challenges (Çöp et al., 2020). The study by Wang et al. indicates that GTL cultivates a learning culture vital for enhancing employees' environmental competencies (Wang et al., 2018; Nurul Alam et al., 2023). Tuan's research demonstrates that leaders possessing environmentally specific transformational attributes can successfully stimulate OCBE (organization citizenship behavior for the environment), thereby strengthening the connection between leadership, knowledge acquisition, and pro-environmental actions (Tuan, 2019). The interaction among GTL, green self-efficacy, and environmental knowledge acquisition has a synergistic effect that improves organizational sustainability. Zhu et al. assert that GTL not only inspires employees to attain environmental objectives but also promotes their ongoing education regarding environmental practices, consequently enhancing their self-efficacy (Zhu et al., 2022). The study conducted by Faraz et al. demonstrates that green self-efficacy moderates the relationship between leadership styles and employees' pro-environmental activities, suggesting that increased self-efficacy correlates with enhanced involvement in sustainable practices (Faraz et al., 2021). The following hypotheses have been driven, as per the aforementioned discussion.

H1- Green transformational leadership positively relates Environmental knowledge learning

H2- Green transformational leadership positively relates to Work pro-environmental behaviors

H3. Green creativity mediates the relationship between green transformational leadership and Environmental knowledge learning

H4. Green Self-efficacy mediates the relationship between green transformational leadership and Environmental knowledge learning

H5. Green creativity mediates the relationship between green transformational leadership and work pro-environmental behaviors

H6. Green self-efficacy mediates the relationship between green transformational leadership and work pro-environmental behavior

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Conceptual framework

1.1. Conceptual framework

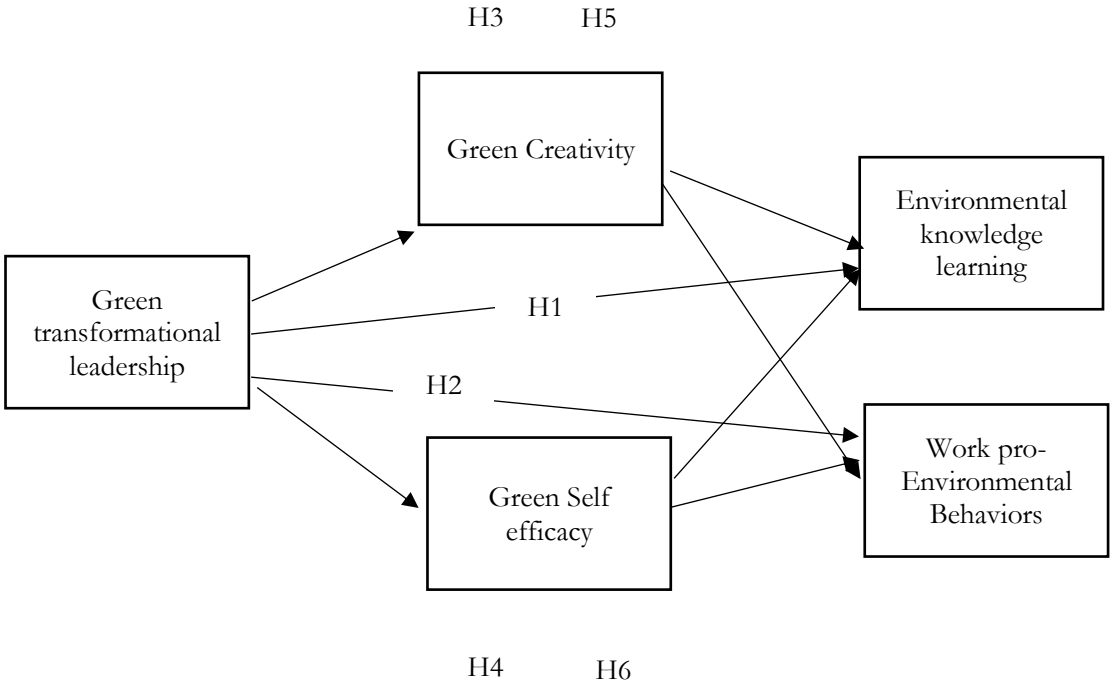

Figure 1. Research model

Research methodology

The study design employed was observational quantitative analytics, which adhered to an explanatory research design that employed a survey-based data collection approach. The data for this research were collected from employees who were either managers or supervisors in the hoteling industry of Riyadh, Saudi Arabia and had been present at this position for more than one year.

Research Target/Subject

The target population consisted of managers and supervisors working in the hotel industry of Riyadh, Saudi Arabia with at least one year of experience. A convenience sampling approach was used to select 500 managers from industry websites. Potential participants were contacted via email and followed up with phone calls to complete the online survey created using Google Forms. The response rate was 279 out of 500, representing a 56 % response rate**.**

Instruments, and Data Collection Techniques

The survey implemented structured questionnaires that were both reliable and valid. Specific measures were implemented, including: Six elements of leadership in the context of green transformation were derived from Chen and Chang (2013). Green Self-Efficacy: 5 items adapted from Chen et al. (2014a), and environmental knowledge sharing: 6 items adopted from Lee et al. (2005), J. Li et al. (2019). Work pro-environmental behavior: six items that are derived from Dumont et al. (2017) (Bissing-Olson et al., 2013) and (Cornwall et al., 2013). The following items are adapted from Chen and Chang (2013): Employee Green

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Creativity. The responses were recorded on a 5-point Likert scale that ranged from "strongly disagree" to "strongly agree."

Results

The proposed theoretical hypotheses regarding the mediating effects of individual leadership influence on employee empowerment and pro-environmental behavior in the workplace were investigated using structural equation modeling and partial least squares (PLS). PLS-SEM is capable of retaining a greater number of reflective items per dimension than other statistical methods (CB-SEM). We employed a two-step methodology to evaluate the data that was gathered. In this technique, the validity and reliability of the exterior model (measurement model) are evaluated. The inner model (structural model) is subsequently evaluated to either confirm or refute the justifiable hypotheses.

Table 1: Demographic Analysis (N=279)

Variables	Items	No	Percentage
Gander	Male	178	64%
	Female	101	36%
	Total	279	100%
Age	20-30	149	53%
	30-40	63	23%
	40-50	29	10%
	50-60	35	13%
	60-Above	3	1%
	Total	279	100%
Experience	5-10	160	57%
	10-15	68	24%
	15-20	28	10%
	20-25	21	8%
	25-Above	2	1%
	Total	279	100%

Table 1

The table provides a demographic breakdown of a group of 279 individuals. In terms of gender, the majority (64%) are male, while 36% are female. Looking at age, the largest proportion (53%) falls within the 20-30 age group, followed by 23% in the 30-40 range. When it comes to experience, the most common range is 5-10 years, accounting for 57% of the group.

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The Structural Model

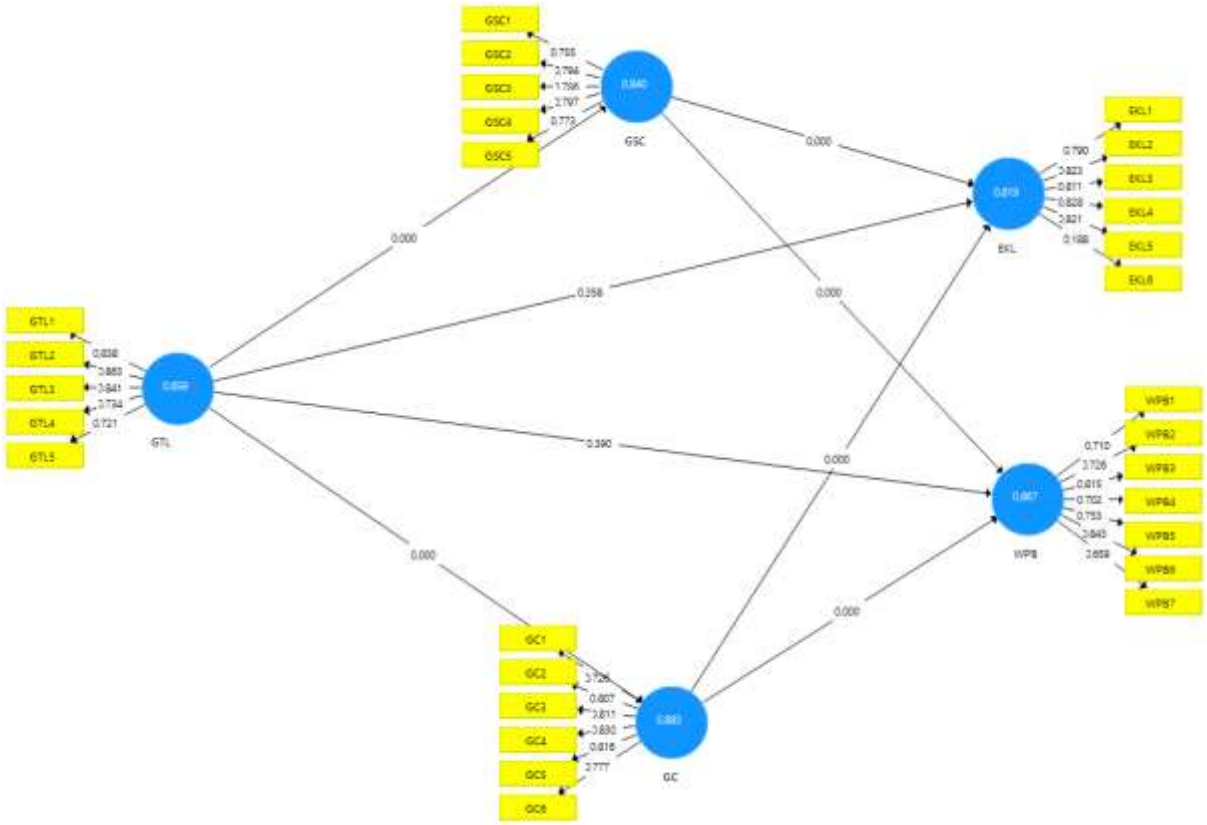

Figure 1.

Table 2. Reliability and validity

Items for variables	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted
EKL	0,819	0,876	.873	.559
GC	0,883	0,887	.912	.632
GSC	0,840	0,841	.887	.610
GTL	0,859	0,866	.899	.642
WPB	0,867	0,876	.898	.557

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

Table 2 presents reliability metrics for variables: GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior) These metrics assess the internal consistency and reliability of the scales used to measure these variables. Cronbach's Alpha, rho_A, and Composite Reliability are internal consistency

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measures that quantify the degree to which the items within a scale are correlated. These metrics indicate improved internal consistency when their values are higher. The internal consistency of all variables is satisfactory, with values exceeding 0.7.

Cronbach' Alpha Histogram

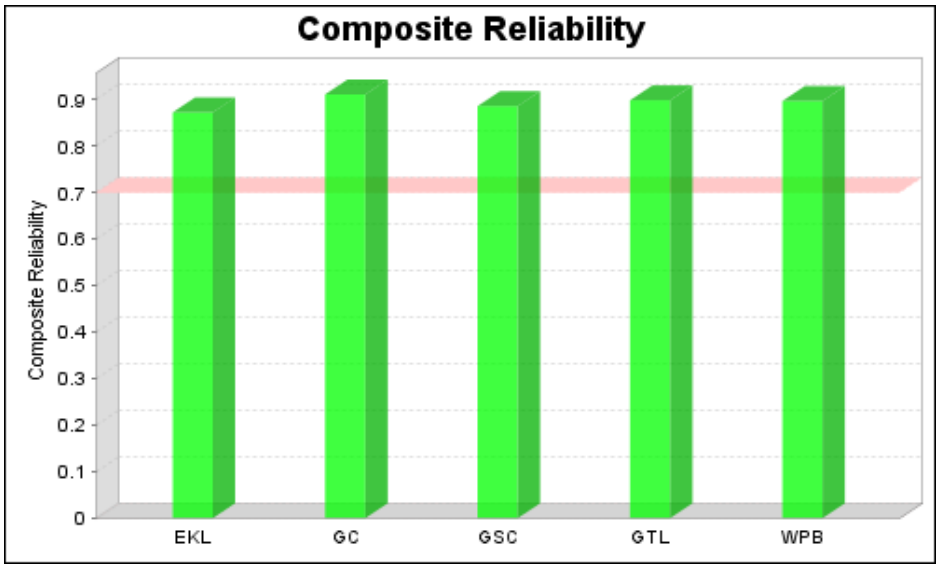

Figure 3.

The chart displays the Cronbach's Alpha values for five variables: EKL, GC, GTL, GSC, and WPB. Cronbach's Alpha is a metric that quantifies the internal consistency of a scale, which is a measure of the degree to which the items within a scale are correlated. Better internal consistency is indicated by higher values. Cronbach's Alpha values exceeding 0.7 indicate that all variables exhibit satisfactory internal consistency.

Table 3. Fornell- larcker Creterion

Variables	EKL	GC	GSC	GTL	WPB
EKL	0,748				
GC	0,682	0,795			
GSC	0,722	0,703	0,781		
GTL	0,717	0,656	0,648	0,801	
WPB	0,716	0,691	0,690	0,667	0,747

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

The Fornell-Larcker criterion, a statistical instrument utilized to evaluate discriminant validity, is illustrated in the preceding table 3. It contrasts the square root of the Average Variance Extracted (AVE) for each variable to its correlations with other variables. The square root of the AVE for each variable should be greater than its correlation with any other variable, ideally. This illustrates that each variable has a stronger relationship with itself than with any other variable, as all diagonal values (square root of AVE) are greater than the corresponding off-diagonal values. This implies that the constructs are distinct and do not overlap, which corroborates the discriminant validity of the measurement model.

Table 4. Heterotrait – Monotrait Ratio (HTMT)

	EKL	GC	GSC	GTL	WPB

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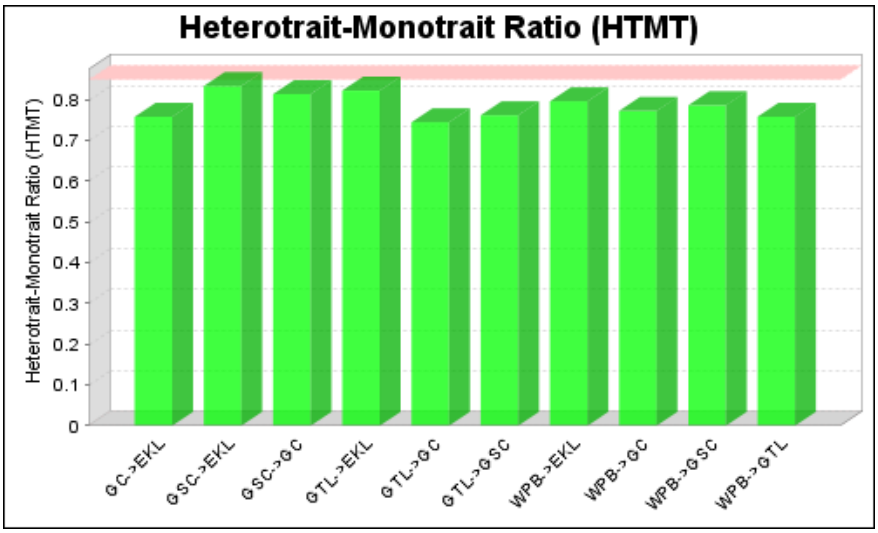
EKL						
GC	0,759					
GSC	0,834	0,814				
GTL	0,823	0,745	0,762	0,762		
WPB	0,797	0,773	0,787	0,759		

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)



GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

Figure 4

The Heterotrait-Monotrait Ratio (HTMT) values are presented in the table 4 and figure, and they are utilized to evaluate discriminant validity. HTMT contrasts the average correlation of each construct with itself (monotrait) to the correlation between two distinct constructs (heterotrait). In order to demonstrate adequate discriminant validity, the HTMT values should be less than 0.85. In this instance, the HTMT values are all less than 0.85, which implies that the constructs are distinct and do not coincide. This supports the discriminant validity of the measurement model, suggesting that the variables are measuring distinct constructs.

Table 5. R Square

Variables	R Square	R Square Adjusted
EKL	.646	.642
GC	.430	.428
GSC	.420	.418
WPB	0598	.594

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

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The R-squared and Adjusted R-squared values for four variables—GTL, EKL, GSE, GC, and WPB—are presented in the table. The proportion of variance in the dependent variable that is accounted for by the independent variables in a regression model is quantified by these statistics.

Table 6. Average variance Extracted

Variables	Original Sample	Sample Mean	Standard Deviation	T statistics	P Values
EKL	0,559	0,559	0,023	24,313	0,000
GC	0,632	0,632	0,035	18,260	0,000
GSC	0,610	0,607	0,036	16,877	0,000
GTL	0,642	0,640	0,030	21,768	0,000
WPB	0,601	0,600	0,034	17,590	0,000

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

The Average Variance Extracted (AVE) values for five variables—GTL, EKL, GSE, GC, and WPB—are presented in the table above. The AVE values for all variables are greater than 0.5, which implies that the constructs are adequately represented by their relevant measures. This suggests that the measurement model has a high level of construct validity.

Table 7. Specific Results

Variables	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	Hypothesis	Final Results
GTL -> EKL	0,358	0,351	0,042	8,591	0,000	HI	Supported
GTL -> WPB	0,358	0,351	0,042	8,591	0,000	H2	Supported
GTL -> GC -> EKL	0,133	0,128	0,049	2,706	0,007	H3	Supported
GTL-> GSC -> EKL	0,225	0,223	0,047	4,793	0,000	H4	Supported
GTL-> GC -> WPB	0,217	0,215	0,060	3,603	0,000	H5	Supported
GTL -> GSC -> WPB	0,148	0,150	0,060	2,485	0,013	H6	Supported

GTL (Green Transformational leadership) EKL (Environmental knowledge learning) GSE (Green self-efficacy) GC (Green Creativity) WPB (work pro-environmental behavior)

The standardized path coefficients are the primary focus of the structural equation model (SEM) analysis in table 7. The strength and direction of the relationships between variables in the model are represented by these coefficients. Each row denotes a particular path or relationship between two or more variables in the model. For instance, "GTL-> EKL" denotes a direct relationship between Green Transformational Leadership (GTL) and Work Pro-Environmental Behavior (WPB), whereas "GTL-> GSE -> WPB" denotes an indirect relationship in which GTL influences WPB through GSE. The p-value associated with the t-statistic is displayed in column 5. A statistically significant relationship between the variables is indicated by a p-value of less than 0.05. The p-values of 0.00 indicate that numerous relationships in the

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model are statistically significant at the 0.05 level. That is, it is probable that these relationships are genuine and not the result of coincidence. For example, there is a substantial direct relationship between GTL and EKL, as well as an indirect relationship between GTL and EKL through GSE.

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Discussion

This study tested several hypotheses. Firstly, this study hypothesized that green transformational leadership enhances environmental knowledge learning. The results match with existing studies. Prior research contends that by enhancing GSE, GTL significantly contributes to the advancement of environmental knowledge acquisition. Çöp et al. assert that efficient GTL procedures promote employee participation in training and development concerning environmental issues, consequently augmenting their comprehension of sustainability challenges (Çöp et al., 2020). The study by Wang et al. indicates that GTL cultivates a learning culture vital for enhancing employees' environmental competencies (Wang et al., 2018). Tuan's research demonstrates that leaders exhibiting environmentally specific transformational traits can effectively stimulate OCBE (organizational citizenship behavior for the environment), thereby strengthening the connection among leadership, knowledge acquisition, and pro-environmental actions (Tuan, 2019). The interaction among GTL, green self-efficacy, and environmental knowledge acquisition has a synergistic effect that improves organizational sustainability. Zhu et al. assert that GTL not only inspires employees to attain environmental objectives but also promotes their ongoing education regarding environmental practices, consequently enhancing their self-efficacy (Zhu et al., 2022). The study of Faraz et al. demonstrates that GSE moderates the link between leadership styles and employees' pro-environmental activities, suggesting that increased self-efficacy correlates with enhanced participation in sustainable practices (Faraz et al., 2021).

The study also identified a favorable and significant influence of GTL (Green Transformational Leadership) on PEBs in the workplace. Leadership is crucial in building business culture and affecting employee behavior, especially with environmental stewardship. Research reveals that employees' pro-environmental activities are influenced by their leaders' commitment to sustainability. Hussain's research indicates that sustainable leadership correlates with improved organizational performance, highlighting the necessity for leaders to incorporate green policies into their strategic planning (Hussain, 2023). This integration promotes a culture of sustainability and encourages employees to embrace pro-environmental activities as integral to their business identity. The empirical evidence provided by Zainab et al. further substantiates this concept, illustrating that sustainable leadership enhances social, economic, & environmental performance (Zainab et al., 2021). This viewpoint corresponds with the comprehensive understanding of sustainable leadership as a complex approach that includes ethical accountability, stakeholder involvement, and dedication to environmental stewardship. The bibliometric analysis by Sengur reveals an increasing acknowledgment of the necessity for educational leaders to implement sustainable methods, which may serve as a paradigm for other sectors (Sengur, 2023).

Thirdly research investigated the GSC as a major mediator between GTL and EKL. Prior research corroborates our findings. Zhang et al. discovered that GTL positively influences green self-efficacy, subsequently augmenting employees' commitment to environmental objectives. Zhang et al. (2020). This corresponds with the conclusions of Chen et al., who assert that GTL is a vital component influencing GP (green performance), with self-efficacy acting as a mediating variable in this dynamic (Chen et al., 2014). Nisar et al. substantiate this concept by illustrating that GSC mediates the link between GTL and green performance, emphasizing the significance of self-efficacy in converting leadership into tangible environmental results (Nisar et al., 2017). Zero Besides enhancing GSC (green self-efficacy), GTL positively contributes to the advancement of environmental knowledge acquisition. Çöp et al. assert that efficient GTL procedures promote employee participation in training and development concerning environmental issues, consequently augmenting their comprehension of sustainability challenges (Çöp et al., 2020). Wang et al. indicate that GTL cultivates a learning culture vital for enhancing employees' environmental competencies (Wang et al., 2018). Tuan's research demonstrates that leaders exhibiting environmentally

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specific transformational traits can successfully stimulate organizational citizenship behaviors for the environment organizational citizenship behaviors for the environment, thereby strengthening the linking between leadership, knowledge acquisition, and pro-environmental actions (Tuan, 2019).

This investigation also identified the mediating effect of green creativity and established a strong link between GTL and EKl. Our discoveries are also evidenced by prior outcomes. Sidney et al. contend that GTL is directly linked to green creativity, suggesting that executives should adopt this approach to foster creativity among employees (Sidney et al., 2022). Mauledy emphasizes the importance of Green Human Resources Management (GHRM) as a mediator in the relationship between GTL and green creativity, positing that effective HR practices may amplify the positive effects of GTL on creativity in the hospitality industry (Mauledy, 2023). Shah et al. argue that GTL influences green creativity and performance, emphasizing the critical role of leadership in the promotion of sustainable innovation (Shah et al., 2021). It is essential to acquire environmental knowledge in order to promote green innovation, as it equips employees with the necessary information to develop effectively. Safari et al. contend that employees' eco-friendly behavior is significantly influenced by their environmental knowledge and awareness. Consequently, it is recommended that companies implement frequent training sessions to enhance this comprehension (Safari et al., 2018).

This study also examined the mediating impact of green self-efficacy and identified it as a significant mediator in the relationship between GTL and WPB. Previous research has suggested that GTL has a positive effect on employees' green self-efficacy by creating a supportive and empowering environment that encourages pro-environmental behaviors. Leaders who exhibit environmentally specific transformational behaviors, such as articulating a clear environmental vision and demonstrating commitment to sustainability, can inspire employees to internalize these values and increase their confidence in their ability to engage in pro-environmental behaviors (Zong-bo et al., 2020; Robertson & Barling, 2012). According to Zong-Bo et al. (2020), transformational leadership that is focused on environmental concerns is essential for promoting the eco-friendly behavior of employees in the workplace, as it fosters a sense of intrinsic motivation and environmental enthusiasm. This study also identified a favorable and significant mediating influence of green creativity between GTL and WPB. GTL fosters environmental innovation by granting staff the independence and motivation necessary to develop their ecological practices. Previous research indicates that when leaders convey a distinct environmental vision and exhibit dedication to sustainability, employees are more inclined to participate in innovative problem-solving concerning environmental challenges (Crucke et al., 2021; Öğretmenoğlu et al., 2021). The relationship between GTL and green creativity is additionally influenced by elements including green self-efficacy and organizational identity, which enable employees to initiate and engage in pro-environmental initiatives (Du & Yan, 2022; Faraz et al., 2021). Besides promoting environmental creativity, GTL considerably influences workplace dynamics. Employees are more inclined to demonstrate pro-environmental actions when they view their leaders as exemplars who emphasize environmental sustainability (Liu & Yu, 2023; Soni, 2022).

Conclusion

This research has significantly enhanced the comprehension of the association between GTL Green Transformational Leadership and its effects on Environmental Knowledge Learning (EKL) & Work Pro-Environmental Behaviors (WPEBs). The results offer robust empirical evidence endorsing the beneficial impact of GTL on individual and organizational sustainability. By cultivating a culture of learning and innovation, GTL leaders may motivate staff to obtain the requisite knowledge and skills to tackle environmental concerns. Furthermore, GTL can incentivize employees to participate in pro-environmental actions, including waste reduction, energy conservation, and the adoption of sustainable practices. The research results hold significant significance for scholars and practitioners alike. This study offers a basis for future research to investigate the intricacies of GTL and its effects on many organizational outcomes. The findings underscore the necessity for practitioners to invest in leadership development programs that prioritize GTL concepts. By cultivating proficient GTL leaders, firms may establish a sustainable future and promote a more environmentally friendly planet.

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Practical & Theoretical implication

The findings of this study have positive practical & theoretical implications for the Saudi Arabian hospitality industry. Theoretically, the research extends the GTL framework by demonstrating its positive impact on various dimensions of sustainability, highlighting the mediating roles of green self-efficacy and green creativity, and underscoring the interconnectedness of GTL, environmental knowledge learning, and WPEBs. Practically, the study suggests that hospitality organizations should invest in leadership development programs that emphasize GTL principles, empower employees through training and development, create sustainable work environments, measure and monitor sustainability performance, and collaborate with stakeholders to promote sustainable practices. By embracing GTL and implementing these strategies, Saudi Arabian hospitality organizations can contribute to a more sustainable future while enhancing their reputation and competitive advantage.

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