RESILIENCE AND LIVABLE CITIES IN A WARMING WORLD

A FESTSCHRIFT IN HONOUR OF

TPL. DR. JOSHUA ADEWUMI ADEBISI FNITP, RTP



EDITED BY

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CHAPTER 03

INTEGRATING SUSTAINABLE STRATEGIES IN THE DESIGN OF CONVENTION CENTERS IN LAGOS, NIGERIA

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Abstract

Convention centers are large public spaces that consume significant amounts of power and water, generate substantial waste, and have a considerable ecological footprint. This document examines the importance of adopting sustainable architectural practices to reduce these impacts, particularly in relation to facility design and operation. The research uses a mixed methodology, including a review of extensive prior studies and an in-depth analysis of five notable global examples: the Las Vegas Convention Center in the USA, the Vancouver Convention Centre in Canada, the Qatar National Convention Centre in Qatar, the Pennsylvania Convention Center in the USA, and the Eko Hotel Convention Center in Nigeria. The evaluation focuses on four main themes: Sustainable Site Layout, Water Conservation and Management, Energy Efficiency and Environmental Impact, and Material and Resource Conservation. The findings indicate that leading exhibition venues utilize strategies such as passive solar design, advanced construction materials, stormwater capture, water recycling systems, renewable energy sources, and locally sourced materials that have minimal ecological impact. The study shows that integrating these strategies early in the planning phase and adopting a holistic approach is not only feasible but also essential for mitigating the environmental damage caused by convention facilities. It provides a practical guide for designers, builders, and stakeholders to ensure that the construction of vital economic centers aligns with global sustainability goals, particularly relevant for upcoming developments in places like Ibadan, Nigeria. This initiative aims to spark a broader conversation about creating environmentally conscious convention centers in developing countries.

Keywords: Convention centers, sustainable design, passive design, energy efficiency, eco-friendly materials.

1.0 Introduction

Convention centers have evolved into pivotal global hubs, serving critical functions in international trade, knowledge dissemination, and professional networking. These expansive civic edifices significantly contribute to the economies of their host cities, generating substantial revenue streams (MICE, 2016). Beyond their economic impact, they enhance civil society by providing venues conducive to both organized and informal interactions, facilitating a wide range of activities from business conferences to cultural events (Whitfield, 2007). In response to increasing demands for versatile and technologically advanced meeting spaces, the design of these facilities has shifted

toward greater flexibility, integrating capabilities for hybrid events and multi-functional use (Egba & N.O. Imaah, 2021).

However, this economic and social utility is accompanied by considerable environmental consequences. Convention centers are significant consumers of energy and water, generate extensive waste, and contribute notably to urban carbon emissions (MICE, 2016). In some cases, meetings and events occur in venues that are not specifically designed for conventions but are spacious enough to accommodate attendees. Convention centers attract visitors from local, national, and international markets, and the type of events hosted influences the various market segments that utilize these facilities. (Xin Jin K. W., 2012). Traditional construction and operational practices often depend on high embodied energy materials and fossil fuel-reliant systems, exacerbating resource depletion and ecological degradation (Xin Jin, 2010). Consequently, the built environment, including these major public venues, is under increasing scrutiny regarding its sustainability and alignment with global climate objectives.

The push for sustainable design in this sector is driven by a confluence of environmental responsibility, regulatory requirements, and compelling economic incentives. Green buildings are progressively perceived not merely as financial burdens, but as strategic investments that can lead to reduced operational costs, enhanced property values, and improved user experiences (Emeka J Mba, 2024). Although sustainability has been defined in a variety of ways, its fundamental goal is to satisfy the needs of the current generation while guaranteeing that future generations can do the same (Tom Kuhlman & John, 2010). The core principle of sustainability fulfilling present needs without compromising future generations' ability to meet their own (WCED, 1987) necessitates a paradigm shift in the conception, construction, and operation of convention centers.

This study advocates for a proactive and integrative approach to sustainability, commencing from the initial stages of convention center planning. Focusing specifically on Lagos, Nigeria, the study explores the effective application of green architecture principles to mitigate the environmental footprint of such facilities. It conducts a comprehensive analysis of five exemplary global projects: the Las Vegas Convention Center (USA), Vancouver Convention Centre (Canada), Qatar National Convention Centre (Qatar), Pennsylvania Convention Center (USA), and Eko Hotel Convention Center (Nigeria), to distill best practices and adaptable methodologies. Employing a mixed-methods research framework, the analysis evaluates these case studies across four critical dimensions: Sustainable Site Planning, Water Management, Energy Efficiency and Environmental Impact, and Material Conservation. The ultimate aim is to provide a pragmatic blueprint for architects and stakeholders to design convention centers that align economic vitality with ecological stewardship and social value, particularly relevant in emerging urban contexts.

2.0 Literature Review

2.1 Conceptual Review

The pursuit of sustainability within the built environment is fundamentally guided by an interdisciplinary understanding of three interrelated pillars:

Environmental, Social, and Economic viability. This framework, often referred to as the "Triple Bottom Line," posits that sustainable development necessitates a careful equilibrium among ecological integrity, social equity, and financial viability (Nathalie Seddon, 2021). It acknowledges how crucial it is to consider how our activities will affect society and the economy in order to attain environmental security. (Lucía Muñoz-Pascual, 2019). When applied to large-scale public infrastructure, such as convention centers, this conceptual model demands a design methodology that transcends basic efficiency to embrace holistic accountability the following dimensions;

a. Environmental sustainability: Environmental sustainability involves the thoughtful management of our natural resources, surroundings, and the overall environment. It recognizes the intricate connection between human activities and the well-being of our planet (Mensah, 2019b). This concept is a crucial aspect of sustainability, as it refers to the ability to protect and preserve the natural environment (Seddon et al., 2021), including its ecosystems, species, and resources, to ensure their long-term viability. Environmental sustainability entails using and managing resources in a way that safeguards the natural environment for present and future generations (Mensah, 2019b). It involves making decisions and implementing strategies that minimize negative impacts on the environment, reduce resource consumption, and promote long-term ecological balance. It encompasses practices aimed at decreasing harmful environmental effects, advancing conservation, and fostering long-lasting environmental stability (Yilun Yang, 2025). At its core, environmental sustainability embodies the delicate balance between human activities and the preservation of the natural world (Zhirong Wang, 2024).
b. Social Sustainability: The long-term prosperity and well-being of individuals, communities, and social systems is what Mckenzie (2004) defines as social sustainability. It recognizes the interconnection of social, environmental, and economic systems and emphasizes the need to integrate social issues into sustainable development strategies. The primary objectives of social sustainability are to address social needs and challenges, promote equity, and safeguard the rights and welfare of all members of society. One aspect of social supportability is the equitable distribution of material and social resources. Food, shelter, clean water, clothing, and electricity are examples of physical resources, but social resources include things like knowledge, information, freedom of speech, participation in decision-making, and strong community networks. (Eizenberg & Jabareen, 2017). According to Polèse and Stren (2000), social sustainability is a developmental approach that grows by promoting civic engagement and ultimately leads to a wealthy environment. They highlighted the crucial roles that diversity, social integration, and values play in their view of social supportability. Social viewpoints are crucial, and their characterization is particularly relevant in urban contexts. These perspectives include social integration, civic involvement, diversity, economic measures, and the physical environment. According to Caistor-Arendar (2011), social supportability is a process that seeks to establish a thriving society by fully comprehending people's needs. This entails knowing what people require from their homes and workplaces in order to create vibrant, sustainable spaces. Social sustainability creates infrastructure that supports social and cultural life and enhances communities by

fusing social and physical planning. Polèse and Stren (2000) defined social sustainability as a developmental approach that evolves by fostering civic engagement, ultimately leading to a more prosperous environment. They highlighted the crucial roles of social integration, diversity, and values in their understanding of social supportability. Their definition is particularly relevant to urban environments and emphasizes the importance of social perspectives, including social integration, civic engagement, diversity, economic measures, and the physical environment. According to Caistor-Arendar (2011), social supportability is a process aimed at creating a prosperous society through a deep and intensive understanding of people's needs. This includes developing sustainable and thriving places by recognizing what individuals require from their living and working environments. Social sustainability combines physical planning with social planning, creating infrastructure that supports social and cultural life, enhances community amenities, facilitates citizen engagement, and allows spaces for individuals and communities to thrive. A favorable state within communities and a method within communities that can attain that state" is how Stephen McKenzie, the director of the Hawke Research Institute, described social sustainability (McKenzie, 2004, p. 23). Social sustainability is therefore viewed as both a state and a process rather than as a far-off goal to be accomplished in the future (Kumarasuriyar, 2016).

c. Economic Sustainability**:** The definition and core concept of economic sustainability are the subject of numerous and ongoing discussions. Barbier (1987) asserts that reducing poverty among the world's poor is a critical problem for sustainable economic development. He said that creating long-term, secure, and stable work is one way to do this. According to the Rutland Report, the economy's main objective in sustainable development is to assess environmental degradation and create appropriate plans to lessen it in developing countries (WCED, 1987). Since sustainable economics cannot be explained independently from the other two sustainability pillars, it is challenging to define. Some scholars stress the need for a distinct definition of sustainable economics (WCED, 1987).

Economic durability, according to Mensah (2019a), is a manufacturing structure that satisfies present consumption levels without endangering future requirements. Economic resilience, according to Rupprecht et al., is the ability of an economy to maintain and grow throughout time while guaranteeing the fair and effective satisfaction of the needs of both the current and future generations (2020).In addition to preventing negative effects on society well-being and the environment, it is an economic structure's ability to maintain a desirable production level (Dogan and Inglesi-Lotz, 2020) and provide a decent lifestyle for its residents by stressing resource efficiency and minimizing scrap (Fatimah et al., 2020). Supporting long-term economic growth and advancement while taking into account the effects on the society and the environment is the goal of economic durability (Giddings et al., 2002).It is reaffirming that advancement initiatives meet current needs without sacrificing standards. The six Rs of economic sustainability Reduce, Reuse, Recycle, Rethink, Refuse, and Repair are frequently used to summarize this (Murray et al., 2017). These recommendations can help planners and policymakers achieve economic sustainability as part of development processes.

2.2 Green building rating systems (e.g., LEED, BREEAM)

A green structure appraisal system provides a basis and tools to support ecological advancement in the built environment. According to Nguyen and Altan, a Green Building Rating Framework (GBRF) is a tool used by the construction industry to assess, improve, and promote the longevity of buildings. Through information processing, evaluations, and benchmarks, these systems provide tools, guidance, and insights about sustainability. They aim to achieve these objectives:

i. Increase the functional output of structures;
ii. Lessen ecological footprint; iii. Quantify the effects of structures on the environment; and
iii. Objectively assess and rank the construction of buildings.

In 1990, the UK saw the introduction of the British Building Research Foundation's Environmental Assessment Method (BREEAM). BREEAM International for New Construction 2016 is the most recent of several global versions that have been released to validate ventures worldwide. A percentage of marks earned from the total number of possible points is used to express the evaluation: 30% for the Passtier, 45% for Good, 55% for Very Good, 70% for Excellent, and 85% for Outstanding. Management, Health & Wellbeing, Energy, Transportation, Water, Materials, Waste, Land Use & Ecology, Pollution, and Construction are the groups for new building endeavors.

The U.S. Green Building Council (USGBC) first published the Leadership in Energy and Environmental Design (LEED) rating system in 1998. LEED is the most widely used and recognized framework for rating green buildings. There are four levels of certification based on the total points earned in the most recent edition, LEED v4 for New Construction (NC), which was released in 2014. The certification levels are Platinum (80 points and above), Gold (60–79 points), Silver (50–59 points), and Certified (40–49 points). A maximum of 126 points can be earned across seven assessment areas. In 2009, the Gulf Organization for Research and Development (GORD) in Qatar developed the Global Sustainability Assessment System (GSAS). This system incorporates effective techniques from various global rating systems, including BREEAM (UK), LEED (US), Green Globes (Canada), CEPAS (Hong Kong), CASBEE (Japan), and the Global SBTool. GSAS features a recognition scale ranging from 1 to 6 stars and is based on eight assessment areas.

These tools have significantly impacted the building industry by promoting environmentally friendly building practices and enhancing overall facility performance. While many global sustainable construction projects focus on site operations and environmental impact, each rating program has its own unique appraisal process, evaluation tools, and grading standards. Developments certified by these frameworks often demonstrate increased overall value, reduced energy consumption, and improved user satisfaction. Green building measurement tools monitor building operations throughout their entire lifecycle, from design to demolition. However, these tools can face criticism for overlooking certain financial and social factors.

2.3 Overview of Sustainable Principles

Energy efficiency: Reducing reliance on synthetic energy sources by optimizing the use of natural resources is associated with energy efficiency in sustainability. By maximizing sunlight to produce natural illumination, this method lessens the need for artificial lighting, which in turn uses less electricity. Additionally, the requirement for mechanical air conditioning systems can be reduced by using natural airflow techniques. Water conservation in the home can also be facilitated by creative water use, such as rainwater collection systems. In tropical regions like Indonesia, where daylight and natural airflow can be efficiently exploited, these ideas are especially pertinent.

i. Land use efficiency**:** In sustainable design, effective land use makes sure that not all of the available space is occupied by buildings, allowing for green spaces and thriving public squares. This results in the design of compact, cohesive structures that increase vegetation through the use of cutting-edge techniques like green facades, rooftop gardens, and vertical plantings. It is essential to preserve existing trees and plants since they can be incorporated into the design to increase their ecological value and aesthetic appeal. Open-plan ideas promote adaptability and harmony with the outdoors by connecting indoor spaces with outside environments.

ii. Using new technology and materials: The sustainability of architecture can be improved by utilizing cutting-edge materials and technologies. Renewable energy sources including solar, wind, and hydro power can be used to create autonomous electrical systems. Opportunities to use accessible and reasonably priced recycled materials for creation are presented by the research and use of new materials around the world. Bamboo, for example, has a lot of potential for environmentally friendly building because of its quick growth and adaptability.

iii. Waste management: The development of closed-loop models that optimize waste handling has advanced in recent years. One useful strategy is to implement decentralized home waste treatment systems that effectively handle greywater and blackwater and reduce the strain on municipal water infrastructure. According to He et al. [38], new approaches that are worth looking into include converting common objects into materials that decompose or may be reused in the environment, as well as organic waste breakdown frameworks that promote natural degradation in situ. These initiatives not only encourage sustainability but also make building procedures more circular. (Christine Mondor, 2013).

2.3.1 Sustainable architecture design strategies

i. Climate Responsive Design**:** Climate-responsive design is a common technique used by designers. This method reduces the need for mechanical systems by making the most of natural light and ventilation through the placement and external design of the building. By strategically placing windows and utilizing features like solar shields or eaves, designers can significantly reduce energy consumption. These concepts increase thermal ease, take use of local weather patterns, and reduce the need for heating and cooling. This promotes a healthier environment for inhabitants in addition to helping with energy efficiency.

ii. Resource efficiency: The effective use of resources is another essential component. The integration of contemporary advancements, such as sophisticated climate control systems, intelligent lighting configurations, and high-end thermal barriers, optimizes power usage and reduces operating costs. These advancements reduce energy waste and enable structures to respond effectively to changing external conditions. Liquid management is another aspect of asset performance; systems for collecting precipitation and reusing used water can conserve water and reduce the environmental impact of new construction.

iii. Eco-friendly local material selection: In ecological design, this is crucial. The use of locally sourced materials, which are renewable and have a lower environmental impact, is becoming more and more important in an effort to reduce the overall carbon footprint of buildings. Architects can further reduce the carbon emissions associated with their projects by using materials that need less energy to produce and transport. Reclaimed wood, recycled alloys, and organic textiles are common examples of eco-friendly materials that not only promote environmental sustainability but also improve the scheme's aesthetic appeal.

iv. Hydrological considerations**:** Innovative water handling configurations are already commonplace in sustainable building design. Techniques like vegetated covers, porous pathways, and rainwater catchment help with effective stormwater management, which reduces the burden on municipal sewage networks. By creating diversity and providing habitat for urban wildlife, these methods not only collect water but also enhance the surrounding ecosystem.

v. Environmental Integration**:** It is becoming more widely accepted that incorporating green features into architecture designs is essential to improving the urban environment. Green roofs, living walls, and city gardens are examples of features that improve air quality, support biodiversity, and provide residents with recreational spaces. By connecting people to the outdoors, these elements not only reduce the urban heat island effect that is frequently seen in cities, but they also foster a sense of community.

vi. Low Carbon planning: Reducing carbon emissions through the use of renewable energy sources and effective transportation planning is becoming a top priority for designers. Building designs that incorporate solar panels, wind turbines, and electric vehicle charging stations encourage people to live low-carbon lifestyles and enable sustainable energy consumption.

vii. Holistic impact assessment: In the planning stage, a detailed evaluation of a structure's ecological impact during the course of its operation is becoming increasingly important. To reduce the overall environmental impact, this analysis involves looking at electricity consumption, liquid consumption, and material purchase.

viii. Universal design principles: Developing areas that are reachable and functional for persons of every capability is increasingly seen as a vital element of societal endurance. Universal design concepts ensure that settings accommodate varied user requirements, fostering inclusion and fairness.

ix. Circular economy principle: The notion of a circular economy in structural design is garnering interest. Developers are more frequently assessing the full lifecycle of structures, emphasizing adaptability, straightforward dismantling, and material recovery. Through arranging for a building's conclusion from the start, planners can ensure that elements are successfully repurposed instead of thrown away, thus reducing refuse and preserving supplies.

x. Nature Inspired Interiors: It has been noted that adding biophilic elements, such as organic materials, decorative vegetation, and passive lighting, improves occupant output and well-being. Planners may create environments that are both aesthetically pleasing and beneficial to the mind by connecting indoor and outdoor spaces.

xi. Enduring design Philosophy: One solution to reduce waste and combat disposal culture is to create timeless designs that remain appealing and functional over long periods of time. This enduring design philosophy encourages a more ecologically responsible relationship with our built environment and emphasizes quality over volume (Samia Parvez, 2021).

2.4 User Oriented Convention Centers

The character and functionality of modern convention facilities are directly impacted by the evolving demands of their clients. These days, the ideal convention space combines technological innovation, experience planning, and spatial versatility. Its primary characteristics include:

i. Wide open spaces that combine the energy of festival-style environments with event encounters.

ii. Expansive open areas that merge event experiences with the vibrancy of festival-like environments.

iii. Plenary halls crafted not just for formal gatherings, but for high-energy entertainment and immersive presentations.

iv. Gallery zones that seamlessly double as pre-function areas, supporting circulation, networking, and informal interactions.

v. Hybrid conference suites equipped to accommodate both physical and virtual participation.

vi. Incubator-style, interactive spaces that foster collaboration, knowledge sharing, and creative idea exchange.

Standard lecture-style arrangements have given way to vibrant, interactive spaces where participants actively engage with the content and one another at contemporary convention facilities (Kain, 2017). This change is being accelerated by technological advancement, which makes it possible for more fruitful collaboration, enhanced creativity, and greater discovery (LMN, 2011).

2.5 Design Standards of Convention Centers

i. Clear external signage, which requires illumination, and an entrance and exit that are easily identifiable.

ii. Enough spaces for loading and unloading to support a range of activities.

iii. Level ground level with loading docks that are big enough for all services, including client cars. 4. There must be spacious coach drop-off and pick-up areas next to the main door that are covered by a roof and have enough height and turning room.
iv. Appropriately sized entrances or walls that may be removed or retracted to provide truck access (trucks transporting staging and display equipment pose unique difficulties).
v. Floor load capacities to make room for a truck.
vi. A clearly marked, climate-controlled entrance and meeting place for guests.
vii. Disabled access with clear signpost.
viii. Monitoring at loading docks and security systems in larger venues.
ix. Separate access for venue staff.
x. Storage space (for several days) for pre-conference shipments including exhibitors' display materials.
xi. The need for parking for cars and other vehicles depends to some extent on the availability of public transportation as well as the proximity of select facilities, such as municipal parking lots, and the rules of use. All parking must be adequate and secure for all participants.
xii. Adaptable space arrangement for different events and seated arrangements.

3.0 Materials and Method

3.1 Study Area

Lagos, Nigeria, as the most densely populated urban center in Africa and a pivotal commercial nexus, serves as the focal point of this study. It exemplifies the challenges of rapid urbanization and infrastructure development that many cities in the Global South face. The region is a hub for large-scale events, generating a significant demand for convention spaces. This paper delves into the intricacies of convention facility planning within this context, using the Eko Hotel Convention Center as a notable case study. This venue provides critical insights into the integration of sustainable design principles within the climatic, economic, and governance frameworks of an emerging nation. The findings are applicable not only to similar urban contexts in sub-Saharan Africa but also to broader global scenarios.

3.2 Methodology

This study used a qualitative, multifaceted methodology to obtain a nuanced understanding of the complexities of ecological design at large-scale assembly sites.
Literature Review: To develop a philosophical framework based on ecological design principles applicable to large assembly sites, a thorough examination of academic journals, foundational works, and relevant industrial material was conducted.
Analysis of a Case Study: Five exposition halls renowned for their exceptional leadership in green design techniques were selected via a methodical selection process. A structured analysis framework based on the four pillars of sustainability location, hydration, power, and components was used to evaluate each study. The selected centers include:

i. Las Vegas Convention Center (USA)

ii. Vancouver Convention Centre (Canada)
iii. Qatar National Convention Centre (Qatar)
iv. Pennsylvania Convention Center (USA)
v. Eko Hotel Convention Center (Nigeria)

To create a thorough analysis of each case, data was acquired from secondary sources such as architectural drawings, project reports, environmental certifications (such as LEED), and pertinent scholarly works.

4.0 Results and Discussion

Venues for conventions have historically served as hubs for collaboration, information sharing, and business networking. These websites have evolved throughout time to meet the evolving needs of organizers of events and gatherings. Unconventional gathering spaces, flexible floor patterns, and innovative revenue-generating components are becoming more and more necessary (Humaid, 2020). MICE, or meetings, incentives, conferences, and exhibitions, is a significant segment of the business travel industry. MICE participants spend up to 17.5% more than vacationers, making them premium guests. Both direct and secondary spending result in significant economic benefits for host locations. The shift from traditional, usually boring assembly rooms to more unique and dynamic spaces is a significant trend in convention center architecture.

4.1 Las Vegas Convention Center (USA)

The Vancouver Convention Centre, which has a large six-acre living roof that feeds wildlife, controls stormwater flow, and offers excellent heat insulation, was identified as a benchmark from a case study. Additionally, it maintains a strong waste diversion strategy, uses seawater heat pumps to regulate temperature, and shows a 73% reduction in water consumption thanks to upgraded fittings. With regard to electricity administration in particular, the Las Vegas Convention Center takes a cutting-edge, technology-driven approach to green practices.

i. Power and Climate: Its highly effective construction shell is designed to reduce heat absorption in arid environments. A 7,500-ton chilled water facility that uses both main and auxiliary pumping circuits for peak cooling effectiveness supports this. Motion sensors and natural light capture in smart illumination management installations result in a significant reduction in lighting electricity requirements.
ii. Green Site Planning: The center's proximity to the monorail network and ease of access were purposefully highlighted to encourage a reduced reliance on private vehicles. While land maximization was considered, the location's incorporation of native habitats is less obvious than it is at the Vancouver Convention Centre.
iii. Water Conservation and Quality: Although the facility uses low-flow fixtures and drought-tolerant landscaping, its runoff control strategies and water recovery initiatives are not as prominently featured in its design as they are in other places, particularly Vancouver.
iv. Conservation of Materials and Supplies: The use of Low-VOC products ensures excellent indoor air quality and demonstrates a commitment to renewable

resources. Actions to reduce waste were also prioritized throughout the construction and expansion processes.

4.2 Vancouver Convention Centre (Canada)

According to the case study, the Las Vegas Convention Center demonstrates its dedication to power conservation by incorporating smart lighting adjustments, daylight harvesting, a massive low-temperature cooling system, and an incredibly efficient building envelope. With its LEED Platinum certification, the Vancouver Convention Centre sets a global standard for environmental soundness. The main feature of the site is its expansive six-acre green roof, which functions as an ecosystem that sustains local animals, collects rainfall runoff, and provides thermal buffering, lowering the need for heating and cooling. Its bayside location strengthens the connection between the natural ecosystem and the manmade setting.

It also includes:

i. Water Saving and Purity: Ultra-low-flow plumbing and an on-site sewage treatment plant that releases wastewater for bathrooms and irrigation have helped the facility achieve a notable 73% reduction in tap water use. The purpose of its surface runoff handling system is to safeguard the surrounding ocean environment.

ii. Power and Environment: Using a marine water heat pump system to warm and cool water from the surrounding port is an example of efficient use of regional renewable resources. The layout incorporates non-active airflow techniques into the room and maximizes daylight.

iii. Saving of Materials and Supplies: The use of locally sourced, recycled, and low-emission materials is important. This includes the use of high-recycled content cement that contains pulverized fuel ash and timber that has been reclaimed from a former coastal pier.

4.3 Qatar National Convention Centre (Qatar)

According to the case study, the Qatar National Convention Centre combines aesthetics with environmental responsibility by highlighting locally sourced components and utilizing large photovoltaic installations, power-saving devices, and inertial mechanisms for temperature control. The QNCC blends cutting-edge environmental technologies appropriate for its arid climate with architecturally significant cultural elements and the following:

i. Energy and Environment: A significant dedication to renewable energy is demonstrated by the extensive array of solar panels built into the building's exterior, which provide a sizeable portion of the electricity needs. Additionally, the area's intense cooling needs are adequately met by highly efficient HVAC (heating, ventilation, and air conditioning) and LED lighting systems, as well as mass dampers for accurate climate management.

ii. Sustainable Site Planning: The venue's main location makes it easier to get to, and the unique façade, which is based on sidra trees, provides symbolic shade and integrates solar technology, successfully fusing traditional tales with environmentally friendly innovations.

iii. Preservation of Materials and Assets: To reduce the embodied energy associated with transportation, the building phase prioritized materials with recovered content and local procurement.
iv. Water Preservation and Excellence: Standard water-efficient fixtures are in place, and given the desert environment, any water-saving measures, such as reclaimed water recycling systems, are essential, albeit less prominent than the center's energy-related features.

4.4 Pennsylvania Convention Center (USA)

According to a case study, the Pennsylvania Convention Center emphasizes the need to integrate eco-friendly power sources and reuse wastewater in order to reduce its reliance on the utility network and operating expenses. The Pennsylvania Convention Center is a prime example of modernizing existing structures to achieve higher sustainability standards through extensive renovation and with the following features:

i. Energy and Environment: Modern, energy-efficient HVAC systems and the extensive use of LED lighting were highlighted in the modifications. Additionally, by implementing renewable energy choices, the venue has significantly reduced its dependency on the power network, which has reduced its carbon footprint and long-term operating expenses.
ii. Water Preservation and Quality: Advanced water-saving techniques were employed, including low-flow plumbing fixtures and a focus on internal wastewater processing and recycling.
iii. Sustainable Site Planning: Its location is thoughtfully integrated into the urban landscape of Philadelphia, providing excellent mass transit access. Additionally, to support regional habitats, the rainwater management design makes use of green system techniques including porous paving and rain beds.
iv. Conservation of Elements and Assets: During the upgrade, a concentrated effort was made to use low-emission, locally sourced components. Recycling and waste reduction strategies were crucial to the construction process, highlighting a commitment to long-term practices.

4.5 Eko Hotel Convention Center (Lagos, Nigeria)

The key features of a convention center and the significant shortcomings in the formalized integration of sustainable design concepts are highlighted in this research, which provides an important viewpoint from the Global South. General Function: The center's extensive exhibition spaces, conference rooms, and banquet facilities provide the main spatial needs for big events. Its operational performance indicates that there is a definite market need for these kinds of venues. However, there is identified sustainability gap. In other words, the evaluation shows that the four sustainability pillars are not being widely adopted. Also, targeted energy-efficiency initiatives, formal water reclamation systems, sustainable site ecologies, or a specific framework for material conservation are all lacking. This pattern is common across the region's canonical constructs and indicates a great deal of room for development. The center acts as a starting point, showing the current state of affairs from which creative, sustainable designs in comparable economic and climatic circumstances must develop.

Although the examination indicated a lower overall incorporation of formal sustainability gauges compared to the worldwide norms, the Eko Hotel Convention Center (Lagos) provides relevant regional insight from the case study, highlighting a potential for significant progress in that location. The best multipurpose conference, dining, and entertainment venue in Nigeria is the Eko Convention Center, which has a floor size of 5,151 square meters. This facility has adequate space for 270-piece booths and can hold conferences and meals for up to 3,000 people. It is the most famous musical scene in Nigeria and can hold up to 6000 people at a concert. The lobby can be split into five separate spaces for smaller events and performances. It features a roll-away stage with carpeting to improve sound effects, well-lit interiors, and integrated sound equipment.

All of these wonderful features may be found in the naturally formed "Grand Ballroom," which can accommodate 350 people for supper. There are thirteen specially designed conference rooms with cutting-edge audio-visual equipment. The Eko Hotel's design concept places a strong emphasis on flexibility and adaptation to suit different meeting forms. The facility has a sophisticated appearance in addition to its interior rooms thanks to outside features including a tennis court, swimming pool, and well-kept landscaping. Accommodations at the conference center include 171 Suites, 146 Club Suites, 9 Premium Suites, 15 Signature Suites, and 1 Presidential Suite. Also, after the conference, attendees can stroll around the outside area, which offers a pleasant view. In addition to improving the overall participant experience and catering to the increased interest in wellness, this also enables guests to take in the local environment without ever leaving the location.

The interior design strategy places a high value on creativity and interaction, highlighting the establishment of cooperative gathering spaces. With a degree of usefulness and adaptability that goes beyond conventional meeting room designs, these areas are purposefully made to support brainstorming sessions, group debates, and other interactive activities. Lagos State's economy, society, culture, and ecology are all impacted by Eko-Hotel Convention Centers.

4.6 Synthesis of Findings

According to a comparative analysis of premier facilities in Vancouver, Las Vegas, and Qatar, sustainability is not viewed as a distinct collection of components but rather as a whole, interconnected system. The following are the identified key success factors:

i. Unique Green Features: In addition to their functional uses, Qatar's sun-facing exterior and Vancouver's green roof also demonstrate the buildings' commitment to the environment.
ii. Environment-Aware Planning: Each project uses techniques tailored to its particular regional climatic conditions, such as energy-efficient, highly insulated shells and chilled water apparatuses in Las Vegas, massive solar panels and shielding techniques in Qatar, and ocean water cooling in Vancouver.
iii. Foundational System Outlays: Highly effective systems for lighting, climate control, and fluid conservation that maintain operational performance are the cornerstones of sustainability.

iv. Upgrade Possibility: The Pennsylvania Convention Center provides a template for modernizing existing structures without necessitating new construction, demonstrating that environmental soundness can be achieved through renovation.

5.0 Conclusion and Recommendations

According to the study, integrating sustainable practices into conference center design is both practical and beneficial, yielding both financial and environmental benefits. These principles are demonstrated in the proposed convention center in Ibadan, Nigeria, through features like natural ventilation, storm water collecting, photovoltaic power generation, and the use of natural resources. The following are the main recommendations for the future layout of the conference center:

i. Adopt a thorough, cohesive planning strategy that prioritizes longevity right away.
ii. To reduce power consumption, focus on passive planning techniques.
iii. Invest in renewable energy sources to increase independence and lower pollution.
iv. Make use of full water circuits to deploy assets efficiently.
v. Select durable, low-impact materials to support a circular economy.

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