



## **A STUDY AMONG GREEN TRANSFORMATIONAL LEADERSHIP, GREEN LEARNING, GOVERNMENT REGULATION AND SUSTAINABLE PROJECT SUCCESS ACROSS RENEWABLE ENERGY INVESTMENTS**

*Um estudo entre liderança transformacional verde, aprendizagem verde, regulamentação governamental e sucesso de projetos sustentáveis em investimentos em energia renovável*

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### **ABSTRACT**

Because of the recent economic disaster, sustainable corporate performance has become a global demand and green measures have been identified as the prominent answer of these issues in literature. This circumstance has piqued the interest of policy makers and new researchers. The study investigated green transformational leadership as a source of green learning to achieve sustainable project success. Although academics have focused on the influencing variables of sustainable success, minimal investigation have been done into the antecedents of sustainable success in renewable energy projects. Using organizational learning theory as a foundation, this study investigates the relationships between green transformational leadership, green learning, and sustainable project success, as well as the moderating effect of government regulations was found. In this vein, data from 325 samples from renewable energy projects in Pakistan was collected with the help of an electronically administered questionnaire. For preliminary data analysis and hypothesis testing, SPSS 21 and Smart PLS 3.0 were employed. The empirical findings demonstrated that green transformational leadership has significant positive effect on sustainable project success via green learning. The findings also demonstrated that government regulations play a moderating influence in the relationship between green learning and sustainable project success. The study not only uncovers the linkages, but it also provides theoretical and practical suggestions for project management to improve sustainable success. The existing research assists policymakers in developing policies and leads new *researchers* in investigating this area in the future.

**Keywords:** Green transformational leadership, Sustainable project success, Green learning, Government regulations, Renewable energy.

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## UM ESTUDO ENTRE LIDERANÇA TRANSFORMACIONAL VERDE, APRENDIZAGEM VERDE, REGULAMENTAÇÃO GOVERNAMENTAL E SUCESSO DE PROJETOS SUSTENTÁVEIS EM INVESTIMENTOS EM ENERGIA RENOVÁVEL

*A study among green transformational leadership, green learning, government regulation and sustainable  
project success across renewable energy investments*

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### RESUMO

Devido ao recente desastre econômico, o desempenho corporativo sustentável tornou-se uma demanda global e as medidas verdes foram identificadas como a resposta proeminente para essas questões na literatura. Essa circunstância despertou o interesse de formuladores de políticas e novos pesquisadores. O estudo investigou a liderança transformacional verde como fonte de aprendizado verde para alcançar o sucesso sustentável do projeto. Embora os acadêmicos tenham se concentrado nas variáveis que influenciam o sucesso sustentável, uma investigação mínima foi feita sobre os antecedentes do sucesso sustentável em projetos de energia renovável. Usando a teoria da aprendizagem organizacional como base, este estudo investiga as relações entre liderança transformacional verde, aprendizagem verde e sucesso de projetos sustentáveis, bem como o efeito moderador das regulamentações governamentais. Nesse sentido, dados de 325 amostras de projetos de energia renovável no Paquistão foram coletados com a ajuda de um questionário administrado eletronicamente. Para análise preliminar dos dados e teste de hipóteses, foram empregados o SPSS 21 e o Smart PLS 3.0. Os resultados empíricos demonstraram que a liderança transformacional verde tem um efeito positivo significativo no sucesso do projeto sustentável por meio da aprendizagem verde. Os resultados também demonstraram que as regulamentações governamentais desempenham uma influência moderadora na relação entre a aprendizagem verde e o sucesso sustentável do projeto. O estudo não apenas revela as ligações, mas também fornece sugestões teóricas e práticas para o gerenciamento de projetos para melhorar o sucesso sustentável. A pesquisa existente auxilia os formuladores de políticas no desenvolvimento de políticas e leva novos *pesquisadores* a investigar essa área no futuro.

**Palavras-chave:** Liderança transformacional verde, Sucesso de projetos sustentáveis, Aprendizagem verde, Regulamentações governamentais, Energia renovável.

## INTRODUCTION

The global energy sector is being criticized for an increased greenhouse gas (GHG) emissions. According to a United Nations (UN) analysis, the energy sector accounts for around 35% of global GHG emissions. Perhaps this is why terms like renewable energy have just entered the academic vernacular. There is numerous research available on green and clean energy that offers it as a solution to reducing CO<sub>2</sub> emissions related to the energy sector (Akhtar et al., 2022; Chien et al., 2021). Renewable energy projects are actually non-diminishing supplies of renewable energy. Wind, sunshine, tides, rain, waves, and geothermal heat are the most popular renewable energy initiatives. Renewable energy projects help to reduce global warming, help in prosperous economic growth, provide cheap resources to fulfill energy needs, and improving human welfare by reducing air pollution (Usman et al., 2022; Yang and Usman 2021; Kasperowicz et al., 2020; Lu et al., 2020; Liobikiene et al., 2019; Li et al., 2019). Pakistan being one of the top ten global warming-affected countries, urgently needs to adopt renewable energy sources (Khan et al., 2019; Maqbool et al., 2020). Pakistan has invested up to 0.6 billion USD in renewable energy development. Conclusively, Pakistan is gifted with abundant renewable energy resources but appropriate usage of these resources and the sustainability of such energy projects are required. According to the Pakistan Ministry of Energy, Power Division (2020) report, the country is more reliant on renewable energy (RE) resources. The government has created a long-term policy for Alternate Renewable Energy (ARE) in 2019. The ARE 2019 strategy outlines the country's entire framework for renewable technologies. The policy apparently aims to have 20 percent of total energy derived from renewable sources by 2025 and 30 percent by 2030, and it envisions the construction of large-scale renewable energy projects in Pakistan. If Pakistan succeeds to achieve its renewable energy objective, it might save up to \$5 billion in potential fuel and other costs (World Bank, 2022).

The term "sustainability" was first coined by John Elkington in business as a triple bottom line idea that help management to assess the long-term survival and development of the business. Sustainable business performance includes financial, environmental and social performance. As a result, the businesses display a strong sense of responsibility regarding the safeguard of natural resources that future generations will rely on (Del Baldo & Baldarelli, 2017). To achieve highly sustainable business performance, managers are required to get proper awareness of the ecological and social needs of consumers, the government and potential customers. Management is required to not compromise on the social welfare and environmental quality. Such corporations can accurately monitor environmental issues originating from its actions and regulates its processes in accordance with the regulations of environmental regulatory bodies (Orobia et al., 2020), and it can thrive in business (Freudenreich et al., 2020). Globalization and advancements in social media have raised public awareness about firms' environmental and social obligations. Businesses must achieve greater sustainable performance to stay competitive (Chang et al., 2021). Pakistan's energy sector is under the direct or indirect authority of government departments and commercial enterprises (Rafique & Rehman, 2017).

Despite the tremendous potential for renewable energy resources in Pakistan, the majority of previous initiatives have not yielded successful outcomes. Failure of such initiatives raises various concerns including economic diversity, political issues, erroneous feasibility studies, inaccurate data collecting, corruption, leadership of the projects, and financial limits (Maqbool et al., 2020). The recent large list of failed or postponed renewable energy projects has raised concerns and challenges (Siddiqui, 2016) that necessitate additional investigation to assist Pakistani authorities in addressing these problems. Despite the substantial contributions of previous researchers (Ashfaq et al., 2019; Maqbool et al., 2018; Maqbool, 2018; Rafique & Rehman, 2017; Baloch et al., 2017; Shahbaz et al., 2012; Sakrani et al., 2012; Sahir & Qureshi, 2008), none of them have placed an emphasis on renewable energy project performance measures. The end goal of such energy projects is not just the completion of such projects but the eventual goal is to achieve efficient or sustainable project success (Maqbool et al., 2020). Because of the extensive scope of these projects, a diversified stakeholder base exists both inside and outside of the project firms (Berrone et al., 2019).

Pakistan is currently one of the worst-affected countries as a result of climate change and environmental pollution (Mumtaz et al., 2019). As a result, the context of this work is critical for practitioners. Despite Pakistan's enormous renewable energy potential, most projects fail to deliver and accomplish their objectives. Multiple problems, such as political and economic instability, lack of transparency, societal barriers, data scarcity, corruption, financial constraints, etc. significantly impede the success of these projects. In Pakistan, the lack of

success in renewable energy projects has resulted in their closure or postponement (Wang et al., 2021). The reality necessitates the investigation of factors that can assist policymakers in turning around deteriorating projects and assisting in the sustainable success of such projects.

Because of the poor leadership, renewable energy projects in Pakistan have failed to meet their objectives (Maqbool et al., 2017). Green human resource management and green leadership styles can help to lessen the negative effects of business activities on the environment and community (Rossi et al., 2020) and achieve sustainable project success. Prior research has looked into the effects of leadership styles on organizational performance and different work-related behaviors (Jabeen & Rahim, 2021; Jabeen & Munir, 2018; Huang et al., 2015; Top et al., 2015) and found that leadership leads to sustainability. Leadership's role in fostering sustainability has been well recognized in the literature. Leaders can produce a variety of organizational outcomes, one of which is sustainable project success (Zaman et al., 2022). Similarly, academicians have placed an emphasis on employees' green conduct in order to achieve sustainable success. Green behaviors can be broadly defined as employee behaviors aimed at conserving the ecological environment and natural resources as well as working to decrease environmental deterioration and improve environmental quality (Norton et al., 2015). Individual qualities (Tariq et al., 2020), leadership attributes (Wang et al., 2018), and organizational climate are currently the focus of scholarly studies on corporate employees' green actions (Zientara & Zamojska, 2018). Green transformational leadership (Tian & Jiang, 2021) in particular has received a lot of attention as a powerful tool for sustainable success or performance. According to previous research, the conclusions of the literature are still vague and cannot be extrapolated to project performance in general.

The purpose of this study is to investigate the relationship between green transformational leadership and sustainable success of renewable energy projects in Pakistan. The study also sought to investigate the moderating effect of government regulations on the association, as well as the mediating impact of green learning in achieving sustainable performance. Given the environmental risks involved with the energy sector, researchers believe that such studies are necessary to advance the debate on the viability of renewable energy projects. The duties of top-level personnel become critical because they affect the firm's sustainability and success. According to several academics, greening the workforce enhances the performance of organizations (Umrani et al., 2020). On the other hand, green transformational leadership has an indirect impact on the performance of the organization (Singh et al., 2020). Academics have also found that green transformational leadership quantifies green innovation (Mittal & Dhar, 2016) and green team resilience (Cop et al., 2021). On the other hand, less attention was put on determining sustainable project performance through green transformational leadership. There have been few empirical studies on sustainable project success and green transformational leadership. Furthermore, researchers believe that green transformational leadership is critical in building employees' green learning behaviors (Bhutto et al., 2021; Mittal & Dhar, 2016). However, these studies ignored the missing link between green transformational leadership and sustainable project success which is green learning. Nonetheless, most energy-related research have a critical gap. As a result, the primary goal of this study is to investigate the aspects that can enhance the sustainability performance of energy-specific projects.

According to organizational learning theory the requirement of organizational learning relates to the uncertainty of the environment in which organizations survive. So, the greater the uncertainty in environments the more learning is needed for organizations (Dodgson, 1993). This theory states that leaders' styles can influence organizational learning behavior (Berson et al., 2006). Transformational leadership can help organizations learn in a variety of ways, including charm, inspirational motivation, intellectual stimulation and personalized consideration (Garca-Morales et al., 2012). Furthermore, transformational leadership promotes both exploratory learning and exploitative learning (Sun & Anderson, 2012; Vera & Crossan, 2004). Organizational learning theory states that learning is an imperative means for organizations to identify external environmental issues as well as internal difficulties and then devise solutions to all of these problems (Cui & Wang, 2021; Zhang & Zhu, 2019). This will assist businesses in changing their mindset and improving their ability to innovate (Zhang & Zhu, 2019; Argote, 2011). As a result, businesses must do learning in order to gain knowledge (Cui et al., 2021; Dodgson, 1993).

## 1 THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT

### 1.1 Green Transformational Leadership and Sustainable Project Success

Green transformational leadership, as compared to traditional transformational leadership focuses on a set of behaviors aimed at safeguarding the environment and fostering sustainable development. Green transformational leadership emphasizes a set of practices that enhance environmental progress, sustainable development, and green willingness among employees. It encourages green creativity in order to attain goals that exceed projected environmental performance (Cui & Wang, 2021; Chen & Chang, 2013). Additionally, green transformational leadership encourages followers' excitement and passion in gaining green knowledge from firms to address environmental concerns and develop environmental practices (Begum et al., 2022). For this reason, green transformational leadership is regarded as an important indicator for businesses. Researchers proposed that organizations prioritize green transformational leadership in order to improve their performance (Rizvi & Garg, 2020). Green subjects are currently of interest to researchers. Green transformational leadership has been explored in many researches in many aspects. Firm performance improves as transformational leadership grows, but the impact of green transformational leadership on long-term project success remains unknown. Green transformational leadership is critical in improving sustainability in corporate performance (Peng et al., 2020). Green transformational leadership focuses the overall performance of the team and promotes sustainable performance. Thus the researchers hypothesize that

H1: There is a significant relationship between green transformational leadership and sustainable project success.

### 1.2 Green Transformational Leadership and Green Learning

According to researchers Chen and Chang (2013), green transformational leadership drives individuals to attain environmental goals and to exceed in predicted levels of environmental performance. It has a significant influence on green creativity. Subsequent research found that green transformational leadership encourage employee behavior related to innovation, creativity, and performance (Li et al., 2020; Singh et al., 2020; Wanget al., 2018; Graves & Sarkis, 2018).

Exploratory green learning seeks novel information and abilities beyond the realm of previous knowledge, as well as new combinations of routines, activities, rules and norms emphasizing disrupting the dominant design. In contrast to exploratory green learning, exploitative green learning centers on current knowledge about recognized products and markets, promoting and reliability efficiency (Zhang & Zhu, 2019; Zhao et al., 2016). In comparison to exploitative learning, exploratory learning is seen as a difficult "high-risk" learning technique (Peters & Buijs, 2022). Green transformational leadership encourages employees to engage in demanding activities and to explore new perspectives and methods to improve traditional products and production processes because of its change-oriented behavior (Begum et al., 2022).

As a result, experts claim that green transformational leadership is willing to embrace change and seek challenges, both of which are critical in the development of organizational green learning (exploratory green learning and exploitative green learning). Green transformational leadership can also encourage employees to remain positive, improve observational learning about green attitudes and beliefs (Khan & Khan, 2022; Chen & Chang, 2013), and aid in sustainability initiatives. According to organizational learning theory, leadership style can influence organizational learning behavior (Berson et al., 2006). The concept of "Guanxi," which means "close group," influences project management practices in China. This concept guides that a healthy relationship exists between the bright side of leadership and project success and a negative relationship between the dark leadership and project success (Chen & Partington, 2004). Transformational leadership, as an effective leadership style can facilitate organizational learning (Garca-Morales et al., 2012).

Green transformational leadership, as opposed to traditional transformational leadership, concentrate on a set of behaviors that aim to improve employees' readiness to learn (Cui & Wang, 2021). Green transformational leadership can assist employees to gain more resilience and confidence in exploring new information by engaging with them and giving material support, so creating a green learning environment (Cui & Wang, 2021). Green

transformational leadership, in other words, may facilitate green learning. As a result, the researchers look into the significance of green transformational leadership in the context of green learning and hypothesize that:

H2. *Green transformational leadership is positively related to green learning.*

### 1.3 Green Learning and Sustainable Project Success

A project is defined as successful if it maintains the quality, cost, stake holders expectations, stability between demands, and scope (PMI 2013). Furthermore, learning may be a critical way for firms to gain access to more diverse knowledge in order to achieve sustainable success. Researchers have adopted the concept of organizational green learning and green knowledge in the idea of sustainable success (Zhang & Chabay, 2020). Green learning or green knowledge is critical for organizational sustainability (Zhang & Chabay, 2020). According to organizational learning theory, learning is an important way for firms to identify external changes in the environment and internal conflicts and it aids in the solution of these issues (Cui & Wang, 2021; Zhang & Zhu, 2019), which will help firms adopt practices that may support them in the sustainable success of their projects (Zhang & Zhu, 2019). The study develops the hypothesis on the basis of these considerations.

H3. *Green learning is positively related to sustainable project success.*

### 1.4 Green Learning as Mediator

Organizational learning theory states that learning is a key approach for firms to identify external changes in the environment and internal conflicts and then generate solutions (Cui & Wang, 2021; Zhang & Zhu, 2019), which will aid firms in their green initiatives for sustainability. As a result, in order to achieve long-term success, businesses must engage in organizational learning to acquire complex and diversified knowledge (Cui et al., 2022).

Leaders are accountable for their employees' learning. Previously, the researcher has employed green transformational leadership to assess green team resilience (Cop et al., 2021) and green creativity (Mittal & Dhar, 2016). Transformational leaders influence business performance in a variety of ways, including employee behaviors, employee engagement, economic performance (Barling, Christie, & Hopton, 2010), green performance (Ramus & Steger, 2000), and psychological performance. Despite significant advances in understanding in this arena, no existing research has investigated the association between green transformational leadership and sustainable project success. Employees' perceptions of perceived green-related support lead to increased levels of green learning, which can also improve project sustainability. The cognitive assessment identifies green learning as a mediator between green transformational leadership and sustainable project success. Furthermore, further research is needed to determine how green learning is related to green transformational leadership and sustainable project success in the context of renewable energy projects. As a result, the research focuses on the mediating effect of green learning on the study variables. Therefore, based on the above literature, we propose the following hypothesis:

H4. *Green learning mediates the relationship between green transformational leadership and sustainable project success.*

### 1.5 Government Regulations as a Moderator

Previous research found that government rules promote or compel businesses to change their behavior in the interest of green implementations (Yang et al., 2015). As a result, in determining SPS, leadership may consider green learning and government laws. Because of the rise of diverse environmental problems, several governments have made substantial measures to limit and solve environmental issues by developing and enforcing rules and regulations (Park & Yoo, 2021).

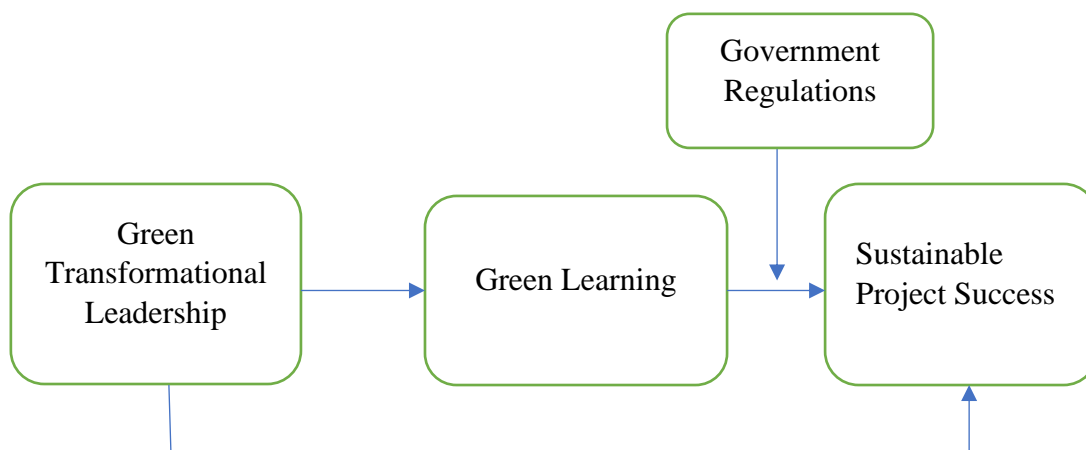
In Pakistan, a 10 billion-tree tsunami plantation is being built to reduce greenhouse gas and CO<sub>2</sub> emissions. Based on the information shown above, it is evident that the role of the government in addressing environmental challenges is crucial (Hafezi & Zolfagharinia, 2018). The government's regulations must expressly address the critical component of the creation of green leadership in firms, which creates green learning among employees and may lead to higher sustainability in the project. According to the literature, government regulations encourage or

even push businesses to adjust their behavior in order to undertake green initiatives (Wu et al., 2020). According to Steg et al. (2005), improving awareness of environmental responsibility, and personal environmental norms can increase support for environmental policies. Because of the penalties, government policies urge people to act green. Government regulation is an unavoidable external phenomenon. If it exists, this will be done better. On the contrary, if it is not functioning it cannot have a significant impact on this relationship.

H5: Government regulations moderate the relationship between green learning and sustainable project success.

Figure 1 - Hypothetical Research Model

Framework



Source: The researchers

## 2 RESEARCH METHODS

### 2.1 Data Collection and Sampling

The purpose of this study is to look into the influence of green transformational leadership in the sustainable success of renewable energy projects in Pakistan. Researchers have conducted a survey analysis approach in this study since it is popular and allows researchers to acquire broad-level data from the target audience. Furthermore, the cost of data collecting is quite minimal if compared to other methods (Heeringa et al., 2017; Roby et al., 2003). Questionnaire was used for data collection. Pilot research was initially undertaken to test the reliability and validity of the created questionnaire. The questionnaire was verified by the respondents, who suggested certain adjustments that were implemented.

The target population of this study included project staff, project managers, and project team leaders. Researchers have gathered information from renewable energy projects in Pakistan. Only established factors from previous studies were used, with measured variables on the Five-Likert scale. A quantitative and cross-sectional approach was adopted as a very quick and affordable approach (Sekaran & Bougie, 2016). On-site and electronic surveys were both utilized. The questionnaire was delivered via e-mail, WhatsApp, and Linked. In the electronic and on-site survey, 500 questionnaires were distributed to respondents and 367 of them were received. Researchers have selected 325 replies for data analysis after eliminating 42 questionnaires with incomplete data. The usable ones were coded for the study, resulting in a 65% response rate. In terms of procedural safeguards, the cover letter

was accompanied by a questionnaire that stated the objective of the study. Furthermore, the anonymity and confidentiality of responses were also guaranteed (Podsakoff et al., 2003).

## 2.2 Measures

### Sustainable Project Success

Four items were used to assess the success of a sustainable project. These items were adapted from previous research (Mishra et al., 2011; Wang et al., 2020). The findings of this study indicate that the alpha value for sustainable project success is 0.811. This number is greater than the standard value to affirm the item's reliability and validity. Some sample items from the scale are “We completed our projects within the budget allocation and given time frame” “We fulfill the all stakeholders demands and requirements with the high quality in the project”.

### Green Transformational Leadership

Chen and Chang (2013) created a six-items scale of green transformational leadership. The scale's Cronbach's alpha coefficient was .924. The typical alpha value is greater than the standard value. Hence, affirming the reliability of the scale. Some sample items from the scale are “leaders let employees work together for the same environmental goals,” “leaders encourage employees to achieve environmental goals beyond expectations,” “leaders inspire employees with environmental plan,” “leaders consider employees' environmental beliefs” “leaders provide employees with a clear vision.”.

### Government Regulations

Carter and Carter (1998) and Darnall (2006) developed a five-items scale to assess government regulations. The study has adopted this scale with an alpha reliability of .794. The items were related to examine the manager's knowledge regarding legislations, management system and policy frameworks for sustainable success.

### Green Learning

To reflect green learning, an exploratory green learning scale was used. Five questions are provided for exploratory green learning based on the scales developed by Atuahene-Gima and Murray (2007) and Cui et al (2021). The study has adopted this scale with alpha reliability. 897. The sample items from the scale are “we actively collect and acquire novel knowledge beyond the scope of our current market and technology,” “we actively acquire knowledge involving experiment, advanced and high market risks,” “we actively acquire and develop knowledge to enter new green markets and technology areas”.

## 2.3 Results

Internal consistency was investigated using composite reliability (CR), which was greater than 0.70 for all latent constructs. Furthermore, researchers advocate estimating average variance extracted (AVE) for convergent validity. The current study meets this condition because the AVE value for all latent constructs is larger than 0.50 (Hair et al., 2014).

## 2.4 Hypothesis Testing Technique

PLS-SEM is used to test the proposed hypotheses of this study. PLS-SEM has been frequently used in management and marketing literature due to its multiple features (Wilden et al., 2013). The use of PLS-SEM in this work is appropriate since PLS produces reliable results with small sample sizes (Hair et al., 2014) and is suitable when data do not satisfy the normality criteria (Hair et al., 2014; Kraus et al., 2020; Rehman et al., 2021; Rehman et al., 2021). The two-stage model, including the measurement and structural models, was used. PLS-SEM is a soft modeling technique that is well-suited for examining models in their early stages of development, as is the scenario of this study. To the best of the researcher's knowledge, no empirical studies have been conducted to investigate the relationship between green transformational leadership, green learning, and sustainable project



success. According to Henseler et al. (2015), Smart PLS is less demanding when the sample size is small, but it produces superior results. Smart-PLS can also improve the predictive relevance of the model (Yong et al., 2019).

## 2.5 Demographic Profile

*Table 1 summarizes the demographic details of the respondents. Male respondents (96%) clearly exceed female respondents (4%). It clearly shows that there is male are greater in number in energy projects. Furthermore, the majority of respondents are between the ages of 40 and 49, followed by those between the ages of 31 and 39. 60 % of respondents possessed bachelor's degrees, while 25% possessed master's degrees.*

**Table 1 - Demographic Attributes of Respondents**

Demographics	Frequency	Percentage
<b>Gender</b>		
Male	312	96%
Female	13	4%
Total	325	100%
<b>Age</b>		
Below 25	13	4%
25-30	18	5.5%
31-39	125	38.6%
40-49	144	44.3%
50 and above	25	7.6%
Total	325	100%
<b>Education</b>		
Bachelor's	195	60%
Master's	82	25%
Ph.D.	16	4.9%
Other	32	9.9%
Total	325	100%

## 2.6 Measurement Model Evaluation

Using Hair et al. (2017)'s guidelines, the measurement model was tested by establishing its convergent validity, composite reliability, and discriminant validity. Cronbach's alpha results are summarized in Table 2 showing all variables have values greater than the 0.70 thresholds recommended by Fornell and Larcker (1981).

**Table 2 - Reliability and validity of constructs**

Variables	Items	Factor Loading	CR	AVE	Alpha
GreenTransformational Leadership	GTL1	0.830	0.932	0.686	0.924
	GTL2	0.756			
	GTL3	0.989			
	GTL4	0.843			
	GTL5	0.894			
	GTL6	0.787			
Green Learning	EGL1	0.883	0.903	0.852	0.897
	EGL2	0.919			
	EGL3	0.809			
	EGL4	0.745			
	EGL5	0.786			
Government Regulation	GP1	0.897	0.898	0.637	0.794
	GP2	0.832			
	GO3	0.875			
	GP4	0.768			
	GP5	0.947			
Sustainable Project Success	SPS1	0.931	0.895	0.776	0.811
	SPS2	0.934			

SPS3	0.875
SPS4	0.934

Note: CR: Composite Reliability; AVE: Average Value Extracted; Alpha: Cronbach Alpha

Furthermore, Hair et al. (2019) consider composite reliability (CR) scores ranging from 0.7 to 0.9 to be 'excellent'. As all the results are between 0.8 and 0.9, verified the measurement model's composite reliability. The extracted average variance (AVE) values confirm the convergent validity. Fornell and Larcker (1981) proposed that AVE values larger than 0.5 indicate convergent validity of the construct. AVE values are above 0.5 establishing the convergent validity of the study constructs, as shown in Table 2. The factor loading was greater than 0.5, and no cross-loadings were found. Hence the results indicate acceptable level of construct validity (Liao & Zhang, 2020).

In some cases, Fornell and Larcker's (1981) criterion does not predict discriminant validity (Pahi et al., 2020). As a result, we used the HTMT ratio as the most recent criteria to investigate discriminant validity (Henseler et al., 2015). A score greater than 0.9 implies perfect similarity among variables.

**Table 3 - Heterotrait-Monotrait Ratio (HTMT), Discriminant Validity of Constructs**

Constructs	GTL	GL	SPS	GR
GTL	1			
GL	.843	1		
SPS	.565	.764	1	
GR	.761	.593	.468	1

Note: GTL: Green Transformational Leadership; GL Green Learning; SPS: Sustainable Project Success; GR: Government Regulations

The results given in Table 3 revealed an acceptable value of HTMT less than 0.9 proving that all of the constructs are discriminant and thus showing the discriminant validity of the constructs.

The details of descriptive statistics of the survey respondents is given in Table 4.

**Table 4 - Descriptive Analysis**

Constructs	N	Minimum	Maximum	Mean	SD
GTL	325	1.20	6.00	3.21	1.20
GL	325	1.33	6.00	3.42	1.67
SPS	325	1.11	6.41	3.52	1.54
GR	325	1.00	6.44	4.05	1.87

Note: GTL: Green Transformational Leadership; GL Green Learning; SPS: Sustainable Project Success; GR: Government Regulations; SD: Standard Deviations

The mean of the responses ranged from 3.21 to 4.05, and the standard deviation ranged from 1.20 to 1.87.

### 3.7 Structural Model Evaluation

The study has used bootstrapping with 5,000 resamples to assess the significance of the model. Tables 5 present the SEM results. As hypothesized, a substantial positive link between green transformational leadership and sustainable project success was discovered (H1:  $\beta = 0.36$ , t-value = 6.76,  $p < 0.05$ ). A substantial positive association between green transformational leadership and green learning was discovered (H2:  $\beta = 0.67$ , t-value = 0.967,  $p < 0.05$ ) and a substantial positive association between green learning and sustainable project success was discovered (H3:  $\beta = 0.48$ , t-value = 2.68,  $p < 0.05$ ).

**Table 5 - Results of Structural Model Assessment**

Paths	$\beta$	t-value	p-value	Decision
GTL →SPS	0.56	11.43	0.000	Supported
GTL →GL	0.67	9.67	0.010	Supported
GL →SPS	0.48	2.68	0.000	Supported
GL × GR →SPS	0.39	12.59	0.000	Supported

Note: GTL: Green Transformational Leadership; GL Green Learning; SPS: Sustainable Project Success; GR: Government Regulations

The study has also unearthed that green learning partially mediates the relationship between green transformational leadership and sustainable project success, as the paths from green transformational leadership to green learning ( $\beta = 0.67$ , t-value = 9.67,  $p < 0.05$ ) and from green learning to sustainable project success ( $\beta = 0.48$ , t-value = 2.68,  $p < 0.05$ ) were both found to be significant. As a result, H4 was also supported as proposed. Finally, researchers have discovered that government regulations have a substantial moderating effect on the association between green learning and sustainable project success (H5:  $\beta = 0.39$ , t-value = 12.59,  $p < 0.05$ ).

### 3.8 Model Fit Analysis

The current study employed the Standardized Root Mean Square (SRMR) approach proposed by (Henseler et al., 2014) for model fit analysis. This technique is referred to as the difference between observed and predicted correlations. The SRMR value should be between 0 and 1, with a value close to 0 fittings properly (Table 6).

**Table 6 - Indirect Effect (Mediation Results)**

Path	B	t-value	p-value	CI (LL)	CI (UL)	Decision
GTL →GL→SPS	0.45	6.65	0.000	0.28	0.47	Supported

Note: GTL: Green Transformational Leadership; GL Green Learning; SPS: Sustainable Project Success; GR: Government Regulations

**Table 7 - Model Fit Evaluation**

Estimated Model	Estimated Values
SRMR	0.127
NFI	0.914

Note: SRMR: Standardized Root Mean Square; NFI: Normed Fit Index

Table 7 displays the Model Fit Summary, which shows an SRMR value of 0.127, which is within the allowed range. Furthermore, Smart PLS includes another criterion NFI to confirm that the model fits a path model. A value closer to 1 fits better as shown in the results.

## 4 DISCUSSION

Connecting back to our research questions, researchers aimed at investigating the functioning of green transformational leadership in the development of green learning and sustainable project success. Additionally, researchers strived to examine whether green learning intervenes in the relationship between green transformational leadership and sustainable project success. Researchers were also interested in answering whether government regulations have an interactional effect on green learning and sustainable project success. Hence, as a core premise of supporting the study model, all of the provided hypotheses were validated using organizational learning theory (Dodgson, 1993). Results showed a significant positive relationship between green transformational leadership and sustainable project success. This implies that green transformational leaders enhance green learning in their employees and that support sustainable project success. This finding are also in line with the findings of Zaman et al. (2022) that supportive leadership (a positive leadership style) and transformational leadership (Zhao & Huang, 2022) significantly and positively impacts sustainable success of projects. Furthermore, results showed that the connectivity of green transformational leadership and sustainable project success is not that straightforward; instead, these are bridged through green learning. This implies that green transformational leadership enables individuals to feel confident while learning green to contribute to organizational sustainable success. This finding also validates earlier findings that the link between green transformational leadership and environmental performance is complex (Zhao & Huang, 2022) and is bridged through green values (Zhao & Huang, 2022).

Moreover, the expectations that government regulations have an interactional effect on the interrelationship of green learning and sustainable project success was also validated. Results showed that the relationship between green learning and sustainable project success gets stronger over increasing levels of government regulations. The explanation in the opening section of this research shows that green transformational leadership, green learning are the major sources of sustainable project success. Thus, researchers see the current study as a novel contribution to the current literature on the subject matter and practice as well.

## 5 THEORETICAL CONTRIBUTIONS

This study demonstrates the positive beneficial interaction effect of green transformational leadership on green learning and sustainable project success, which can assist the academic community in better understanding how green-related contextual elements influence project sustainability. The moderating role of government regulations was also found. Scholars Graves and Sarkis (2018) have highlighted on the impact of green transformational leadership on employees' green behavior as well the impact of green human resource management techniques on employees' green behavior (Graves & Sarkis, 2018; Zhou & Zhang, 2018) but have neglected the important contextual factors such as government regulations in this context. By elucidating the dynamic mechanism of green transformational leadership and green learning, this study can bridge the gap between green leadership, green learning, and sustainable project success. The research also helps to a better *understanding of the mechanism that promote green learning in the workplace.*

### Practical Implications

According to the study's findings, businesses should prioritize and encourage the green leadership behaviors required for sustainable success. Green transformational leadership is essential for developing green learning in employees which will help support project sustainable success. As a result, researchers believe that a company's green transformational leadership develops green competencies in its personnel. The study suggests that sustainable project success depends upon the quality of green transformational leadership and green learning. Furthermore, the study also suggests that leaders and managers in organizations should perceive the green perspective as a strategic resource and leverage it to attain the project's sustainable success. Furthermore, this research contributes to the challenge of implementing green practices for sustainable success by motivating project managers from both developing and developed nations. To summarize, experts recommend that leaders and managers should incorporate green responsibilities into performance appraisals and management systems to encourage employees to exhibit green learning behaviors on a continual basis.

### Limitations

This work has a few limitations, which are discussed along with future research directions. This research is conducted in the production of renewable energy projects in Pakistan, which limits the generalizability of the findings of this study to the energy sector. Researchers propose that future study should broaden this conceptual research framework to include the manufacturing sector, such as SMEs. Our study sampled green transformational leadership and organizational members' green learning to measure sustainable project success. According to the study, future researchers should sample the perceptions of both external and internal stakeholders in order to better understand and explain the sustainable performance of SMEs.

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