A COMPARATIVE STUDY ON THE IMPACT OF SUSTAINABLE LEADERSHIP AND KNOWLEDGE LEADERSHIP ON SUSTAINABLE PERFORMANCE WITHIN THE HOTEL INDUSTRY

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Abstract

Objectives: The primary objective of this research is to explore the impact of sustainable leadership (SL) and knowledge leadership (KoL) on sustainable performance (SP) within the hotel industry. Specifically, the study examines how these leadership styles influence the achievement of sustainable development goals (SDGs) and green capabilities (GC). **Methodology/Design:** A quantitative methodology was employed, using a meticulously designed questionnaire to collect data from 323 hotel proprietors in Peru. Data were analyzed using partial least squares structural equation modeling (PLS-SEM), allowing for the simultaneous examination of measurement and structural components to validate the proposed hypotheses. **Results:** The findings reveal that SL positively influences SP and significantly impacts the achievement of SDGs. Similarly, KoL significantly impacts SDGs. However, GC did not significantly mediate the relationship between SL and SP or KoL and SP. **Originality/Value:** This study contributes to the existing body of knowledge by highlighting the critical role of SL and KoL in enhancing hotel performance through sustainability initiatives. It underscores the importance of integrating sustainability into leadership strategies to achieve outstanding performance outcomes. **Practical Implications:** The research provides practical insights for hotel managers in Peru, emphasizing the need to adopt leadership styles that prioritize sustainability. By aligning strategic objectives with SDGs, hotels can enhance their performance and gain a competitive advantage. It also suggests that, while governance compliance is important, it should be complemented with proactive leadership initiatives to drive meaningful performance improvements.

Keywords: sustainable leadership, knowledge leadership, sustainable performance, sustainable development goals (SDGs), green capabilities, hotel industry, sustainability, hotel management, Peru

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ESTUDIO COMPARATIVO SOBRE EL IMPACTO DEL LIDERAZGO SOSTENIBLE Y EL LIDERAZGO DEL CONOCIMIENTO EN EL DESEMPEÑO SOSTENIBLE EN LA INDUSTRIA HOTELERA

Resumen

Objetivos: el objetivo principal de esta investigación es investigar el impacto del liderazgo sostenible (SL) y el liderazgo del conocimiento (KoL) en el desempeño sostenible (SP) en la industria hotelera. Específicamente, el estudio examina cómo estos estilos de liderazgo influyen en el logro de los Objetivos de Desarrollo Sostenible (ODS) y las capacidades verdes (GC). **Metodología/diseño:** se empleó una metodología cuantitativa, utilizando un cuestionario meticulosamente diseñado para recopilar datos de 323 propietarios de hoteles en Perú. El estudio utilizó el Modelo de Ecuaciones Estructurales de Mínimos Cuadrados Parciales (PLS-SEM) para analizar los datos, lo que permitió un análisis simultáneo de los componentes de medición y estructurales para validar las hipótesis propuestas. **Resultados:** los hallazgos indican que el liderazgo sostenible influye positivamente en el desempeño sostenible e impacta significativamente en el logro de los Objetivos de Desarrollo Sostenible. El liderazgo del conocimiento también impacta significativamente en los Objetivos de Desarrollo Sostenible. Sin embargo, las capacidades verdes no mediaran significativamente la relación entre SL y SP o KoL y SP. **Originalidad/valor:** este estudio contribuye al cuerpo existente de conocimiento destacando el papel crítico del liderazgo sostenible y del conocimiento en la mejora del desempeño hotelero a través de iniciativas de sostenibilidad. Subraya la importancia de integrar la sostenibilidad en las estrategias de liderazgo para lograr resultados de desempeño superiores. **Implicaciones prácticas:** la investigación proporciona ideas prácticas para los gerentes de hoteles en Perú, enfatizando la necesidad de adoptar estilos de liderazgo que prioricen la sostenibilidad. Al alinear los objetivos estratégicos con los ODS, los hoteles pueden mejorar su desempeño y obtener una ventaja competitiva. También sugiere que, si bien el cumplimiento de la gobernanza es importante, debe complementarse con iniciativas de liderazgo proactivo para impulsar mejoras sustanciales en el desempeño.

Palabras clave: liderazgo sostenible, liderazgo del conocimiento, desempeño sostenible, objetivos de desarrollo sostenible (ODS), capacidades verdes, industria hotelera, sostenibilidad, gestión hotelera, Perú

1. INTRODUCTION

The importance of sustainable leadership (SL) within the hospitality industry has gained increasing attention in recent years as businesses strive to balance economic growth with environmental and social responsibilities. Ensuring that economic, social, and environmental objectives are harmonized enhances long-term effectiveness and provides advantages to ecosystems, society, and habitats (Caiado et al., 2019). Despite the growing recognition of sustainability, more comprehensive studies need to examine the comparative impact of SL and knowledge leadership (KoL) on sustainable performance (SP) in

the hotel sector. This paper aims to fill this gap by exploring the intricate relationships between these leadership styles and their influence on achieving sustainable development goals (SDGs) within hotels.

The resource-based view (RBV) posits that a firm's resources—when valuable, rare, inimitable, and non-substitutable (VRIN)—can provide sustained competitive advantage (Barney, 1991). The dynamic capabilities theory (DCT) extends RBV by emphasizing a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997, p. 516). By leveraging RBV and DCT, this study provides a nuanced understanding of how internal resources and dynamic capabilities drive SP in the hospitality industry.

The primary objective of this research is to explore the impact of SL and KoL on SP within the hotel industry. Specifically, the study examines how these leadership styles influence the achievement of SDGs and GC. The following research questions guide this study: (1) What is the relationship between SL and SP? (2) How do SDGs mediate the relationship between leadership styles and SP? (3) What is the role of GC in this context?

This study contributes to the existing body of knowledge by highlighting the critical role of SL and KoL in enhancing hotel performance through sustainability initiatives. SL prioritizes long-term sustainability and balances economic, social, and environmental solutions (Kafetzopoulos & Gotzamani, 2022). In contrast, KoL involves the effective use of knowledge to stimulate innovation and facilitate organizational learning (Lunden et al., 2017). The practical implications of this research are significant for hotel managers aiming to implement effective sustainability practices and achieve competitive advantage.

A quantitative methodology was employed to empirically test our hypotheses. Data were collected using a meticulously designed questionnaire distributed to 323 hotel proprietors in Peru. The analysis was conducted using partial least squares structural equation modeling (PLS-SEM), allowing for the simultaneous examination of measurement and structural components (Hair et al., 2021).

The structure of the paper is as follows: The Literature Review section explores the relevant literature on SL, KoL, and SP. This is followed by the Methodology section, which details the research design, data collection, and analysis methods. The Results section presents the study's findings, while the Discussion section interprets these findings in the context of the existing literature. Finally, the Conclusion section summarizes the key contributions, implications, and potential avenues for future research.

2. LITERATURE REVIEW

2.1 Sustainable Leadership and Sustainable Performance

In addition to financial and operational key performance indicators (KPIs), SP in the hotel industry integrates environmental, social, and governance (ESG) factors into business operations (Hoang, 2018; Pesqueira & Sousa, 2024). Ensuring that economic, social, and environmental objectives are in harmony enhances long-term effectiveness and provides advantages to ecosystems, society, and habitats (Caiado et al., 2019). Integration is crucial for hotels to compete on a global scale and effectively meet stakeholders' diverse needs. Achieving consistent performance in these areas requires the implementation of SL. This leadership style prioritizes the long-term sustainability of complex systems and strives

to balance economic, social, and environmental solutions (Kafetzopoulos & Gotzamani, 2022). Performance is directly correlated with SL, significantly impacting environmental innovation and performance (Pham et al., 2023). Sustainability leaders prioritize collaboration over giving commands, prioritize the long-term sustainability of complex systems, and strive to balance economic, social, and environmental solutions (Ferdig, 2007).

Sustainable hospitality leadership fosters ecological innovation and enhances operational effectiveness (Fatoki, 2021). Hoteliers recognize the importance of SL in advancing environmental initiatives and improving performance (Öğretmenoğlu et al., 2022). He et al. (2020) found a positive correlation between green managers' expertise, leadership style, and environmental performance. This supports the idea that SL is linked to improved hotel performance. Based on the insights from this literature, the following hypothesis is put forward:

H1: SL and SP have a positive and significant relationship.

2.2 The Mediating Role of SDGs in the Relationship Between SL and SP

SL necessitates harmonizing economic, social, and environmental objectives to accomplish the SDGs (Liao, 2022; Kafetzopoulos & Gotzamani, 2022). Leadership styles impact companies' social and environmental sustainability (Kafetzopoulos & Gotzamani, 2022). SL facilitates the attainment of SDGs by fostering SP in different organizations (Iqbal & Piwowar-Sulej, 2021). SL is crucial for successfully implementing health SDGs, particularly in the service sectors (Reddy et al., 2017). Leaders at all levels should implement policies and change how they rule to accomplish the SDGs (Biermann et al., 2017). SL enhances employee performance, which is essential for the long-term viability of an organization (Tripathi et al., 2020).

To accomplish the SDGs, the hotel industry needs SL to effectively and sustainably manage economic, social, and environmental objectives (Liao, 2022). Organizations' social and environmental sustainability is influenced by different leadership styles (Clark et al., 2009). According to Patiar and Wang (2016), SL in the hotel industry, when focused on transformation, can enhance the performance of different departments and increase staff engagement, leading to improved service quality and overall performance. Effective SL is essential for achieving SP in the hotel industry (Fatoki, 2021).

Hoteliers should implement environmentally friendly practices to fulfill the environmental SDGs (Chaudhuri et al., 2024). To foster sustainability, hotels should implement environmentally friendly measures (Chung, 2019). The relationship between SL and hospitality firms' performance is evident, emphasizing the crucial role of effective leadership in promoting sustainability (Fatoki, 2021). Based on the insights from this literature, the following hypothesis is put forward:

H2: SL and SDGs have a positive and significant relationship.

The SDGs are critical in implementing sustainable practices within the hospitality industry, particularly in hotels. Castro et al. (2021) emphasize the importance of aligning different objectives and fostering sustainable innovations, underscoring the need for a comprehensive approach for successful implementation. Nevertheless, Veland et al. (2022) highlight the challenges of balancing economic growth with environmental preservation and achieving significant transformations through synchronized endeavors and strategic foresight.

According to Horan (2022), the success of the SDGs in promoting global sustainability relies on resolving conflicts and utilizing synergies between the targets.

Studies highlight the incorporation of SDGs into sustainable hotel operations. Ferrero-Ferrero et al. (2023) analyze the integration of SDGs into the reporting of leading sustainable hotels, showing the tangible outcomes of aligning hotel operations with these global objectives. Bacari et al. (2021) provide examples of SDG projects in international hotels, demonstrating practical implementations of sustainable development principles within the hotel industry. Additionally, Chaudhuri et al. (2024) emphasize the significance of integrating green hotel practices into operational planning to accomplish environmental SDGs and promote sustainability.

Research also explores various aspects of sustainability within hotels. Huang and Tsaih (2021) provide valuable insights into prioritizing design variables in hotel lobbies, demonstrating how strategic design components can enhance the overall guest experience. Aboramadan and Karatepe (2021) conducted a study on sustainable practices in Mediterranean hotels, focusing on the employees' perspectives. Their study emphasizes the holistic nature of sustainability, encompassing social, economic, and environmental aspects. In addition, Fatima and Elbanna (2023) suggest a sustainable balanced scorecard (SBS) aligned with SDGs to improve water resource management in hotels. This approach emphasizes the importance of integrating sustainability initiatives with global development goals. Based on the insights from this literature, the following hypothesis is put forward:

H3: SP and SDGs have a positive and significant relationship.

The literature above suggests that SL may impact SDGs (Clark et al., 2009; Fatoki, 2021), thereby influencing SP (Ferrero-Ferrero et al., 2023). Hence, the following hypothesis is proposed:

H4: SDGs mediate the relationship between SL and SP.

2.3 The Mediating Role of SDGs in the Relationship Between KoL and SP

KoL is essential in contemporary businesses, especially those heavily relying on knowledge or technology (Pellegrini et al., 2020). It encompasses the deliberate planning and effective use of knowledge to stimulate innovation, enhance performance, and facilitate organizational learning (Lunden et al., 2017). KoL, which includes implementing knowledge management (KM) and governance, is essential for successfully attaining the SDGs. KM has a substantial influence on green innovation and the activities related to corporate sustainable development. It affects the sustainability of the environment, society, and economy (Abbas & Sağsan, 2019; Shahzad et al., 2020). Implementing KM strategies is crucial for achieving the SDGs, especially in developing nations. KM is vital in promoting poverty alleviation, improving healthcare, ensuring access to clean water, creating good employment opportunities, and taking effective measures to combat climate change (Costa et al., 2023; Upadhyay & Patel, 2023). Introducing KM approaches in general educational institutions can effectively advance sustainable development despite the persistent challenges of insufficient motivation and financial resources (Raudeliūnienė et al., 2020). Effective KoL, encompassing the regulations and standards regulating knowledge, is pivotal in linking knowledge to sustainable behaviors and outcomes. It improves human welfare, manages resources, and promotes global public goods (Kerkhoff, 2013).

The impact of green knowledge on sustainability is reflected through altering consumption habits and providing information for government policies, resulting in improved economic and environmental consequences (Tabassi et al., 2016). KoL plays a crucial role in enabling and encouraging employees to achieve sustainable development, with a particular focus on fostering a knowledge-based economy. Based on the insights from this literature, the following hypothesis is put forward:

H5: KoL and SDGs have a positive and significant relationship.

The literature above suggests that KoL may impact SDGs (Lunden et al., 2017; Pellegrini et al., 2020), thereby influencing SP (Aboramadan & Karatepe, 2021; Fatima & Elbanna, 2023). Hence, the following hypothesis is proposed:

H6: SDGs mediate the relationship between KoL and SP.

2.4 The Mediating Role of GC in the Relationship Between SL and SP

The significance of SL in promoting environmentally conscious talents within companies is well acknowledged (Khan et al., 2023). This synthesis examines the correlation between SL and GC, drawing on insights from various research publications. Studies have demonstrated that SL, specifically green transformational leadership, has a substantial positive impact on the efficiency and innovation of green product development, enhancing GC (Chen et al., 2025). Aboelmaged and Hashem (2019) emphasize that the implementation of green innovation in small and medium-sized enterprises (SMEs) is significantly strengthened by leadership that prioritizes sustainability and collaboration.

Dynamic skills are essential for boosting green innovation and eco-design capabilities, encompassing resource creation, adaptability, reconfiguration, and integrating external resources. Ultimately, these characteristics improve the market performance of environmentally friendly products (Dangelico et al., 2017; Huang & Li, 2017). Moreover, integrating green dynamic capabilities and transformational leadership has both direct and indirect positive impacts on the performance of green product development by fostering green creativity (Chen et al., 2025). Incorporating big data technology, green supply chain management, and green human resource management techniques effectively improves sustainable capabilities and overall SP (Singh & El-Kassar, 2019). SL is crucial for firms to significantly enhance their green innovation and SP, accomplished by promoting green transformational leadership, cultivating dynamic abilities, and integrating green practices (Chen et al., 2025). Based on the insights from this literature, the following hypothesis is put forward:

H7: SL and GC have a positive and significant relationship.

The growing recognition of the impact of GC on SP underscores their significance in fostering environmental and financial accomplishments. This synthesis gathers information from numerous research papers to clarify the impact of GC on SP. Green innovation, dynamic capabilities, green entrepreneurial orientation, and green intellectual capital are all significant factors in the overall context, as evidenced by key findings from multiple studies (Albort-Morant et al., 2016; Dangelico et al., 2017; Huang & Li, 2017; Jiang et al., 2018; Yusliza et al., 2020). Furthermore, integrating eco-friendly strategies (Singh & El-Kassar, 2019) and factors that mitigate this relationship, such as the agility of green technology and digital leadership (Jiang et al., 2018; Sarfraz et al., 2022), also influence this

correlation. Understanding these processes enables companies to enhance their environmental and financial sustainability. Based on the insights from this literature, the following hypothesis is put forward:

H8: SP and GC have a positive and significant relationship.

The literature above suggests that SL may impact GC (Chen et al., 2025; Singh & El-Kassar, 2019), thereby influencing SP (Albort-Morant et al., 2016; Dangelico et al., 2017; Huang & Li, 2017). Hence, the following hypothesis is proposed:

H9: GC mediates the relationship between SL and SP.

2.5 The Mediating Role of GC in the Relationship Between KoL and SP

KoL is crucial in ensuring long-term business success, as supported by numerous academic research. SL has a favorable correlation with sustainable project performance, and this relationship is mediated by knowledge integration (Zada et al., 2024). Studies show that effective KM leadership positively impacts performance, especially in cultures that emphasize group efforts, emerging countries, and the manufacturing sector. This type of leadership helps organizations match their aims with sustainability objectives (Liu et al., 2021). SL favors the execution of sustainable projects, and the integration of knowledge mediates this influence. Efficient knowledge integration guarantees the smooth implementation of sustainable practices and innovations within organizations (Wang et al., 2022). KoL promotes a culture of ongoing learning and innovation, maximizes the utilization of resources, and enables the incorporation of sustainable practices within firms (Shan & Wang, 2024). Based on the insights from this literature, the following hypothesis is put forward:

H10: KoL and SP have a positive and significant relationship.

Academic research has shown evidence of a favorable and significant association between KoL and GC. KoL facilitates the efficient administration of knowledge processes, essential for developing and improving environmentally friendly skills within businesses (Ureña Espaillat et al., 2022). KoL plays a crucial role in shaping GC by fostering green innovation through the acquisition and application of new ideas on sustainability (Shahzad et al., 2020). KoL substantially impacts GC by incorporating sustainable practices into the culture and operations of a business, thereby ensuring that green efforts are deeply ingrained throughout the organization (Abbas & Khan, 2023). According to Shafait and Huang (2024), KoL substantially impacts GC by utilizing transformational leadership to optimize resource use and enhance operational efficiency and sustainability. Based on the insights from this literature, the following hypothesis is put forward:

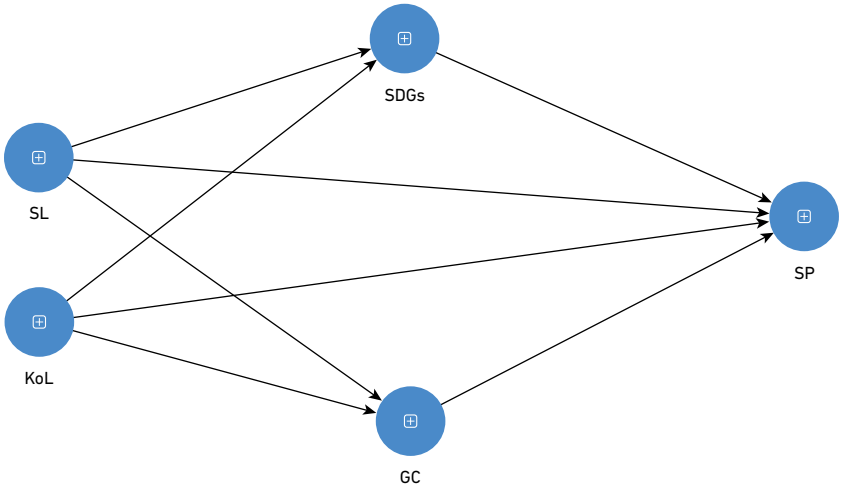
H11: KoL and GC have a positive and significant relationship.

The literature above suggests that KoL may impact GC (Shan & Wang, 2024; Wang et al., 2022), thereby influencing SP (Abbas & Khan, 2023; Shahzad et al., 2020). Hence, the following hypothesis is proposed:

H12: GC mediates the relationship between KoL and SP.

Figure 1

Research Model



3. METHODOLOGY

The study adopted a positivist approach and employed quantitative measurements to assess crucial components. The SL examination utilized a 15-item scale developed by McCann and Holt (2010) to assess various aspects of SL, including strategic foresight, ethical conduct, stakeholder engagement, and long-term orientation. The participants rated their level of agreement with each statement on a Likert scale ranging from one (strong disagreement) to five (strong agreement). KoL was assessed using the measurement tool created by Donate and Pablo (2015). Achieving SDGs was evaluated through a measurement framework comprising 17 components developed by Carlsen and Bruggemann (2022). This scale measures the degree of alignment between corporate strategy and the 17 UN SDGs, using a grading system ranging from one (low alignment) to five (high alignment). GC was measured with a seven-item scale created by Pavlou and El Sawy (2011), which evaluates the efficient resource allocation and utilization, eco-friendly product development, and waste minimization. A Likert scale was employed for scoring. The SP assessment was carried out using a six-item scale devised by Lin et al. (2013). Data were collected through a meticulously designed questionnaire and analyzed using PLS-SEM to evaluate hypotheses and validate the accuracy of the measurement models. This methodology allows for the simultaneous analysis of the measurement and structural components, leading to a comprehensive evaluation of the proposed model. A survey was conducted among 323 hotel proprietors in Peru, all of whom willingly and enthusiastically provided informed consent by signing a consent form.

4. DATA ANALYSIS AND RESULTS

The study used PLS-SEM to test the research framework. This method is a two-step process: first, the measurement model assessment, which examines outer loadings, construct reliability, and construct validity; and second, the structural model assessment, which validates the proposed hypotheses by assessing the significance of path coefficients.

4.1 Measurement Model Assessment

According to Hair et al. (2021), evaluating the measurement model involves examining outer loadings and establishing construct reliability and validity. Initially, outer loadings were assessed with a recommended threshold of 0,70. However, loadings between 0,40 and 0,70 could be retained if their removal did not improve reliability and validity. To improve convergent validity, this study removed the following items: SP3, SP2, GC7, SL1, and SL6.

Next, construct reliability was examined using Cronbach's alpha and composite reliability. The analysis showed that both measures exceeded the recommended threshold of 0,70, with Cronbach's alpha values ranging from 0,704 to 0,926 and composite reliability values from 0,717 to 0,928, thus confirming construct reliability.

Construct validity was then evaluated through convergent and discriminant validity. Convergent validity was assessed using the average variance extracted (AVE), where a value of 0,50 or higher indicated adequate convergent validity (Fornell & Larcker, 1981). The AVE values in this study ranged from 0,532 to 0,648.

Table 1 presents item descriptive statistics, outer loadings, Cronbach's alpha, composite reliability, and AVE values. The evaluation demonstrated that the measurement model achieved acceptable reliability and validity levels, ensuring the robustness of subsequent analyses.

Table 1

Item Descriptive Statistics, Outer Loadings, Construct Reliability (Cronbach's Alpha and Composite Reliability), and Convergent Validity (Average Variance Extracted)

	Outer Loadings	Cronbach's Alpha	Composite Reliability	AVE
GC1	0,811	0,892	0,896	0,648
GC2	0,742			
GC3	0,809			
GC4	0,818			
GC5	0,825			
GC6	0,822			
KoL1	0,721	0,845	0,843	0,566
KoL2	0,787			
KoL3	0,809			
KoL4	0,780			
KoL5	0,774			
KoL6	0,628			
SL10	0,713	0,926	0,928	0,534
SL11	0,764			
SL12	0,743			
SL13	0,799			
SL14	0,710			
SL15	0,782			

(*continues*)

(*continued*)

	Outer Loadings	Cronbach's Alpha	Composite Reliability	AVE
SL2	0,753			
SL3	0,650			
SL4	0,601			
SL5	0,769	0,926	0,928	0,534
SL7	0,792			
SL8	0,698			
SL9	0,698			
SP1	0,617			
SP4	0,778	0,704	0,717	0,532
SP5	0,771			
SP6	0,739			

As part of the construct validity assessment, discriminant validity was examined to establish the uniqueness of each construct. The heterotrait-monotrait (HTMT) ratio of correlations and the Fornell–Larcker criterion (Fornell & Larcker, 1981) were used for this purpose. Discriminant validity is established if the HTMT ratio is below 0,90 (Henseler et al., 2015). In this study, the HTMT ratio of correlations for all constructs were below 0,90, confirming discriminant validity based on this criterion.

According to Fornell and Larcker (1981), constructs are considered unique if the square root of their AVE exceeds their correlation with other constructs. The analysis showed that the square root of AVE for each construct was greater than its correlations with other constructs, thereby establishing discriminant validity (Tables 2 and 3).

Table 2

HTMT Ratio of Correlations

	GC	KoL	SDGs	SL	SP
GC					
KoL	0,434				
SL	0,466	0,887	0,371		
SP	0,327	0,457	0,532	0,462	

Table 3

Fornell–Larcker Criterion

	GC	KoL	SDGs	SL	SP
GC	0,805				
KoL	0,390	0,752			
SL	0,437	0,782	0,355	0,731	
SP	0,265	0,355	0,434	0,378	0,729

Validating the Formative Construct of SDGs

SDGs were treated as a formative construct based on the 17 UN SDGs. First, multicollinearity was assessed using the variance inflation factor (VIF) to validate the formative construct. In the present study, collinearity did not pose any threat, as the VIF values were below five (Hair et al., 2021) (Table 4). Next, statistical significance and relevance of the outer weights were assessed (Sarstedt et al., 2019). Some outer weights were insignificant (p > 0,05). However, outer loadings were assessed if outer weights were insignificant (Hair et al., 2021). The results showed that outer loadings were significant for each indicator forming SDGs (Sarstedt et al., 2019). Hence, the formative construct was validated.

Table 4

Validating the Formative Construct of SDGs

SDGs	VIF	Outer Weights	t-Statistic	*p*-Value	Outer Loadings	*p*-Value
SDG1	1,854	-0,070	0,594	0,276	0,436	0,000
SDG2	1,667	-0,125	1,078	0,140	0,413	0,000
SDG3	1,982	0,398	2,937	0,002	0,633	0,000
SDG4	2,778	-0,219	1,712	0,043	0,454	0,000
SDG5	2,516	0,059	0,465	0,321	0,512	0,000
SDG6	2,741	-0,030	0,228	0,410	0,505	0,000
SDG7	2,577	0,190	1,362	0,087	0,679	0,000
SDG8	2,738	0,056	0,425	0,335	0,683	0,000
SDG9	2,478	0,062	0,496	0,310	0,686	0,000
SDG10	2,338	0,011	0,087	0,465	0,633	0,000
SDG11	2,414	0,076	0,648	0,258	0,698	0,000
SDG12	2,169	0,232	1,978	0,024	0,758	0,000
SDG13	2,181	0,252	2,275	0,011	0,770	0,000
SDG14	2,556	0,056	0,496	0,310	0,648	0,000
SDG15	2,190	0,097	0,854	0,197	0,597	0,000
SDG16	1,834	-0,081	0,768	0,221	0,503	0,000
SDG17	1,765	0,306	2,781	0,003	0,728	0,000

4.2 Structural Model Assessment

Explanatory Power (R-Square) and Predictive Relevance (Q-Square)

R-square and Q-square statistics were used to assess the model's explanatory power and predictive relevance. The R-square for SP was 0,250, indicating that SL, SDGs, KoL, and GC accounted for 25 % of the variance in SP. The R-square values for the mediators GC and SDGs were 0,197 and 0,149, respectively. This suggested that SL and KoL accounted for 19,7 % of the variance in GC and 14,9 % in SDGs. These R-square values were considered satisfactory, exceeding the recommended threshold of 0,10 (Hair et al., 2021).

Predictive relevance was assessed using the Q-square value. The Q-square values for all the endogenous variables (SP, smart technologies, GC, and SDGs) were above 0, indicating that the model has predictive relevance. The R-square and Q-square statistics are presented in Table 5.

Table 5

Explained Variance and Predictive Relevance of Constructs

	R-Square	Q-Square
GC	0,197	0,180
SDGs	0,149	0,131
SP	0,250	0,136

Direct Hypotheses Results

In the next phase of data analysis, the proposed hypotheses were assessed by evaluating the significance of the path coefficients. The results of the structural model strongly supported all hypotheses, with each relationship being either significant or partially significant.

The results of our structural model reveal several significant and non-significant relationships among the constructs. The path from SL to SP (H1) is significant (path coefficient = 0,187, t-statistic = 2,012, *p*-value = 0,022), indicating that SL positively influences SP. Similarly, SL significantly impacts SDGs (H2) (path coefficient = 0,166, t-statistic = 1,885, *p*-value = 0,030), suggesting that leadership is crucial in advancing sustainability. The relationship between SDGs and SP (H3) is also significant (path coefficient = 0,325, t-statistic = 5,230, *p*-value = 0,000), highlighting the importance of integrating sustainability into the strategic framework to enhance performance. Additionally, KoL significantly impacts SDGs (H5) (path coefficient = 0,242, t-statistic = 2,678, *p*-value = 0,004), emphasizing the need for KoL in promoting sustainability initiatives. SL significantly affects GC (H7) (path coefficient = 0,340, t-statistic = 4,467, *p*-value = 0,000), underscoring the role of leadership in governance. However, the paths from GC to SP (H8) (path coefficient = 0,056, t-statistic = 0,991, *p*-value = 0,161), KoL to SP (H10) (path coefficient = 0,065, t-statistic = 0,777, *p*-value = 0,219), and KoL to GC (H11) (path coefficient = 0,125, t-statistic = 1,514, *p*-value = 0,065) are not significant, indicating that governance, compliance, and KoL alone may not directly impact performance. These findings suggest that while SL is crucial for performance and sustainability, governance, compliance, and KoL require further exploration to understand their full impact.

Mediation Analysis

The mediation analysis in our study reveals the indirect effects of SL and KoL on SP through SDGs and GC. The indirect path from SL to SP through SDGs (H4) is significant (path coefficient = 0,054, t-statistic = 1,703, *p*-value = 0,044), indicating that SDGs partially mediate the relationship and suggesting that SL improves performance by fostering sustainability initiatives. Similarly, the mediating role of SDGs in the relationship between KoL and SP (H6) is significant (path coefficient = 0,079, t-statistic = 2,506, *p*-value = 0,006), highlighting that KoL enhances performance through its positive impact on sustainability efforts.

However, the indirect path from SL to SP through GC (H9) is not significant (path coefficient = 0,019, t-statistic = 0,918, *p*-value = 0,179), and neither is the mediating role of GC in the relationship between KoL and SP (H12) (path coefficient = 0,007, t-statistic = 0,718, *p*-value = 0,236). These findings indicate that while SDGs are crucial in linking SL and KoL to enhance performance, GC do not serve as significant mediators in these relationships, emphasizing the importance of sustainability initiatives in achieving performance outcomes (Table 6).

Table 6

Direct Hypotheses Results

	Path Coefficient	SD	t-Statistic	*p*-Value
H1: SL → SP	0,187	0,093	2,012	0,022
H2: SL → SDGs	0,166	0,088	1,885	0,030
H3: SDGs → SP	0,325	0,062	5,230	0,000
H5: KoL → SDGs	0,242	0,090	2,678	0,004
H7: SL → GC	0,340	0,076	4,467	0,000
H8: GC → SP	0,056	0,056	0,991	0,161
H10: KoL → SP	0,065	0,084	0,777	0,219
H11: KoL → GC	0,125	0,082	1,514	0,065
H4: SL → SDGs → SP	0,054	0,032	1,703	0,044
H6: KoL → SDGs → SP	0,079	0,031	2,506	0,006
H9: SL → GC → SP	0,019	0,021	0,918	0,179
H12: KoL → GC → SP	0,007	0,010	0,718	0,236

5. DISCUSSION

The strong positive correlation between SL and SP (H1) highlights the crucial role of SL in driving performance. This finding is consistent with previous studies that emphasize the significance of leadership in establishing strategic objectives and attaining organizational goals. Moreover, the substantial influence of SL on SDGs (H2) indicates that leadership plays an essential role in advancing sustainability efforts within firms. This relationship emphasizes the need for leaders to integrate sustainability into their strategic vision to promote enduring organizational success.

The strong correlation between SDGs and SP (H3) strengthens the idea that integrating sustainability into the strategy framework improves performance. This finding indicates that hotels prioritizing sustainable practices are more likely to achieve enhanced performance outcomes, hence supporting the increasing focus on sustainability within the hospitality industry.

The influence of KoL on SDGs (H5) suggests that leadership expertise is essential for promoting sustainability initiatives. This finding underscores the significance of cultivating leadership competencies specifically tailored to sustainability. It implies that training and

development initiatives should prioritize equipping leaders with the necessary expertise and skills to effectively advocate for and implement sustainable practices.

The substantial impact of SL on GC (H7) underscores the importance of leadership in guaranteeing adherence to governance standards. This finding implies that successful leadership involves more than just establishing strategic objectives; it also entails ensuring that the firm complies with governance regulations, which is crucial for upholding organizational integrity and accountability.

The insignificant paths from GC to SP (H8), KoL to SP (H10), and KoL to GC (H11) suggest that the individual factors of GC and KoL do not have a direct impact on performance or governance. These findings indicate that while expertise in governance and leadership is valuable, its impact on performance may be limited. However, their influence might be more subtle and indirect, functioning through other intermediary factors like environmental measures.

The mediation study offers an additional understanding of the indirect impacts of SL and KoL on SP. The significant indirect pathway from SL to SP through SDGs (H4) suggests that SDGs play a partial mediating role in this relationship. This finding implies that SL enhances performance by promoting sustainability efforts, emphasizing the importance of sustainability as a key mechanism through which leadership influences performance.

Furthermore, the study indicates that the SDGs play a crucial role in mediating the relationship between KoL and SP (H6), suggesting that a strong understanding of leadership contributes to improved performance by fostering sustainability initiatives. This outcome highlights the significance of cultivating leadership skills aligned with sustainability objectives to attain improved performance results.

Nevertheless, the insignificant indirect paths from SL to SP through GC (H9) and from KoL to SP through GC (H12) suggest that GC does not play a key role as a mediator in these connections. These findings highlight that although governance is important, sustainability measures have a more crucial impact on connecting leadership and performance.

6. THEORETICAL IMPLICATIONS

Our study offers significant theoretical insights into the dynamics between leadership, sustainability, and performance in the hotel industry. The results confirm the critical role of SL in promoting SP and attaining SDGs. This supports the idea that strong leadership is essential for encouraging sustainability efforts and improving organizational performance. The strong association between SDGs and SP highlights the importance of integrating sustainability into the strategic frameworks, contributing to a deeper theoretical knowledge of how sustainability might improve performance. Moreover, the significant impact of KoL on SDGs underscores the crucial role of leadership expertise in promoting sustainability initiatives, enhancing leadership theories by clarifying how leadership skills contribute to sustainable results. The indirect impacts of SL and KoL on SP through SDGs offer a more comprehensive understanding of mediation mechanisms, indicating that sustainability initiatives play a crucial role in the interaction between leadership and performance. Nevertheless, the limited influence of GC on these relationships calls for a reassessment of its theoretical importance. These findings suggest that compliance alone is inadequate for improving performance and warrants additional theoretical research.

7. PRACTICAL IMPLICATIONS

Our study provides practical insights for professionals in Peru's hotel industry on improving organizational performance through the implementation of strategic leadership and sustainability programs. The strong influence of SL on both SP and SDGs highlights the need for hotel managers to embrace leadership styles that prioritize sustainability. Hotels can obtain improved performance outcomes by including sustainability objectives into their strategic plans. The findings further emphasize the significance of allocating resources to leadership development programs that enhance KoL, as this directly supports the advancement of sustainability projects. Pragmatic approaches should prioritize providing leaders with the necessary expertise and skills to advocate for and execute sustainability projects efficiently. In addition, while governance compliance remains essential, the results suggest that it should be complemented with proactive leadership initiatives to achieve substantial performance enhancements. Hotel management should not depend exclusively on compliance but rather foster a culture of sustainability and continuous improvement. Ultimately, our research suggests that combining SL and sustainability can improve hotel industry performance. By adopting this approach, hotel managers can establish a clear pathway to achieve sustainable growth and a stronger competitive edge.

8. CONCLUSIONS

Our study offers an in-depth understanding of the direct and indirect connections between different factors in sustainability and performance. The findings from the structural model strongly support the proposed hypotheses, uncovering numerous noteworthy connections and elucidating the complex interplay of leadership, sustainability, and performance. The results demonstrate that SL positively impacts both SP and the achievement of SDGs, suggesting that leadership plays a crucial role in promoting sustainability. The correlation between SDGs and SP underscores the significance of incorporating sustainability into the strategy framework to improve performance. Moreover, understanding leadership plays a key role in achieving SDGs, highlighting the importance of leadership expertise in advancing sustainability projects. The substantial impact of SL on GC further emphasizes the importance of leadership in driving sustainability. Nevertheless, the findings also suggest that the mere adherence to governance regulations does not directly influence performance, and leadership expertise alone does not automatically improve performance or governance compliance. Our mediation analysis shows that SL and KoL have significant indirect effects on SP through SDGs. This means that SL improves performance by promoting sustainability initiatives, while KoL contributes to performance by positively influencing sustainability efforts. On the other hand, GC do not play a major role in mediating these relationships, highlighting the key significance of sustainability measures in obtaining performance goals. Overall, SL and KoL are pivotal in promoting sustainability and improving performance. However, the impact of GC on these factors warrants further exploration to fully understand its significance.

Data availability

Data available upon request due to ethical or privacy restrictions. The data supporting the findings of this study are available upon request from the corresponding author at jsosa4@uagm.edu

Conflict of interest

No potential conflict of interest was reported by the author(s).

Author Contributions

DNC: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Visualization, Supervision.

JSV: Conceptualization, Formal analysis, Investigation, Writing—original draft preparation, Writing—review and editing, Visualization, Supervision, Project administration.

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