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GREEN LEADERSHIP, DIGITAL TECHNOLOGY INTEGRATION, AND GUEST OUTCOMES IN BAGHDAD'S HOSPITALITY SECTOR: TOWARD A SUSTAINABILITY-AUTHENTICITY-TECHNOLOGY (SAT) FRAMEWORK

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ARTICLE INFO	ABSTRACT
Article history: Received: 2025-11-20 Received in revised form:2025-12-05 Accepted:2025-12-30 Available online:2026-06-26 Keywords: green leadership; digital sustainability integration; guest satisfaction; hotel loyalty JEL classification L83, Q56, M14, O33	<i>Environmental accountability has emerged as a crucial strategic issue in Baghdad's hotel industry, which is currently experiencing rapid reconstruction and economic recovery after periods of conflict. However, the ability to translate green leadership to genuine results for guests has not been fully explored so far considering the importance of digital technology in the Iraqi hospitality sector. We aim to understand how green leadership and digital sustainability are interwoven and how these two are related to guest satisfaction and loyalty intentions in classified hotels in Baghdad. We will also explore whether the perception of sustainability authenticity (SPS) and digital-human alignment serve as intervening mechanisms within these relationships. Researchers used survey data from 250 hotel guests in Baghdad who were at five, four, and three-star sustainability-compliant and green properties in four cultural groups. They used different statistical methods and found a strong correlation between green leadership visibility and guest satisfaction ($\rho = 0.64$, $p < 0.001$). Sustainability authenticity perception mediates the relationship between leadership and loyalty (indirect $B = 0.24$), and digital-human alignment (indirect $B = 0.17$) are important factors that influenced these findings. The highest satisfaction is associated with sustainability perception and integration intensity ($SI = 4.71$). In the context of the Sustainability-Authenticity-Technology (SAT) framework, green leadership is an authenticity signal and is the message of digital-human communication. Baghdad hotels need to ensure coherent integration, which is not only a good fit for the new tourism market but also incorporates different technologies into the environmental narrative.</i>

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1. INTRODUCTION

Baghdad's hospitality sector has a unique place in the contemporary Middle Eastern tourism sphere. As the city of Iraq's capital is in the midst of post-conflict reconstruction and economic growth, the city's classified hotels are being required to serve a wide range of tourists (business travelers, diplomatic delegations, cultural tourists, and reconstruction workers), and it is also becoming increasingly necessary for the organization to take environmental responsibility into account (Hawela et al., 2025; Alshimmari & Shneikat, 2025). Whereas environmental responsibility was once largely absent from the discourse about service quality in the hotel

industry in Iraq, it is gradually being incorporated into the consideration of international and regional customers as well as into the way in which they want to choose, decide on, and return to a hotel. On the other hand, a measured but growing number of artificial intelligence apps, Internet of Things infrastructure, and AI-driven concierge platforms have been installed in Baghdad's hotel properties, and their interactions are changing the way services are presented to them (Spektor et al., 2023; Roy & Pagaldiviti, 2023).

A relation between green leadership and digital technology in enhancing guest satisfaction and loyalty in the Arab and Iraqi hospitality context is still not clear. Previous studies have demonstrated that a transformational leadership strategy aimed at sustainability has a positive impact on employee behavior (Muftiyanto & Jatmika, 2025; Chan et al., 2024) and that organizational citizenship behavior related to environmental concerns leads to good guest experiences (Cordeiro et al., 2024; Salama, 2024). Furthermore, in hospitality digitization research, the prevalence of digital technologies is linked to better service perception, but the degree to which digital technology is used is to be determined by the context and preparedness of the staff (Giannitsas et al., 2026; Pastor, 2025). Nevertheless, theoretical models of these two research streams, especially related to the institutional culture and operational dynamics of Baghdad's hotel sector, have yet to be developed.

This study fills in the gap by presenting the SAT framework which is based on social exchange theory, social identity theory and planned behavior. In this framework, sustainability authenticity (SPS) is the key pathway through which green leadership is perceived for guest loyalty. Digital-human alignment is a secondary transmission channel for the impact of technology investment on customer satisfaction. Cultural origin clusters and digital exposure are also considered as boundary conditions for the strength of the relationships among Baghdad's diverse guest population. Based on survey data from 250 hotel guests in three property classes in Baghdad, the study aims at five related objectives: (1) to quantify the relationship of green leadership visibility to guest satisfaction; (2) to investigate whether SPS mediates the leadership-loyalty relationship; (3) to examine digital-human alignment as a mediator between integration intensity and satisfaction; (4) to assess cultural origin cluster as a moderator of the leadership-SPS relationship; and (5) to assess digital exposure level as a moderator of the integration-loyalty relationship. The paper is organized as follows: Section 2 sets the literature review and five testable hypotheses; Section 3 introduces the SAT Framework; Section 4 explains the methodology; Section 5 summarizes the empirical results; Section 6 offers theoretical and practical suggestions; and Section 7 concludes.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Green Leadership in the Hospitality Context

Green leadership is differentiated from its transformational predecessor in that it is a very clear and practical goal of ecological stewardship as a terminal value and a real goal (Alshimmari & Shneikat, 2025). While transformational leaders generally define a vision of organizational excellence, green transformational leaders place strong motivation, idealized influence and intellectual stimulation on environmental outcomes to form an organization's identity rather than as an optional duty to them (Hassan Abdou, 2025). This distinction is empirical; guests perceive and reward these leadership orientations differently and find green transformational leadership environments more satisfying than non-green ones, as shown in Table 4 of the present study.

The central factor influencing guests is behavioral role modeling. When hotel managers in Baghdad are demonstrated to engage in sustainability and to share in sustainability activities (say, by communicating eco-friendly activities during check-in, doing community-oriented environmental events or publicly recognizing workers who come up with resource-saving ideas) they convey authentic attributes to the guests (Aboramadan et al., 2022). Staff who observe that behavior will adopt it as a way of being and be able to reproduce it in their interactions with guests as genuine and not just a matter of appearance (Abedelrahim et al., 2024). And in the case of green leadership, staff autonomy is important, in that they can adapt sustainability offers for their guests as they see fit, thus turning the same policies to fit their own lifestyle (Hasanein & Elrayah, 2025). This is especially important in Baghdad, where the quality of customer service remains very much at the center of guest experience.

Comparative analysis across leadership styles consistently confirms the superiority of explicitly green transformational approaches in shaping hospitality guest outcomes (Nazarian et al., 2026). The results in Section 5 demonstrate that green transformational leadership is associated with the highest mean satisfaction score and the strongest recommendation rate among all leadership styles examined, supporting the following hypothesis:

Hypothesis 1 (H1): Green leadership visibility is positively associated with guest satisfaction index scores in Baghdad's classified hotels.

2.2 Digital Technology Integration and Sustainable Practice

Today's hotel digitization involves different levels of operations: physical assistance robotics, AI-driven interaction, and algorithmic management (Spektor et al., 2023; Roy & Pagaldiviti, 2023). Table 3 shows the adoption for all the different types of properties in Baghdad, and shows that five-star international hotels have considerably higher digital penetration—AI chatbot adoption rates reach 78% and voice recognition control 80% in comparison to three-star ones—this is indicative of the investment gap in Baghdad's hotel industry, where international properties are embedded with digital infrastructure more than independent mid-tier hotels.

Digital tools and sustainability practices are in a unique strategic challenge in the Iraqi context. Technologies that are operationally able to save resources only yield environmental benefits when they are communicated, contextually framed and linked to guest experience (Low et al., 2025; Sun et al., 2025). A climate control system that quietly controls room temperature does not make any impact on resource use; the same system is accompanied by real-time dashboard notifications that convert abstract efficiency into a human-driven sustainability experience. This distinction, we will call it digital-human connection, is crucial to understand why technology would help to spread green leadership narratives in Baghdad's hotels through the lens of technology. Table 5 shows that properties that have high digital sustainability integration perform better than their lower-integration peers in SI and SPS metrics.

Hypothesis 2 (H2): Digital-human alignment mediates the relationship between digital sustainability integration intensity and guest satisfaction in Baghdad's classified hotels.

2.3 Sustainability Authenticity as a Central Mechanism

As guests respond to a hotel's sustainability claims, they do so with implicit verification— they look at if what they observe is in line with the hotel's promises, whether it is a good example of leadership action in line with policy documents and whether the behavior of staff is rooted in genuine environmental values rather than regulatory compliance or superficial reputational management (Yilmaz, 2025; Yikilmaz et al., 2025). When they conclude positive, guests associate

better service with the hotel and feel more emotional attachment to it. This process is more relevant in Baghdad's hospitality system where Arab Gulf States guests are aware of high-quality sustainability practices in other countries and therefore have a more developed evaluation process based on a higher level of knowledge of these. The mediation results in section 5 show that SPS is indicative of 52% of the total impact of green leadership visibility on likelihood-to-revisit as in hospitality literature (Chedrawi et al., 2025; Guerra-Lombardi et al., 2025).

Hypothesis 3 (H3): Sustainability authenticity perception (SPS) mediates the relationship between green leadership visibility and guest loyalty intention in Baghdad's hotel market.

2.4 Cultural and Technological Moderators

The theory of planned behaviour and value-belief-norm theories both suggest that cultural conditioning is involved in individuals' response to environmental messages and how they interpret them (Guerra-Lombardi et al., 2025). In the diverse population of guests in Baghdad with a strong emphasis on individualist and collectivist cultures, Western/European guests are more sensitive to direct, leader-like messages, whereas Iraqi Arab Nationals and Arab Gulf States visitors are more sensitive to group-level environmental behaviour and ecological narratives (Giannitsas et al., 2026; Doctorarastoo et al., 2026). Digital exposure adds to a second boundary condition through a familiarity-driven route: the many technological activities we have to cope with in our daily life and the knowledge of how the environment can be a source of satisfaction are more likely to make us more satisfied in a cohesive integration ecosystem (Pastor, 2025).

Hypothesis 4 (H4): The cultural origin cluster moderates the relationship between green leadership visibility and sustainability authenticity perception, with stronger positive associations observed among guests from individualist (Western/European) backgrounds relative to collectivist-oriented Arab guest segments.

Hypothesis 5 (H5): Digital exposure level moderates the relationship between integration intensity and guest loyalty intentions, with stronger effects observed among high-exposure guests.

3. THEORETICAL FRAMEWORK: THE SAT FRAMEWORK

3.1 Conceptual Architecture and Three Core Propositions

SAT is a holistic view of the Sustainability-Authenticity-Technology (SAT) model in the middle of the scale for social exchange theory, social identity theory and planned behavior to understand how green leadership and digital technology impact guest performance in hospitality settings. In Baghdad, such a model is particularly relevant as it integrates the international sustainability certification pressure and cultural expectations of a predominantly Arab guest base and the connection between authenticity, technology and leadership is very important. Proposition 1 (Leadership-Authenticity Pathway): Green leadership visibility is what the guests perceive as authentic: This is reinforced by a behavioral modeling process that involves managerial ecological behavior in front of the front line and how it is reflected in their actions to ensure they are pro-environmental action and thus create the visible quality signals that can be perceived by guests as an authentic commitment to the organization. The path to the digital sustainability integration is influenced by cultural factors in Baghdad: Western/European guests are more sensitive to leader-specific individualist signals and Iraqi Arabs and Gulf States visitors need to be given more group-normative feedback to update their SPS estimates.

Proposition 2 (Technology-Alignment Pathway): The digital sustainability integration intensity leads guests to a higher level of satisfaction but that in turn is largely mediated by the coherence that is perceived between automated system outputs and employee accounts of the internal environment; digital-human alignment. When Baghdad's hotels are infused with sustainability information that staff can translate into culturally relevant information like Islamic environmental stewardship principles for Arab guests or quantitative efficiency metrics for Western business travelers, the effect is much larger than either channel alone. This pathway is moderated by digital exposure level.

Proposition 3 - Reciprocal Amplification Effect: The two pathways are multiplicative but not additive in the case of congruence. Both SPS and integration intensity are at a higher level, and the satisfaction and loyalty outcomes are higher than what either pathway predicts independently, a result that is well tested statistically ($\Delta R^2 = .064$, $p < .001$). This logic is at odds with the management approach to green leadership and digital transformation as parallel but independent strategic paths, which is also the case for Baghdad hotel operators who tend to compartmentalize these two areas of investment.

3.2 Positioning Within Existing Theory

The SAT Framework builds existing hospitality organizational behavior models in three principal ways. The first is to bring authenticity perception (best researched in consumer behavior and tourism identity research) to the green leadership literature, which has previously considered employee-level processes like the behavior of employees for citizenship, engagement, and environmental engagement (Alshimmari & Shneikat, 2025; Hassan Abdou, 2025). Second, it considers digital-human alignment as an active mediating construct, rather than as a productivity-based metric (Spektor et al., 2023; Low et al., 2025). Third, it considers cultural origin and digital exposure as boundary conditions, which recognizes that Baghdad's hotel guests are mixed in their response to the same sustainability message from different cultures (Nazarian et al., 2026; Giannitsas et al., 2026).

4. METHODOLOGY

4.1 Research Design

This study has used a cross-sectional descriptive survey approach that is based on post-positivist epistemology. This design captures naturalistic perceptions from hotel stay exposure instead of manipulated situations to create the highest ecological validity (Zhang & Wang, 2026). In order to do this, we combined on-site questionnaire administration during hotel lobby and guest floor use in Baghdad and after checkout digital form distribution through QR code-linked instrumentation to capture participants' participation and reduce single-method bias. For primary inference, we used Spearman's rho and chi-square non-parametric statistics as the objective to investigate the distribution of loyalty intention distributions as they are more than one digit in number and as we found non-normality for loyalty intention distribution to be a common feature of the sampling distribution. This approach to data collection was organized at the guest relations and front office levels of the properties, and the collection of data has been done to ensure that the instrument was delivered in a low-congestion time to the guests for the best quality of response.

4.2 Sampling Strategy and Justification

The target audience was hotel guests who visited at least two consecutive nights in Baghdad to find sustainable properties with real sustainability commitments, with digital technology deployment levels. Two types of sampling criteria were used: (1) property selection with a leadership level of involvement in sustainability programming and technology systems (from minimal IoT to complete AI integration) and (2) respondent inclusion with at least 18 years of age, at least two nights in Baghdad, and at least one meeting with staff-led sustainability programs or digital services.

The $n = 250$ sample size was calculated with power analysis, which indicated that detecting small to moderate effect sizes ($f^2 = 0.02$) with $\alpha = .05$ and power ≥ 0.80 was required in at least 200 cases when various aspects of the prediction and interaction were considered (Baczynska et al., 2024). A further 50 cases served as a buffer for incomplete responses and preserved analytic cell viability when aggregating property classification criteria, cultural origin cluster, and digital exposure tier. Table 1 shows the sample composition and provides a glimpse of the demographics of the international and regional hotel customers in Baghdad.

Table 1. Sample Demographic Composition ($n = 250$)

Variable	Category	n	%
Travel Purpose	Business	122	48.8
	Leisure	88	35.2
	Mixed (Bleisure)	40	16.0
Occupancy Duration	≤ 3 nights	102	40.8
	4–7 nights	87	34.8
	> 7 nights	61	24.4
Cultural Origin Cluster	Iraqi Arab National	96	38.4
	Arab Gulf States (GCC)	70	28.0
	Western/European	50	20.0
	Asian & Other Regions	34	13.6
Property Classification	Five-Star International	88	35.2
	Four-Star Sustainability-Compliant	94	37.6
	Three-Star Basic Green Policy	68	27.2
Digital Exposure Level	High (> 5 functions)	112	44.8
	Moderate (3–4 functions)	83	33.2
	Low (1–2 functions)	55	22.0

Note. Digital exposure level is based on the count of distinct technology functions used during the stay. The Iraqi Arab National cluster includes both Baghdad-resident and non-Baghdad domestic travelers. The Arab Gulf States cluster encompasses guests from Bahrain, Kuwait, Qatar, Saudi Arabia, the United Arab Emirates, and Oman

4.3 Survey Instrument

The questionnaire was organized into five categories: demographic profiling, digital function exposure inventory, green leadership visibility perception items, service quality and sustainability satisfaction ratings, and loyalty intentions. Green leadership perception items were based on validated frameworks based on role modeling, empowerment, and ecological communication alignment (Aboramadan et al., 2022). Satisfaction was assessed with multi-item 5-point Likert scales that combined traditional service dimensions with sustainability-weighted criteria (Wee, 2025) for a total Satisfaction Index (SI) of 1–5 for within-study analyses. A complementary 10-point scale that combines multiple service dimensions was calculated for leadership and communication mechanisms as well. The pilot testing with $n = 20$ guests drawn from Baghdad hotels corroborated item comprehension and internal consistency of all constructs

(Cronbach's $\alpha > .85$ for all constructs). Bilingual forward and backward translation procedures ensured semantic equivalence between the Arabic and English versions of the instrument (Hassan et al., 2024).

4.4 Analytical Strategy

Descriptive statistics were constructed for all continuous constructions. Spearman's rho was used to evaluate bivariate association. Chi-square tests were performed to examine categorical association between integration levels and loyalty brackets. Mediation was estimated to be using bias-corrected bootstrapping with 5,000 resamples (Chedrawi et al., 2025). Moderation was measured by hierarchical regression in which interaction terms are entered after the main effects to separate the incremental variance explained. Data cleaning excluded the responses with more than 20% missing values and verified the identity of the responses by timestamp-IP matching. Ethical approval was obtained from the Research Ethics Committee at Mustansiriyah University's Faculty of Tourism Sciences, and all participants were informed before the data were collected.

5. RESULTS

5.1 Descriptive Statistics

Table 2 gives descriptive statistics on the key studies. The overall satisfaction score (SI) of 4.32 (SD = 0.39) and Sustainability Perception Score (SPS) of 4.30 (SD = 0.41) are good indicators of a favorable guest evaluation environment as the participating properties. The smaller Digital-Human Alignment Rating mean (4.11, SD = 0.56) compared with the Green Leadership Visibility Score of 4.18 (SD = 0.44) indicates that the level at which guests are satisfied with leadership commitment is more variable but the level of digital sustainability information that consumers in Baghdad are equipped with is more variable and will be an important aspect of the mediation analysis that we will analyze in the next section.

Table 2. Descriptive Statistics for Study Constructs (n = 250)

Construct	Mean	SD	Range
Satisfaction Index (SI) [1–5]	4.32	0.39	3.0–5.0
Sustainability Perception Score (SPS) [1–5]	4.30	0.41	2.9–5.0
Green Leadership Visibility Score [1–5]	4.18	0.44	2.5–5.0
Digital-Human Alignment Rating [1–5]	4.11	0.56	2.3–5.0
Integration Intensity Score (composite) [0–10]	8.15	1.02	5.0–10.0
Likelihood-to-Revisit (LTR) [%]	78.4	14.7	40–100
Likelihood-to-Recommend (LTC) [%]	80.2	13.9	45–100
Observed OCB Frequency (acts per stay)	2.4	1.1	0–5

Note. SI and SPS were measured on 1–5 Likert scales anchored to Baghdad hotel stay contexts. OCB = organizational citizenship behavior (voluntary pro-environmental acts observed per stay). The Integration Intensity Score is a composite of digital function breadth and environmental visibility, scored 0–10. LTR = likelihood to revisit; LTC = likelihood to recommend

Table 3 presents digital technology adoption rates across Baghdad's hotel classifications, demonstrating systematic increases with property tier across all function categories. These data served as the empirical referent for the digital exposure level classification variable used throughout the analyses.

Table 3. Digital Technology Adoption Rates by Property Classification in Baghdad Hotels

Technology Function	3-Star (%)	4-Star (%)	5-Star (%)
AI Chatbot Customer Service	42	65	78
Voice-Recognition In-Room Control	38	58	80
Food Delivery Robotics	15	34	55
Automated Cleaning Systems	12	29	48
Algorithmic Occupancy Forecasting	25	60	77

Note. Values represent the percentage of guests who encountered each technology function during their stay. Five-star properties include internationally affiliated hotels operating in Baghdad's commercial and diplomatic districts.

Table 4 presents guest satisfaction and loyalty metrics by perceived leadership style within Baghdad's sampled hotels, confirming the superiority of green transformational approaches across all outcome indicators. SI values in Table 4 reflect the supplementary 10-point composite scale.

Table 4. Guest Satisfaction and Loyalty Metrics by Perceived Leadership Style — Baghdad Hotels

Perceived Leadership Style	SI Mean (1–10) ^a	SD	LTC > 80% (%)
Green Transformational	9.2	0.5	87
Transformational (Non-Green)	8.6	0.7	78
Servant Leadership	8.8	0.6	80
Ethical Leadership	8.4	0.8	74
Transactional Leadership	7.5	1.0	60

Note. ^a SI values reflect the supplementary 10-point composite scale for comparative purposes. Leadership style classifications are derived from guests' narrative characterizations of managerial behaviors observed during their stay. LTC = Likelihood-to-Recommend.

5.2 Hypothesis Testing

5.2.1 H1: Green Leadership Visibility and Guest Satisfaction

It can be seen in Spearman's rho analysis that there is a strong positive relationship between green leadership visibility and the guest satisfaction index ($\rho = 0.64$, $p < .001$) that supports H1 and is the strongest bivariate relationship in our study and held across all three types of properties in Baghdad's hotel market. The effect was more pronounced in the five-star international properties ($\rho = 0.71$, $p < .001$) where guests are usually treated to full-fledged leadership-driven sustainability rituals and less so in three-star properties ($\rho = 0.52$, $p < .001$) where leadership visibility is limited in operation. Table 5 presents the satisfaction index scores disaggregated by digital sustainability integration level, contextualizing the leadership effect within the broader technological landscape.

Table 5. Satisfaction Index (SI) and Sustainability Perception Scores (SPS) by Digital Sustainability Integration Level — Baghdad Hotels

Integration Level	SI Mean [1–5]	SPS Mean [1–5]	p-value (SI vs. SPS)
High Integration (Score > 8)	4.61	4.54	< .001
Moderate Integration (Score 6–8)	4.29	4.23	< .001
Low Integration (Score < 6)	3.96	3.88	< .01

Note. Integration level is based on the composite Integration Intensity Score (0–10). p-values reflect Spearman's rho tests of the SI–SPS correlation within each integration tier.

The bias-corrected bootstrapping mediation analyses (5,000 resamples) supported both H2 and H3. For H3, the SPS partially mediated the relationship between the visibility of green leadership and likelihood of revisiting: the total effect was $B = 0.46$ ($p < 0.001$) and the indirect pathway through SPS was $B = 0.24$ (95% CI [0.14, 0.36])—representing approximately 52% of the total effect. The direct effect was still significant ($B = 0.22$, $p < 0.001$) and the indirect pathway was still

significant (but not as much as the direct pathway). For H2, digital-human alignment somewhat mediated the integration intensity-satisfaction relationship, and the indirect pathway was still significant (95% CI [0.09, 0.27]). Table 6 summarizes the mediation results.

Table 6. Mediation Analysis Results — Baghdad Hotel Sample

Pathway	Total B	Indirect B	Direct B	95% CI
GL Visibility → SPS → LTR (H3)	0.46***	0.24***	0.22***	[0.14, 0.36]
Integration → Alignment → SI (H2)	0.38***	0.17***	0.21***	[0.09, 0.27]

Note. *** $p < .001$. GL = Green Leadership; SPS = Sustainability Perception Score; LTR = Likelihood-to-Revisit; SI = Satisfaction Index. Bootstrapping with 5,000 resamples.

5.2.3 H4 and H5: Moderation Analyses

Hierarchical regression analyses with interaction terms confirmed the moderating effect of cultural origin cluster (H4) and digital exposure level (H5). The relationship between green leadership visibility and cultural origin cluster strongly predicted SPS ($B = .18$, $p < .05$) and simple slopes ($b = .65$, $p < .001$) were obtained for Western/European guests and $b = .42$ for Arab Gulf States that supports H4. The higher-slope results for Western/European guests are in line with the individualist nature of the cultural origin cluster and make authenticity cues of a leader more diagnostic than those of the Arab majority in Baghdad. The digital exposure level (H5) interaction was significant ($B = .24$, $p < .01$) and high-exposure guests had a steeper slope than low exposure guests ($b = .21$). Tables 7 and 8 summarise regression model summary and significant moderation effects.

Table 7. Hierarchical Regression Summary — Moderation Models, Baghdad Hotel Sample

Predictor	Model 1 β	Model 2 β	Model 3 β	p-value
Green Leadership Visibility (GL)	.51***	.48***	.46***	< .001
Cultural Origin Cluster	—	.22***	.21***	< .001
GL × Cultural Origin (Interaction)	—	—	.18*	< .05
Integration Intensity	.44***	.41***	.40***	< .001
Digital Exposure Level	—	.27***	.25***	< .001
Integration × Digital Exposure (Interaction)	—	—	.24**	< .01
ΔR^2 (Interaction terms)	—	—	.064***	< .001

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Standardized coefficients (β) reported. Model 1 = main effects only; Model 2 = main effects + moderators; Model 3 = full model including interaction terms. $n = 250$.

Table 8. Summary of Significant Moderation Effects — Baghdad Hotel Sample

Moderator Variable	Interaction β	p-value	Key Pattern in Baghdad Context
Cultural Origin Cluster	GL × Culture = .18	< .05	Steeper slope: Western/European > Arab Gulf States guests
Digital Exposure Level	Integration × Exposure = .24	< .01	Strongest slope for high-exposure guests in 5-star Baghdad properties
Cultural Origin Cluster	Alignment × Culture = .15	< .05	Higher sensitivity: Arab Gulf States guests to Arabic-language sustainability messaging
Digital Exposure Level	SPS × Exposure = .19	< .05	LTR sustained only at moderate-to-high digital exposure tiers in Baghdad hotels

Note. Moderation effects derived from hierarchical regression analyses. GL = Green Leadership visibility. All interaction terms entered after main effects. Cultural origin cluster treated as a categorical moderator with Western/European as the reference category.

5.3 Interaction Effects: Sustainability × Technology

SPS and integration intensity explained an additional 6.4% of the variance beyond the main effects ($\Delta R^2 = .064$, $p < .001$). This confirms that sustainability perception and technology deployment are both complementary with respect to Baghdad's hotel environment. Table 9 shows the cell means after high/low SPS and integration. The highest satisfaction ratings (SI = 4.71; LTC = 87.2%) were only achieved when both the SPS and integration intensity were high in combination, and even the best technical systems are unable to significantly increase SI when sustainability cues lack authenticity (SI decreases to 4.18 in high-integration/low-SPS conditions). This is very relevant to Baghdad's five-star hotels, which have over the past few years spent big on an AI-driven digital system but not enough on human service behavior to ensure that they are not just making automated sustainability claims.

Table 9. Satisfaction Index (SI) and LTC by Combined Sustainability Perception and Integration Level — Baghdad Hotels

SPS Level	Integration Level	SI Mean [1–5]	LTC Mean (%)
High (> 4.3)	High (Score > 8)	4.71	87.2
High (> 4.3)	Low (Score < 7)	4.43	81.5
Low (< 3.6)	High (Score > 8)	4.18	76.4
Low (< 3.6)	Low (Score < 7)	3.89	61.9

Note. The highest SI (4.71) and LTC (87.2%) occurred exclusively when both SPS and integration intensity were simultaneously high, confirming the multiplicative amplification proposition of the SAT Framework. LTC = Likelihood-to-Recommend

Table 10 illustrates that digital-verbal messaging achieves the highest satisfaction scores, averaging 9.2 on a 10-point composite scale, and garners the most substantial rate of guests expressing strong recommendation intentions at 64%. This figure remains significantly superior to those of other communication methods. Notably, this insight is particularly striking considering that hotels in Baghdad have traditionally relied on interpersonal service excellence as their primary differentiator in quality. These findings suggest that this relational strength can be augmented not supplanted by effective digital sustainability communication.

Table 10. Guest Satisfaction and Loyalty by Sustainability Communication Channel — Baghdad Hotels

Communication Mode	SI Score (1–10) ^a	High LTC (> 80%) %
Combined Digital + Verbal Messaging	9.2	64
Digital Interface Integrated Suggestions	8.4	58
Verbal Invitations by Staff Only	8.1	44
Static Signage Only	7.9	37
No Sustainability Communication	6.5	18

Note. ^a SI values reflect the supplementary 10-point composite scale for comparative purposes. LTC = Likelihood-to-Recommend. Data derived from the Baghdad hotel sample ($n = 250$).

5.4 Hypotheses Summary

All five hypotheses received empirical support, collectively validating the three central propositions of the SAT Framework within the context of Baghdad's classified hotel sector. Table 11 consolidates the hypothesis outcomes alongside key statistical evidence.

Table 11. Hypothesis Test Outcomes Summary — Baghdad Hotel Sample

H	Hypothesis Statement	Outcome	Key Statistical Evidence
H1	Green leadership visibility positively predicts guest satisfaction (SI) in Baghdad's hotels	Supported	$\rho = 0.64, p < .001$
H2	Digital-human alignment mediates Integration Intensity $\rightarrow$ SI	Supported	Indirect $B = 0.17$, 95% CI [0.09, 0.27]
H3	SPS mediates Green Leadership Visibility $\rightarrow$ LTR (partial mediation)	Supported	Indirect $B = 0.24$, 95% CI [0.14, 0.36]
H4	Cultural origin cluster moderates GL Visibility $\rightarrow$ SPS relationship	Supported	$B = .18, p < .05$; Western/European slope steeper
H5	Digital exposure level moderates Integration Intensity $\rightarrow$ LTR relationship	Supported	$B = .24, p < .01$; high-exposure slope strongest

Note. All hypotheses tested on the Baghdad hotel sample ($n = 250$). SPS = Sustainability Perception Score; LTR = Likelihood-to-Revisit; SI = Satisfaction Index; GL = Green Leadership. Bootstrapping with 5,000 resamples for mediation analyses.

6. DISCUSSION

6.1 Theoretical Contributions

The SAT Framework's main theoretical contribution is to posit the role of authenticity perception as the mechanism that green leadership plays in creating loyalty results. Long-standing hospitality leadership research has focused on the leader-to-employee pathway and the role of green transformational leadership in staff organizational citizenship behavior, intrinsic motivation and environmental engagement (Alshimmari & Shneikat, 2025; Hassan Abdou, 2025). Our findings in Baghdad are a further extension of this literature and suggest that guest-facing authenticity perception (SPS) is a theoretically and empirically separable construct that partially mediates the leadership-to-loyalty pathway, which has not been formally discussed in hospitality organizational behavior research in the context of Iraq.

Since the results indicate a partial rather than full mediation of the leadership-loyal relationship in this study, it is not clear whether SPS is sufficient to see more than one side of this relationship that would be important in future studies. In the hospitality context in Baghdad, these can be indicative of the quality-of-service innovation, the Arabic language environmental storytelling, Islamic ecological value alignment (which is not captured in current hospitality scenarios) and co-creation experiences that send leadership signals to guests. SPS is also consistent with self-determination theory: those who attribute sustainable behavior to intrinsic organizational commitment rather than instrumental compliance are more likely to associate the property with the person and to have longer loyalty responses, which might be especially true of Iraqi Arab National guests, who are much more motivated by their institutional trustworthiness in the sense that they can be evaluated more critically about the institution.

The second theoretical contribution—digital-human alignment as a mediating framework—posits the technology adoption literature and behavioral hospitality research in ways applicable to Baghdad's digitizing hotel sector. Current research has presented digital investment as a means of explaining operational efficiency, but the present perspective is to consider it as a communication infrastructure that is built to help to connect automated activities to human service in the world of the hospitality industry (Low et al., 2025; Sun et al., 2025). Rather than focusing only on accuracy or efficiency of AI outputs, Baghdad's hotels should evaluate sustainability-relevant AI outputs to the extent to which they enable staff to make meaning (in a bilingual narrative training context) which needs to be done deliberately.

Third, the reciprocal amplification result– the maximum satisfaction is when SPS and integration intensity are in conjunction above threshold values– is an important feature for interaction research in service management. The value of the interaction term is large over the magnitude of the main effect variance, suggesting that research that does not incorporate this interaction could underestimate the effect of the combined investments in sustainability and technology. For Baghdad's hotel operators, this implies that the returns on digital sustainability investment are dependent on prior or concurrent investments in green leadership visibility– and this finding is at odds with the common managerial conception of them as assets that are not continuous but products of one another but can be deployed as one and all.

6.2 Practical Implications for Baghdad's Hotel Sector

The findings have impactful implications for hospitality management in Baghdad in a variety of areas. First, green leadership visibility should be considered a measurable behavior variable that can be quantified in terms of frequency and context, since the data confirm a direct positive impact of leadership visibility on satisfaction levels. Baghdad properties in the three-star category may get the best per unit satisfaction effect of more leadership visibility, as the interaction analysis shows leadership partially compensates for lower integration intensity, which is a strategically important finding for the mid-tier hotels that can still be capital constrained in the post-reconstruction context in Iraq.

Second, digital interface investments should be conditioned on whether staff are ready to interpret and contextualize system outputs for Baghdad's multicultural guest segments. Expanding the scope of technological function without a fair investment in interpretive training may not yield high returns. Training programs should integrate technical operations with narrative communication skills: training staff to translate resource-saving metrics into culturally relevant ecological stories, whether in terms of Islamic stewardship principles for Arab guests or quantified environmental impact for Western and Asian business travelers.

Third, communication strategies need to vary by channel and be sensitive to the cultural composition of each property's guest mix. Table 10 shows that the combination of digital and verbal communication is the most effective in terms of satisfaction and loyalty. Baghdad's hotels serving mainly Arab Gulf States guests should frame sustainability messages in terms of collective participation, shared environmental responsibility, and regional identity, which is consistent with collectivist culture. Properties with more Western/European guests may also employ more individualist, leader-centered messaging with the same effect.

The post-departure communication phase, in turn, must be studied as the loyalty-building mechanism for Baghdad hotels. A collection of sustainability contribution reports for each property that describe a guest's resource-saving contribution and contextualize it within the property's collective environmental outcomes during the stay, therefore, provides additional authenticity for the SPS-LTR relationship post-stay (Chedrawi et al., 2025). For Baghdad hotels, who are working to build international reputation in a competitive regional market, this way of seeing things as low-cost differentiation vehicles in comparison with more established sustainability-certified competitors in neighboring Gulf cities can be helpful.

7. CONCLUSION

7.1 Summary of Findings

We investigated the effects of green leadership and digital technology on hotel guests' satisfaction and loyalty using a cross-sectional survey of 250 hotel guests across three property types in Baghdad, Iraq. All five hypotheses in the SAT Framework were confirmed. Green leadership visibility directly and positively contributed to satisfaction ($\rho = 0.64$, $p < 0.001$); sustainability authenticity perception partially mediated leadership-loyalty pathway (indirect $B = 0.24$, $CI [0.14, 0.36]$); digital-human alignment mediated the integration intensity-to-satisfaction relationship (indirect $B = 0.17$, $CI [0.09, 0.27]$); cultural origin cluster moderated the leadership-SPS relationship ($B = 0.18$, $p < 0.05$), Western/European guests were the most steeply slope and digital exposure level moderated the relationship between integration and loyalty ($B = 0.24$, $p < 0.01$). The relationship between SPS and integration intensity was found to be in the same direction ($\Delta R^2 = 0.064$) and authenticity and technology are complementary to each other in Baghdad's classified hotel environment.

7.2 Contributions to Theory and Practice

The SAT Framework advances hospitality organizational behaviour theory by characterising authenticity perception as the primary mediating mechanism in the green leadership-loyalty pathway, representing digital-human alignment as a second-order transmission mechanism and advocating that authenticity and technology are complementary and mutually reinforcing as a means for best guest satisfaction. We argue that these propositions are well grounded in the special institutional, cultural, and operational context of Baghdad and could be considered as the basis for future work on hospitality and other service opportunities in the Arab world and beyond. This framework also underscores practitioners in Baghdad's rapidly changing hotel market that coherence in leadership signals, staff behaviour, and technological messaging leads to guest outcomes that neither investment stream can achieve independently.

7.3 Limitations and Future Research Directions

This study has a number of limitations. The cross-sectional nature of the research makes it difficult to draw causal conclusions; longitudinal research with the same guests over multiple visits would enhance claims about directionality and allow us to observe changes in perceptions of sustainability authenticity as Iraq's green hospitality sector develops. Self-reported information on leadership visibility and sustainability perceptions is likely to lead to social desirability bias that may be reduced by observational and ethnographic methods. While the sample from Baghdad was demographically varied compared to other regional studies, it was restricted to one city; conducting similar studies in other Iraqi cities such as Basra, Erbil, and Najaf, as well as in broader Middle Eastern hospitality settings, would help to explore the limits of the cultural moderation findings.

In the future work, the implications of the SAT Framework should be examined in more than just the service sector in Iraq: religious tourism (especially as Najaf and Karbala are located abroad), airport and conference facilities. Longitudinal research based on experience sampling can be used to study how within-person perception of authenticity changes during the guests' journey. Arabic-language online guest reviews in Iraqi hotel-listing platforms could be used as external test cases for SPS, and large samples could be replicated in an unbiased manner. Finally, the theoretical framework could be applied to complexity leadership theory (Brown et al., 2026) to have better insights into how the adaptive co-creation of leaders, staff and guests contributes to the emergence of authenticity perceptions in Baghdad's fast-changing hospitality sector.

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