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Assessing Green Building Practices in Nigerian Hotels Based on LEED Criteria and Certification Standards

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Abstract **Original Research Article**

The hospitality industry is a major consumer of energy in the built environment, prompting hoteliers to focus on energy conservation strategies. Green building practices aim to reduce and ultimately eliminate the environmental and health impacts of new constructions. This study assesses the integration of LEED's green building strategies in hotel design in Nigeria, focusing on six key variables: energy efficiency, water efficiency, material conservation, indoor environmental quality, waste management, and land usage/site sustainability. A comparative case study methodology was used, involving four major hotels: Transcorp Hilton Hotel (Abuja), Eko Hotel (Lagos), Sheraton Hotel (Abuja), and Raddison Blu Hotel (Lagos). Data were collected through field observation and a structured checklist, with comparative analysis employed to determine the extent of strategy implementation.

The findings reveal significant variations in the adoption of green strategies across the case studies. Transcorp Hilton demonstrated the highest integration, with a score of 63 out of 85, indicating comprehensive implementation of energy-efficient lighting, low VOC materials, local sourcing, and water conservation technologies. The other hotels showed moderate adoption, with scores ranging from 57 to 60. All hotels incorporated basic green features like LED lighting and low-flow fixtures but failed to adopt renewable energy systems, relying instead on diesel generators, which counteract environmental goals. Notably, indoor environmental quality and sustainable site planning were well addressed, while waste management and renewable energy use were minimal.

The study concludes that while green strategies are being integrated in hotel design, implementation is uneven and often lacks depth. It recommends greater adoption of renewable energy systems, use of locally sourced materials, and low-impact construction techniques. Architects should guide the process from design to post-occupancy, and hotel operators should improve guest awareness of sustainability efforts to advance eco-conscious hospitality in Nigeria.

Keywords: Green Building Strategies, Nigeria Hotel, LEEDS label, Tourism Sustainability and Built Environment.

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INTRODUCTION

Most hotels around the world and Nigeria in particular seem to be highly synthetic. They lack natural features like water bodies and greenery which help to cool the environment naturally. Also, most hotels are not properly integrated with the environment considering site terrain and climatic factors. It has increased impacts of building construction on ecological systems and biodiversity, while decreasing the ecological values of site. However, a number of researchers have studied benefits of adopting green building strategies in hotel as opposed to conventional ones. Such researcher includes Eichholtz, Kok, and Quigley (2013), (Woolley, 2006).

From the literature reviewed various The research findings emphasize Adopting Green building strategies offers a myriad of Benefits including Environmental sustainability, Energy efficiency and cost savings, enhanced guest experience, resource conservation, waste reduction and recycling Certification and recognition, competitive edge in the market. These advantages not only contribute to the hotel's financial success but also align with global sustainability goals and foster a positive impact on the environment and society. As the

hospitality industry evolves, the adoption of green building Strategies becomes increasingly essential.

A number of researchers have studied green building strategies in hotels. Such researcher include Tuan Giang (2006), Reynold (2004), Spiegel and Meadows (1999), Kasim (2007) ,Erdogan and Baris (2007). From the LEEDS rated check lists reviewed, various green building strategies adopted in hotels can be categorized under the following variable: Energy efficiency, Water efficiency, Material conservation, Indoor environmental Quality, Waste Management, Sustainable site planning. Energy efficiency includes the use of LED Bulbs, Window openings, for natural lighting of the spaces as well as ventilation. Material Conservation include the use of recycled content materials, locally available materials, Indoor environmental quality include the use of Low VOC materials, daylighting and ventilation, Waste management include provision of recycle bins for proper disposal of waste. Water efficiency includes the use of water saving fixtures, rain water harvesting system. Sustainable site planning includes proper planning and landscaping of site, solar orientation of the building to reduce the environmental impact of the building.

As global awareness of environmental sustainability continues to grow, the implementation of green building strategies has become a critical component in contemporary architectural practices. Leadership in Energy and Environmental Design (LEED) is one of the most recognized green building certification systems globally, offering a comprehensive framework for designing, constructing, and operating sustainable buildings. However, the integration of LEED's green building strategies into hotel design in Nigeria remains limited and under-assessed. Despite the increasing demand for environmentally responsible tourism infrastructure, hotels in Nigeria often fall short in aligning with LEED guidelines due to various economic, technical, cultural, and regulatory challenges. This lack of integration hampers the nation's effort toward sustainable development, especially in urban centers where environmental degradation and resource inefficiency are prevalent. Therefore, this study seeks to assess the extent to which LEED's green building strategies are integrated into hotel design in Nigeria, while identifying and discussing the key problems affecting their effective adoption and implementation.

One significant problem affecting the integration of LEED's green building strategies in hotel design in Nigeria is the high initial cost of implementation. The strategies, particularly those related to energy efficiency—such as using high-performance glazing, energy-efficient appliances, and advanced HVAC systems—require substantial capital investment (Olusegun & Omole, 2021). Many hotel developers in Nigeria, especially small- to medium-sized enterprises, are constrained by limited financial resources and often prioritize short-term profit over long-term sustainability. This economic barrier discourages investment in energy-saving technologies despite their potential to reduce operational costs in the long run. The high upfront cost is further exacerbated by the lack of accessible green financing options and government incentives to support sustainable construction practices.

Another key issue is the limited availability and high cost of certified green building materials in the Nigerian market. LEED emphasizes the use of sustainable, locally sourced, and recycled construction materials to reduce environmental impact. However, Nigeria's construction industry is heavily reliant on imported materials due to inconsistent local supply and limited production capabilities (Ede, 2020). Even when available, locally produced green materials may not meet LEED's strict standards. This situation not only increases construction costs but also complicates material specification and procurement processes. The absence of national standards or certification bodies for green materials further hinders the verification and adoption of LEED-compliant materials in hotel projects.

Poor indoor environmental quality in many Nigerian hotels also poses a challenge to LEED integration. Hotels often use building materials and interior finishes that emit volatile organic compounds (VOCs), which affect the health and comfort of occupants. LEED recommends the use of low-emission materials, natural ventilation through operable windows, and maximization of daylight. However, due to inadequate awareness and technical expertise among architects and builders, indoor environmental quality is frequently overlooked during the design and construction phases (Akinwale & Salau, 2022). Furthermore, urban noise pollution and security concerns often lead hotel operators to seal windows and over-rely on artificial lighting and mechanical ventilation, thereby negating the benefits of natural design elements.

Land use inefficiencies and poor site planning constitute another barrier to the successful implementation of LEED strategies. Nigerian cities are characterized by haphazard urban development and poor zoning regulations, making it difficult to adopt sustainable site development practices such as habitat restoration, use of permeable pavements, and compact building footprints (Nwachukwu & Ugwu, 2023). Hotel developers often maximize land coverage for commercial gain without considering the ecological consequences. This not only limits opportunities for green landscaping but also exacerbates urban flooding due to reduced ground permeability and poor stormwater management. Consequently, LEED strategies aimed at improving land usage and site sustainability are often compromised during hotel project execution.

Water conservation and waste management practices in Nigerian hotels remain rudimentary, undermining LEED's goals of environmental responsibility. Despite the existence of water-saving technologies and rainwater harvesting systems, their adoption is rare due to a lack of technical expertise, infrastructure, and awareness (Ogunbode et al., 2021). Similarly, waste segregation, recycling, and the use of treated greywater for non-potable purposes are not widely practiced. This inefficiency leads to excessive water consumption, environmental pollution, and poor resource utilization. Implementing LEED strategies in this domain would significantly improve sustainability outcomes, but the absence of relevant policies, training, and operational frameworks impedes progress in this area.

Despite the several impacts of hotels on the environment, the areas of energy and water consumption as well as waste generation and management typify the central challenges of hotels and their negative impact on the environment (Chan and

Lam, 2003; Bohanowicz, 2006 cited in Mensah, n.d; Chan and Lam, 2001; Mensah, 2006 and Mensah, 2007). This overexploitation and use of natural resources have led to several ecological crises such as water pollution, solid and liquid waste burden, water shortages for neighboring communities where hotels are located (ecological crisis) (Kasim, 2007).
The adoption and practice of sustainable service quality delivery strategies have been argued and proven to be a medium for minimizing the negative environmental impacts of hotels such as reduction in carbon footprint, pollution, improved water and energy conservation, profitability (cost savings), employee retentions, positive organizational reputation, etc. (Moreo, 2008; Hsieh, 2012) Sustainable service quality delivery such as proper solid and liquid waste management, efficient use of energy and water are suggested initiatives for hotels across the globe towards environmental and business sustainability

Literature reveals that hotels have played an important role in ecological deterioration even though their impacts have not been pronounced as the mainstream extractive industries like mines, airlines, automobiles, cruise ships etc. (Timothy and Teye 2009). Notably, sewage and waste materials (both solid and liquid) from hotels across the globe are dumped into rivers, lakes and drains in their immediate environment creating environmental hazards and unpleasantness (Lozano-Oyola et al., 2012). In the view of Taylor et al. (1994) increase in solid waste typifies an additional key environmental impact of hotel operations in the world. In Nigeria for example, the uncontrolled development of hotels has invariably increased the burden of solid and liquid waste in the municipality (Mensah, 2006). Due to improper recycling methods and treatment procedures, there have been reported cases of some hotels discharging sewage into unauthorized drains with some spillover effects on streets in Nigeria.

Because of these negative externalities from their operations, it therefore prudent that management of these hotels incorporates sustainable service quality delivery models into their businesses. A number of studies have been conducted on how hotels can adopt sound sustainable service quality delivery to deal effectively and efficiently with the negative environmental challenges that arise from their operations (Alvarez, Burgos & Cespedes 2001; Bansal 2005; Bohdanowicz et al. 2011; Hsieh 2012; Timothy & Teye 2009; Mensah, 2006; Mensah; 2007; Kuuder, 2014). For instance, measures such as water and energy conservation, effective recycling methodologies, environmental health and education of staff and guest were suggestions made by Mensah (2007), Kuuder, (2014) Heish, (2012) in Africa and Europe respectively. To minimize environmental impacts, some studies also suggested that hotels be furnished with biodegradable soaps and detergents to minimize water pollution, adopt paperless communication by reducing waste, use ecolabels, low-flow showerheads, etc. (Timothy & Teye 2009; Mensah, 2006; Mensah; 2007; Kuuder, 2014). According to the literature, these practices will, provide economic incentives to hotels, gain competitive advantage, reduce cost, thus cultivating positive image, increasing employee loyalty and retaining customers (Hsieh, 2012; Claver-Cort'es et al., 2007; Graci and Dodds, 2008; Newman and Breeden, 1992; Tzschentke et al., 2004). Despite the impact of hotels on the environment, the areas of energy consumption (Chan and Lam, 2003); water consumption (Bohanowicz, 2006 cited in Mensah, n.d); solid and liquid waste generation (Chan and Lam, 2001) characterizes the central challenge of most hotels in Nigeria (Mensah, 2006 and Mensah, 2007).
Nigeria, like many countries, faces environmental challenges such as climate change, resource depletion, and pollution. The impact of the built environment, including hotels, on the environment is a pressing concern. This research therefore seeks to investigate what are the various green building strategies that are adopted in hotels in Nigeria. The idea behind this study is to illustrate by which green building strategies will promote reduction of pollution and degradation of environment in order to provide insights into sustainable practices that reduce environmental impact.

METHODOLOGY

This study employed survey descriptive research method to analyze the data obtained from selected case study. The procedure of collecting data in the case study will involve visitation to the various sites, taking visual observation and analysis of the various green building strategies adopted which will then be evaluated based on the outlined variable of study. Checklist established from LEED Green Associate Study Guide was used to access the various buildings along with the variables identified from available literature. These variables include energy efficiency, water efficiency, material conservation, Indoor environmental quality and reduction and recycling of waste. Samples were selected purposively based on the research scope. The selected samples for case studies are selected for this study were sampled based on the following criteria;

- Ecofriendly hotel located within Nigeria
- Green Building Strategies adopted in these hotels
- Facilities provided and how it relates to the facility being proposed
- Hotels with LEEDS or ETIC green score rating

Based on the criteria above, the following cases were selected;

- Transcorp Hilton Hotel, Abuja.
- Eko hotel, Lagos
- Sheraton hotel, Abuja
- Radisson blu hotel, VI Lagos

Table 4.1 Variable to generate research problem and analysis

S/No	Green Building Strategies	Requirements
1	Energy Efficiency	Optimize passive solar orientation Use of high performance low e glazing Use of Energy Star certified energy efficient appliance Use of energy efficient bulbs
2	Materials for Construction	Optimize the use of green building materials Identify ways to use high recycled content materials Use of locally available materials.
3	Indoor Environmental Quality	Use building materials, adhesives, sealants, finishes and furniture which do not generate of release any gaseous contaminants. Use of operable window to provide natural ventilation, day lighting to maximize users comfort and performance.
4	Land Usage and Site	Make more efficient use of spaces In the building Use of landscape design to preserve and restore the region's original habitat. Use of permeable pavement for walkways.
5	Water quality and Conservation	Make us of water saving fixtures and technologies Use of on-site storm water treatment Rain water harvesting system
6	Waste Generation and Management	Storage and collection of recyclables Use of treated water from washroom, laundry, kitchen for vehicle washing and gardening.

Case study One Sheraton Hotel, Abuja
Background Information

This hotel was initially the Hyatt Regency Hotel, Abuja and was managed by Hyatt Hotel Managers International for the owners, capital Hotels. As a result of disagreement between both parties, the hotel manager had to quit, then, Sheraton hotel managers were invited to manage the hotel, thereby changing the name to Abuja Sheraton. However, the hotel was constructed between 1985 and 1989. It was used in May, I989, for the African Development Bank (ABD) Conferences in Abuja but was officially opened on the 15th of January, 1990,

Location

The Abuja Sharon Hotel is situated on Ladi Kwadi Way, approximately 39 kilometers (24 miles) from Abuja International Airport. This implies that it was located on the heart of the newly growing Federal Capital Territory.

Structure and description

The first impression of Abuja Sheraton is that of a truncated pyramidal frustum. However, it would be more appropriate to interpret the structure as an Egyptian Mastaba punctured by holes. This system also attempts to redefine the tower podium concept by encapsulating the podium in the lower part of the Mastaba. The location of the conference hall, kitchen and Luigi restaurant is in the podium extending further from the main tower. As result of the shape of the tower, the rooms were staggered vertically on top of each other to get equal room and corridor spaces. Moreover, this irregularity factor in the floor areas allowed only for single loaded corridors with empty spaces in between them which form a court yard round the whole hotel. The courtyard is housed by the building in a manner that it forms an atrium. More also, the courtyard is divided into two parts by an 8- story bridge which houses the shaft. The sloping sides of the towers are punctured by holes used for the balconies. This creates a feeling of array or voids

and adds texture to the form of building approximately 400 square feet (37 sqm).

Architecture

The Abuja Sheraton's design is based on a regular square grid. The structural elements of the hotel were also based on square grid which forms a structural unit. These structural units form rooms, and the size of these rooms depends on the number of units used. They range from one unit for the standard bedroom to six for the presidential suites. The walls slant upwards in elevation and are supported by concrete beams and columns The design or the hotel considers a humane approach to architecture whereby lighting effects were used in the entrance lobby to excite and wet the user‘s appetite. Acrylic skylight was used to infuse light into these areas. The courtyard attempts to subdue the brutal atmosphere of most hotel accommodation tower by trying to bring the guest into the natural and humane perspective.

Construction and Materials

The on-site construction technique was predominantly adopted in the Abuja Sheraton Hotel building. This was due to the building's form, which did not allow for pre-fabrication of most parts of the building. Consequently, concrete was used extensively as a construction material. The exterior finishes of the building is mainly beige, polka doted 2.5cm main finish and ceramic tiles. These tiles were extensively used in the accommodation tower of the hotel and in the lower parts of the hotel building. Internally, numerous materials were used: matt water-proof wall paper, wood finish, marble tiles, internal railed vermiculite ceiling finishes, carpet finishes etc. Also lighting used in the internal design of the hotel ranged from hollow submerged lighting fixture in the entrance lobby to bed side lamps in the guest rooms.

Eco-Friendly Strategies Adopted in the Design and Construction of Proximity Hotel

Energy Efficiency:

 Use of high efficient windows: Windows and Double Glazed Curtain Wall Systems was used to minimize solar heat gains while also allowing for natural light.

 Use of energy-efficient lighting like LED or CFL bulbs: The interior space is lit up with LED bulbs during the night which comes in different forms and colors and are energy-efficient, long-lasting, and emit less heat.

 Use of high efficient windows: Large energy efficient windows which allows for natural lighting and ventilation while also connecting guest to the outdoors.

Water Efficiency:

 Use of on-site storm water treatment: Sheraton Hotel employed a non-potable water source for plant irrigation. The hotel made use of permeable pavement for walkways also planted local, adaptable plants around which work to absorb storm water.

 Water saving fixtures and technologies: Reducing water use is perhaps the biggest challenge facing the hotel and lodging industry. Sheraton Hotel uses low-flow shower heads, low-flush toilets and low-flow sink faucets. According to the developer, the implementation of water conservation measures has reduced demand by over 30 percent compared to water usage at other luxury hotels.

 Water Efficient Landscaping: Soft landscape features like shrubs were planted all around. The hotel also made use of impervious pavement.

Material Conservation

 Use of green building materials: Materials such as cement, sand and glass, wood, were used in the construction of the building.

 Use of recycled materials: Over 75 percent of construction waste was recycled, diverting it from landfills.

 Use of locally available materials: It was estimated that 40 percent of the total building materials is sourced from local suppliers.

 Reduction and Recycling of Waste

 Storage and collection of Recyclable: The hotel provides recyclable bin in every unit for easy collection of recyclables like plastic bottles etc.

Indoor Environmental Quality

 Use of low VOC materials: The Carpeting and paints use in the spaces have low levels of volatile organic compounds (VOCs),

 Use of operable windows for increased natural ventilation: double glazing window were used to improve Natural lighting and ventilation while reducing UV radiation.

 Interior Lighting: The interior space is lit by allowing natural light through the window. It also makes use LED which is currently one of the most efficient and rapidly and developing lighting technologies.

 View to outside: The large energy-efficient “operable” windows in the rooms connects guests to the outdoors by achieving a direct line of sight to the outdoor environment for more than 97% of all regularly occupied spaces.

Land Usage and Site

 Efficient utilization of space: The site was planned in such a way that it reduces environmental impact.

 Solar orientation of the building: The layout of the building is such that the longer side faces the north-south direction, taking advantage of glare reduction that the layout provides.

Plate 4.20: Image showing the exterior view of Sheraton Hotel, Abuja along with permeable walkways
Source: Author's Field Work (2023)

Plate 4.22: Image showing the use of Skylight in the Circulation Area
Source: Author's Field Work (2023)

Plate 4.25: Image Showing Room window to allow Natural Lighting and Vegetation
Source: Author's Field Work (2023)

Case study Two: Eko Hotel, Lagos
Background Information

The hotel was proposed by the Federal Government. After a competition was conducted, the architects, Oluwole, Olumuyiwa were given the go-ahead to design the hotel. The hotel was completed in March 5th, 1977, and was managed by Holiday Inn corporation, thus called Eko Holiday Inn, until 1988 when it was taken over by Meridien and became Eko Meridien Hotel but presently, the hotel is known as Eko Hotel.

Location

It occupies a site at Victoria Island, Lagos on the bay of Kuramo River. It is ideally located in the privacy of this bay and is in walking distance of the bar beach. Its location is about ten minutes' drive to the city centre and forty minutes' drive to the Murtala Mohammed International Airport, lkeja.

Structure and description

The hotel is based on the tower atop a podium. The tower is a modified rectangular box with 45° trapezoidal extensions on each side. That is, two staggered parallel diagonal shafts joined together by a central rectangular one. The elevators are lit by large curtain walls that span through the whole floors. These curtain walls allow for vistas of the densely built areas of Victoria Island. There are four fire escapes, one fire escape in each diagonal shaft and two in the central shaft. The rectangular shaft remained the same throughout the entire floors that is in terms of room design. However, the diagonal shafts, especially the lower shaft: and the junction to the rectangular shaft were changed on different floor levels to form different room types. The pent house restaurant (Shangri-la) is atop the tower, and could be reached by the elevators. The restaurant has two terraces, one overlooking Kuramo waters and the swimming pool, while the other overlooks the office building in Victoria Island. This restaurant houses the water tanks. On the ground floor, are the lobby and a central courtyard. The lobby is not defined by walls but by columns and it has a small man-made waterfall. The staggered floor level in the basement, as a result of the slope of the land towards the Kuramo bay, houses most of the (back of house) activities.

Architecture

The building is based on a square grid which applies to most of the tower. However, this grid is used in conjunction with a 450 to the horizontal plane immediately one alights in the car-port (Porte cochere), one enters a lobby that is not really defined and is informal to the core. The only hint that this might be a lobby is the presence of reception desk and cashier's booth. This space flows to the elevator lobby and retail shop from which there is a vertical movement to the more formal areas in the accommodation tower. More also, below, the lobby flows towards the restaurants and bar areas. The conference facilities are located behind. Descending down the staircase, one sees the swimming pool area with the cocktail bar and the Kuramo cafe restaurant. The cocktail bat Haws to the pool deck which includes the barbecue and pool terrace seating. The architecture of the Eko Hotel tries to incorporate informality and freedom of space in the public areas and strict formality in the private areas

Eco-friendly strategies adopted in the design and construction of the building of Eko Hotel, Lagos.

Energy Efficiency

 Use of high efficient windows: Windows and Double Glazed Curtain Wall Systems was used to minimize solar heat gains

while also allowing for natural light. During construction, a thermal comfort design and an interior air quality management plan were used

 Use of energy-efficient lighting like LED or CFL bulbs: The interior space is lit up with LED bulbs during the night which comes in different forms and colors and are energy-efficient, long-lasting, and emit less heat.

Water Efficiency

Use of on-site storm water treatment: The building made use of permeable pavement for walkways also planted local, adaptable plants like shrubs around which work to absorb storm water. Storm water drainage installation was also done in the building.

 Water saving fixtures and technologies: The Building incorporated high-efficiency fixtures fittings, such as water closets, dual flush toilets, waterless urinals, and low-flow showers, to improve water efficiency.

 Water Efficient Landscaping: Soft landscape features like shrubs were planted, source of water to the building is the use of borehole, and this means that it has water efficient landscape.

Material Conservation

 Use of green building materials: The structure comprises of majorly glass and steel which are green building materials.

 Use of recycled materials: A large quantity of waste generated by construction was reused, recycled, or otherwise diverted from landfills.

 Use of locally available materials: Although not all materials were locally sourced,the cement, sand, wood used for the construction were gotten locally thus reducing air pollution produced by vehicles.

Reduction and Recycling of Waste

 Storage and collection of Recyclable: Waste is disposed through the town's waste disposal companies. Waste generated during construction was reused in the building construction.

Indoor Environmental Quality

 Use of low VOC materials: Adhesives, glue, paints and primers used contained low volatile organic compounds.

 Use of operable windows for increased natural ventilation: The exterior is finished with metal panel and coated double glazing creating a sleek and contemporary look which allows natural light to flood the interior, creating a bright and airy workspace for users

 Interior Lighting: The building is lit up in the night with LED light and natural light during the day

 View to outside: The Windows and Double Glazed Curtain Wall Systems allows for proper view to the outside

Land usage and site

 Efficient utilization of space: The building covers minimum space through the maximum utilization of vertical space. The site landscape is characterized with hard landscape which is made up of interlocking walkways, roadways, and vehicle parking spots, while the soft landscaped is made up of short trees, growing trees, bushes, grasses and shrubs.

 Solar orientation of the building: The sides exposed to the direct sunlight are recessed to provide shading minimizing heat island on the external surrounding which is considered ideal orientation for heat gain prevention in hot climates.

Plate 4.14: EKO HOTEL LAGOS – External Façade with good Views from Balconies
Source: (Author's Field Study, 2023)

Plate 4.16: Image Showing car park integrated within the landscape in Eko Hotel, Lagos
Source: (Author's Field Study, 2023)

Plate 4.18: Image showing the use of Led light in the room as well as SPC floor
Source: Author's Field Work (2023)

Plate 4.19: Image Showing Window Opening which allows for Natural Lighting and Ventilation
Source: Author's Field Work (2023)

Case Study Three: Transcorp Hilton Hotel, Abuja

Background information

Transcorp Hilton Abuja is a 5-Star, state of the art, hotel located at 1 Aguiyi Ironsi Street, Maitama**,** Abuja. Transcorp Hilton Abuja has 670 luxuriously decorated rooms and offers complimentary breakfast, all-day snacks and refreshment, cocktails, local/international newspapers and magazines to all guests. These rooms are categorized into: Twin Guest Room, King Guest Room, King Deluxe, King Room, Twin Guest Room, Business Suite, Ambassadorial Suite and Presidential Suite. Guests also enjoy 24 hours room service and outside catering services. The hotel site is properly landscaped with guest relaxation and recreational facilities and extensive parking spaces properly zoned.

The combination of steel frames with concrete used in the building construction gives the building a strong and impressive character. The project's implementation started in 1982 and was accomplished in 1986, but was formally opened in April, 1987.

Location:

The site is located in the central area of the Federal Capital Territory precisely the Wuse district. It is estimated to be less than one kilometer from the ministry and embassy sites. The site is slightly sloppy and it is threatened by erosion menace. congress hall to the porte-cochere behind.

Eco-friendly strategies adopted in the design and construction of the building of Transcorp Hilton Hotel.

Assessment of green building strategies employed in the design of Transcorp Hilton Hotel, Abuja are provided below, and the include Energy efficiency, water efficiency, material conservation, reduction and recycling of waste, indoor environmental quality.

Energy Efficiency:

According to literature reviewed, energy efficiency is a very important strategy towards achieving green building strategies. Energy efficiency elements assessed in this study comprises of Onsite Renewable energy sources, Use of Energy Star-qualified products, Use of high efficient windows, Use of energy-efficient lighting like LED or CFL bulbs.

 Onsite Renewable energy sources: No renewable source of energy was found on site

 Use of energy-efficient lighting like LED or CFL bulbs: The rooms are lit through the low energy bulbs which are energy-efficient, long-lasting, and emit less heat.

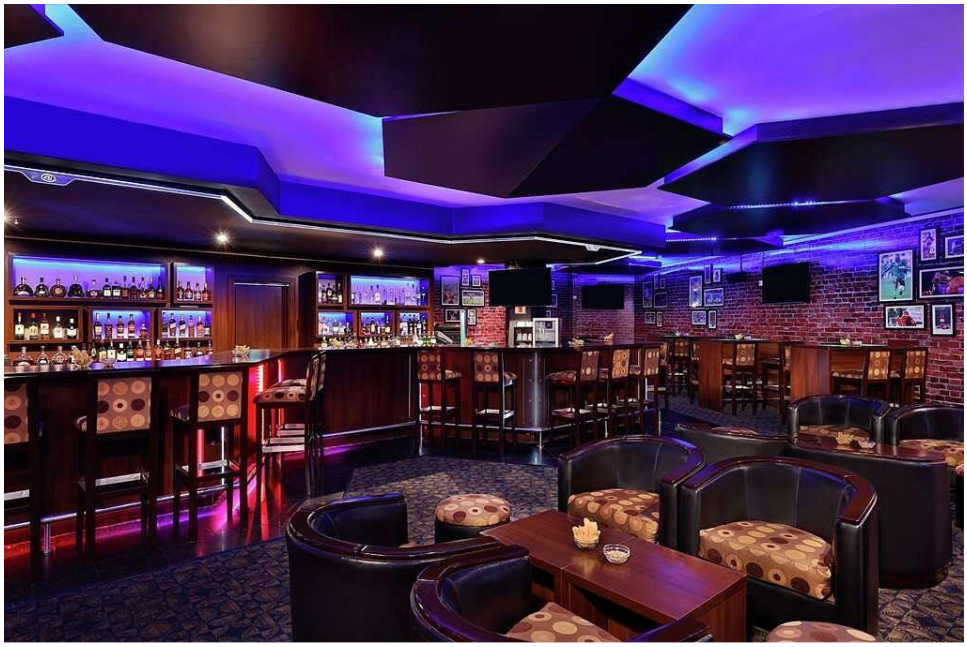

Plate 4.2 View of Capital bar showing the use of LED light
Source: (Author's Field Study, 2023)

 Use of high efficient windows: Transcorp Hilton hotel is built to be nature and environment friendly. The rooms consist of large horizontal windows to allow natural lighting into the interior space and also a view to the outside.

 Use of Energy Star-qualified products: The hotel made use of energy star rated electronics seen in appliances like televisions, air conditioner.

Water Efficiency:

 Use of on-site storm water treatment: Permeable pavement were used for the sidewalks which allow storm water to infiltrate through porous surfaces. Also trees were also planted around which work to absorb storm water.

 Water saving fixtures and technologies: The building achieves a laudable 42 percent reduction in water usage with the use of waterless urinals, low flow faucets and dual flush water closets.

Plate 4.5 Showing water savi ng fixtures;
Source: (Author's Field Study, 2023)

 Water Efficient Landscaping: the hotel vegetation consists of water efficient plants which creates beautiful landscapes, but also benefit the environment and save water.

Material Conservation:

 Use of green building materials: Materials such as steel, wood, bamboo which are sustainable materials was used in the hotel buildings both internally and externally. Traditional thatched roof is used in areas such as craft village and the Fulani pool bar reflect the culture of Nigeria's Fulani.

 Use of recycled materials: Some of the recycled material used in the hotel are steel, wood, glass.

 Use of locally available materials: Not all materials were locally sourced. Some of the locally sourced material seen include sand, cement, wood, thatch.

Plate 4.6: View of Fulani pool bar Showing the use of Thatch roof
Source: (Author's Field Study, 2023)

Reduction and Recycling of Waste:

Storage and collection of Recyclable: All waste water on the site is recycled for reuse. They have also partnered with Chanja Datti, a social enterprise that collects waste plastic and other recyclables like paper, glass bottles and supply to recyclers for use in the manufacture of other products.

Plate 4.9: Showing the van used for collecting recyclables
Source: (Author's Field Study, 2023)

Indoor Environmental Quality:

 Use of low VOC materials: Thermal comfort design and Interior air quality management plan was used during the construction. Portland cement plaster, vinyl flooring adhesive Adhesives, paints and primers used contained low volatile organic compounds. All these measures were taken to ensure good indoor air quality.

 Use of operable windows for increased natural ventilation: Natural ventilation and lighting was increased by use of windows and double glazing to reduce ultraviolet rays.

 Interior Lighting: The rooms are lit both naturally and with the use of the low energy bulbs which are energy-efficient, long-lasting, and emit less heat.

 View to outside: The hotel made use of large efficient windows to give a proper view to the outside, this provides comfort to the users of the space.

Land usage and site

 Efficient utilization of space: Transcorp Hilton, Abuja is built to be nature and environment friendly through the use of sustainable site planning and landscapes. The hotel site is properly landscaped with guest relaxation and recreational facilities and extensive parking spaces properly zoned. The building covers minimum space, and the maximum utilization of vertical space was designed to achieve this.

 Solar orientation of the building: The hotel has a y'shaped plan with 670 rooms and is 10 storey high.. The building is designed as 91 framed structures, constructed from concrete, glass and steel materials. The orientation of the building ensures that minimal heat gain results in indoor thermal comfort. The rays of the sun produce a splash of rainbow colors on the glass façade.

Plate 4.12: Image Showing the Large Window Openings in Transcorp Hilton Hotel, Abuja
Source: (Author's Field Study, 2023)

Case study Four: Raddison Blu Hotel, Lagos Background Information

The luxurious Radisson Blu Anchorage Hotel enjoys a privileged location in the financial and business district of Lagos. It is situated on Victoria Island, surrounded by all the embassies and close to Bar Beach, Mega Plaza Mall, City Mall and the commercial district. The city centre is within easy reach, and the international airport is at a distance of only 40 km. The magnificent hotel welcomes guests in a refined ambience exuding luxury and style. The contemporary rooms and suites are designed by Swedish hospitality designer Christian Lundwall and feature all the necessary amenities one would expect at this level. The hotel boasts an outdoor infinity pool, a fantastic fitness centre and a top-class spa area. Business guests will appreciate free WIFI and the meeting facilities. The exquisite restaurant and the bar enjoy marvellous panoramic views over the lagoon. This superb hotel is a perfect choice for a stay in Lagos.

Location

The hotel is located in 1a Ozumba Mbadiwe Avenue, Victoria Island Lagos

4.5.5.3 Eco-friendly strategies adopted in the design and construction of Raddison Blu Hotel Energy Efficiency

 Use of energy-efficient lighting like LED or CFL bulbs: Radisson blu hotel make use of LED light and fluorescent lamps to reduce energy consumption in the hotel

 Use of high efficient windows: The rooms include large dual-pane glass **windows** which are designed to take advantage of natural light while controlling glare and yielding warmth during the colder seasons.

Water Efficiency

 Use of on-site storm water treatment: This was achieved by planting native and adaptive trees and plants, and constructing a drip irrigation system or water-saving irrigation system if permanent irrigation of the landscape was necessary.

 Water saving fixtures and technologies: The hotels incorporated high-efficiency fixtures fittings, such as water closets, dual flush toilets, waterless urinals, and low-flow showers, to improve water efficiency and and minimize waste consumption in the hotel.

 Water Efficient Landscaping: Planting of native and adapted plants, which supports biodiversity and also add beauty to the environment, and the avoidance of the use of turf grass on the site.

Material Conservation

 Use of green building materials: Wood, recycled steel, glass**,** was used on the building.

 Use of recycled materials: A large quantity of waste generated by construction was reused, recycled, or otherwise diverted from landfills.

 Use of locally available materials: Cement, sand, wood used for the construction were gotten locally thus reducing the

environmental impact of transportation on the environment

Reduction and Recycling of Waste

 Storage and collection of Recyclable: Provision of recyclable bin in every room and central areas for easy collection of recyclables.

 Asking suppliers to use reusable containers to reduce package waste

 Encouraging guests to offset carbon emissions through Radisson rewards

 Excellent glass, cardboard, and paper recycling

 Excellent recycling of hazardous WEEE (Waste Electrical and Electronic Equipment) by providing guests with collection point in main hotel reception

 Trash separation to reduce landfill waste

Indoor Environmental Quality

 Use of low VOC materials: All the Adhesive sealants paints and glues, as well as carpeting and flooring, used on the project contain low quantities of harmful volatile organic compounds (VOCs)

 Use of operable windows for increased natural Ventilation: To address interior air quality, 95 percent of the hotels' occupied area provides access to natural daylighting and ventilation as well as views of the outdoors.

 Interior Lighting: This is achieved through the use of large dual-pane glass windows as well as LED lights and fluorescent lamps around.

 View to outside: The large window provides a nice view to the outside.

Land usage and site

 Efficient utilization of space: Radisson blu hotel offers carbon fiber bicycles and on-site producing gardens. As guests travel throughout the property, they can encounter various landscape features and sculptures encouraging them to connect with their natural environment and retreat into a space that does the same.

 Solar orientation of the building: The hotel was initially built with passive design solutions, such as overhangs, solar shading, natural lighting, orientation. cross ventilation.

Plate 4.26: Image Showing The exterior view of Radisson Blu Hotel VI , Lagos
Source: (Author's Field Work, 2023)

Plate 4.27: Image Showing The use of Led light to lit up the building
Source:(Radisson Blu Website,2023)

Plate 4.28: Image Showing Window openings in room for natural lighting and ventilation and view to outside
Source :(Radisson Blu Website,2023)

Comparative analysis of case studies

A comparative analysis of green building strategies across the case studies is presented in Table 4.5 below. The table indicates that Transcorp Hilton hotel adopted highest level of approach to green building strategies than the other buildings. Given that the other building's design incorporates some of the green building strategies that were mentioned in the literature review, it is obvious that the adoption of green building strategies served as a guiding principle in the building's conception, design, construction, and use.

Table 4.2: Comparative Analysis of the four selected Case Studies

Case Study	**Transcorp Hilton Hotel, Abuja.**	**Eko Hotel, Lagos.**	**Sheraton Hotel, Abuja.**	**Raddison Blu Hotel, Lagos**
Variables				
Energy efficiency	The building adopted the use of low energy bulbs for lighting, large horizontal windows in rooms to allow natural lighting a view to the outside. Energy star rated electronics seen in appliances like televisions, air conditioner.	The building is lit up with LED bulbs at night Windows and Double Glazed Curtain Wall Systems was used to minimize solar heat gains and allow natural light	The hotel consist of approximately 100 solar panels on the rooftop, LED bulbs which are energy efficient, Large energy efficient window for natural lighting and ventilation, Energy star rated electronics	The hotel Adopted the use of LED light and fluorescent lamps to reduce energy consumption, make use of large dual-pane glass windows for natural light and control glare.
Water Efficiency	Permeable pavement was used for the sidewalks, tress was also planted to absorb storm water, water efficient plant	The building made use of permeable pavement for walkways, planted local, adaptable plants to absorb storm	The building employed a non-potable water source for plant irrigation, low-flow shower heads, low-flush	Planting of native and adaptive trees and plants, construction of drip irrigation system for storm water
like shrubs for landscape, use of waterless urinals, low flow faucets, water saving shower heads, dual flush water closets.		water. Storm water drainage installation was also done.	toilets, ow-flow sink faucets. Soft landscape features like shrubs were planted all around	management, high-efficiency fixtures fittings, such as water closets, dual flush toilets, waterless urinals, and low-flow showers, to improve water efficiency.
Material Conservation	Use of green and recycled materials like Steel, wood, bamboo thatched roof in and around the building, cement, wood used for the construction were sourced locally.	The structure comprises of glass and steel which are green building materials. A large quantity of waste generated by construction was reused, recycled, or otherwise diverted from landfills. Cement, sand, gravel, wood used for the construction were gotten locally.	Use of materials like cement, sand and glass, wood, over 75 percent of construction waste was recycled, diverting it from landfills, 40 percent of the total building materials is sourced from local suppliers.	Wood, Aluminum composite board**,** was used on the building. Cement, wood used for the construction were sourced locally.
Reduction and Recycling of Waste:	Waste plastic and other recyclables like paper, glass bottles are collected and supply to recyclers for use in the manufacture of other products	Waste is disposed through the town's waste disposal companies, Waste generated during construction was reused in the building construction	Roughly 20 percent of the cost of the building went toward recycled materials, recyclable bin in every unit for easy collection of recyclables	Provision of recyclable bin in every room and central areas for easy collection of recyclables

Indoor Environmental Quality:	Portland cement plaster, vinyl, flooring adhesive, paints and primers used contained low VOC, large window openings and double glazing to reduce UV rays, allow natural lighting and ventilation. The rooms are lit in the naturally in the day and LED bulbs at night	Adhesives, glue, paints and primers used contained low VOC, Metal panel and coated double glazing which allows natural light, and view to the outside, LED bulbs at night to lit up the space	The carpeting and paints use in the spaces have low VOC, double glazing window to improve Natural lighting ventilation while reducing UV radiation and achieving view to the outside ,	Adhesive sealants paint and glues, carpeting and flooring contains low VOC, of large dual-pane glass windows for natural light and view to outside , The rooms are lit up with LED lights and fluorescent lamps
Land usage and site	Sustainable site planning and landscaping .The orientation of the building ensures that minimal heat gain results in indoor thermal comfort	The building covers minimum space through the maximum utilization of vertical space, The longest side of the building faces the north and south to ,minimize solar gain	Bicycle racks are provided with bicycles available for guests, The layout is such that the longer side faces the north-south direction	The hotel was initially built with passive design solutions, such as, natural lighting, orientation. Natural ventilation.

Researcher's Field Observation Checklist

Table 4.3 Summary, Green Building Strategies Checklists. Variables

	Total	**Transcorp Hilton Hotel, Abuja.**	**Eko Hotel Lagos.**	**Sheraton Hotel, Abuja**	**Raddison Blu Hotel VI, Lagos**
Energy Efficiency	**15**	**12**	**9**	**9**	**9**
Water Efficiency	**20**	**12**	**12**	**10**	**12**
Material Conservation	**15**	**11**	**11**	**10**	**11**
Reduction and Recycling of Waste.	**5**	**4**	**3**	**4**	**4**
Indoor Environmental Quality.	**20**	**16**	**15**	**16**	**16**
Land Usage and Site	**10**	**8**	**8**	**8**	**8**
TOTAL	**85**	**63**	**58**	**57**	**60**

From the analysis on Table 4.1, 4.2, 4.3, 4.4, it can be deduced that the building differs in the implementation of green building strategies. The highest level of green building strategies was achieved case study 1 with 63/85 followed by case study 4 with 60/85, case study 2 with 58/65 and case study 3 with 57/85. This shows that case study 1 (Transcorp Hilton Hotel, Abuja) has the highest level of green building strategies followed by case study 4 (Raddison Blu Hotel V.I Lagos) then case study 3 with case study 4 having the lowest.

DISCUSSION

From the Table 4.5 above, the case studies adopted the use of high efficiency lighting, double glazing, sun shading devices and proper building orientation to reduce heat gain reduce energy required to maintain thermal comfort in the buildings, use of green building materials and sustainable site development. All the hotels didn't adopt renewable source of energy rather, make use diesel powered generators as an alternative source of energy which is a disadvantage because the fumes from the generator is harmful to the natural environment. To ensure water conservation, Transcorp Hilton, Eko Hotel, Sheraton Hotel adopted the use of low flow water fixtures, low VOC finishes, paints and adhesive were used in the interiors to ensure optimum indoor air quality. Also interior lighting was achieved through the use of double glazing windows and LED bulbs in all the cases.

SUMMARY OF FINDINGS

Various green building strategies adopted in hotels in Nigeria can be categorized under the following variable:

Energy efficiency, Water efficiency, Material conservation, Indoor environmental Quality, Waste Management, Sustainable site planning. Energy efficiency includes the use of LED Bulbs, Window openings, for natural lighting of the spaces as well as ventilation. Material Conservation include the use of recycled content materials, locally available materials, Indoor environmental quality include the use of Low VOC materials, daylighting and ventilation, Waste management include provision of recycle bins for proper disposal of waste. Water efficiency include the use of water saving fixtures, rain water harvesting system. Sustainable site planning includes proper planning and landscaping of site, solar orientation of the building to reduce the environmental impact of the building.

CONCLUSION

In conclusion, this research conducted has provided valuable insights into the intersection of sustainable architecture and the adoption of LEEDS green label rating within the hospitality industry. Through an extensive examination of green building strategies and their implications, several key findings have emerged.

From the research findings, it is evident that the implementation of green building strategies in the Hotel has had a positive impact on various aspects of the guest experience. These strategies have contributed to improved indoor air quality, energy efficiency, and the overall sustainability of the hotel. Users have reported positive experiences related to comfort and a sense of well-being during their stays, which can be attributed to the hotel's eco-friendly design and operations.

Furthermore, the study highlights the importance of communication and transparency in conveying a hotel's commitment to sustainability. While some guests were well-informed about green building materials and their benefits, others had limited awareness. Therefore, there is a need for hotels to effectively communicate their green initiatives to guests, providing information that helps them make informed choices and appreciate the environmental efforts in place.

In summary, the findings of this research underscores the importance of green building strategies in enhancing the user experience and promoting sustainability within the hospitality industry. It serves as a valuable resource for hoteliers, designers, and policymakers looking to create more environmental friendly accommodations. As the hospitality sector continues to evolve, the findings from this study offer valuable guidance in shaping a more sustainable and eco-conscious future for hotels in Nigeria and beyond.

RECOMMENDATIONS

The recommendations that can be applied to implement eco-friendly design principles in the design of mixed use building in Nigeria are:

1. In the design of hotel in Nigeria, the eco-friendly design framework as proposed by the study should be adopted as a design strategy.

2. Renewable energy sources such as solar and wind energy should be adopted as primary source of energy and building materials should be recycled or locally sourced to reduce the embodied energy accumulated from the transportation of materials over long distances.

3. Low impact design and construction methods should be adopted to reduce energy consumption during construction and operation of hotel buildings. During site clearing, the eco-system of the site should be undisturbed, vegetation that needs to be removed should be transplanted and the use of vertical space should be maximized to reduce disturbances caused to the earth during building construction

4. Architect should play a great role in ensuring these green building strategies are implemented from the design stage of a building to the post-occupancy stage.

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