



CRITERIA FOR PUBLIC GREEN BUILDING DESIGN IN SAVANNAH AREA: A CASE STUDY OF BAUCHI METROPOLIS FITNESS CENTERS

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ABSTRACT: *Green construction methods and buildings have emerged as a major trend that is here to stay. Green buildings are becoming commonplace, from eco-friendly residential construction to multibillion-dollar business projects. As a result, eco-friendly structures generate less waste, greenhouse gas emissions, and natural resource consumption. In order to reduce architectural disability and increase diversity in the built environment, the seven main universal design principles improve the wide usage of places. The goal of the study is to examine several standards that should be used when creating a well-designed structure that can provide a standard and safe environment for activities. To enable research triangulation and a broad range of data collection, a qualitative research approach was employed for the study. Transcription, review themes, and familiarization, content analysis of interviews, visual surveys, and observation of the relevant case studies chosen for the study are among the data collection tools which are employed in this investigation. The study discovered that in all of the chosen cases examined, there is a limited application of general universal design principles, which makes the structures unmarketable. Additionally, it was discovered that none of the chosen case studies contained any unique or specialized buildings that sufficiently satisfied the architectural specifications of an eco-friendly structure. As a result, the study specified standards to be applied in the planning and development of an environmentally friendly, sustainable structure.*

KEYWORDS: Bauchi metropolis, Buildings, Green, Sustainability, Techniques.



INTRODUCTION

Green building is a building that uses fewer natural resources as well as renewable and or alternative resources that produces fewer greenhouse emissions and waste. Some green buildings create a positive impact on the environment around them and contribute to improving the global climate (Nallathiga, et al. 2022). Green building also known as green construction or sustainable building refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition (Srivastava, et al. 2022). It is designed, constructed, and operated to enhance the well-being of its occupants and support a healthy community and natural environment.

The five principles of green building are:

- Livable communities
- Energy efficiency
- Indoor air quality
- Resource conservation
- Water conservation

LITERATURE REVIEW

Being physically active has always been crucial to life. The evolution of fitness can be ascribed to man's drive for survival and can be traced back to the beginning of mankind where people would keep physically fit in order to hunt and survive, (Baloh, 2022). It is theorised that when people left a hunter-gatherer lifestyle and developed stable communities focused on agriculture. Physical fitness levels declined. This is not to argue that levels of physical labour were reduced, but that the type of work conducted was not necessarily as conducive to a general level of fitness. As such, regulated workout routines were either invented or became increasingly prevalent.

Fitness facilities first developed following the fall of the Greco-Roman Empires; gyms, along with art and music, vanished since it was frowned upon to value and pursue a well-defined body (Murtha et al., 2021). In classical societies like Ancient Greece and Rome, this was particularly true. In Greece, physical fitness was regarded as an essential component of a healthy existence and it was the standard for men to frequent a gymnasium (Martinovic, et al 2021). Regimens for physical fitness were also seen to be crucial to a country's capacity to prepare its soldiers for an effective armed force. Partly for these reasons, organized fitness routines have throughout known history and evidence of them can be found in many places.

Nowadays, more people are realising how important fitness centers are for encouraging physical fitness and overall wellness. Therefore, even while it can be acknowledged that this is a positive step toward improving the general public's level of fitness and health, it should not be surprising that there has been a recent growth in the opening of fitness centers in our culture.



Nigerians' greater understanding of the many advantages of exercise has led to a rise in their desire to exercise, resulting in the growth of fitness centers that, by all accounts, lack conventional operating procedures and design.

Proliferation is ensuring that people working in health and fitness businesses have the minimum qualification before they apply for certification with various organisations or associations. Health and fitness center providers are required by regulation to apply for registration, obtain a licence to operate, and adhere to the scope of practice as advised by the accreditation committee. (Iwuoha, 2015; Adeogun et al. 2019). Choosing to become certified as an exercise physiologist is a crucial step towards being acknowledged as a qualified practitioner. By determining whether a professional meet predetermined standards of competence in the knowledge, skills, and abilities required to perform the job safely and effectively, a certification's main goal is always to safeguard the public from harm. For professional, a certification can separate him or her from those who have not proven themselves to be at the same level of competence (Adeogun, et al. 2019).

As stated by Òatrevičs et al. (2021). The goal of green buildings is to lessen the overall impact of the built environment on human health and the natural environment. New technologies are continuously being developed to complement existing methods in developing greener structures.

- i Efficiently using energy, water, and other resources
- ii Protecting occupant health and improving employee productivity
- iii Reducing waste, pollution, and environmental degradation.
- iv Energy efficiency and conservation: measures to reduce energy consumption and maximize the efficiency of the energy used.
- v Renewable Energy: using renewable energy like solar and wind power to meet the needs of the building as a whole or in part.
- vi Effective use of water: water use reduction efficiency and greywater recycling.
- vii Effective waste and emissions management: use of measures to reduce waste generation and facilitate reuse and recycling. Implementation of measures to minimize or offset emissions and pollution, especially air and water pollution.
- viii Sustainable Construction Materials: the building is constructed with non-toxic, ethically sourced materials, sustainably sourced from suppliers with minimal environmental impact.
- ix Environmentally Conscious Construction Methods: the use of construction techniques that focus on reducing the impact of construction on the surrounding natural environment by reducing noise and light pollution and protecting local flora and fauna from harm during the construction phase.
- x Harmonious Design: buildings designed to make the most of features like natural lighting and ventilation for heating/cooling. Designed to fit harmoniously into the surrounding natural environment and contribute to the preservation of local ecology.



- xi Socially Responsible Design: buildings designed to be beneficial to their human occupants and improve their health and well-being.
- xii Circular Life-cycle Design: buildings designed with their full life-cycle in mind, from conception to operation, and from renovation and adaptation to eventual demolition.

Over the past ten years, sustainable building techniques have changed significantly and continue to be developed. Awareness of environmental issues and the implications of the construction process on the natural environment has increased, leading to greater 'best practices' for the industry and tighter legislation limiting how construction is handled. These vary by location and are usually considered throughout the design and planning stages of development. However, the guiding concepts underlying these measures remain the same and are closely related to the goals of eco-friendly construction above (Fauzan, et al. 2021). The two most important factors to take into account are waste production and resource utilization:

- i Use resources and materials that are renewable, sustainable, and ethically sourced.
- ii Make use of reclaimed and recycled materials as far as possible
- iii Limit the waste generated by construction, reuse as many materials as possible, and dispose of any unusable materials as responsibly as possible
- iv Make use of methods and techniques that produce the least emissions and pollution
- v Use locally sourced materials and labor
- vi Focus on energy and water conservation during and after the build

According to (Lu, et al. 2021). Environmentally conscious builders often use of renewable energy, reclaimed or repurposed materials during construction.

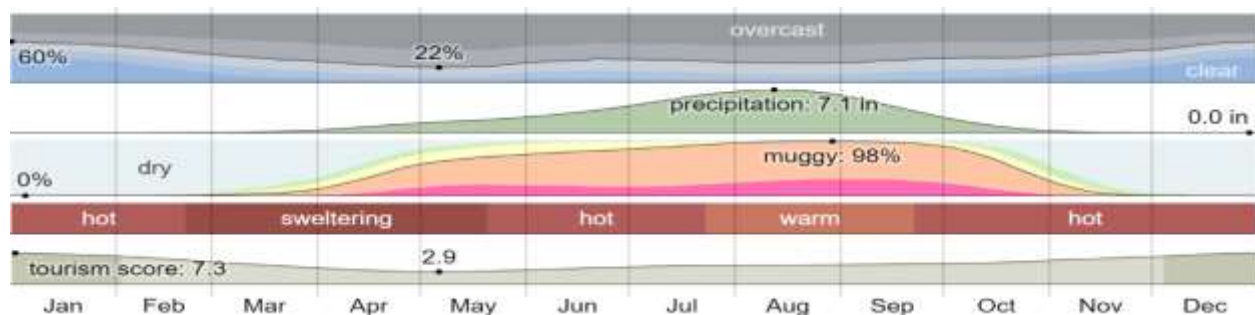
These Green building materials include:

- i Reclaimed Timber
- ii Recycled Steel
- iii Bio composites
- iv Mycelium – mushroom insulation and particleboard replacement
- v Bark siding
- vi Tesla Solar Roof Shingles
- vii Adobe And Rammed Earth
- viii Grasscrete Paving
- ix Ferrok
- x Insulated Concrete Forms
- xi Plant-Based Polyurethane Rigid Foam
- xii Straw Bales
- xiii Structural Insulated Panels

- xiv Plastic Composite Lumber
- xv Bamboo and Hemp
- xvi Low-Emissivity Window Glass and Vacuum Insulation Panels

METHODOLOGY

Situated between latitudes $9^{\circ} 3'$ and $12^{\circ} 3'$ north of the equator, Bauchi state has a total land area of 49,119 km², or roughly 5.3% of Nigeria's total land mass. Longitudinally, the state sits between $8^{\circ} 50'$ and 11° east of the Greenwich meridian. Seven states border the state: Taraba and Plateau to the south, Gombe and Yobe to the east, Kaduna to the west, and Kano and Jigawa to the north. One of the states in northern Nigeria that spans two separate vegetation zones—the Sudan savannah and the Sahel savannah—is Bauchi State. The southern portion of the state is covered in Sudan savannah flora. In general, the flora is less uniform and the grasses are shorter than what grows even farther south, that is, in the middle belt's forest zone. However, the vegetation becomes increasingly richer as one moves south, particularly beside water sources or rivers. As one travels from the south to the north of the state, the Sahel type of savannah—also referred to as the semi-desert vegetation becomes apparent. Bauchi State, located in the North-Eastern portion of Nigeria is characterised with hot – humid climate condition which experiences variance in climatic factors due to daily weather variations consequently producing imbalance and discomfort in buildings the Sahel savannah.



Source; https://weatherspark.com/y/61868/Average-Weather-in-Bauchi-Nigeria-Year-Round#google_vignette

Bauchi metropolis in Bauchi local government of Bauchi state made up the primary population for this study. There are 9 fitness facilities functioning in Bauchi metropolitan according to the coalition of fitness club associations. These are;

1. Sani Abacha Gymnasium, Murtala Muhammed Way, Bauchi.
2. 02 fitness center, Yakubun Bauchi road, Bauchi.
3. Babayo Liman Sports Arena, Gida Dubu housing estate, Bauchi.
4. City Gymnasium, Old GRA Bauchi
5. Gym 4 She, Adamu Jumba Road, Bauchi
6. Lys Gymnasium, Bauchi



7. Newlook Beauty Parlour and Gymnasium
8. Chinmuntah City, Bauchi
9. Angale Gymnasium, Bauchi.

Because there aren't many fitness centers with comparable features operating in Bauchi city, only five of the nine fitness centers have operational buildings. Purposive sampling is used to select cases that will allow for adequate and appropriate data collection with regard to the theoretical framework. Sani Abacha Gymnasium, Murtala Muhammed Way, Bauchi.

1. 02 fitness center, Yakubun Bauchi road, Bauchi.
2. Babayo Liman sports Arena, Gida Dubu housing estate, Bauchi.

The above 3 fitness centers formed the population of the study and fit the selection criteria of the case studies.

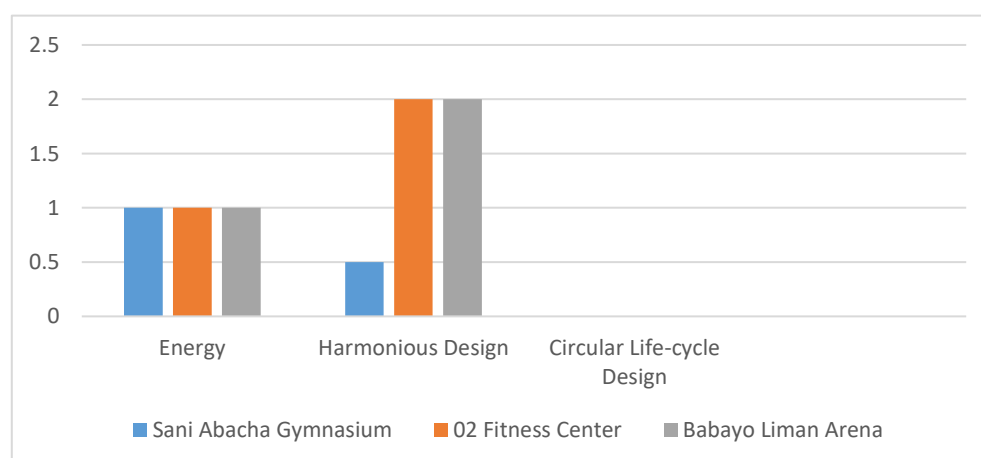
As qualitative research, case studies, visual surveys and interviews are adopted in the cause of this research to ease data collection during the fieldwork. Collected data are then subjected to content analysis using the theoretical frame work of inclusion of the green building features and general design principles.

RESULTS AND FINDINGS

Features of Green buildings considered for the study area include the following;

- i. Energy
- ii. Harmonious Design
- iii. Circular Life-cycle Design

Figure 1 Summary of case study assessment based on the reflection of the features of eco-friendly building.



Key: 1 = Poor, 2 = Not Adequate, 3 = Fairly Adequate, 4 = Adequate, 5 = Very Adequate

Source: Author's field work; (2025)



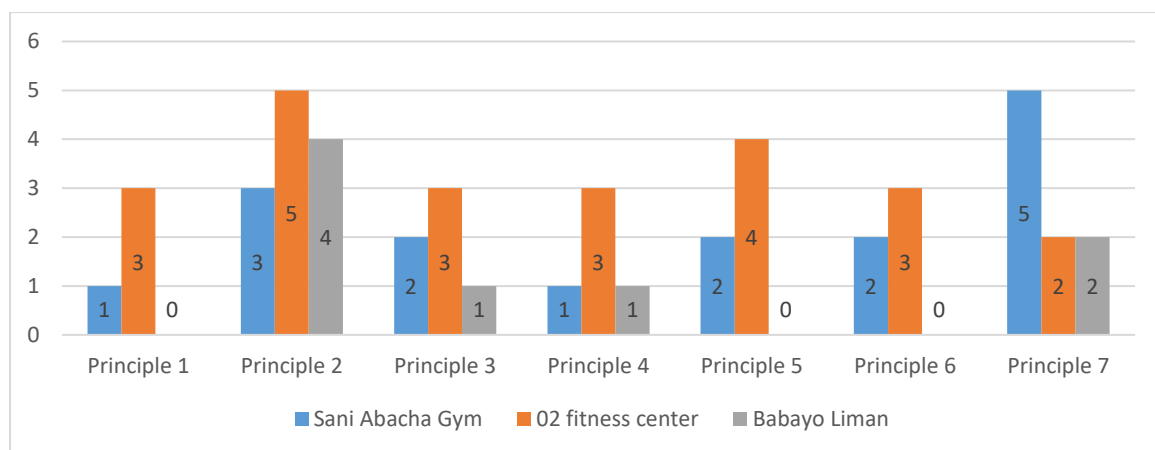
Among the three case studies, Babayo Liman Sport Arena is rated the least in terms of the degree of reflection and application of the seven general universal design principles. This can be attributed to the fact that arena is below the basic requirement for a sporting facility and there were no design considerations made for the arena. The 02 fitness center shows some level of architectural design considerations with respect to some of the principles. The Sani Abacha gymnasium further reflects and applies a little more of the general design principles than the 02 fitness center. A summary of the assessment on the degree of reflection/application of the general design principles is shown in Table 4.1 and in Figure 4.1 below.

Table 1: Summary of case studies assessment based on the level of compliance using the general design principles

Variable	Sani Abacha Gym	02 Fitness center	Babayo Liman Arena
1. Simple and Intuitive Use	1	3	1
2. Equitable Use.	3	2	4
3. Perceptible Information	2	2	2
4. Tolerance for Error.	1	3	3
5. Flexibility in Use.	1	3	2
6. Low Physical Effort.	1	2	1
7. Size and Space for Approach and Use.	5	2	3

Source: Author`s field work; (2025)

Figure 2: Summary of case study assessment using the general design principles



Key: 1 = Poor, 2 = Not Adequate, 3 = Fairly Adequate, 4 = Adequate, 5 = Very Adequate

Source: Author`s field work; (2025).

Plates 1, 2 and 3 below show the various fitness exercises from the cases studied



Plate 1: Sani Abacha Gymnasium in Bauchi is poorly lit and poorly ventilated, and the general design principles are not considered.

Source: *Author`s field work; (2025).*

Plate 2: 02 fitness and physiotherapy center Bauchi is poorly lit and poorly ventilated, and the general design principles are not considered.



Source: *Author`s field work; (2025).*

Plate 3: Babayo Liman Sport Arena, Bauchi is poorly lit and poorly ventilated, and the general design principles are not considered.



Source: *Author`s field work; (2025).*

DISCUSSION

The three selected case studies used in the study indicate that the areas are used in the gaining of physical fitness and because there is no adequate provision for the design requirements of the fitness centers, players and spectators find it difficult to use the available facilities and equipment at the selected case study. This suggests the inadequate consideration of the eco-friendly features and general design principles in the design approach of the selected case studies. This results in the social exclusion the various able and disabled persons from participation in fitness activities and leads to constraining people from using such facilities.

By safeguarding the quality of the air and water and conserving natural resources, these initiatives help to protect our environment for future generations. By enhancing our comfort and well-being and assisting in maintaining a healthy air quality, they benefit us today. Finally, green construction practices are beneficial to everyone's finances since they minimize the need for maintenance and repair, lower utility costs, lower the price of home ownership, and raise property and resale prices. To improve the well-being of residents and to promote a healthy community and natural environment, green buildings are planned, built, and run. Practically, green building refers to a whole-systems approach to construction that incorporates the following criteria:

- Making livable communities a priority
- Making the most of the site's and the sun's natural lighting, heating, and cooling systems for the building
- Water-saving techniques and native, drought-resistant plants for landscaping



- Creating strong, high-quality structures
- Cutting down and reusing debris from construction and destruction
- Providing adequate insulation and ventilation
- Using strong, recycled, recyclable, and ethically sourced components
- Making use of healthy building materials and procedures
- Making use of water- and energy-saving fixtures, appliances, and technology.

CONCLUSION

The design adequately considered the application of features of eco-friendly fitness center and the general universal design principles that can be incorporated in the design of eco-friendly fitness center, the design is useful and marketable to people with diverse abilities to make use of the facilities meaningfully, the design accommodates a wide range of individual preferences and abilities so that different people can use the built environment in different ways and the use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. The design is energy efficient with renewable energy such as solar energy to power the needs of the building as a whole or in part. The building is also designed to make the most use of features like natural lighting and ventilation for heating/cooling and is designed to fit harmoniously into the surrounding natural environment and contribute to the preservation of local ecology.

RECOMMENDATION

The following recommendations are made from the findings and the design proposal.

- i. Designs are to make the most use of features like natural lighting and ventilation.
- ii. Marketable to people with diverse abilities.
- iii. The design should communicate necessary information effectively to the user, regardless of ambient conditions.
- iv. The design should use renewable energy.
- v. The design should fit harmoniously into the surrounding natural environment and contribute to the preservation of local ecology.



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