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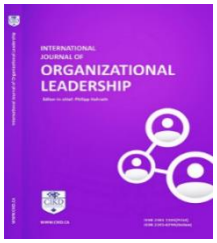

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Impact of Sustainable Leadership on Construction Project Success: Mediating Role of Green Innovation and Organizational Learning

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ABSTRACT

Using concepts from the Resource-Based View (RBV) and Knowledge-Based View theory (KBV), this research explores how sustainable leadership affects the success of construction projects over constructive stages. This study investigated the role of green innovation and organizational learning as mediators between sustainable leadership and project success in the construction sector. The sample used for this study consisted of 310 employees, mainly working on construction sites across Pakistan. Smart-PLS 4 was used to conduct analysis and hypothesis testing. To validate the direct and mediated effects, this study employed partial least squares structural equation modelling, and the results highlight a positive relationship between sustainable leadership and the array of sustainable project outcomes. Moreover, the results further support the idea that green innovation and organizational learning mediate the link between sustainable leadership and Project success. There is a lack of empirical inquiry into the association between sustainable leadership and project success in emerging countries. Through the interplay of sustainable leadership, project success, green innovation, and organizational learning, this study provides relevant clues on mechanisms that help uphold sustainability in building and construction, which is one of the first studies to investigate the interrelationships between sustainable leadership, project success, green innovation, and organizational learning.

The construction industry plays a vital role in economic growth in developing countries (Fareed et al., 2024; Shaukat et al., 2021) . Currently, researchers focus on evaluating leadership styles in Pakistan's construction firms intending to achieve Project Success (Iqbal & Latif et al., 2020). The success of a project depends on multiple situational conditions and chosen project management strategies. According to expanding research studies, leadership is considered one of the most impactful factors for the management and success of the project (Aga et al., 2016; Latif et al., 2020b). Previous research has shown that Sustainable Leadership is essential for the ProS (Bulmer et al., 2022). Sustainable leadership involves making decisions for the future, encouraging teamwork and innovation, creating a skilled and committed team, and emphasizing producing high-quality projects. Sustainable leadership can deliver favorable results on a wide range of business performance metrics (Aung & Hallinger, 2022; Iqbal & Piwowar-Sulej, 2023). Construction companies are moving toward sustainable project management because projects are complex and require sustainable solutions to successfully meet client expectations to achieve project success (Ullah et al., 2020). Therefore, it is important to study the relationship between SusL and ProS in the construction industry (Bulmer et al., 2022).

This study also focuses on green innovation, defined as creative products and procedures that provide benefits to consumers and companies while significantly decreasing negative environmental impacts (Zhao et al., 2018). Alsharif and Tong (2019) highlighted the significance of overcoming challenges to green innovation in the construction industry, including conserving energy, material reduction, and pollution control. Hence, there is a requirement for organized and structured procedures for green innovation in project-based management, especially in the construction industry; according to (Zhang et al., 2015) green innovation refers to the proactive incorporation of environmentally sustainable practices and technological advances within project management processes (Zhang et al., 2015). Implementing green innovation can also increase a company's productivity and overall effectiveness, especially for small and medium-sized companies (Robinson & Stubberud, 2013). Green innovation is essential for project management because it improves sustainability and minimizes negative environmental impacts, especially in the construction industry (Wu et al., 2019).

Organizational learning aims to increase the organization's production and effectiveness. Present leadership and management styles contribute to organizational learning as an innovative strategic approach to boost productivity and manage the organization's project success (Hsu & Fang, 2009). Organizational learning involves more than simply improving employee knowledge; it also enhances their capabilities, ultimately leading to the organization's growth and flexibility (Saadat & Saadat, 2016). Organizations are considered to be OrgL, intending to stay active in the market and become competitive in the current market situation (Talari & Khoshroo, 2022). Organizational learning aims to gather new information and understand its impact on the triple bottom line. The purpose of organizational learning is to gather new information and understand its impact on the triple bottom line. Organizational learning is a key component that promotes companies to be flexible and responsive (Malik & Mehmood, 2022).

The current study indicates several gaps that need to be addressed regarding the mechanisms of SusL, OL, GI, and PS. Considering the growing recognition of sustainable leadership, there remains a significant lack of development in the real-world implementation of sustainable

leadership practices (Shamim et al., 2017). The function of sustainable leadership in management and the ProS is yet to be completely examined (Shaukat et al., 2021). Underlined the necessity of investigating the relationship between sustainable leadership and project performance. Second, the addition of a mediating mechanism may strengthen the direct association between SusL and ProS (Hu et al., 2023).

Leadership in isolation is inadequate for its capacity to enhance the ProS (Latif et al., 2020a) The literature believes that various variables can obstruct the interaction between leadership and ProS (Yang et al., 2020). Looking at the variables that act as mediators in the relationship can help us understand how leadership affects project success and show us other ways leadership can help projects be more successful (Latif et al., 2020b). The discipline of business management is beginning to recognize the role of sustainable leadership. According to Baird et al. (2023), most of the research that has already been conducted determines how sustainable leadership impacts particular corporate achievements. However, a significant study gap exists in investigating how sustainable leadership impacts project objectives, such as project success. Iqbal et al. (2024) claimed that sustainable leadership is growing in popularity in company setups, given the significance of worldwide dedication to the Sustainable Development Goals (SDGs). They further proposed the mediating function of green innovation between sustainable leadership and organizational performance. To the best of our knowledge, and based on a review of the Web of Science, there is limited research that incorporates the variables of the influence of SusL on ProS and the mediating role of green innovation and organizational learning. Siddiqui et al. (2023) and Shaukat and Alam (2023) emphasized that the relationship between SusL and ProS completion in the construction industry in underdeveloped nations is still in its early stages. To address these gaps in the existing literature, this research aims to investigate the influence of SusL styles on ProS, with the role of green innovation and organizational learning serving as mediators and answers the following questions:

1) Does sustainable leadership Affect Sustainable ProS?
2) Does GreI mediate the relationship between SusL and ProS?
3) Does OrgL mediate the relationship between SusL and ProS?

According to the concept of resource-based view, resources are special, exclusive, and sustainable. However, gathering, assembling, and coordinating resources has received much attention, while possible benefits associated with resource management and the Resource-Based View (RBV) have received significantly less attention (Clough et al., 2019). Concentrating on leadership techniques in achieving competitive advantage is a factor contributing to this research gap. One of an organization's most important assets is its leadership, and a sustainable leadership style relies primarily on sustainable development, open communication, and collaboration among team members for improved productivity and efficiency (Avery & Bergsteiner, 2011). The RBV has evolved over the last thirty years, which is an essential rationale for the decision-making processes that enterprises take to achieve and maintain competitiveness in dynamic industries. The resource-based view specifies how leadership utilizes company assets to achieve and maintain the benefits. According to the RBV, intangible as well as tangible assets have unique characteristics that act as the foundation for those characteristics. The RBV has already been used in numerous organizational and business contexts due to its inherent popularity (Nason & Wiklund, 2018). The leadership utilizes their

autonomy to complete all the responsibilities associated with resource management and utilize resources effectively. The leadership utilizes their intelligence, perception, and industrial knowledge to manage the resources. They engage in rational decisions while managing resources based on their objectives, previous experiences, and beliefs.

The study examines whether green innovation and organizational learning mediate the link between susL and PS. The principal motivation behind the investigation was to break down the significance of keeping up a viable susL for improving PS. This study is relevant from a theoretical and practical standpoint. Theoretically, it will improve and fill a gap in the literature that has arisen as a result of the failure to discover a link between the variables in this study. In practice, this research will be extremely beneficial to construction project managers, who will be able to recognize the influence of their support and leadership style on project performance. Project managers, particularly in the construction industry, are frequently perplexed as to how to boost organizational learning and ensure ProS. Therefore, the findings of this study may be beneficial to project managers, who will be able to obtain better theoretical knowledge of their function and its influence on the project and will be able to plan their tactics appropriately to increase the organization's productivity.

This research identified major challenges that the construction industry in Pakistan encounters in its bid to attain project success, including inadequate effective and systemic leadership and sustainable project delivery. Despite the fact that this critical factor has been identified as having a great impact on economic development, many projects do not satisfy the clients or have inadequate leadership strategies (Khan et al., 2019; Waqar et al., 2024). This sector requires sustainable leadership to ensure that long-term planning, teamwork, and innovation are embraced since they remain additionally underdeveloped (Bulmer et al., 2022). Further, green innovation and organizational learning are poorly implemented, and significant gaps exist between the two strategies, resulting in organizational wastage and negative environmental impacts (Lu et al., 2017; Monahan, 2014). This research will address these gaps by examining the effects of sustainable leadership on project success by utilizing green innovation and organizational learning as mediators and by offering a framework to enhance the performance of projects in the construction industry of Pakistan.

Literature Review

Sustainable Leadership

Sustainable leadership refers to a leadership style that focuses on sustainability principles and practices as well as engagement and collaboration with stakeholders and teams. Sustainable leadership establishes long-term project management strategies and emphasizes team development and training for the successful execution of project objectives (Bulmer et al., 2022). Implementing sustainable practices for sustainable development and developing responsive strategies are characteristics of sustainable leadership (Suriyankietkaew et al., 2022).

SusL shares collaborative behaviors, commitment, autonomy, authority, resource availability, and social interactions with collaborative teams (Iqbal & Ahmad et al., 2020). According to Avery and Bergsteiner (2011), focus on long-term strategic approaches in the decision-making procedure, encouraging teamwork to satisfy the demands of stakeholders by providing highly qualitative projects. However, there is still a lack of empirical work examining

how these long-term strategies affect project outcomes in different cultures. Furthermore, there is a need to examine the nature of the satisfaction of the stakeholders in different industries (Uribe et al., 2018). Sustainable leadership collaborates with a project team to implement unique projects for their stakeholders (Javed et al., 2020). The literature review established that incorporating sustainable leadership practices has a positive impact on project innovation and employee motivation (Iqbal & Ahmad et al., 2020). However, there is still a gap in the literature regarding the degree to which sustainable leadership impacts organizational resilience and flexibility in a fast-paced environment (Suryaningtyas et al., 2019).

Project Success

A project is crucial for generating financial benefits and creating a competitive edge (Zhang et al., 2018). Project completion with optimal resource usage is successful (Basten et al., 2011). The literature clarifies that determining success is an important task. The concept of ProS has several dimensions. ProS is the primary goal of every project-oriented organization and is considered an essential and crucial concept in project management literature (Yudi & Rahayu, 2019). Considering the wide range of opinions, interpretations, and uncertainties that encircle a project, it can be challenging to determine its precise degree of success (Ika, 2009)

Researchers and decision-makers have begun to see that, along with the iron triangle concept, several other factors, including stakeholder satisfaction, company efficacy, user acceptance, and prospects for future opportunities, were important in determining the ProS (Ika, 2015). According to Bogopa and Marnewick (2022) the crucial factors for the project's success are people, procedures, and technology. A project-oriented company's three key success components are satisfying the customers, achieving creative objectives, and competitive advantages (Wu et al., 2017). The previous research investigations reveal that the emergence of flexibility in process management increase the chances of project success in uncertain conditions (Leybourne, 2009). These studies exemplify the appropriateness of sustained stakeholder communications and adaptable resource management which are indispensable factors when evaluating the project's success (Boaz et al., 2018). The ProS depends on several factors including effective leadership, a dedicated and inspired team, client engagement, well-defined requirements, and the accomplishment of the project objectives (Bogopa & Marnewick, 2022).

Sustainable Leadership and Project Success

Al-Hakim and Hassan (2016) identified a link between good leadership and ProS. Latif et al. (2020a) state that project success requires excellent leadership. Similarly, Mariam et al. (2022) discovered a strong correlation between leadership and the ProS in their study. Barney's (1991) RBV is used in this study to look at how SusL affects PS. The RBV states that a company has its own unique resources that help it reach its strategic goals and is the foundation of its efficiency (Barney, 1991). Companies use leadership as a form of human capital because leaders are knowledgeable, hard to replace, and one-of-a-kind (Harris & McMahan 2015). Shaukat and Alam (2023), using RBV as a guide, believed that SusL applications are unique, growing, innovative, valuable, and cannot be replaced. They also believed they could help a company get ahead of other companies entering the market. However, even with these insights, there is a significant research gap in the empirical literature concerning the analysis of the direct

and indirect effects of SusL on project success. Therefore, this study seeks to bridge this gap by examining the direct impact of SusL on project success while considering Green innovation and organizational learning as mediation variables. More recent studies have, therefore, stressed the importance of identifying and mediating variables to facilitate understanding of the relationships between leadership and project performance. For example, Tang et al. (2017) have focused on the importance of green innovation as a moderate variable, proving that green initiatives can improve project performance. Similarly, Noruzy et al. (2012) observed that organizational learning may also pose the capacity to act as organizational learning processes through which leadership styles affect project performances. These studies indicate a positive relationship between leadership, innovation, and learning in the achievement of project goals. However, these studies rarely consider construction industries in developing countries. SusL was employed in this study because it is founded on these ideas and is seen as an important leadership style in the era of sustainability. Thus, the present study is a continuation of prior research and uses the most recent sources of information and fill in the gaps. It focuses on the construction industry of Pakistan, especially, exploring the applicability of SusL and understanding the role of green innovation and learning organizations in improving the outcome of projects. It extends the existing literature and contributes relevant information to project managers in similar settings. Based on the above logic, we assume the following hypothesis:

H1: *SusL has a positive and significant effect on project success.*

Mediating Role of Green Innovation

The concept of green innovation from the project management perspective highlights the utilization of environmentally friendly strategies and techniques that deliver positive results in projects (Zhang et al., 2020). Green innovation integrates sustainability practices and concepts into project management practices to accomplish environmental goals and enhance project success (Lestari et al., 2023). This project effectively implements green innovation practices that can gain a competitive edge and enhance environmental and sustainable performance, Project success is significantly affected by green innovation. According to previous studies, implementing green innovation practices boosts company performance in new project innovation (Ahmad, 2023).

However, the literature reviewed in this study does not provide extensive studies on the role of green innovation in mediating the SusL-ProS relationship. Previous studies employed a direct effects approach for various factors, but they do not investigate the mediating effect of green innovation and other factors that may be present. The importance of such a gap can be noted in the sense that knowing these mechanisms can aid organizations in improving their leadership and innovation potential for project success. GreI is recognized as the most significant strategy tool for successful sustainable development (Weng et al., 2015). Green innovation is an appropriate response to consumer demands, as consumers are prepared to pay more for sustainable projects (Tang et al., 2017). Green innovation is essential to project success by utilizing sustainable techniques throughout the project life cycle (Yang et al., 2015). By removing projects' harmful impact on the environment, green innovation in project management allows companies to maintain their environmental stewardship responsibilities (Wu, 2013). Green innovation contributes to identifying and reducing project-related

environmental risk, maintaining compliance with rules, and minimizing possible legal and social problems (Lenderink et al., 2022).

Numerous studies illustrate the importance of green innovation in promoting sustainable development and project success. Bintara et al. (2023) highlight the significance of a green competitive edge that can boost productivity and contribute to sustainable business. Islam (2023) examines how business models can be transformed and how environmental sustainability can be promoted through green technology development. Small and medium-sized businesses (SMEs) have successfully reduced their environmental effect, managed waste, and promoted GreI (Tereshchenko et al., 2023). Nevertheless, further research employing more detailed empirical analysis is still required to identify the strengths and weaknesses of green innovation in different environments, especially in developing countries. Based on the given logic, we make the following assumption:

H2: *GreI has a considerable mediating effect on the link between SusL and ProS.*

The Mediating Role of Organization Learning

In the context of project management, the method of creating, preserving, and sharing knowledge within an organization is known as OrgL (Rose et al., 2020). In a project-based firm, organizational learning involves gathering, analyzing, and using project-related knowledge to enhance project success (Zhao et al., 2022). Knowledge management and the growth of organizational capabilities are two domains of organizational learning (Eriksson & Leiringer, 2015). Organizational learning can be boosted by providing a formal project management office that can assist in the creation and maintenance of project management standards, procedures, and databases of lessons learned (Law & Chuah, 2019). Several studies have indicated the importance of organizational learning for a project's success (Wang et al., 2008). Both demonstrate how organizational learning improves project knowledge and performance.

OrgL serves as a mediating role in developing an organization's capabilities, governance, SusL role, and long-term success. According to Senge (2006), organizations mainly give information to individuals committed to learning. However, organizational learning is more beneficial for organizations as compared to individual learning. Modern leadership styles are required to understand complex problems and facilitate productive work performance when employees share their knowledge within the company (Alblooshi et al., 2020). Recent studies have noted that organizational learning has a considerable impact on projects and their outcomes, allowing for constant enhancement of organizational performance and adaptability (Ghahramani et al., 2022). Malik and Mehmood (2022) explore how organizational learning mediates the relationship between sustainable development goals and susL. Successful management and leadership techniques can contribute to organizational success within the framework of sustainable development. The purpose of organizational learning is to enhance the organization's productivity and performance. However, some areas still need further research on how organizational learning is a mediator between sustainable leadership and project success, especially in cross-cultural and organizational settings (Shafait & Huang, 2024). Organizational learning is an innovative technique since modern management and leadership styles provide a strategic tool to boost productivity and optimize the firm's performance and suitability (Naqshbandi & Tabche, 2018). Sustainable leadership is required

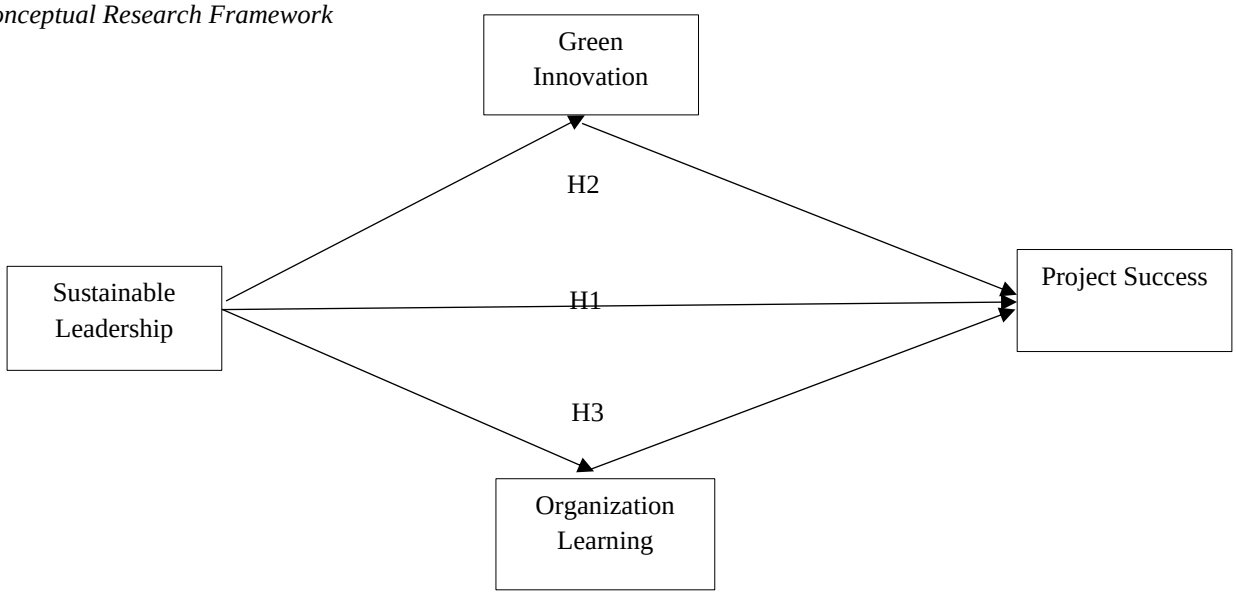
for cooperative learning by bringing employee ideas and abilities into corporate processes and ensuring that the company has innovative employees. According to Obeso et al. (2020), OrgL is a long-term idea that improves organizational performance. Contemporary research has underlined the need to merge sustainable leadership practices with organizational learning to enhance project outcomes, even though these researches often fail to provide an integrated framework that explains the relationships between these factors. Developing organizational commitments and learning through sustainable leadership ultimately leads to sustainable project success (Macke & Genari, 2019). Sustainable leadership maintains the organization's learning process and facilitates its employees to grow in their careers through knowledge sharing and teamwork (Piwowar-Sulej & Iqbal, 2023). Adu-Yeboah et al. (2023) explore how organizational learning contributes to sustainability by providing an integrated model that highlights the relationship between contextual factors and learning procedures. Organizational learning, as defined by Lopes et al. (2023), plays a crucial role in the promotion of sustainability, which can also be seen on the basis of an integrated model that compares contextual factors and learning procedures. This has revealed the knowledge gap that exists regarding the nature and processes by which organizational learning moderates the relationship between sustainable leadership and project success. The following hypothesis is predicated on the logic shown above:

H3: *OrgL significantly mediates the relationship between SusL and ProS.*

Based on the above hypothesis, we created the research conceptual framework model illustrated in Figure 1.

Figure 1

Conceptual Research Framework



Method

Sample and Procedure

The data were acquired from a Pakistani construction firm. This study used a quantitative cross-sectional strategy, with survey questionnaires as the primary data collection technique. Quantitative research frequently employs a range of methodologies, the most prevalent of

which are surveys and experimental studies (Creswell, 2009). This study used a survey-based research approach because it provided consistency in data collection for identifying components and investigating the hypothesized correlations between them (Malhotra & Grover, 1998). The study employs a correlational method of inquiry to assess the impact of SusL on ProS, focusing on the mediating mechanism between green innovation and organizational learning. Pakistan's small and medium construction firms served as data sources in this study to facilitate further examination and elaboration of the findings. Convenience sampling was used to collect data from participants effectively. This technique worked practically and efficiently and was accessible because these factors are critical to the data collection procedure.

The survey mechanism was considered to measure the main concepts of sustainable leadership, organizational learning, green innovation, and project success. Multiple items from previous research papers were adopted to measure the constructs. Through personal relationships, 500 questionnaire survey forms were distributed to teams working in Pakistani construction firms. The data collected from construction firms contributed 348 responses, of which 38 were not included because specific entries were missing. Overall, 310 responses were considered for further analysis processes. Information regarding participants' demographics was requested for this study. Respondents' demographic information is presented Table 1.

The following arguments can support the justification of the sample of 310 responses in this study. The responses obtained from 310 participants can be justified based on the 'rule of ten', which is widely used in structural equation modeling and regression analysis. According to the most recent studies, when it comes to survey-based research, a sample size of between 200 and 400 is normally sufficient enough to provide statistically sound results (Liu, 2013). A power analysis supports the assertion by revealing that the present study's sample of around 300 has an adequate power of .80 to detect medium effect sizes at the alpha level of .05 to establish the credibility and dependability of the study (Ahmad & Halim, 2017). Moreover, the response rate was quite high, being 69.6 percent among all employees in the organization. Of 500 surveys, 348 distributed surveys represent 69.6%, and the responses were efficient, which indicates that participants were interested and committed to answering the surveys. The exclusion of surveys with incomplete responses improves the overall data quality. The study adopted the convenience sampling technique, which was convenient and feasible to obtain the required samples; the employees from the small and medium construction firms of Pakistan included the results to generalize the findings.

Instrumentation and Measures

The research instruments for the current study were obtained from the measuring scales used in previous studies. The items were modified as needed to ensure they were appropriate for the present study. This study consisted of four variable questionnaire items. SusL is the independent variable, ProS is the dependent variable, and organizational learning and green innovation serve as mediators. Each variable item is measured using a five-point Likert scale ranging from strongly disagree to strongly agree. The scale of SusL was adapted from the research conducted by McCann and Holt (2010), and the scale of ProS was adapted from the research conducted by Aga et al. (2016). The scale of Organizational learning was adapted from the research conducted by Iqbal and Ahmad (2020), and the scale of GreI was adapted from the research conducted by Chen et al. (2006).

Data Analysis Procedure

This study employed IBM SPSS version 21 for data entry and screening; only filtered data were used for analysis. This study evaluated the models using the Smart PLS-4 software. The data collected from the study participants were analyzed using the partial least squares structural equation modelling technique (PLS-SEM). The PLS-SEM technique has been widely used in project management research to analyze data and generate results (Aga et al., 2016).

Results

Descriptive Analysis

Quantitative analysis was performed on the dataset received from the project participants. Understanding the histories and personalities of respondents was aided by this division. In addition to the information regarding the distribution of demographic variables, such as gender, age, qualifications, and experience, quantitative data (mean, standard deviation, etc.) were also provided for other variables such as emotional intelligence, organizational culture, team cohesion, and project success.

The sample population for the survey comprised male and female team members from various Pakistani construction industries. The sex distribution of the sample is shown in Table 1. Of the 310 participants surveyed, only 28 were female. Men make up a disproportionately large audience. Age is an essential demographic variable. A construction company surveyed four age groups. The age distribution of the participants is shown in Table 1. 17.1% of individuals surveyed fell between the 18 to 25 age range, 54.8% between 26 and 33, 22.9% between 34 and 41, and 5.2% between 42 and older. A disproportionately large number of replies came from those between the ages of 26 and 33. Table 1 contains a description of each participant's eligibility requirements. There were 310 responses, of which 42.6% had a bachelor's degree or higher, 11.6% had a master’s degree, 41.9% had an MS/MPhil, and 3.9% had a PhD. The number of single men who responded is presented in Table 1. The majority of respondents (13.9 percent) had employment histories of less than five years, while the remaining respondents (58.1 percent) had employment histories of five years or more (6-10 years) 58.1 percent of respondents reported having at least some industry experience, compared to 21.0 percent of those aged 11–15 years. The response rate for this age group (16–20 years) was 4.5%. 2.6% of the respondents said they had more than 20 years of experience. Future strategies should focus on increasing gender diversity and developing a large knowledge base in the workforce, which is consistent with theories of organizational learning and human capital accumulation (Warren et al., 2019).

Table 1

Demographic Data of Respondent

Category	Option	Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	282	90.6	90.6	90.6
	Female	28	9.4	9.4	100
Age	18 to 25	53	17.1	17.1	17.1
	26 to 33	170	54.8	54.8	71.9
	34 to 41	71	22.9	22.9	94.8
	42 and above	16	5.2	5.2	100
Education	Bachelors	132	42.6	42.6	42.6
	Master	36	11.6	11.6	54.2
	MS/MPHIL	130	41.9	41.9	96.1
	PhD	12	3.9	3.9	100
Experience	Less than 5 years	43	13.9	13.9	13.9
	6-10 Years	180	58.1	58.1	71.9
	11-15 years	65	21.0	21.0	92.9
	16-20 years	14	4.5	4.5	97.4
	Above 20 years	08	2.6	2.6	100

Measurement Model

Using PLS-SEM, we created the measurement model illustrated in Figure 2. We examined the measuring model to assess the validity and reliability of the constructs. Loadings, alpha, composite reliability, convergent validity, and discriminant validity were further examined as part of the evaluation process. According to Gefen and Straub (2005), factor loading > .60 is regarded as acceptable, composite reliability is .70 (Ringle et al., 2018), and alpha is .70. We employed Average Variance Extracted (AVE) to assess convergent validity, which met the cut-off value. 60 (Ringle et al., 2018). We used the HTMT ratio with a cut-off value of < .90 to test discriminant validity (Henseler et al., 2014). Table 2 shows that these findings support the validity of the instruments.

The results of these analyses add to the validity of the measurement model applied herein; these results are also consistent with theoretical works underscoring the significance of construct validity in empirical studies. Achieving results, acceptable and high factor loadings, and reliable composite measures foster theoretical constructs of organizational learning and sustainable leadership paradigms to decipher their roles towards the prescription of project success (Pham & Kim, 2019). This theoretical focus means that the constructs are well-defined and the interrelations between variables are well-quantified, which helps to increase the reliability and validity of the findings of the study.

The subjective validity of the scales was thoroughly examined using a confirmatory factor analysis. In various investigations, researchers have used an advanced statistical method known as CFA to better investigate the correlations between variables. The primary purpose of this strategy was to increase or improve the number of scales for each variable. The results are described in detail and are in compliance with the applicable criteria in the following paragraphs. According to Fornell and Larcker (1981), none of these questions should have been deleted because of the low factor loading, as they all had a factor loading of .70. Cronbach's alpha was used to calculate both the developing and composite reliability, as indicated in Table 2. The results provide empirical support to the theoretical framework used in the context of using CFA to validate the measurement scales. High factor loadings and Cronbach’s alpha values that were used in this study show the internal consistencies and reliabilities of the measures; this is important since it enhances the validity of theoretical constructs in empirical

research. This validation process ensures that the constructs measure what the theoretical concepts being used in the study represent, thus improving the credibility of the study.

Table 2

Confirmatory Factor Analysis

Variables	Items	Loadings	α	CR	AVE
Sustainable Leadership	SusL6	.84	.74	.85	.66
	SusL7	.80			
	SusL12	.79			
Organizational Learning	OrgL1	.84	.74	.85	.66
	OrgL2	.87			
	OrgL3	.71			
Green Innovation	GreI6	.82	.78	.87	.70
	GreI7	.88			
	GreI8	.79			
Project Success	ProS1	.81	.74	.85	.65
	ProS2	.85			
	ProS3	.76			

Discriminant validity is a technique used in research to confirm that the variables under comparison are different. To further understand the differences in perceptions of the four variables, we calculated the discriminant validity of each measure separately to ensure the integrity of the research. According to the Fornell-Lacker criterion in Table 3, a suitable HTMT level is determined when all relevant variables have values of less than .85. The main goal of this investigation was to determine the ideal threshold value for assessing discriminant validity.

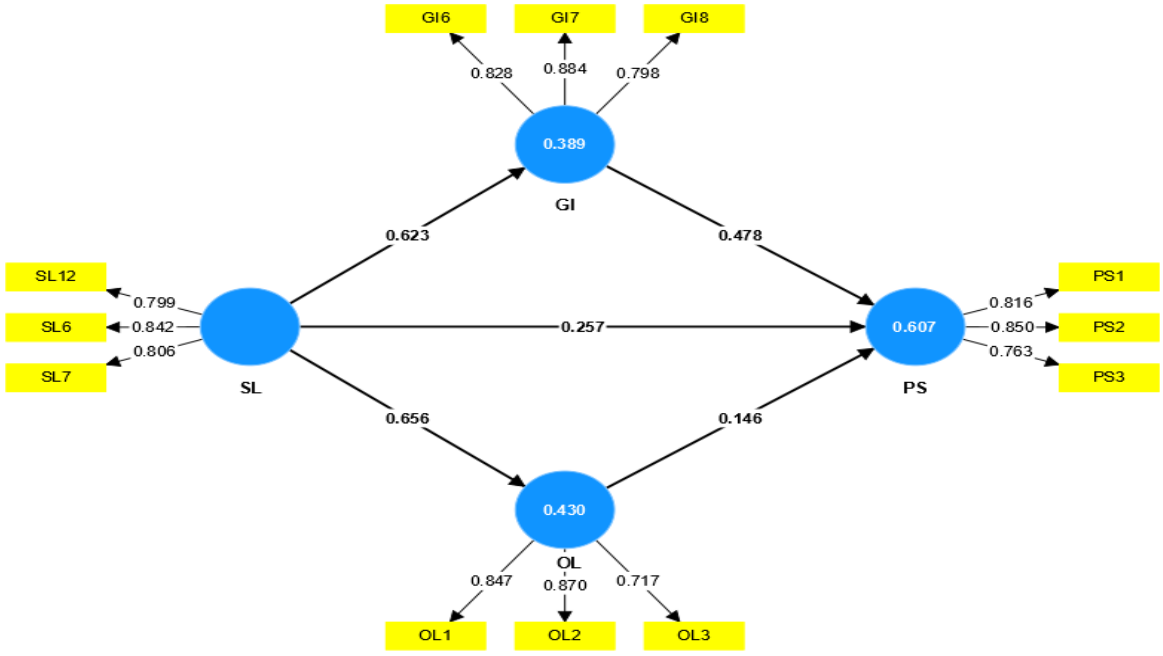
Table 3

Discriminant Validity

	Green Innovation	Organizational Leadership	Project Succes	Sustainable Leadership
Green Innovation	.83			
Organizational Leadership	.63	.81		
Project Success	.73	.61	.77	
Sustainable Leadership	.62	.65	.65	.71

Figure 1

Measurement Model



Correlation Analysis

Table 4 shows that the correlation matrix displays the relationships among four variables: GI, OL, PS, and SL. Correlation coefficients vary from 0 to 1, showing the intensity of these relationships. A correlation of 1.000 shows a perfect positive correlation, whereas .000 shows no correlation. In this analysis, GI and OL exhibit a strong positive correlation (.63). Positive correlations are found between GI and PS (.73), GI and SL (.62), OL and PS (.61), OL and SL (.65), and PS and SL (.65). Overall, the matrix illustrates strong positive relationships between the variables, indicating that fluctuations in one variable may be linked to changes in the others, providing insight for additional analysis or decision-making.

Table 4

Correlation analysis

	1	2	3	4
1. Green Innovation	1			
2. Organizational learning	.63	1		
3. Project Success	.73	.61	1	
4. Sustainable Leadership	.62	.65	.65	1

Structural Model

Model Fit

Table 5 shows the model fit indices of the estimated model to evaluate the fitness of the model, the chi-square, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), and Root Mean Square Error of Approximation (RMSEA). The observed data appears to be extremely consistent with the suggested model, as indicated by a p-value of .000, which indicates an Excellent model fit. The ratio of Chi-square/df of the estimated model is 4.34, which can be considered relatively acceptable for describing the overall fit of the model. It ranges from 0 to infinity, and for this model, the RMSEA value is .10, while the ideal value, according to the analysis, should be less than .08 but still well within a range for what could be considered a good fit. The GFI and AGFI values are .74 and 70. The SRMR was .06, which shows a good practice fit below the .08 threshold. The suggested model's fit is contrasted with a baseline model in which all variables have no correlation using the Comparative Fit Index. While numbers closer to 1 imply a better match, a score of .73 can be considered relatively acceptable for model fit.

Table 5

Model Fit

Short Form	Exposition	Result	Fitness
Likelihood Ratio	"P-value"	0.000	Excellent
ChiSqr/df	"Chi-square/Degree of Freedom"	4.34	Good
RMSEA	"Root Mean Square Error of Approximation"	0.10	Fine
GFI	"Goodness of Fit Index"	0.74	Fine
AGFI	"Adjusted Goodness of Fit Index"	0.70	Fine
SRMR	"Standardized Root Mean Squared Residual"	0.06	Good
CFI	"Comparative Fit Index"	0.73	Fine

The commonly used performance assertion measures were the model's predictiveness and the coefficient of determination (R^2). As presented in Table 6, the findings showed that sustainable leadership contributed 60 percent of the variances in project success (R^2 = .60), while the model explains 38. 9% of the green innovation (R^2 = .38) indicates that none of the independent variables contribute to the distribution of organizational leadership (R^2 = .43).

Figure 3 goes a long way in showing that the model has quite a high level of predictability (Hair et al., 2017). Furthermore, the blindfolding technique was employed to determine the Q^2 values that affirmed the model's predictive significance. Levels of Q^2 greater than zero are the evidence of high predictability. The Q^2 values for project success, organizational leadership, and green innovation obtained in this research were .57, .39, and .46, respectively. Thus, it can be stated that the given model is rather effective in terms of the base model's predictive potential. Overall, a quantitative measure of the model fit shows that the proposed model is robust, and the empirical findings revealed that sustainable leadership has a significant impact on the desired outcomes as predicted by the theory.

Table 6

Coefficient of Determination

Variables	R^2	Q^2
GI	.38	.46
OL	.43	.39
PS	.60	.57

Hypotheses Testing

We used PLS-SEM to create the structure model shown in Figure 3. The structural model displays the path relationship between the study's constructs in Table 7. H1 determines whether sustainable leadership significantly affects project success. The results indicate that sustainable leadership positively impacts project success ($\beta = .25$, $t = 3.90$, $p < .000$); Hence H1 is accepted. Two mediating variables, organizational learning, and green innovation, were selected to assess the mediation role of the relationship between SusL and ProS. H2 evaluated whether organizational learning mediates the relationship between SusL and ProS. The results proved that there was a significant indirect influence of SusL on ProS through organizational learning, and the impact of SusL on ProS was still significant after the mediating variable was included ($\beta = .16$, $t = 2.19$, $p < .02$). H3 analyzes whether green innovation mediates the relationship between SusL and ProS. SusL significantly influences ProS, even after controlling for green innovation ($C = .29$, $t = 7.02$, $p < .000$). This finding suggests complementing partial mediation, which explains why H2 and H3 are acceptable. The findings of this study align with the suggested theoretical model reflecting the role of sustainable leadership in improving project success through organizational learning and green innovation. This concurs with prior studies, which have proposed that positive leadership enhances the creation of a learning culture that leads to the achievement of project results, thus encouraging innovation.

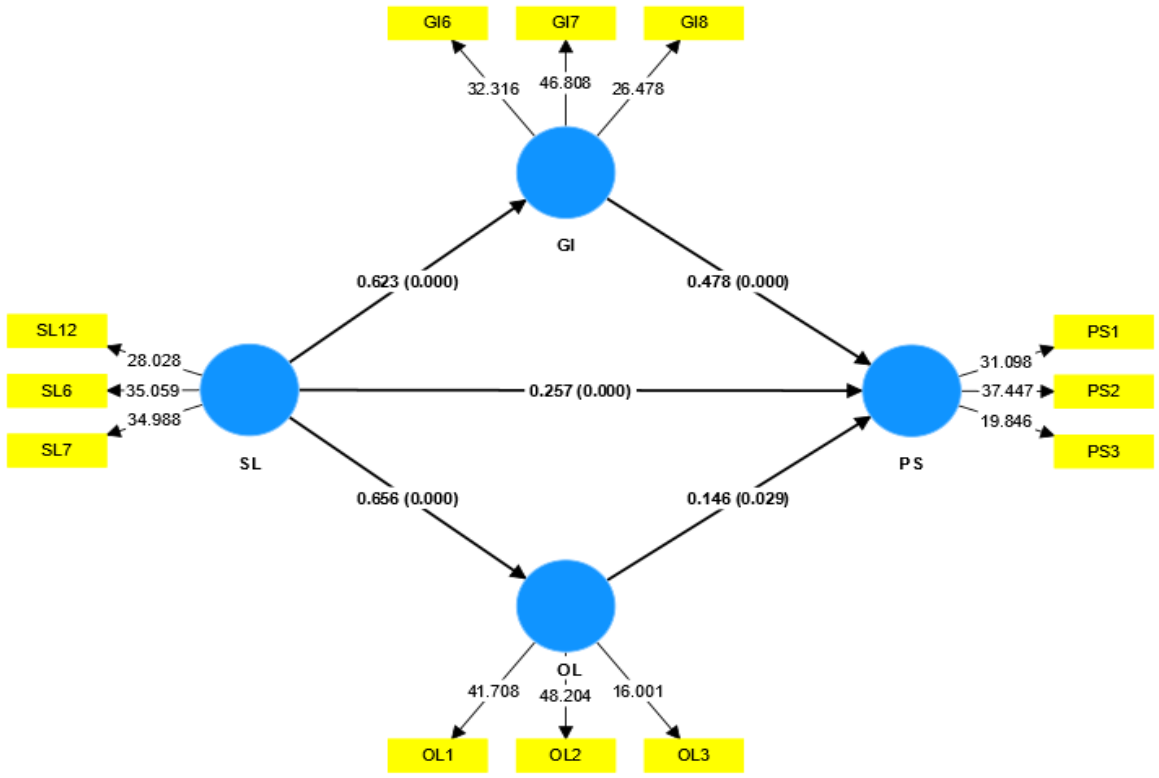
Table 7

Hypotheses Testing

Hypothesis	Relationship	β	*SD*	*t*	*p*	Status
H1	SusL→ ProS	.25	.06	3.99	.000	Accepted
H2	SusL→OrgL→ProS	.16	.04	2.19	.029	Accepted
H3	SusL→GreI→ProS	.29	.04	7.02	.000	Accepted

Figure 2

Structure Model



Discussion

The aim of this research is to investigate how SusL affects ProS. RBV and KBV were utilized to construct a research framework that aimed to determine how the constructs of the study correlated with each other. Sustainable leadership is highlighted in this research as a SusL style that aims to achieve ProS. This indicates how sustainable leadership promotes innovation, resilience, wisdom, and organizational growth. A wide range of evidence confirms that sustainable leadership plays a critical role in long-term sustainable ProS. SusL had a positive effect on ProS, according to the findings of this study. These findings are consistent with those of previous research. Bulmer et al. (2022) investigated the link between sustainable leadership and ProS and discovered that projects are more efficient when led by sustainable leaders. According to Gerard et al. (2017), SusL practices should be incorporated to boost innovation, achieve targets, and improve an organization's future. Thus, the outcomes of this study align with those of a previous study (Peterlin et al., 2015), which found that companies with higher levels of sustainable leadership practices are more capable of achieving long-term performance. Similarly, Piwowar-Sulej and Iqbal (2023) investigate diverse leadership styles and their effects on long-term sustainability. Their research revealed that SusL is the most widely used leadership system for achieving sustainable project success. Therefore, sustainable leadership is widely considered an innovative approach that provides many possibilities for achieving long-term ProS. The current study revealed that OrgL strongly mediated the relationship between SusL and ProS. These findings support this predicted link. The current conclusion is consistent with the findings of this investigation, which show that OrgL plays an important

mediating role. Rezaei-Zadeh and Darwish (2016) confirmed that organizational learning (OrgL) plays an important role in the specific learning opportunities provided to a project team with the primary goal of ProS.

Conclusion

This study investigates the themes of SusL, ProS, organizational learning, and green innovation. These variables prove that adopting these concepts significantly enhances the long-term success of a project. This study is one of the first to attempt to create the proposed framework, which links SusL and ProS through green innovation and organizational learning. The findings demonstrated that SusL leadership had a direct impact on ProS, with green innovation and organizational learning serving as key mediators. The primary finding of this study was that sustainable leadership has a significant impact on long-term project success. Green innovation and organizational learning are critical mediators in this effect, operating via both direct and indirect paths. To increase overall performance and promote sustainability goals, it is critical to incorporate sustainable leadership principles into project success. This demonstrates SusL's multidimensional impact on delivering sustainable results and ensuring sustainable project success.

Implications

From a theoretical standpoint, this study expands considerably from the RBV. It investigates the complex relationship between sustainable leadership and its impact on green innovation, organizational learning, and project performance in the context of construction companies. The critical role of sustainable leadership expands our knowledge of leadership dynamics in modern technological contexts. Scientific research emphasizes the importance of sustainable leadership in generating highly competent and dedicated personnel who produce higher-quality results and ensure the company's future. Furthermore, our research emphasizes the relationship between SusL and ProS by emphasizing the mediating roles of green innovation and organizational learning. This complicated knowledge adds to the growing understanding of effective leadership approaches to long-term project outcomes. Practically, these findings have important implications for construction firms.

Project leadership and project teams better understand the importance of green and organizational learning. These factors clarify the essential role of these variables in the relationship between SusL and ProS. This research provides practitioners with a roadmap to understand how their leadership style might affect the overall effectiveness of their organization. Understanding sustainable leadership roles can help project managers improve their decision-making processes and tactics, ultimately increasing their companies' productivity and organizational success. HR departments can employ this information to improve their leadership selection and recruitment procedures. They can recognize and support leaders who exhibit sustainable leadership qualities and understand how they possess the capacity to have an important impact on long-term performance in the particular setting of SMEs. This study provides an informative guide for SMEs, concentrating on increasing managerial decision-making and overall organizational effectiveness when pursuing sustainability.

Limitations and Future Research Directions

This study uses a cross-sectional approach, while in the future, it should be given high priority to carry out longitudinal studies to highlight how sustainable leadership transforms over time and how it contributes to sustainable project success. Second, the data were collected exclusively from Pakistan's construction sector. The future goal of this study is to collect data from various sectors in Pakistan. This allows for the evaluation of differences across sectors in both the developing and developed worlds. Third, we determined the role of GreI and OrgL as mediators. Future research should focus on additional supportive mediating variables. Teamwork should be included in the same context as a possible mediator because it has been recognized as a crucial component of sustainable leadership. Finally, based on our research findings, we claim that sustainable leadership is an evolving entity with multiple characteristics to achieve wider sustainability goals. This realization creates opportunities for further study in this field.

Declarations

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