ARTS AND DESIGN FOR A SUSTAINABLE BUILT ENVIRONMENT

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ABSTRACT

Buildings account for a large amount of land use, energy and water consumption, air and atmosphere alteration. Considering the statistics and the impact of the built environment on human health as well as the natural environment, reducing the number of natural resources consumed by the buildings industry and the amount of pollution given off is seen as critical to achieve a sustainable environment. This study aimed at assessing arts and design for a sustainable built environment. The methodology adopted is the descriptive research method which involved an indepth review of literature related to the study, observation schedule and selection of foreign and local Case studies to compare and deduce data concerning eco-friendly and mixed-use buildings, and field surveys to obtain data on some of the selected case studies. This study established a design frame work from the findings, through which a design proposal for a mixed-use, eco-friendly building while implementing eco-friendly design. The research concluded that eco-friendly building principles and techniques have five major components namely: energy efficiency and conservation, water efficiency and conservation, materials conservation, waste reduction, reuse and recycling and humane adaptation. Adopting these five criteria in the design and construction of buildings in Nigeria will improve the environment by reducing the negative impacts of unsustainable building practices as recommended by the study.

Keywords: Arts, Design, Sustainable, Environment

INTRODUCTION

Our built environment has significant impacts on people and the environment. It affects air quality, transportation patterns of communities, and the overall way of life for present and future generations (Michael et al., 2007). While the built environment provides us with shelter and various advantages, it also has disadvantages that negatively impact our natural environment (Kolawole, 2005). The solution lies in creating a dynamic equilibrium that minimizes the negative impact on the environment (Zubairu, 2012). This has led to the emergence of the concept of green buildings, which are designed to be environmentally friendly and have minimal impact on the natural environment (Gunnell, 2009). The built environment plays a crucial role in shaping the quality of life for individuals and communities (UN-Habitat, 2016), but conventional approaches to design and construction have often neglected environmental considerations, leading to negative impacts on the planet and human well-being (Gissen, 2017).

In recent years, there has been a growing recognition of the need to address sustainability challenges in the built environment. Sustainable development aims to meet present needs without compromising the ability of future generations to meet their own needs (Brundtland, 1987). Sustainable building practices seek to minimize the environmental impact of construction, promote energy efficiency, reduce waste generation, and improve the overall performance and livability of built spaces (Cole, 2005). However, it is increasingly understood that technical solutions alone are not sufficient to create truly sustainable built environments (Perez-Gomez, 2013). Aesthetic and cultural aspects also play a crucial role in shaping people's interactions with their surroundings and

influencing their attitudes towards sustainability (Lederbogen et al., 2011). This has led to the exploration of arts and design as powerful tools for promoting sustainability within the built environment.

Artistic expression and design principles have the potential to create visually appealing spaces that inspire a sense of connection and stewardship towards the environment (Chittaro et al., 2019). By integrating arts and design into sustainable building practices, we can enhance the aesthetic value of buildings, foster a sense of place, and promote a more holistic and people-centered approach to design (Dewey, 1934; Irwin et al., 2013).

Buildings are major consumers of natural resources and significant contributors to greenhouse gas emissions (Yi-Kai et al., 2010). While the integration of arts and design in the built environment holds potential for enhancing sustainability, there is a lack of comprehensive research that explores the barriers and opportunities associated with leveraging arts and design for a sustainable built environment, hence the need for this study.

LITERATURE

Definition of a Sustainable Built Environment

According to the United Nations's World Commission on Environment and Development, sustainability means meeting the needs of the present without compromising the ability of future generations to meet their own needs (UNFCCC, 2006). Users of this definition cite the "three-legged stool" of sustainability: social, economic, and environmental (Holdren, 2008). Sustainable development, presented as almost synonymous with "sustainability," is challenged by authors who argue that "development" itself is antithetical to sustainability because development is inherently

unsustainable: human development must occur without overwhelming the natural ecosystems that we depend on for survival (Wood, 2015).

The term "sustainable" is often used to characterize a technology with a lower environmental impact on a single environmental problem (climate change and water resource use), often quantified in terms of reduced resource use or pollution emissions as a fraction or percentage. Sustainability should address the complex interactions among social-ecological systems (Michael & Sander, 2015). According to UNFCCC (2006), sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. A primary goal of sustainability is to reduce humanity's environmental or ecological footprint on the planet. Sustainable development has given rise to eco-friendly buildings commonly known as green buildings.

The term "sustainable built environment" refers to the design, construction, and operation of buildings and urban spaces that prioritize environmental responsibility, social well-being, and economic viability (BRE, 2016). It encompasses a holistic approach that considers the long-term impact of human activities on the natural environment and seeks to minimize resource consumption, reduce waste generation, and promote resilience in the face of climate change (Brotas et al., 2017).

In order to achieve sustainability, the built environment must adhere to key principles such as energy efficiency, water conservation, waste reduction, and the use of environmentally friendly materials (UNESCO, 2011). Additionally, it emphasizes the importance of creating spaces that are healthy, inclusive, and socially equitable, fostering a sense of community and enhancing the quality of life for residents (Jablonski, 2016).

The concept of a sustainable built environment recognizes the interconnectedness between human activities, the natural environment, and social well-being (Manchado et al., 2018). It goes beyond simply minimizing negative impacts and aims to promote positive environmental and social outcomes. This includes the integration of renewable energy systems, the preservation of biodiversity, the promotion of sustainable transportation options, and the consideration of cultural heritage in design and planning processes (Manchado et al., 2018; Brotas et al., 2017).

The sustainable built environment encompasses a comprehensive and integrated approach to design and construction that prioritizes environmental responsibility, social well-being, and economic viability (BRE, 2016). It seeks to create buildings and urban spaces that are environmentally efficient, socially inclusive, and economically sustainable, thereby promoting a better quality of life for current and future generations (UNESCO, 2011; Jablonski, 2016).

Impact of Buildings on the Environment

The International Energy Agency (2006) released a publication that estimated that existing buildings are responsible for more than 40 percent of the world's total primary energy consumption and for 24 percent of global CO2 emissions. This implies that the building sector uses more energy than other sectors like the industrial and transportation sectors. Due to an increase in urban population and attendant residential pressures, energy consumption is projected to rise in buildings, especially in fast-growing countries (Odebiyi, 2010).

The world's continued population growth has led to the implementation of resource-efficient measures in all areas of human activities, especially in the built environment, which has a significant impact on all resources while also affecting the air quality and transportation patterns of communities; both the present and the future generations (Dalibi, 2012). Eco-friendly

architecture in the African context is the indigenous approach of building practices with the goal of sustaining the ecosystem. It puts into consideration the easily affordable local resources and the development of concepts that sustain the socio-cultural value system within the building sector. Buildings are the dominant energy consumers in modern cities, but their consumption, according to Dalibi (2012), can be largely cut back through improving efficiency. Energy demand for heating and cooling is greater than ever, as most available energy is based on fossil fuel, the increased energy demands contribute significantly to more greenhouse gas emissions (Kolawole & Anigbogu, 2005).

Urbanization trends in developing countries are accelerating the growth of this sector relative to residential buildings, according to the World Business Council on Sustainable Development (WBCSD, 2016). Reducing these emissions is therefore a cornerstone intention and responsibility of green building initiatives. The green building will improve the environment through environmental sustainability and greenhouse gas emission reduction.

Importance of Arts and Design in Sustainability

Arts and design play a significant role in promoting sustainability within the built environment by offering innovative approaches, fostering creativity, and inspiring behavioral change (Matarasso, 2019; Zeisel, 2017). Arts and design have the power to raise environmental consciousness and create awareness about sustainability challenges (Birkeland, 2015; Matarasso, 2019). Visual representations, such as sculptures, installations, and interactive exhibits, can effectively communicate complex environmental concepts and inspire individuals to engage in sustainable practices (Birkeland, 2015; Vergragt & Cohen, 2013). For example, environmental art installations

that incorporate recycled materials or highlight environmental degradation can provoke reflection and encourage responsible resource consumption (Birkeland, 2015; Vergragt & Cohen, 2013).

Arts and design provide a platform for community engagement and participatory processes in sustainable development (Matarasso, 2019; Zeisel, 2017). Collaborative art projects and participatory design initiatives enable community members to contribute their perspectives, knowledge, and creativity to the development of sustainable built environments (Zeisel, 2017; Condon & Hamilton, 2016). This involvement not only enhances a sense of ownership and pride but also facilitates the creation of culturally relevant and socially inclusive spaces (Condon & Hamilton, 2016). Arts and design encourage innovative thinking and problem-solving, driving sustainable design and technological advancements (Heschong, 2018; Matarasso, 2019). By embracing artistic approaches, architects and designers can explore unconventional materials, spatial configurations, and renewable energy solutions (Heschong, 2018; Zeisel, 2017). This integration of artistry and design can result in more aesthetically pleasing, resource-efficient, and resilient built environments (Matarasso, 2019; Zeisel, 2017).

Arts and design have the potential to evoke emotional responses and influence human behavior towards more sustainable choices (Verplanken & Wood, 2006; Matarasso, 2019). Artistic representations can evoke empathy, compassion, and a sense of urgency regarding environmental issues, motivating individuals to adopt sustainable lifestyles (Verplanken & Wood, 2006; Matarasso, 2019). Moreover, design interventions that make sustainable behaviors more convenient, attractive, and socially desirable can encourage widespread adoption of sustainable practices (Zeisel, 2017; Verplanken & Wood, 2006).

Arts and design play a vital role in promoting sustainability within the built environment by enhancing environmental consciousness, fostering community engagement, inspiring sustainable design, and influencing behavior change. Through creative and artistic expressions, individuals are motivated to actively participate in the creation of sustainable built environments and embrace sustainable practices for a more resilient and ecologically balanced future.

METHODOLOGY

This research work was achieved using a descriptive survey method that required extensive literature review on the study area. The literature review was conducted using various web search engines like Google and Research Gate for journals and publications, as well as case studies both local and foreign. Additionally, an observation checklist was utilized. According to Denzin & Lincoln (2003), descriptive research involves an explanatory, realistic approach to its subject matter, seeking to understand phenomena within specific contexts.

Data Type and Sources

This research aims to collect qualitative data, which will be gathered from field visits to selected case studies, existing literature, and previous research work. The data used in this research work was secondary data.

Criteria for Case Study Selection

All case studies were selected based on their relation to the study. The selection criteria relied on the building's function, LEED (Leadership in Energy and Environmental Design) certification, and LEED registration. The five samples studied demonstrate how effectively the variables stated are applied in the design and construction of the buildings.

Population of Study

The research population for this study comprises mixed-use eco-friendly buildings from Nigeria and the USA, selected through purposive sampling.

Sample Size and Sampling Technique

Sampling involves selecting a subset of the research population to represent the entire population (LoBiondo & Haber, 2006). For this research, non probability sampling was used, specifically purposive sampling. Five eco-friendly buildings were selected based on their functions, LEED certification, and registration. The sampling was limited to five mixed-use buildings within the research scope, namely AVA Little Tokyo, Heritage Place (Ikoyi), Nestoil Tower, U.S Embassy Annex, and No.4 Bourdillon Building.

Table 3.1: Selected samples, functions, LEED registrations, and LEED certifications

Sample	**Function**	**LEED Registration**	**LEED Certification**
AVA Little Tokyo	Mixed-use building	Certified	LEED Gold (71.5/110)
Heritage Place, Ikoyi	Mixed-use building	Certified	LEED Certified (45/110)
Nestoil Tower	Mixed-use building	Certified	LEED Silver (50/110)
U.S Embassy Annex	Mixed-use building	Certified	LEED Gold (65/110)
No4-Bourdillon Building	Mixed-use development	Registered	LEED (Certification in progress)

Source: Author's compilation

Method of Data Collection

Data for this research was collected from secondary sources. The secondary source of data includes information gathered from literature reviews.

Secondary source of information

This refers to the evidence generated for the study other than the primary source of information. This comprised of the literature used in developing the conceptual framework. Here, information pertaining to the case study buildings already documented was used as well. The desktop literature was used for two primary purposes: i) to provide the general framework that set the tone for the literature and ii) to serve as evidence to support the analysis of the data drawn from the above-mentioned respondents in order to achieve the set objectives.

Variables of the Study

The basic principles of eco-friendly architecture were adopted as variables for the study. These variables include:

i. energy efficiency
ii. water efficiency
iii. material conservation
iv. humane adaptation
v. reduction and recycling of waste (Akadiri, Chinyio, Olomolaiye, 2012)

Method of Data Analysis and Presentation

The method of data analysis refers to the techniques employed to provide potential answers to relevant questions raised in the research work. This is done through the analysis of data gotten from the various sources for the research. The data gotten was analyzed descriptively and presented using tables, figures, and other data analysis techniques are used to provide space analysis of the proposed design.

Table 3.2: Sample of checklist used in data collection

Eco-friendly design checklist	Scale Factor: Excellent=5. Adequate=4, Good=3, Fair=2, Poor=1
Energy efficiency	
Water management	
Materials conservation	
Waste management	
Humane adaptation	

Source; Author compilation

RESULTS AND DISCUSSION

In this chapter, we will discuss the details of the analysis and results obtained from the survey, as well as the results derived from literature and empirical evidence. Descriptive statistics were used to determine the significance of the variables identified in the available literature. These variables include energy efficiency, water efficiency, material conservation, humane adaptation, and reduction and recycling of waste. The samples for the case studies were selected purposively based on the research scope. The selected case study samples are AVA little Tokyo, Nestoil towers, the Heritage place, the U.S embassy annex, and No 4 Bourdillon building. Consequently, the results of the overall measurement are reported.

Case Studies

Case study 1: AVA little Tokyo

Background information

AVA little Tokyo is a residential mixed-use building located at 236 South Los Angeles, Little Tokyo District, Los Angeles, as shown in Figure 4.1. The building has earned a LEED pilot credit for the street network and the high density of intersections in the surrounding area. It consists of 280 apartment units, ground floor retail spaces, restaurant space, an indoor chilling lounge, a gym, a social bar, and a movie hall.



Figure 4.1 Google Satellite Map of AVA Little Tokyo's Location Source: Googlemaps (2019)

Eco-friendly strategies adopted in the design and construction of the building of AVA Little Tokyo are as follows:

a) Energy Efficiency: AVA Little Tokyo surpasses California's excellent energy usage standards by more than 18%. This was achieved by installing high-efficacy lighting throughout the building and in all units. The ductwork is well sealed, allowing only 6% or less leakage.

b) Water Efficiency: Instead of installing turf or grass, which typically requires significant watering, AVA Little Tokyo opted for drought-tolerant plants with drip line irrigation controllers that prevent watering during rainfall. High-efficiency fixtures, including low-flow showers, faucets, and toilets, were installed in every unit. As a result, indoor water use is reduced by more than 20% compared to similar projects.

c) Material Conservation: During the construction process, 80% of the waste generated was either reused, recycled, or diverted from landfills. Environmentally preferable wood products were used throughout the project.

d) Humane Adaptation:

i. Indoor Air Quality: Indoor air quality is a crucial aspect of green building and contributes to the health and well-being of the tenants. AVA Little Tokyo is a smoke-free building, reducing occupants' exposure to second-hand smoke. The MERV 8 air filters surpass industry standards, effectively trapping and capturing a greater number of airborne pollutants. All units provide fresh air directly, and a low-volume, continuously running exhaust fan ensures that stagnant or moist air is not trapped for extended periods. Bath fans are equipped with automatic humidistats, which activate when moisture levels increase in bathrooms.

The paints, primers, sealants, glues, carpeting, and flooring used in the project contain low levels of volatile organic compounds (VOCs), which can be harmful when inhaled. These measures, combined with the building envelope's insulation and natural ventilation, as shown in Plate I, enhance thermal comfort and indoor air quality, promoting a healthier indoor environment and potentially minimizing sick building syndrome.



Plate I: Building Envelope and Building Interior

Source: Avalon Communities (2019)

ii. Sustainable Site

The heat island effect is caused by the sun's heat striking surfaces such as parking lots, steel, and glass structures, which absorb and then give off heat. Vehicle parking for AVA Little Tokyo is located entirely underground, maximizing space and minimizing the urban heat island effect.

AVA Little Tokyo's roof is made of a white membrane, which keeps the upper units cool and helps reduce the heat island effect. Cooler units also result in reduced air-conditioning usage, saving tenants approximately 15% to 20% on cooling costs and reducing wear-and-tear on equipment.

In terms of waste reduction and recycling, all water waste on the site is recycled for use in flushing toilets and watering plants. The water from the pool shown in Plate II is recycled and utilized for flushing toilets and watering the green areas. During construction, all recyclable materials were reused on-site. Organic waste is sold to nearby farms as manure, while inorganic waste is given to waste management agencies for the purpose of recycling and upcycling.



Plate II: The pool

Source: Avalon Communities (2019)

Observation: Merits and Demerits of the Eco-friendly Practices Adopted by AVA Little Tokyo

Table 4.1: Summary of Findings on AVA Little Tokyo Eco-friendly Design Checklist Scale Factor: Excellent=5, Adequate=4, Acceptable=3, Fair=2, Poor=1

Variable	**Features**	**Method Adopted**	**Scale Factor**	**Remarks**
Energy efficiency	Efficient HVAC system ducts and low e devices	Use of properly sealed ducts and high efficacy lighting	5	Excellent
Water efficiency	Drought-resistant plants, low-flow fixtures	Use of drought-tolerant plants to reduce the need for constant watering and use of low-flow fixtures	4	Adequate
Material conservation	Environmentally friendly wood, recycled foundation	Foundation aggregate and building insulation were from recycled construction materials	4	Adequate
Humane adaptation	MERV air filters, paints, primers and sealants	Use of filters to purify indoor air, and low impact volatile organic compound for the indoor environment	3	Acceptable
Waste reduction and recycling	Recycled building materials, water, and inorganic waste	Reuse of water on site, use of inorganic waste for compost	3	Acceptable

Source: Author's fieldwork

Case Study 2: Heritage Place Ikoyi

Background Information

Heritage Place Ikoyi, as shown in Plate 4.2, sits in a prime location in Lagos, advantageously situated at the crossroads of Lugard Avenue and Kingsway Road. The project is registered with the U.S. Green Building Council for Leadership in Energy and Environmental Design (LEED) certification and is rated at 45/110 points. It comprises 15,600 sq. m of office space over eight floors and five levels of parking for the building users and surrounding users. The large floor plates offer great flexibility and efficiency to the modern occupier and are fitted to internationally recognized Grade A standards, available from 450 sq. m to 2,000 sq. m. All the offices have equal access to the reception, meeting, and dining area on the ground floor and over 350 private car parking spaces.



Figure 4.2: Satellite Map Location of Heritage Place

Source: Google maps (2019)

CONCLUSION AND RECOMMENDATIONS

Conclusion

The integration of arts and design in creating a sustainable built environment is a critical aspect of addressing the pressing challenges of our time. This research project has explored the significance of arts and design in fostering sustainability, promoting environmental consciousness, and enhancing the quality of life in urban spaces. Through the analysis of various case studies and examples, it has become evident that arts and design can play a transformative role in sustainable architecture, urban planning, and infrastructure development. By incorporating artistic elements and design principles, we can create buildings and structures that are energy-efficient, environmentally friendly, and visually appealing. However, it is crucial to recognize that the integration of arts and design into sustainable built environments requires interdisciplinary collaboration, involving architects, urban planners, artists, designers, and other stakeholders. The research project has highlighted the importance of fostering partnerships and creating platforms for knowledge exchange and collaboration.

In conclusion, arts and design have a significant role to play in creating a sustainable built environment. By embracing creativity, innovation, and community engagement, we can construct cities and buildings that are not only environmentally sustainable but also aesthetically pleasing, socially inclusive, and conducive to a high quality of life. It is through such holistic approaches that we can build a future where sustainability and artistic expression go hand in hand, enriching our cities and the lives of their inhabitants.

Recommendations

The following recommendations can be implemented to incorporate arts and design into a sustainable built environment:

1. Conduct awareness campaigns, workshops, and training programs aimed at stakeholders. These activities should enhance their understanding of the benefits and potential of integrating arts and design into sustainable building practices. The initiatives should emphasize the role of arts and design in enhancing sustainability outcomes, dispel misconceptions, and showcase successful examples.

2. Foster collaboration among architects, designers, urban planners, policymakers, artists, and sustainability experts. This collaboration should be encouraged in the early stages of project planning to facilitate the integration of arts and design. By adopting an interdisciplinary approach, innovative design solutions can be developed that seamlessly incorporate sustainability principles and artistic elements.

3. Embrace low-impact design and construction methods to minimize energy consumption during the construction and operation of mixed-use buildings. When clearing a site, efforts should be made to preserve the existing ecosystem, and any necessary removal of vegetation should be accompanied by transplantation. Additionally, maximizing the use of vertical space can help reduce disturbances to the earth during the construction process.

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