



ASSESSMENT OF THE APPLICATION OF ECO-FRIENDLY STRATEGIES IN RESORT BUILDINGS IN NORTH-CENTRAL NIGERIA

TSADO, S. B. & AKANDE, K. O.

Department of Architecture, Federal University of Technology Minna, Nigeria

ABSTRACT

It has been observed that the built environment contributes to the relationship between humanity and nature. To achieve this, researchers suggest that the desires of humans, the integrity of both natural and managed ecosystems, the design of nature, economic sustainability, the ecological economics, various indigenous biodiversity, and the environmental literacy available for sustainable development, resource conservation, and protection of the natural world; all have need to be considered. This paper aims to weigh the use of eco-friendly strategies in resort buildings in Nigeria as it affects the relationship between humans and nature. This would be carried out through the use of questionnaires which were administered to 250 building design team members, visitors and users of resort buildings in North-central Nigeria. Analysis helping software like the SPSS and MS-Excel were used in analysing the data through the Likert-scale and Mann-Whitney U-test while presentations made through charts and figures. This evaluation considered the progress made from previous researches in the identification of eco-friendly strategies as well as the synergy of both ecology and the built-environment. It is recommended that the relationship and the responsiveness of the stakeholders is considered in Biophilic design. This research would help in guiding building designers and landscape specialists in enhancing ecology in resort design in Nigeria.

Keywords: *Biophilic Design, Built Environment, Ecology, Humans, Nature*

INTRODUCTION

The world has observed some level of major industrial and technological revolution since the medieval ages. Regardless of its commended benefits to humanity, this revolution has resulted in a worrisome low level of interaction with our environment (Emmanuel, Jerry, & Dzigbodi, 2018). An example of this is the absence or low-number of buildings designed to blend with the site and its features, this not only means gap between man and nature but also makes very little or low room for the exploration of the incentives the original site environment makes for the building from a sustained ecology to improved environmental awareness and human nature relationship. The case

of the tourism industry as in the case of holiday resort centres cannot be taken out of this discussion. Given the definition of tourism by the World Tourism Organization (WTO) as an activity involving the travel of people to places outside their usual environment for leisure, it is indicative of how such activities may benefit host and local economies and communities. However, Yozcu & Cetin (2009) proved that the tourism industry is very susceptible to crises of different origins. Examples include natural disasters, political crises, epidemics, economic crises, and terror.

However, the need for an eco-friendly design cannot be over-emphasized. Going further, it is important to define the term eco-friendly. Eco-friendly is formed from two terms with the first being "eco", which is described by the Macmillan dictionary, is an abbreviation for ecology, and defined as the system of relationships between living things and their environment. While, the term "Friendly" implies beneficial, or at least not harmful. Knowing resort is a place frequented for relaxation, usually a place which has natural and cultural features, with other relevant services. According to Yusuf (2019), the use of conventional strategies in the design of resorts over time has created an adverse effect on the environment and, ultimately, on human health. It is in line with this that this paper attempts to weigh the use of eco-friendly strategies in resort buildings in Nigeria as it affects the relationship between humans and nature.

ECO-FRIENDLY STRATEGIES

The eco-friendly strategy is adopted to make a place more attractive while sustaining and improving the existing ecosystem. In Nigeria, eco-friendliness and other green concepts that consider both sustainability and environmental issues are rarely put into consideration when designing a new building or renovating an old one (Otegbulu & RSV, 2011). From literature reviewed, this paper grouped the application of eco-friendly strategies into five (5) based on the emphasis in their application in the different parts and components of the building;

Emphasis on the topography

This is seen in the arrangement of the spaces in the building, the topography is highlighted in the exposure of landscape views to multiple interior spaces, while making room for solar exposure and facilitating natural ventilation (Scott, 2006). This integrates the land on the site to the building form (Scott, 2006). Equipe ArchDaily Brasil (2021) wrote of buildings which have been identified for using the eco-friendly strategy with emphasis on the topography by bringing the experience of the external environment into the building.

Emphasis on microclimate and space

This deals with majorly the severe parts of the prevailing climate on the site by making the building to fit it through the use of passive techniques (Scott, 2006; Fazlic, 2008). Insulating the building envelope is important as a well-insulated building can reduce

energy consumption by 50% due to the low heat loss or gain and its effects on the occupants (Akadiri *et al.*, 2012). This strategy adopts techniques like daylighting, porosity, shading and passive cooling (Maleki, 2011; Scott, 2006). Use of passive energy design techniques can aid in the comfort of the occupants and users of the built space and hence, making them at-home in it (Akadiri *et al.*, 2012).

Emphasis on typology and assemblies

This works with specificity of particular forms and physical architectural style or language to arrange public and private zones, indoor and outdoor zones and all the spaces that make up the architecture of the building while considering the volume and the experience of the occupant in it (Scott, 2006). This considers the thermal mass, solar shading devices, roof overhangs, forms, verandas, courtyards, and other interior and exterior spaces (Fazlic, 2008; Scott, 2006) A well-insulated building envelope can help in mitigating heat loss and heat gain (Amaral *et al.*, 2020). Using photovoltaics for passive heating of indoor spaces is also advantageous (Amaral *et al.*, 2020). The implementation of night-time ventilation, earth-air heat exchange is beneficial alternatives (Amaral *et al.*, 2020; Akadiri *et al.*, 2012). Energy conservation can also be achieved with; Materials that require less energy during construction like precast slabs, Products that conserve energy like CFL lamps, Materials that help reduce the cooling loads like aerated concrete blocks, and Fixtures & equipment that help conserve water like Dual flush cisterns.

Emphasis on ecology and resources

This works with materials available and resource in the ecology into the design of the building. This works on using reuse, recycling and recyclable materials while eliminating toxic, volatile organics and carcinogenic compounds (Fazlic, 2008; Scott, 2006). This also ensures the planting of trees and the creation of green spaces in the built space both in the interior and the exterior (Scott, 2006). Choosing materials with low embodied energy will help reduce activities that dampen the ecosystem like mining, and the other processes that are involved in their production (Akadiri *et al.*, 2012). This also considers the proximity of the building and the materials used for it to its location, anything other than this can lead to a high level of energy and financial cost (Akadiri *et al.*, 2012). Recyclable materials can be chosen because; they can be Reused or recycled as different product like Steel, aluminium, or they are biodegradable (meaning they decompose easily) like Wood or earthen materials. Some of these also add Performance to the building structure, like; reducing material use showing energy efficiency as well as helping in reducing the dead load of a building, an example is Ferrocement. Some materials are exceptionally durable, or require low maintenance like PVC pipes.

Emphasis on effective implementation of waste management

This involves the engagement of reusable and recyclable building materials (Akadiri *et al.*, 2012), use of nature based building materials as alternatives like mycelium-biomass

and mycofilters, placement of waste systems into the building by design such as water recycling (Akadiri *et al.*, 2012; Amaral *et al.*, 2020 Elgizawy *et al.*, 2016). Reduced energy use, reduced pollution, reduced water use, and reduced waste all cause for a green environment and lead to healthy living (Fazlic, 2008). Pollution reduction for Air pollution can be mitigated with the use of materials with low VOC emissions like Cement paints, while Water pollution can be achieved with materials that prevent leaching, and Land pollution through the use of materials that reuse waste that would otherwise have resulted in landfill like FlyAsh bricks.

There are seven principles for ecological design that were brought forward: (Shu-Yang, Freedman, & Cote, 2004; Lak, Hasankhan, & Garakani, 2020):

1. The need to meet the inherent needs of humans and their economies;
2. The requirement to sustain the integrity of the structure and function of both natural and managed ecosystems.
3. The appropriateness of emulating the inherent designs of nature in anthropogenic management systems is discussed.
4. The need to make progress towards a sustainable economy through greater reliance on renewable resources and more focus on recycling, reusing, and efficient use of materials and energy;
5. The use of ecological economics (or full-cost accounting) to comprehensively take resource depletion and environmental damage into consideration and thereby address issues of natural debt;
6. The need to conserve natural ecosystems and indigenous biodiversity at viable levels; and
7. The desirability of increasing environmental literacy to build social support for sustainable development, resource conservation, and protection of the natural world.
8. Recent samples of the application of these principles of ecological design to the planning and management of human surroundings, industrial spaces and networks, architectural practice, and products have shown how much this idea has to give to the immediate need for quick physical advancement towards a sustainable human economy.

METHODOLOGY

Applying eco-friendly strategies in resort buildings as found from literatures reviewed can be directly influenced by the; location, climate, topography and available building materials. These features also influence the nature of the buildings constructed in the area due to; embodied energy that would be necessary for the application of the eco-friendly strategies, available man-power with the skill-set for the eco-friendly strategies, and knowledge of the eco-friendly strategies. The north central region of Nigeria is blessed with beautiful terrains and in it are found some resorts namely; the Jos wildlife park, Plateau state, Wonderland amusement park and resort, Abuja (Federal Capital

Territory), Millennium park, Abuja (Federal Capital Territory) and the Murtala park in Minna Niger state.

The instruments that were used for this research were questionnaires. This instrument was applied for the assessment of the eco-friendly strategies applied in resort buildings. The sample size for the distribution of questionnaire in this study area is two hundred and fifty (250) as administered to the stakeholders of resort buildings, which includes owners, visitors, workers, and built environment professionals who are also the designers and builders. Their se are data obtained directly onsite by the researcher of this thesis, they include; Professional opinion on eco-friendly strategies. The method of data analysis that was adopted for this study was the quantitative data analysis methods as the Likert-scale and Mann Whitney-U were used with the aid of SPSS and Microsoft office excel package in making the assessment for this paper. Figures, tables, and charts were used for the presentation and interpretation of the results from the analysis.

RESULTS AND DISCUSSION

Questionnaires were administered to about two hundred and fifty (250) from which 52 was valid from a response rate of 27% (Table 1 and 2) leading to 92% of the calculated sum was given to respondents in the different groups that and other stakeholders in the use, administration, design and construction of holiday resort buildings. These personnel were people of different cadre of experience in their particular experience as stakeholders in the hospitality industry. The data obtained with a very high reliability of 0.943 (Table 2) were analysed in this study.

Table 1: Results of questionnaires on collection

	<i>Frequency</i>	<i>Percentage administered (%)</i>	<i>Percentage response (%)</i>	<i>Percentage response (%)</i>
Total administered	250	100	-	-
Total response	68	27	100	-
Valid response	55	22	81	100

Table 2: Case Processing Summary for all variables

		<i>N</i>	<i>%</i>
Cases	Valid	52	98.1
	Excluded ^a	1	1.9
	Total	53	100.0

a. Listwise deletion based on all variables in the procedure.

Table 3: Reliability Statistics for all variables

<i>Cronbach's Alpha</i>	<i>Cronbach's Alpha Based on Standardized Items</i>	<i>N of Items</i>
.950	.943	31

The opinion of the stakeholders from tables 4, 5 and 6 showed that there was disagreement that Electricity(Energy) supply was basically from renewable sources while they were neutral on the statements that the holiday Resorts adopts eco-friendly design strategies as a way to reduce the negative impacts of buildings on their natural environment, Resort provides adequate and proper waste management, Efficient Landscaping and responsible environmental activities, and Efficient Water supply & management.

To help in the assessment, and in testing the results to see the agreement of built environment professionals and other holiday resort stakeholders on the experience of users to the eco-friendly strategies as applied by holiday resorts in the Northern Nigeria, the **hypothesis** below was made;

H₀: There is a significant difference in the opinion between the opinion of the built environment professionals and the other stakeholders in the holiday resorts on the experience of users to the eco-friendly strategies as applied by holiday resorts in the Northern Nigeria.

Table 4: Number of respondents per opinion on eco-friendly strategies for a holiday resort

	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Total</i>
A	7	9	16	13	8	53
B	11	29	6	4	3	53
C	11	14	14	11	4	54
D	6	13	13	12	9	53
E	10	13	10	15	5	53
The holiday Resorts adopts eco-friendly design strategies as a way to reduce the negative impacts of buildings on their natural environment						A
Electricity(Energy) supply is basically from renewable sources						B
Resort provides adequate and proper waste management						C
Efficient Landscaping and responsible environmental activities						D
Efficient Water supply & management						E

Table 5: Sum of respondents on eco-friendly strategies for a holiday resort

	<i>Strongly Disagree X1</i>	<i>Disagree X2</i>	<i>Neutral X3</i>	<i>Agree X4</i>	<i>Strongly Agree X5</i>	<i>Total</i>
A	7	18	48	52	40	165
B	11	58	18	16	15	118
C	11	28	42	44	20	145
D	6	26	39	48	45	164
E	10	26	30	60	25	151

The holiday Resorts adopts eco-friendly design strategies as a way to reduce the negative impacts of buildings on their natural environment	A
Electricity(Energy) supply is basically from renewable sources	B
Resort provides adequate and proper waste management	C
Efficient Landscaping and responsible environmental activities	D
Efficient Water supply & management	E

Table 6: Relevance of eco-friendly strategies for a holiday resort

<i>Measured Variable</i>	<i>Num ber</i>	<i>Su m</i>	<i>Me an</i>	<i>Interpr etation</i>
The holiday Resorts adopts eco-friendly design strategies as a way to reduce the negative impacts of buildings on their natural environment	53	165	3	<i>Neutral</i>
Electricity(Energy) supply is basically from renewable sources	53	118	2	<i>Disagree</i>
Resort provides adequate and proper waste management	54	145	3	<i>Neutral</i>
Efficient Landscaping and responsible environmental activities	53	164	3	<i>Neutral</i>
Efficient Water supply & management	53	151	3	<i>Neutral</i>

From the Mann-Whitney U-test, it was found that there is a significant difference in the opinion of the built environment professionals (standard deviation=0.8794, mean=2.6833, median=3, n=36) and the other stakeholders in the holiday resorts by a small effect (standard deviation=1.2487, mean=3.0235, median=3, n=17), $U=261$, $z=-0.860$, $p=0.390$, $r=0.118$ (Table 7 and 8). Hence, the hypothesis H_0 , which states that there is a significant difference in the opinion between the opinion of the built environment professionals and the other stakeholders in the holiday resorts on the experience of users to the eco-friendly strategies as applied by holiday resorts in the Northern Nigeria, is true (figure 1).

Table 7: Mann-Whitney Test Ranks

		<i>Category of respondents</i>	<i>N</i>	<i>Mean Rank</i>	<i>Sum of Ranks</i>
Applied Strategies	Eco-Friendly	built environment professionals	36	25.75	927.00
		Others	17	29.65	504.00
		Total	53		

Table 8: Mann-Whitney U Test Statistics with Grouping Variable: Category of respondents

<i>Applied Eco-Friendly Strategies</i>	
Mann-Whitney U	261.000
Wilcoxon W	927.000
Z	-.860
Asymptotic Significance (2-tailed)	.390

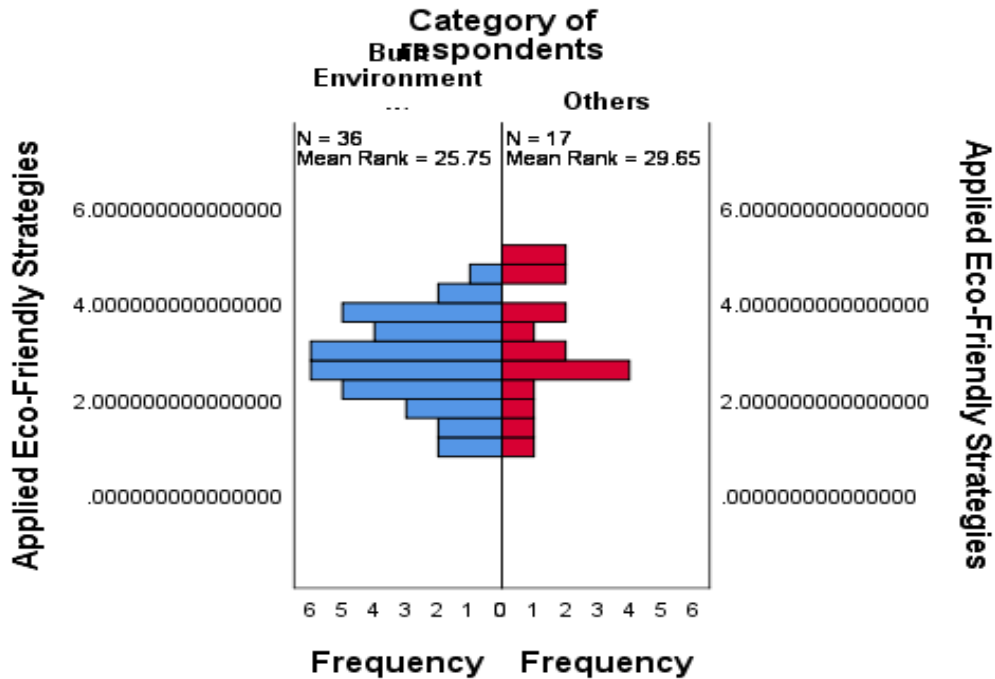


Figure 1: Independent-Samples Mann-Whitney U Test for Applied Eco-Friendly Strategies

CONCLUSION

From the results above, due to the neutrality and disagreement of the respondents to the application of Eco-friendly strategies in resort buildings applied. It is therefore, safe to assert that in north central Nigeria, it is either that Eco-friendly strategies are not in use or are sparingly used. There is a lot of things that can cause this outcome. It could be that the concept is not well known by the populace or the built environment is not fully aware of them or it is challenged by the absence of sufficient knowledge, skills and resources. In Nigeria, rarely are there buildings with a holistic approach to sustainable design, the operating climate for construction remarkably differs from what is obtained in Western Europe for instance where there is a strong sustainability drive in the construction sector and a lot of the sources of information helping to shape the practice of sustainable construction originate from outside of Nigeria (Dania, 2017). As asserted by Olagunju et al. (2017), there is also a need for education of energy efficiency and resource capacity among built environment professional to ensure sustainability in the application of Eco-friendly techniques in resort buildings design. Dauda and Akande (2018), Zhiri & Akande (2018) and Zhiri & Akande (2020) also added that the education should include the addition of ecological features to reduce ecological degradation and an inclusion of passive design techniques to reduce energy consumption which can lead to environmental pollution. From Nwishiényi and Akande (2018) the concept of eco-

efficiency also can be considered in the design and construction of eco-friendly resort buildings as it encourages innovation and sustainability.

RECOMMENDATION

There is a gap between empirical knowledge of eco-friendly principles adapted to buildings in Western Europe and the principles adapted to buildings in Nigeria. Further research and education should be made on built environment professionals in encouraging the adoption of eco-friendly strategies.

REFERENCES

- Akadiri, P. O., Chinyio, E. A., & Olomolaiye, P. O. (2012). Design of a sustainable building: A conceptual framework for implementing sustainability in the building sector. *Buildings*, 2(2), 126-152.
- Amaral, R. E., Brito, J., Buckman, M., Drake, E., Ilatova, E., Rice, P., ... & Abraham, Y. S. (2020). Waste management and operational energy for sustainable buildings: a review. *Sustainability*, 12(13), 5337.
- Dania, A. A. (2017). Sustainable construction at the firm level: case studies from Nigeria. Doctoral dissertation, University of Reading.
- Dauda, C. G., & Akande, O. K. (2018). Evaluation of Eco-Friendly Approach for the Physically Challenged People in Nigeria. *Contemporary Issues and Sustainable Practices in the Built Environment. In School of Environmental Technology Conference, SETIC*. Minna, Nigeria.
- Elgizawy, S., Nassar, K., & El-Haggar, S. (2016). Quantification of construction waste: Egypt case study. In *4th International Conference on Sustainable Solid Waste Management* (pp. 23-25).
- Emmanuel, A. Y., Jerry, C. S., & Dzigbodi, D. A. (2018). Review of environmental and health impacts of mining in Ghana. *Journal of Health and Pollution*, 8(17), 43-52.
- Equipe ArchDaily Brasil. (2021). Architecture and Topography: 25 Projects with Different Approaches to Relief. Received from Archdaily Web Site: <https://www.archdaily.com/924149/architecture-and-topography-15-projects-with-different-approaches-to-relief>
- Fazlic, S. (2008). Design strategies for environmentally sustainable residential skyscrapers. In *CTBUH 8th world congress, Dubai* (pp. 1-11).
- Lak, A., Hasankhan, F., & Garakani, S. A. (2020). Principles in practice: Toward a conceptual framework for resilient urban design. *Journal of environmental planning and management*, 63(12), 2194-2226.
- Maleki, B. A. (2011). Shading: Passive cooling and energy conservation in buildings. *International Journal on Technical and Physical Problems of Engineering (IJTPE)*, 3(4), 72-79.
- Nwshienyi, A. O., & Akande, O. K. (2018). Eco-Efficient and Innovative Measures for Sustainable University Senate Building in Nigeria: The Case for Research. In *Proceedings of the 3rd Nbiennial Africa International Renewable Energy Conference (SOLAR Africa 2018)* Usman Danfodio University, Sokoto, Nigeria.
- Olagunju, R. E., Akande, O. K. & Metu, J. N. (2017). Investigation into Green Attitudes towards Shopping Malls' Design in Minna, Nigeria.
- Otegbulu, A. C., & RSV, F. (2011). Economics of green design and environmental sustainability. *Journal of Sustainable Development*, 4(2), 240.
- Scott, A. (2006). Design strategies for green practice. *Journal of Green Building*, 1(4), 11-27.
- Shu-Yang, F., Freedman, B., & Cote, R. (2004). Principles and practice of ecological design. *Environmental Reviews*, 12(2), 97-112.
- Yozcu, O. K., & Cetin, G. (20019). A Strategic Approach to Managing Risk and Crisis at Tourist Destinations. In *In Tourist Destination Management* (pp. 273-287). Springer, Cham.
- Yusuf, M. O. (2019). Synergistic-effect of iron-filing and silica-fume on the absorption and shrinkage of cement paste. *Инженерно-строительный журнал*, 7, 16-26.

- Zhiri, G. H. & Akande, O. K. (2018). Passive Techniques for Energy Conservation in Hotel, Buildings in Minna, Nigeria. *Contemporary Issues and Sustainable Practices in the Built Environment. In School of Environmental Technology Conference, SETIC* (pp. 95-104). Minna, Nigeria.
- Zhiri, G. H. & Akande, O. K. (2020). Architectural Interventions for Passive Cooling of Hotel Buildings in Minna, Nigeria. *Architectural Journal 3(1)*, 89-99. ISSN (Print): 2636-6747.