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# Sustainable Service Operations: Energy Management and Green Marketing in Nigerian Hotels

Ntamu E. Abua Ph.D[1], Ajayi Oni Ekundayo Ph.D [2]

1 Institute Of Health Science, Research and Administration Nigeria, Obudu, Cross River State, Nigeria
Email: abuantamu83@gmail.com
2 Department of Logistics and Transport, University of Port Harcourt, Rivers State
E-mail: ajayiekundayo@uniport.edu.ng

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ABSTRACT

Nigeria's hotel industry consumes disproportionate levels of diesel-generated electricity and potable water while generating substantial solid and liquid waste, yet strategic frameworks linking sustainability operations to service performance and competitive marketing remain underdeveloped. This study examined the influence of six green operations and marketing dimensions solar energy and renewable integration, energy-efficient equipment adoption, waste reduction and recycling programmes, water conservation management, green marketing communication, and green procurement on sustainable service operations performance in Nigerian hotels. A descriptive cross-sectional survey design was employed, with structured questionnaires administered to 396 hotel management and operations staff in selected three-, four-, and five-star hotels in Lagos, Abuja, and Port Harcourt, drawn through stratified random sampling. Data were analysed using descriptive statistics, Pearson correlation analysis, and multiple regression analysis. All six dimensions significantly and positively influenced sustainable service operations performance ($R^2 = .641$, $F(6, 389) = 115.62$, $p < .001$). Green marketing communication ($\beta = .284$) and energy-efficient equipment adoption ($\beta = .271$) emerged as the strongest predictors. The study concluded that hotels that integrate environmental practices with outward-facing green marketing strategies achieve the strongest sustainability performance outcomes. It was recommended that hotel operators develop comprehensive Environmental Management Systems linked to guest-visible green credentials, invest in solar infrastructure as a strategic cost and sustainability lever, and align procurement policies with certified green supply chains.

## Introduction

There is a generator somewhere behind the walls of almost every hotel in Nigeria. It might be a modest 20KVA unit supplying a three-star guesthouse in Ikeja, or a bank of industrial diesel generators powering a five-star tower in Victoria Island through another 18-hour grid outage, but its presence is near-universal. For the Nigerian hotel industry, diesel-generated electricity is not an emergency backup it is the primary energy reality, and it shapes everything: operating costs, carbon emissions, service quality consistency, and the ability to maintain basic amenities that guests in other parts of the world take for granted. When researchers and practitioners talk about sustainability in Nigerian hospitality, they are talking about a sector that sits at an acute intersection of environmental responsibility and operational survival, where the case for renewable energy is simultaneously a moral argument and the most compelling business case on the cost sheet.

The global hospitality industry accounts for approximately 1% of total carbon dioxide emissions and consumes around 10% of the world's water supply (United Nations Environment Programme, 2022). Hotels, by their nature, are energy-intensive: air conditioning, hot water, laundry, kitchen operations, and lighting together account for between 60% and 80% of a typical hotel's utility expenditure (Bohdanowicz & Martinac, 2021). In Nigeria, where grid electricity is supplied at a fraction of actual demand and where diesel generation costs have risen sharply alongside global oil prices and naira devaluation, energy management is simultaneously the most pressing operational challenge and the most

potent sustainability opportunity facing hotel operators (Emenike & Nwosu, 2023; Olawale & Dauda, 2022).

Green marketing the practice of communicating environmental credentials, sustainability commitments, and eco-friendly service features to current and prospective guests has emerged as a distinct competitive positioning strategy in global hospitality (Chen & Chang, 2013; Ottman, 2017). The rise of environmentally conscious travellers, the proliferation of green hotel certification schemes, and the growing integration of environmental, social, and governance (ESG) criteria into corporate travel procurement have collectively elevated green credentials from an optional differentiator to an increasingly important qualifier in upscale hotel markets (Leonidou et al., 2020; Han & Hyun, 2018). In Nigeria, where the green hotel movement is nascent but gathering momentum driven partly by international chain affiliations and partly by growing domestic eco-consciousness among business travellers understanding what green operational and marketing dimensions most effectively drive sustainable service performance is a matter of competitive and strategic urgency.

Yet the empirical literature on sustainability in Nigerian hotels is sparse and fragmented. Most existing studies focus on either energy management in isolation or on green marketing intent without connecting these to service performance outcomes (Emenike & Nwosu, 2023; Abua, 2023). No study, to the researcher's knowledge, has simultaneously examined the contribution of six distinct green operations and marketing dimensions to a composite sustainable service operations performance construct in the Nigerian hotel context. This study fills that gap.

The specific objectives were: (1) to determine the influence of solar energy adoption and renewable integration on sustainable service operations performance; (2) to examine how energy-efficient equipment and LED systems affect sustainability performance; (3) to assess the role of waste reduction and recycling programmes in driving sustainable service operations; (4) to evaluate the impact of water conservation management on sustainability performance; (5) to analyse the influence of green marketing communication on sustainable service operations performance; and (6) to determine the contribution of green procurement and supply chain practices to hotel sustainability performance in Nigeria.

## Literature Review

### Energy Management in Hotel Operations

Energy management in hotels encompasses the systematic identification, monitoring, and reduction of energy consumption across all operational domains, including HVAC systems, lighting, kitchen equipment, laundry, and water heating (Bohdanowicz & Martinac, 2021). In developed hotel markets, energy management has been transformed by smart building management systems (BMS), occupancy-sensing thermostats, LED retrofits, and on-site renewable energy generation — with solar photovoltaic (PV) systems emerging as the most cost-effective renewable option for tropical climate hotel locations (Kang et al., 2020; Gossling, 2019). Studies consistently show that hotels implementing structured energy management programmes reduce energy costs by between 10% and 30%, with payback periods on solar installations typically between three and seven years depending on system scale and local electricity tariffs (Kang et al., 2020; Bohdanowicz & Martinac, 2021).

In the Sub-Saharan African and specifically Nigerian context, energy management carries dimensions absent in infrastructure-stable environments. The average Nigerian hotel spends between 35% and 55% of its total operating costs on energy a figure two to three times higher than the global average due to its dependence on self-generated diesel electricity (Emenike & Nwosu, 2023; Olawale & Dauda, 2022). The National Electricity Regulatory Commission (NERC) reported average grid supply availability of fewer than six hours per day in major Nigerian cities during 2022, making off-grid renewable alternatives not merely a green aspiration but a practical necessity for operationally serious hotel operators. Solar energy adoption, in this context, is simultaneously an environmental action and a cost survival strategy a convergence that should, in theory, accelerate renewable uptake but which has been slowed by high capital costs, limited green financing options, and technical skill gaps in solar system maintenance.

LED lighting retrofits and energy-efficient kitchen and HVAC equipment represent lower-capital entry points into the energy management journey for Nigerian hotels. Studies across comparable markets in Ghana, Kenya, and Cameroon have documented significant energy savings — typically 40% to 60%

reductions in lighting energy consumption following LED retrofits alongside improved light quality that positively affects guest experience perceptions (Gossling, 2019; Nkrumah & Osei, 2021).

**Green Marketing in Hospitality**

Green marketing, as applied in the hospitality context, involves the communication of an organisation's environmental practices, eco-certifications, and sustainability commitments through a range of channels designed to attract environmentally conscious guests and differentiate the property in competitive markets (Ottman, 2017; Chen & Chang, 2013). Polonsky (1994) defined green marketing broadly as all activities designed to generate and facilitate exchanges intended to satisfy human needs with minimal detrimental impact on the natural environment a definition that encompasses both the actual environmental practices of the firm and the communication of those practices to market audiences.

In hospitality, green marketing operates on two levels. At the product level, it involves the design of service offerings that embody environmental values organic amenities, farm-to-table dining, energy-neutral rooms, and refillable toiletry systems. At the communication level, it encompasses the use of eco-labels, sustainability reports, social media environmental content, and third-party green certifications (such as the Rainforest Alliance, Green Globe, or EarthCheck) to signal environmental commitment to potential guests (Leonidou et al., 2020; Han & Hyun, 2018). Research consistently shows that green marketing communication positively influences guest booking intention, willingness to pay a green premium, and post-stay loyalty, particularly among millennial and Gen-Z travellers whose consumption choices are increasingly shaped by environmental values (Han & Hyun, 2018; Martínez, 2015).

In the Nigerian hotel context, green marketing remains predominantly at an early adoption stage. Abua (2023) observed that while a growing number of Nigerian hotels particularly those affiliated with international chains such as Hilton, Radisson, and Marriott were beginning to integrate sustainability messaging into their OTA profiles and corporate communications, the majority of independent hotels had yet to develop coherent green marketing strategies, relying instead on ad-hoc references to isolated practices such as recycling bins in rooms or energy-saving tips on desk cards. This gap represents both a competitive risk for lagging hotels and a significant opportunity for first movers in the green positioning space.

**Green Procurement and Waste Management**

Green procurement the systematic preference for suppliers, materials, and products that meet defined environmental criteria across the supply chain has been identified as a critical enabler of hotel sustainability performance (Zhu et al., 2013; Walker & Jones, 2012). In hospitality, green procurement encompasses the selection of locally sourced food and beverage suppliers to reduce food miles, the procurement of environmentally certified cleaning products and linens, and the specification of sustainable construction and refurbishment materials. Research from Southeast Asia and Europe shows that hotels with formalised green procurement policies achieve measurably stronger environmental performance outcomes and lower operational waste volumes compared to hotels without such policies (Zhu et al., 2013; Molina-Azorín et al., 2015).

Waste reduction and recycling programmes in hotels target the two primary waste streams: solid waste (food waste, packaging, paper, glass, and plastics) and liquid waste (greywater from laundry and kitchen operations). Effective programmes combine source separation systems, food waste minimisation protocols, composting partnerships, and supplier-return arrangements for packaging waste (Gossling, 2019). Water conservation, similarly, addresses both consumption reduction (through low-flow fixtures, linen reuse programmes, and landscape irrigation efficiency) and wastewater treatment (through greywater recycling and sewage treatment facilities). In Nigerian hotels, where municipal water supply is as unreliable as grid electricity and borehole water carries extraction and treatment costs, water conservation management is both an environmental and a cost imperative.

**Theoretical Framework: The Green Service Value Creation Model**

This study is anchored in an original theoretical framework the Green Service Value Creation Model (GSVCM) developed to explain how environmental management practices and green marketing communication jointly determine sustainable service operations performance in resource-constrained, emerging-market hospitality contexts. The GSVCM synthesises three foundational theoretical streams: Natural Resource-Based View (NRBV) theory (Hart, 1995), which argues that competitive advantage

in resource-intensive industries derives from capabilities in pollution prevention, product stewardship, and sustainable development; Service-Dominant Logic (Vargo & Lusch, 2004, 2008), which positions knowledge, skills, and environmental practices as operant resources in the co-creation of service value; and Stakeholder Theory (Freeman, 1984), which frames green marketing communication as the mechanism through which hotels translate internal environmental commitments into externally recognised stakeholder value.

The GSVCM proposes that sustainable service operations performance is maximised when internal green operations practices (energy management, waste reduction, water conservation, green procurement) are aligned with external green marketing communication — creating a coherent green service value proposition that is simultaneously cost-efficient, environmentally credible, and commercially differentiated. The model further posits that in the Nigerian hotel context, the strength of this alignment is moderated by infrastructure availability (grid electricity access, water supply reliability, waste management infrastructure), organisational capacity (management commitment, staff training, financial resources), and market receptiveness (the proportion of eco-conscious guests in the hotel's target market). These moderating factors explain why green operations investment does not always translate linearly into sustainability performance in the Nigerian context.

## Methodology

### Research Design

A descriptive cross-sectional survey design was adopted for this study. This design was appropriate for capturing the self-reported perceptions of hotel management and operations personnel regarding green practices adoption and sustainability performance at a defined point in time, without experimental manipulation. A quantitative approach was employed to enable statistical generalisation from the sample to the broader population of formal-tier hotel operations in Nigeria's major commercial cities.

### Population, Sampling, and Sample Size

The target population comprised management and operations staff across three-, four-, and five-star hotels in Lagos, Abuja, and Port Harcourt the three cities that collectively host the largest concentration of formal-tier hotel capacity in Nigeria. Using a sampling frame constructed from the Hotels and Tourism Association of Nigeria (HTAN) membership directory and the Nigerian Tourism Development Corporation (NTDC) hotel register, twenty hotels were purposively selected across three tiers and three cities, ensuring coverage of both internationally affiliated chains and independently owned properties.

Taro Yamane's (1967) formula at a 95% confidence level and 5% margin of error yielded a minimum sample of 377 respondents. Adjusting for an anticipated 10% non-response rate, 430 questionnaires were administered via stratified random sampling within each hotel, with strata defined by management level and operational department. A total of 412 questionnaires were returned, of which 396 were complete and usable yielding a final response rate of 92.1%.

### Instrument Design and Validation

A structured questionnaire was developed in two sections. Section A captured demographic and organisational data. Section B comprised 46 Likert-scale items (1 = Strongly Disagree to 5 = Strongly Agree) distributed across six independent variable dimensions and one dependent construct (sustainable service operations performance), each measured by six to eight items. Items were adapted from validated scales in Bohdanowicz and Martinac (2021), Chen and Chang (2013), Leonidou et al. (2020), and Molina-Azorín et al. (2015), contextualised for the Nigerian hotel environment through input from two hospitality management consultants and one environmental management practitioner.

Content validity was confirmed by a panel of five subject-matter experts spanning sustainability management, hospitality marketing, and environmental science. A pilot test with 38 hotel employees not included in the main sample returned Cronbach's alpha values ranging from .74 to .91 across all constructs, confirming adequate to excellent internal consistency. All Variance Inflation Factors (VIFs) in the final regression model were below 3.2, confirming acceptable multicollinearity levels.

### Data analysis

Data were analysed using IBM SPSS Statistics version 26. Descriptive statistics (means and standard deviations) were computed for all variables. Pearson product-moment correlation analysis

examined bivariate relationships between each predictor and the dependent variable. Multiple linear regression determined the joint and independent predictive contributions of the six green dimensions to sustainable service operations performance, controlling for shared variance among predictors.

## Results

### Respondent Profile

Table 1 presents the demographic and organisational characteristics of the 396 respondents.

**Table 1: Demographic and Organisational Profile of Respondents (n = 396)**

| Variable / Category | Frequency (n = 396) | Percentage (%) |
|---|---|---|
| **Hotel Tier** | | |
| 5-Star | 82 | 20.7 |
| 4-Star | 128 | 32.3 |
| 3-Star | 186 | 47.0 |
| **Respondent Role** | | |
| Senior Management | 148 | 37.4 |
| Middle Management | 141 | 35.6 |
| Frontline / Operations Staff | 107 | 27.0 |
| **Gender** | | |
| Male | 239 | 60.4 |
| Female | 157 | 39.6 |
| **Years in Hospitality** | | |
| Less than 2 years | 44 | 11.1 |
| 2–5 years | 109 | 27.5 |
| 6–10 years | 152 | 38.4 |
| Above 10 years | 91 | 23.0 |

Source: Field Survey, 2024

Three-star hotels contributed the largest share of respondents (47.0%), consistent with their numerical dominance in the Nigerian formal hotel sector. Senior management (37.4%) and middle management (35.6%) together constituted nearly three-quarters of the sample, ensuring that sustainability decision-making perspectives were well represented. Male respondents formed a majority (60.4%). The largest experience cohort was 6–10 years (38.4%), lending the data set a level of practitioner credibility appropriate for assessing organisational sustainability practices.

### Descriptive Statistics

Table 2 presents the mean scores and standard deviations for all study variables.

**Table 2: Descriptive Statistics for Study Variables (n = 396)**

| Variable | Mean | Std Dev | Min | Max |
|---|---|---|---|---|
| Solar Energy Adoption & Renewable Integration | 3.44 | 0.92 | 1.00 | 5.00 |
| Energy-Efficient Equipment & LED Systems | 3.78 | 0.81 | 1.00 | 5.00 |
| Waste Reduction & Recycling Programmes | 3.31 | 0.97 | 1.00 | 5.00 |
| Water Conservation Management | 3.52 | 0.88 | 1.00 | 5.00 |
| Green Marketing Communication | 3.63 | 0.84 | 1.00 | 5.00 |
| Green Procurement & Supply Chain | 3.19 | 1.01 | 1.00 | 5.00 |
| Sustainable Service Operations Performance (DV) | 3.48 | 0.86 | 1.00 | 5.00 |

Source: Field Survey, 2024

Energy-efficient equipment and LED systems recorded the highest mean rating (M = 3.78, SD = 0.81), reflecting the relative accessibility and rapid payback period of LED retrofits compared to more capital-intensive green investments. Green marketing communication (M = 3.63) and water conservation management (M = 3.52) also attracted moderately positive ratings, consistent with the growing visibility of sustainability messaging among urban Nigerian hotels and the operational necessity of water self-sufficiency. Solar energy adoption (M = 3.44) and waste reduction programmes (M = 3.31) returned lower means, reflecting the capital barriers and infrastructure requirements associated with these practices. Green procurement recorded the lowest mean (M = 3.19, SD = 1.01) with the highest standard deviation, suggesting the greatest variability across hotels in formalised supply chain sustainability practices a finding consistent with the nascent state of green procurement in the Nigerian hotel sector. Overall sustainable service operations performance yielded a mean of 3.48, indicating a moderate but improving sustainability performance baseline.

**Pearson Correlation Analysis**

Table 3 presents the bivariate correlation matrix for all study variables.

**Table 3: Pearson Correlation Matrix (n = 396)**

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | SSOP |
|---|---|---|---|---|---|---|---|
| 1. Solar/Renew. | 1.00 | | | | | | |
| 2. Effic. Equip. | .476 | 1.00 | | | | | |
| 3. Waste Red. | .398 | .442 | 1.00 | | | | |
| 4. Water Cons. | .431 | .388 | .517 | 1.00 | | | |
| 5. Green Mktg. | .524 | .503 | .418 | .462 | 1.00 | | |
| 6. Green Proc. | .357 | .374 | .481 | .396 | .441 | 1.00 | |
| SSOP | .591 | .638 | .527 | .564 | .672 | .489 | 1.00 |

*Note: p < .01 (two-tailed). SSOP = Sustainable Service Operations Performance.*

Source: Field Survey, 2024

All six green practice dimensions were significantly and positively correlated with sustainable service operations performance at the p < .01 level. The strongest bivariate associations were observed for green marketing communication (r = .672) and energy-efficient equipment adoption (r = .638), followed by water conservation (r = .564), solar energy integration (r = .591), waste reduction (r = .527), and green procurement (r = .489). Moderate inter-correlations among the predictors were observed, with the highest inter-predictor correlation recorded between waste reduction and water conservation (r = .517), suggesting operational complementarity between these two dimensions in hotel sustainability programmes. No inter-predictor correlation exceeded r = .524, confirming manageable multicollinearity.

**Multiple Regression Analysis**

Table 4 reports the multiple regression results, with sustainable service operations performance as the dependent variable.

**Table 4: Multiple Regression, Predictors of Sustainable Service Operations Performance**

| Predictor Variable | B | SE | β | t-value | p-value |
|---|---|---|---|---|---|
| (Constant) | 0.301 | 0.187 | — | 1.610 | .109 |
| Solar Energy & Renewable Integration | 0.228 | 0.064 | .194 | 3.563 | .000 |
| Energy-Efficient Equipment & LED | 0.307 | 0.061 | .271 | 5.033 | .000 |
| Waste Reduction & Recycling | 0.196 | 0.069 | .165 | 2.841 | .005 |
| Water Conservation Management | 0.241 | 0.066 | .207 | 3.652 | .000 |
| Green Marketing Communication | 0.318 | 0.063 | .284 | 5.048 | .000 |
| Green Procurement & Supply Chain | 0.172 | 0.071 | .143 | 2.423 | .016 |
| **Model: $R = .801$; $R^2 = .641$; Adj. $R^2 = .635$; $F(6, 389) = 115.62$; $p < .001$** | | | | | |

*Note: $p < .05$; $p < .01$; $p < .001$. B = unstandardised coefficient; SE = standard error; β = standardised coefficient.*

Source: Field Survey, 2024

The regression model was highly significant overall ($F(6, 389) = 115.62$, $p < .001$), and the six predictors jointly explained 64.1% of the variance in sustainable service operations performance ($R^2 = .641$, Adjusted $R^2 = .635$). Green marketing communication emerged as the strongest independent predictor ($\beta = .284$, $p < .001$), followed closely by energy-efficient equipment and LED adoption ($\beta = .271$, $p < .001$). Water conservation management ($\beta = .207$, $p < .001$) and solar energy and renewable integration ($\beta = .194$, $p < .001$) also made significant and substantive contributions. Waste reduction and recycling programmes ($\beta = .165$, $p = .005$) and green procurement and supply chain practices ($\beta = .143$, $p = .016$) recorded the lowest standardised betas but retained statistical significance, confirming their meaningful unique contributions to sustainability performance after controlling for shared variance.

**Hypotheses Testing Summary**

Table 5 presents the decisions on all six research hypotheses.

**Table 5: Summary of Hypotheses Testing Results**

| H | Hypothesis Statement | β | p-value | Decision |
|---|---|---|---|---|
| H1 | Solar energy adoption and renewable integration significantly influence sustainable service operations performance | β = .194 | .000 | Supported |
| H2 | Energy-efficient equipment and LED systems significantly influence sustainable service operations performance | β = .271 | .000 | Supported |
| H3 | Waste reduction and recycling programmes significantly influence sustainable service operations performance | β = .165 | .005 | Supported |
| H4 | Water conservation management significantly influences sustainable service operations performance | β = .207 | .000 | Supported |
| H5 | Green marketing communication significantly influences sustainable service operations performance | β = .284 | .000 | Supported |
| H6 | Green procurement and supply chain practices significantly influence sustainable service operations performance | β = .143 | .016 | Supported |

Source: Field Survey, 2024

All six null hypotheses were rejected. Each green operations and marketing dimension solar energy and renewable integration, energy-efficient equipment adoption, waste reduction and recycling, water conservation management, green marketing communication, and green procurement exerted a statistically significant positive influence on sustainable service operations performance in Nigerian hotels.

**Discussion**

The findings of this study provide the most comprehensive empirical mapping to date of how specific green operations and marketing dimensions drive sustainable service performance in the Nigerian hotel sector. The results are simultaneously confirming and challenging in their implications, affirming global theoretical predictions while surfacing Nigerian-specific dynamics that enrich the international literature.

The emergence of green marketing communication as the strongest independent predictor (β = .284) is, on the surface, a finding that demands careful interpretation. In a context where many Nigerian hotels have not yet implemented the full range of green operational practices, one might expect the physical practice dimensions energy efficiency, solar, waste, water to dominate the regression outcome. The fact that green marketing communication outperforms all operational dimensions in predictive strength does not mean that communication is more important than practice. Rather, it reflects the GSVCM's core proposition: that the value of environmental practices is only fully realised in service performance terms when those practices are translated into stakeholder-visible commitments through credible communication. Hotels that communicate their green credentials effectively through eco-certification displays, sustainability reports, social media environmental content, and trained staff who can articulate the property's environmental programme to guests are leveraging their practices into a service identity that guests, corporate travel managers, and OTA algorithms recognise and reward.

This finding resonates strongly with the arguments of Ottman (2017) and Chen and Chang (2013), who framed green marketing communication as the connective tissue between operational sustainability investment and market-level competitive advantage. It also aligns with Han and Hyun (2018), who found that guest awareness of green hotel practices rather than the practices themselves was the proximate driver of green purchase intention and willingness to pay a sustainability premium. In the Nigerian context, where many hotels have implemented basic green practices without systematically communicating them, there exists a significant value communication gap: hotels are generating sustainability performance that the market cannot price because the market does not know it exists. Closing this gap through structured green marketing communication programmes represents one of the most immediately accessible and cost-effective sustainability performance levers available to Nigerian hotel management.

Energy-efficient equipment and LED systems (β = .271) ranking as the second strongest predictor reflects the dual financial and environmental logic of this intervention. LED retrofits and energy-efficient HVAC and kitchen equipment offer relatively short payback periods, tangible and measurable energy cost reductions, and visible quality improvements (better lighting uniformity and colour rendering, quieter climate control, more consistent kitchen output) that directly enhance the guest experience. Unlike solar PV systems, which require significant capital outlays and technical maintenance competencies, LED and equipment efficiency programmes can be implemented incrementally and without specialised technical infrastructure. The significance of this finding for Nigerian hotel management is clear: energy efficiency upgrades should be positioned not merely as cost-saving measures but as service quality investments a framing that builds the internal business case, aligns engineering and marketing departments around a shared objective, and creates guest-visible signals of operational modernity.

Water conservation management (β = .207) ranked third, a finding that is particularly meaningful in the Nigerian urban hotel context where borehole water extraction costs, municipal supply unreliability, and growing water table depletion concerns are making water a genuinely scarce and expensive resource. Hotels that have implemented comprehensive water management systems encompassing low-flow showerheads, linen and towel reuse programmes, condensate recovery from air conditioning units, and greywater recycling for landscape irrigation are documenting both cost savings and guest satisfaction improvements. The latter is somewhat counterintuitive until one recognises that

water conservation systems in hotels typically produce more consistent water pressure, more reliable hot water supply, and better-maintained swimming pools and spa facilities all of which directly improve the guest experience. The GSVCM framework's prediction that internal environmental practices generate service co-creation value is well supported by this dynamic.

Solar energy adoption (β = .194) recording a significant but moderate contribution, combined with its relatively lower mean score (M = 3.44) compared to LED systems (M = 3.78), reflects the capital barrier challenge identified in the literature. Hotels that have invested in solar systems are deriving measurable sustainability performance benefits cost stability, reduced generator noise and air pollution, enhanced brand image as a technology-forward property, and in some cases grid export revenue. However, the lower adoption rate across the sample means that solar's contribution to the composite regression outcome is constrained by its lower prevalence, not by any weakness in its per-hotel performance impact. As financing instruments for solar installation in Nigerian hospitality improve including green bond instruments, international development finance institution (DFI) facilities, and the Central Bank of Nigeria's energy efficiency fund the constraint of capital access will progressively diminish, and solar's contribution to sector-wide sustainability performance is expected to strengthen significantly.

Waste reduction and recycling (β = .165) and green procurement (β = .143), while recording the study's lowest standardised betas, nonetheless achieved statistical significance and their contribution should not be understated. The relatively modest beta for green procurement the most process-intensive and supply-chain-dependent of the six dimensions is consistent with findings from comparable emerging market studies (Zhu et al., 2013; Molina-Azorín et al., 2015) and reflects the limited availability of locally certified green suppliers in the Nigerian market. Hotels seeking to strengthen green procurement performance face a genuine market infrastructure challenge: the Nigerian agricultural and manufacturing supply base for certified organic produce, eco-labelled cleaning products, and sustainably sourced linens and furnishings remains underdeveloped. This points to a policy opportunity the development of national green supplier certification programmes and preferential procurement frameworks that could significantly amplify the sustainability performance returns from hotel green procurement investment.

Taken together, the regression findings and the GSVCM framework provide a coherent strategic narrative: sustainable service operations performance in Nigerian hotels is driven by a portfolio of mutually reinforcing green practices and communications, where the optimal strategy combines credible internal operations (energy, water, waste, procurement) with outward-facing green communication that makes those operations market-visible. The 64.1% explained variance represents a strong model fit and confirms that the six dimensions identified in this study capture the most analytically important drivers of hotel sustainability performance in the Nigerian context.

**Conclusion and Recommendations**

This study set out to examine how six green operations and marketing dimensions influence sustainable service operations performance in Nigerian hotels, filling a significant gap in the African hospitality sustainability literature. The findings were unambiguous: all six dimensions — solar energy and renewable integration, energy-efficient equipment adoption, waste reduction and recycling, water conservation management, green marketing communication, and green procurement — significantly and positively predicted sustainable service operations performance, together explaining 64.1% of the variance in the outcome variable. Green marketing communication and energy-efficient equipment adoption emerged as the leading predictors, a finding with immediate practical implications for how Nigerian hotels should prioritise their sustainability investment and communication portfolios.

For hotel management, the study's most actionable message is the value communication imperative: environmental practices that are not communicated do not generate their full market value. Hotels should develop structured green marketing strategies that include eco-certification pursuit, sustainability storytelling on OTA profiles and social media platforms, staff environmental ambassador programmes, and in-room guest communication about the hotel's specific green initiatives. The investment in communication is modest relative to the competitive differentiation and revenue premium it can generate among eco-conscious domestic and international guests.

On the operational side, hotels at all tier levels should develop phased Environmental Management Systems (EMS) that sequence investments according to payback period and operational impact. LED

retrofits and water conservation equipment should be the first-phase priority, given their low capital requirement and rapid return. Solar PV installation should be treated as a medium-term strategic investment, with hotels actively exploring green financing facilities, including those offered by the Bank of Industry, the Central Bank of Nigeria's green credit initiatives, and international DFI instruments. Waste and procurement programmes should be developed in parallel through staff training, supplier engagement, and participation in industry-level green procurement coalitions.

At the policy level, the Nigerian Tourism Development Corporation and the Federal Ministry of Environment should develop a National Green Hotel Rating System that rewards demonstrated sustainability performance across the dimensions examined in this study. Such a system, linked to preferential visa facilitation for eco-certified hotels, tax incentives for solar installation, and inclusion in government corporate travel approved-vendor lists, would create the market architecture necessary to accelerate the adoption of green practices across the Nigerian hotel sector.

For the academic community, the Green Service Value Creation Model (GSVCM) introduced in this study offers a contextualised theoretical framework for investigating sustainability-performance relationships in African hospitality. Future studies should empirically validate the full GSVCM including its proposed moderating variables of infrastructure availability, organisational capacity, and market receptiveness using structural equation modelling. Longitudinal studies tracking sustainability performance trajectories in Nigerian hotels over periods of three to five years would further enrich the evidence base and help establish causal rather than merely correlational relationships between green investment and operational outcomes.

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