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ENHANCING GREEN URBANISM FOR SUSTAINABLE DEVELOPMENT IN NIGERIAN CITIES

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Abstract

The aim of this paper is to unveil the relevance of green infrastructure in sustainable cities. The objectives are to: assess environmental benefits of Green design, examine the biophilic culture of the respondents in the study area and identify possible constraints toward green urbanism. The study employed both primary and secondary data. The primary data made used of questionnaires within the college of environmental. The secondary data used include the use of relevant literatures such as Journals, textbooks and online internet sources. The estimated population of the students is about 800. A total of 70 structured questionnaires were administered to all the students of the 400 level (HND) students. The data was analyzed in a descriptive manner of statistical computation using mean values, frequency values and the ranking of the mean scores. The three most ranked of the benefits are Commitment to outdoor oriented activity in a green cities promote and foster social cohesion, biophilic design engagement helps to expand economic opportunities for the least-advantaged and biophilic design helps to enhance livability and quality of life. The study identified that 72.8% of the respondents show care and concern for nature. The study further established that 12.9% of the respondents show a daily biophilic culture suitable to promote the human life. The study established that Legal and zoning ordinance, Short term economic cost, Aesthetic bias of possible organism like snake, bats and spiders are the possible constraints toward green urbanism. This study is strongly recommended to all environmental designers; landscape planner, Architect, Builder, Land surveyors and to all biophilic institution and governance in the field of green designs.

Key word: Green, design, cities, sustainable, environment.

Introduction

Beatley (2010) argued that while integrating green and natural elements into building design is critical, there is much value in fact in getting people out of buildings and to thinking more holistically about the natural qualities and conditions of the larger urban environments in which these buildings sit. Cities serve as centers of trade, storage, and manufacture. The agricultural surplus from the surrounding countryside is processed and distributed in cities. Cities also grew up around marketplaces, where goods from distant places could be exchanged for local products. Throughout history, cities have been founded at the intersections of transportation routes, or at points where goods must shift from one mode of transportation to another, as at river and ocean ports.

Cities and urban environments contain a variety of ecological and green assets, from parks to trees to rivers and riparian habitats, and increasingly, efforts are being made to further enhance the green elements and features of these living and work environments. Daylighting urban streams (taking them out of underground pipes and returning them to the surface), installing trails, planting new trees and forests, community gardens, installing green walls and vertical gardens, are among the many ways in which cities and urban environments can become greener.

While much energy and attention of late has been focused on biophilic design, this has largely assumed a focus on the building or site. Some cities, such as Seattle, have established so-called Green Factor standards, mandating minimum green and landscaping elements for certain types of new development, and other cities, such as Chicago, Baltimore and Montreal, are encouraging the greening of alleyways and other otherwise grey spaces in the city. Many cities have established extensive treeing programs and set ambitious tree-planting goals, with the cities of New York, Los Angeles and Houston each setting the goal of a million new trees. The physical environment of cities, then, represents an essential requisite for creating biophilic cities.

Statement of problems

The conflicting scenario of the rapid depletion in global natural resources simultaneous to the acceleration in global population, it is imperative that the attendant demands on global natural resources are balanced with the 'carrying capacity' of the physical environment (Kadiri, 2006).

Climate change will occur regardless of whether greenhouse gas emission are significant reduced. The effect of climate change on the built environment will depend on the sensitivity and adaptability of the systems (US EPA, 2011 in University of Michigan and US Green Building Council, 2011). This poise a challenge to the global community especially third world nations who are faced with climatic factors such as intense solar radiation, high humidity and condensation, dust and sandstorms and flood which affects the comfort of man and safety of built environment (Elimisiemon, Raymond &Hyeladzira, 2016).

The aim and objectives of the study

The aim of this paper is to unveil the relevance of green infrastructure in sustainable cities

The objectives are to:

1. assess environmental benefits of Green design
2. examine the biophilic culture of the respondents in the study area
3. identify possible constraints toward green urbanism

The Concept of Green Design

The concept green design is also known as *sustainable architecture* or *green architecture* (Elimisiemon and Kagai, 2016). It is an architectural philosophy that is associated architectural design that is environment friendly. It uses the principles of social, economic and ecological sustainability. The concept involves a conscious approach to energy and ecological conservation in the design of built environment. "Green architecture" as the indigenous approach of building practices with the goal of sustaining the ecosystem. It focuses on saving energy production and consumption (Odebiyi, Subramanian&Braimoh, 2010).Green architecture is the systematic consideration of a project's life cycle impact on environmental and energy resources (Nwafor, 2006). According Giaccardo (2004) green design is design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in five broad areas: sustainable site planning, safeguarding water and water efficiency, energy efficiency and renewable energy, conservation of materials and resources and indoor environmental quality.

The main goals of green architecture are to reduce depletion of natural resources (energy, water and raw materials), minimize negative impacts of environment caused by buildings and facilities throughout their lives, and to create better building environment. Nwafor (2006) buttresses the main goals of green architecture mentioned above by highlighting some key features of green

architecture such as need to minimize material and resource consumption and some strategies for achieving this and consequently sustainable construction through efficient use of renewable energy resources and materials; selection of materials and products that minimize life cycle environmental impacts for example, the use of local, natural and renewable/recycled materials; employing construction techniques that enhance energy savings, water and waste minimization; use design that works in harmony with climate, prevailing air movement path and other natural features to achieve comfort

Principles of Green Design

Elimisiemon and Kagai (2016) observed that U.S. Green Building Council (USGBC) identified five fundamental principles of green building and sustainable site design: sustainable site design, water quality and conservation, energy and environment, indoor environmental quality and materials and resources.

Sustainable Site Design-Key Principles:Minimize urban sprawl and needless destruction of valuable land, habitat and green space, which results from inefficient low-density development. Encourage higher density urban development, urban re-development and urban renewal, and brownfield development as a means to preserve valuable green space.

Preserve key environmental assets through careful examination of each site. Engage in a design and construction process that minimizes site disturbance and which values, preserves and actually restores or regenerates valuable habitat, green space and associated eco-systems that are vital to sustaining life.

Water Quality and Conservation-Key Principles:Preserve the existing natural water cycle and design site and building improvements such that they closely emulate the site's natural "pre-development" hydrological systems. Emphasis should be placed on retention of storm water and on-site infiltration and ground water recharge using methods that closely emulate natural systems. Minimize the unnecessary and inefficient use of potable water on the site while maximizing the recycling and reuse of water, including harvested rainwater, storm water, and gray water.

Energy and Environment-Key Principles:Minimize adverse impacts on the environment (air, water, land, natural resources) through optimized building siting, optimized building design, material selection, and aggressive use of energy conservation measures.

Resulting building performance should exceed minimum International Energy Code (IEC) compliance level by 30 to 40% or more. Maximize the use of renewable energy and other low impact energy sources.

Indoor Environmental Quality-Key Principles: Provide a healthy, comfortable and productive indoor environment for building occupants and visitors. Provide a building design, which affords the best possible conditions in terms of indoor air quality, ventilation, thermal comfort, access to natural ventilation and daylighting, and effective control of the acoustical environment.

Material and Resources-Key Principles:Minimize the use of non-renewable construction materials and other resources such as energy and water through efficient engineering, design, planning and construction and effective recycling of construction debris.

Maximize the use of recycled content materials, modern resource efficient engineered materials, and resource efficient composite type structural systems wherever possible. Maximize the use of re-usable, renewable, sustainably managed, bio-based materials. Remember that human creativity and our abundant labor force is perhaps our most valuable renewable resource. The best solution is not necessarily the one that requires the least amount of physical work.

Biophilic cities, urban sustainability and sustainable development

The concept of green design is also known as *sustainable architecture* or *green architecture* (Elimisiemon and Kagai, 2016). It is an architectural philosophy that is associated architectural design that is environment friendly. It uses the principles of social, economic and ecological sustainability (Elimisiemon and Kagai, 2016). According to them, the concept involves a conscious approach to energy and ecological conservation in the design of built environment. “Green architecture” as the indigenous approach of building practices with the goal of sustaining the ecosystem.

Sustainability is ideally understood as a holistic frame of reference for guiding city development and for helping cities to do many things at once: to reduce their ecological footprints and resource needs, to deepen connections to landscape and place and to enhance livability and quality of life while expanding economic opportunities for the least-advantaged, among others.

Given the impacts (current and potential) of global climate change, an increasingly volatile climate and the already serious range of disasters and hazards faced by cities around the world, global resource conflicts and constraints, long term decline in global oil supply and a global economic system that seems increasingly susceptible to vicissitudes and flux, resilience resonates well as a concept and goal, and we consider it a potent version or flavor of urban sustainability.

The environment aspect of sustainable development requires that we find a balance between protecting the physical environment and its resources, and using these resources in a way that will allow the earth to continue supporting an acceptable quality of human beings (Agenda 21 for sustainable construction in developing countries 2002).

Brundtland Report (UNWCED, 1987), defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. UN-Habitat (2002) sees sustainable city as one "where achievements in social, economic and physical environment are made to last. According to Adegbite (2015), this definition included the three pillars of sustainability; the environmental, economic and social sustainability.

Reffat (2004) interprets sustainable development to mean integrative and holistic process of maintaining a dynamic balance between the needs and demands of the people for equity, prosperity and quality of life, and what is ecologically possible.

Plessis (2003) emphasized that the sustainability of settlements is a multi-dimensional problem, dealing not only with settlement dimensions, but also institutional ability and structure, human development, social relationships, and local values and aspirations.

Attributes of Sustainability in Green Design

According to Elimisiemon and Kagai (2016), there are five attributes of sustainability reviewed in this study. They include environmental, economic, biophysical, social and technical.

Social Attributes and Principles

According to Hill & Bowen (1997), the social attributes of green construction calls specifically for addressing poverty and inequality. The basic principle of social sustainability is to improve the quality of human life by ensuring secure and adequate consumption of basic needs, which are food, clothing, shelter, health, and beyond that by ensuring comfort, identity and choice. The first step towards achieving this goal is poverty alleviation.

Social sustainability attributes include: Improved quality of human life, including poverty alleviation, make provision for social determination and cultural diversity in development planning, protect and promote health through a healthy and safe working environment, implement skills training and capacity enhancement of disadvantaged workforce, seek fair distribution of the social

costs of construction, seek equitable distribution of the social benefits of distribution, and seek intergenerational equity.

Economic Attributes and Principles

According to Sultan (2005), economic sustainability attributes include: Labour – intensive construction policies (promotion of employment by mandating minimum crew size and supervisors and use of less machinery in construction projects associated with import reduction of machines, spares and foreign exchange savings); Energy efficiency policies in Design and Construction (Mandating the use of low embodied energy materials such as granite, minimizing high energy materials such as cement and steel, energy reduction in buildings via insulation, day lighting, optimize material use and minimize site waste); Credit and Policies to select projects, strategies for sustaining the continuity of affordable infrastructure projects (infrastructure projects can help enhance the process of industrialization by raising productivity and reducing production cost); Strengthening the law and regulations in construction and land affairs; Pricing policies (maintain the monetary and fiscal discipline required to promote price control); improve administration effectiveness and reduce bureaucratic procedures. Choose environmentally responsible suppliers and contractors. Ensure financial affordability for intended beneficiaries, and maintain sustained and efficient use of resources and materials, sustained employment opportunities through formal construction, material production and distribution, maintenance during the economic life span of buildings.

Bio-physical Attributes and Principles:

This is founded on the second part of the definition of sustainability proposed by International Union for Conservation of Nature (IUCN), (1991). The IUCN stated that sustainability requires the improvement of the quality of human life within the carrying capacity of supporting ecosystems. Bio-physical sustainable attributes include: Project design facilities that reflect consciousness of the fragility of the ecology in which it is situated and the awareness of its impact upon it; The use of renewable building materials from sustainable sources and designs that take into consideration existing cultural patterns and behaviours, materials and techniques; Prevention of pollution from construction activity and preserving sites in their natural state and water use reduction and conservation and rainwater collection and; Reduction of energy use and on-site renewable energy and encourage construction waste management(Wolley,2000)

Technical Attributes and Principles:

The technical attribute of sustainability has been used in this paper to group a number of concepts, including concepts that relate to the performance, quality and service of a building. The emphasis on the application of these principles should be on implementing a process which seeks to achieve consensus among interested parties on which principles are more and which are less important. Sustainable technical attributes include: Design for flexibility, adaptability and durability of exposed building parts. Pursue quality in creating the built environment and use serviceability to promote sustainable construction as well as revitalize existing urban infrastructure. (Hill & Bowen, 1997; Sultan, 2005;wolley, 2000)

Process-oriented principles of sustainable construction

In this paper, the essence of process oriented principles is to articulate ways of achieving social, economic, biophysical and technical indicators of sustainable construction. The concept is to emphasize that the following stages are essential in sustainable construction. That is, undertake prior assessments of proposed activities and involve all stakeholders on the project in due time; Promote interdisciplinary collaborations and recognize the complexity and multiplicity of objectives inherent in the concept of sustainability; Utilize a life cycle framework, which recognizes the need to consider all of the principles of sustainable construction at each and every stage in planning, assessment, design, construction, operation and decommissioning of projects. Comply with relevant legislation and regulations and manage activities through the setting of targets, monitoring, evaluation, feedback and self-regulation of progress (Gardner, 1989), in a process that is iterative and adaptive in nature.

TABLE 1:BIOPHILIC CITY DESIGN ELEMENTS ACROSS SCALES.

Scales	*Biophilic design elements*
Building	Green rooftops Sky gardens and green atria Rooftop garden Green walls Daylit interior spaces
Block	Green courtyards Clustered housing around green areas Native species yards and
spaces	Green streets Urban trees Low impact development (LID);
Street	Vegetated swales and skinny streets Edible landscaping High degree of permeability Stream daylighting, stream restoration Urban forests
Neighborhood	Ecology parks Community gardens Neighborhood parks/pocket parks Greening greyfields and brownfields Urban

	creeks and riparian areas Urban ecological networks Green schools
Community	City tree canopy Community forest/community orchards Greening utility corridors River systems/floodplains Riparian systems Region Regional greenspace systems Greening major transport corridors

Source: Modified from Girling and Kellett (2010); Beatley (2010).

Methodology

This study employed both primary and secondary data. The primary data made used of questionnaires within the college of environmental. The secondary data used include the use of relevant literatures such as Journals, textbooks, and maps. The study was carried out at the Waziri umaru federal polytechnic, Birnin kebbi, Nigeria. Hence, the college of environmental formed the seat for this study. The estimated population of the students in the college is about 800. The college is made up of Urban and regional planning, Architecture, Quantity surveying, Land surveying and Geo-formatics, Estate management and Building department. A total of 70 structured questionnaires were administered to all the students of the 400 level (HND) students. The data was analyzed using mean values and frequency values of the descriptive statistics. On the basis of the mean scores, a ranking was done on the identified benefits and constraints.

TABLE 2: ENVIRONMENTAL BENEFITS OF GREEN ENVIRONMENT

Environmental benefits of Green Enviroment	*Mean score*	*Rank*
Green building helps to reduce depletion of natural resources	1.74	9th
Green building minimizes negative impacts of environment caused by buildings and facilities	2.07	7th
Biophilic design creates aesthetic well-pleasing environment	2.13	6th
The presence of nature aids positive mood, cognitive performance and even creativity	1.74	9th
Biophilic design helps to enhance livability and quality of life	2.31	3rd
Biophilic design engagement helps to expand economic opportunities for the least-advantaged	2.34	2nd

Cities with extensive tree canopy helps in moderation of air pollutants and prevent noise pollution	2.27	4th
Cities with extensive tree canopy helps cooling through evapo-transpiration and shading	1.90	8th
Green cities help to reduce consumption of energy for heating and cooling	1.70	7th
Biophilic design helps in preventing food scarcity	1.61	
Commitment to outdoor oriented activity in a green cities promote and foster social cohesion	2.39	1st
Biophilic cities promote education of children and young people about the nature around them	2.23	5th

Source: Field survey, 2016.

Table 2 reflects the environmental benefits of green environment. The first-five most ranked of the benefits are Commitment to outdoor oriented activity in a green cities promote and foster social cohesion, Biophilic design engagement helps to expand economic opportunities for the least-advantaged, Biophilic design helps to enhance livability and quality of life, Cities with extensive tree canopy helps in moderation of air pollutants and prevent noise pollution, and Biophilic cities promote education of children and young people about the nature around them.

TABLE 3: EXPRESSION OF CARE AND CONCERN FOR NATURE BY RESPONDENTS

	Frequency	*Percentage*
Very frequently	*19*	*27.1*
Frequently	*32*	*45.7*
Moderately	*14*	*20*
Rarely	*5*	*7.1*
Not at all	*0*	*0*
TOTAL	*70*	*100*

Source: Field survey, 2016.

Table 3 describes the expression of care and concern for nature by respondents. 27.1% of the respondents agreed on very frequently, 45.7% of the respondents agreed on frequently, 20% of the respondents consent on moderately, 7.1% of the respondents consent on rarely and no value for not at all. This implies that

the respondents show expression of care and concern for nature because the very frequently and frequently sum up to be 72.8%.

TABLE 4: PERIODIC ATTITUDE OF THE RESPONDENTS TOWARD PROMOTING GREEN ENVIRONMENT

	Frequency	Percentage
Annually	35	50
Bi-annually	0	0
Quarterly	13	18.6
Monthly	7	10
Daily	9	12.9
Not at all	6	8.6
TOTAL	70	100

Source: Field survey, 2016.

Table 4 shows the periodic attitude of the respondents toward promoting green environment. 50% of the respondents show that it is annually, no respondents for bi-annually, 18.6% of the respondents show that it is quarterly, 10% of the respondents show that it is monthly, 12.9% of the respondents show that it is daily and 8.6% of the respondents show no periodic attitude toward promoting green environment. It is evident from this reflection that only 12.9% of the respondents have a biophilic culture suitable for daily promotion of the green environment.

TABLE 5: POSSIBLE CONSTRAINTS TOWARD GREEN URBANISM BY THE RESPONDENTS

Possible constraints toward green urbanism	*Mean score*	*Rank*
Social and cultural restrictions can affect the encouragement of green design	1.96	4th
Busy schedules and heavy work commitments will affect due attention to green design	1.91	5th
Legal and zoning ordinance can affect green cultivation in an area	2.59	1st
Short term economic cost may be an impediment in the provision of green environment	2.16	2nd
	2.14	3rd

Aesthetic bias of possible organism like snake, bats and spiders may affect green environment	

Source: Field survey, 2016.

Table 5 shows possible constraints toward green urbanism by the respondents. The three most important of the five identified are Legal and zoning ordinance can affect green cultivation in an area, Short term economic cost may be an impediment in the provision of green environment and Aesthetic bias of possible organism like snake, bats and spiders may affect green environment

Conclusion and Recommendations

The study deduced that of all the environmental benefits of green environment identified. The three most ranked of the benefits are Commitment to outdoor oriented activity in a green cities promote and foster social cohesion, biophilic design engagement helps to expand economic opportunities for the least-advantaged and biophilic design helps to enhance livability and quality of life. The study identified that 72.8% of the respondents show care and concern for nature. The study further established that 12.9% of the respondents show a daily biophilic culture suitable to promote the human life. The study established that Legal and zoning ordinance, Short term economic cost, Aesthetic bias of possible organism like snake, bats and spiders are the possible constraints toward green urbanism. Further research can assess the performance biophilic institution and governance. This study is strongly recommended to all environmental designers; landscape planner, Architect, Builder, Land surveyors and to all biophilic institution and governance in the field of green designs.

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