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RESEARCH ARTICLE

Porous Morphology Eco-Efficiency Design Process of a Selected Masterpiece Building and its prospects on the Environment

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Abstract
The characteristic of urbanization, modernization and it effect on the environment has become a disastrous event especially towards the beginning of 20th Century (C). Researches have shown an excessive exploitation of minerals both on and beneath the earth crust were consume every year for the purpose of construction alone. Thus, not only decrease in volume of earth materials but also the impact on environmental thus need attentions. This study observes that the conversion of material; exploitation; energy used during construction; energy associated with heating; cooling; lighting and ventilating commercial buildings have potential consequence on the environment. A selected study of masterpiece building with philosophy of porous structure, which certified Leadership in Energy and Environmental Design (LEED) in Nigeria, was reviewed. Finding indicates that conceptual design from the school of thought help in setting reasonable objectives at the designing process stage. Also, energy efficient building will reduce wastage of earth materials with alternate source of natural energy, application of natural element other than artificial during building construction and occupancy stage are mitigation strategies to negate aforementioned effect on the environment. Conceptual frameworks with composite notions from various domains were explored to include concept of *porosity* from medicine among others was utilized, acceptable for maximum lighting, cross ventilation and circulations. Hence, energy efficiency was achieved which is friendly to the environment.

Keywords: Sustainable building; Porosity for fenestration; Iconic and modernization; Pollution; Environmental Impact Assessment (EIA)

Introduction

Vernacular building types evolved in response to local availability of resources such as wood, grass, clay, stone (Arthur, 1991) and the basic need of shelter for man (Adedeji and Olotuah, 2011). The discovery of copper, lead, iron and glass which are more efficient in response to structural stability and modern architecture encourages industrial revolution; manufacturing technologies created new opportunities from existing materials and introduced entirely new materials for construction with the help of mass exploitation of fossil fuels from abundant sources of coal, crude oil and natural gas in Nigeria but with energy inefficient buildings (RAEng, 2007; Arthur, 1991). The industrial revolution thus resulted to increasingly construction of mass building and simultaneously urbanization through commercial and industrial organizations (WHO, 1992; Olotuah, 2005, RAEng, 2010; Amoa, 2012; Aribigbola, 2001). Building types that evolved includes intensive, massive both in height and width and iconic.

Environmental Protection Agency (EPA) highlighted 'significant changes on the surface of the land' due to construction activity which involves clearing vegetation, excavation, disrupting habitats, changes to drainage patterns and the water table, noise pollution, dust, vibration among others (FRN, 2006). According to the United Kingdom Green Building Council (UKGBC, 2019) opined that the construction sector uses more than 400 million tons of material each year, much of which has a negative environmental impact due to intensive extraction of raw materials, transporting to manufacturing plant and site, consecutively with generation of waste, energy consumption both in manufacturing and in use.
The Town and Country Planning of England and Wales Regulations (2011) sets out a requirement to carry out an environmental impact assessment (EIA) as part of the planning application process for certain projects been large, high magnitude or complex projects basically to ensure that the environmental effects of a proposed project development are properly accessed before consideration (UKGBC, 2019). An EIA provides the local planning

authority with better information about certain types of project, enabling them to make an informed decision about whether permission should be granted or to allow imposition of more appropriate conditions and responsibility purposely to mitigate possible negative impacts (Development Control Department, 2007; FRN, 2006; Lagos State of Nigeria, 2005; Vagale, 2000; Oyo State of Nigeria, 2012; Oyo State Government of Nigeria, 2014; UKGBC, 2019). However, natural forces, element and advantages over time have been encouraged to be utilized and it is the major process to mitigate urban housing design and construction impact on the environment. In the 20C, many buildings became totally dependent on fossil fuel energy to make them habitable. Before 21C, buildings must be designed to function with much lower levels of energy dependency (RAEng., 2010). Natural ventilation is one of the most familiar aspects of energy efficient building design. This work tend to review existing completed construction project that satisfied LEED criteria and requirements, to correlate its existing ecosystem friendly expectation thus, to propagate its contribution to knowledge, to encourage springing up of friendly prototype and typology towards safe of the built environment.

Problem Definition

Impact on the environment of masterpiece development in the urban center takes a cognizance examination of processes, materials and technologies to improve air movement, thermal performance, and control of moisture, ambient energy, light and acoustics during construction, occupancy stage and variably, need to mitigate change in climatic implication on the environment. Research has demonstrated that buildings which combine good architecture to include perceptions, beliefs, principles, aims and or school of thought underlying individual's practices and conduct with environmental design can result in significant increase in occupant satisfactions and productivity as regard low energy building (Fadamiro, 1998).

The aim is to study the impact of masterpiece development on the environment while the objectives of the study are to:

i. Identify and to select a masterpiece building in Nigeria,
ii. Determine the architectural philosophy of the Design process,
iii. Examine the impacts of such development on the environment,
iv. Examine significant increase in occupant satisfactions with good architecture of environmentally energy efficient design.

Background Knowledge to Philosophy of Porosity in Design Process

Schön (1990) examines the design process as a situated activity during which designers seek to solve a problem. The conceptual task of a designer is to analyze the problems that require solution and the approach through a framework. Steven Holl is one of the most influential contemporary American architects, Holl as stated in the work of Sotirious (2007) implemented porosity as a concept transferred from medicine, biology and organic chemistry in designing the 350-unit student residence named Simmons Hall at MIT as shown in Plate 1. Holl's philosophy is identified as porous (Sotirios, 2007).

Review of Porosity's School of thought in Simmons Hall Building

Sotirious (2007) described the features and location of the Simmons Hall dormitory that it belongs to a strip of potential new MIT buildings along Vassar Street, in Cambridge, Massachusetts. The strip forms the Vassar Street edge along the Briggs Athletic Field, and it is located next to the railroad tracks. The Simmons Hall is 350 bed residences of 10 stories high, 382 feet long, providing amenities to students such as a 125-seat theater, a night café, a restaurant with an exit to the Vassar Street. Instead of the typical in Massachusetts urban brick wall model, the strip was envisioned by architect Holl and his architectural team with a "porous" membrane characteristic (Sotirious, 2007). During the process of designing Simmons Hall as shown in Plate 1, the features of *pores* and porous materials were approached. Sotirious (2007) explained further that the design concept of *porosity* was imported from biology, medicine and organic chemistry to transform a "porous" morphology for Simmons Hall, via a series of design operations. Accordingly, building mass of Simmons Hall was designed to have five large scale recesses, while a system of vertical cavities creates vertical porosity allowing light and air to circulate within the building envelop. Moreover, the building facades have a large number of operable sieve-like windows (Sotirios, 2007).

Plate 1: Simmons Hall student residence at MIT showing pores on its facades
Source: Sotirios, 2007

Environmental Emission Performance

In the early 20C, the modern architectural movement emerged, bringing new forms of building (Amao, 2012) that neglected former primitive form and many of these early examples of modernist movement showed little concern about rate of energy consumption, pollution, scope, magnitude, building's performance and impact consideration to its immediate environment. Effect consideration arose after World War II in response to building's environmental performance (RAEng, 2010). The field saw a strong interest at the time of the energy crisis during 1970s and again now as energy efficiency is becoming more concern in the evolution of buildings.

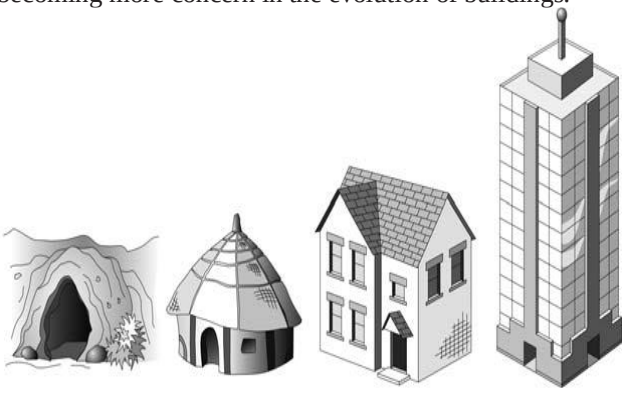

Figure 1: Building Metamorphosis from shelter, house, mansion and masterpiece
Source: RAEng, 2010

Vernacular building types evolved in response to local availability of resources (Arthur, 1991). The mass exploitation of fossil fuels instigated man to build resource and energy inefficient buildings (RAEng, 2010). Figure 1, shows the metamorphosis of primitive shelter which is one of the three major necessity of life has opined by Adedeji and Olotuah (2011), vernacular architecture is the traditional ways of life which simultaneously reflect on human shelter whereas; modern architecture involves revolutionary ideas and styles in art especially, architecture as a reaction to traditional forms; and international style is an early 20C architectural style in the United States and Europe that favored the use of simple geometric lines, spacious interiors, materials such as steel, reinforcement concrete, glass, columns, long façade/open window, open space are achievable with aid of technological advancement (Adedeji and Olotuah, 2011; Anthony, 2014; Fadamiro, 1998).

Building impact studies became one of the principal drivers in construction of new buildings for the 21C to meet emerging challenges. Hence, the urgent need to reduce mass exploitation of the earth materials, dependence on fossil fuels for energy and resources conservation which are the major steps to reduce effect on the ecosystem. The need for sustainable buildings is important and achievable through application of energy efficiency and natural element (RAEng, 2010). However, Low energy buildings require a detailed understanding of the natural forces (sun, natural ventilation and other climatic factor) at play.

Figure 2, shows the Building Regulations Carbon Emission and Emission Relative Revision Trajectory by RAEng. (2010) shows that for domestic sector projects over the periods of 2004 to 2015, there is successful progressive changes in regulation to carbon neutral which is not significant in the building industries thus, need to set a targets for energy efficiency which is carbon reduction to mitigate impact on the environment.

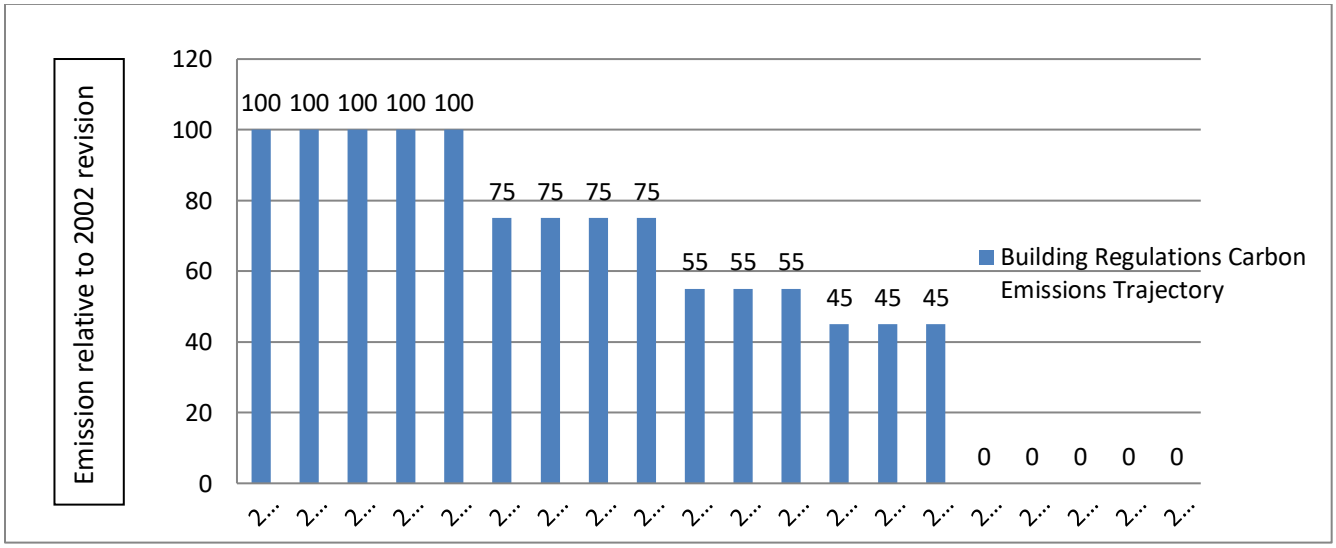

Figure 2: Building Regulations Carbon Emissions
Source: RAEng., 2010.

Methodology

This research pivoted at analyzing elements on development and optimal use of master piece buildings in Nigeria, taking a review of not only an iconic building but relatively tall. That is, this study involves physical investigation of a selected high-rise building by visual inspection, personal interviews with employees occupying this tall building, physical appraisal and deficiencies in the building. Questionnaires were distributed to thirty (30) professionals and thirty (30) non-professionals on problems they perceived, associated with masterpiece structure in Nigeria and how they can be avoided. The administrations of structured questionnaires included colored photographs of the selected building and questions relating to eco-friendly evaluation and demographic information of respondents. Regarding the selection of respondents, the sampling did not pretend to be statistically representation of the population of Lagos but preference was given to understanding the energy efficiency expression of the building. Information on efficiency element, renewable natural element (sunlight for day lighting, wind for ventilation through control fenestration), exploitation of construction materials, fossil fuel and alternate source of energy, landscaping element and their immediate effect on the environment was investigated while secondary data were collected from library banks to include journals, newspapers, magazines, Internet and also from other personnel with information as regard masterpiece buildings. Lagos state in Nigeria was selected as the study area being the economic stronghold of West Africa sub-region and former capital of Nigeria. Tall, masterpiece and iconic building development in Nigeria are noted to be significant in the city. Hence, data for this research was collected by visiting a selected high-rise structure in Lagos to determine its current status compare to a selected case study of international standard. Amongst problems investigated include maintenance, functionality, emergency preparedness, energy efficiency and comfort.

Tall Buildings in the Continents, Africa and Nigeria

Hierarchically, Anthony (2014) noted that most tall buildings of significance were built in the United State of America, some countries across Europe and later Asian countries. Anthony (2014) quoted data published in the 1980s that about 49% of the world's tall buildings were built in North America and that it has now changed drastically as Asia now has the largest share of 32% against North America's 24% as shown in Table 1.

Table 1: Tall Buildings per Continents

Region	Nos. Countries	Percent (%)	Nos. Building
Asia	20	32.2	35,016
North America	18	23.9	26,053
Europe	20	23.7	25,809
South America	10	16.6	18,129
Oceania	7	2.6	2,839
Africa	20	1.0	1,078
Total	95	100	108,92

Source: Emporis, 2006

In 2009, Anthony (2014) pointed that the UN population fund recorded that the population of Africa had reached 1,022,234,000 hence, proclaimed Africa the second most populated continent behind Asia and also noted that the continent's population is expected to reach 1.9 billion by the year 2050 and this will definitely spur developmental challenges especially in the urban cities. Massive, tall and masterpiece development begun to spring up to meet the demand of the increased population in Africa and notable buildings are listed in Table 2.

Table 2: List of High-rise Masterpiece Buildings in Africa

S/N	Building's Name	Floor	Height	Year	Country
1	Carlton centre	50	223m	1973	South Africa
2	Ponte city Apartments	54	173m	1975	South Africa
3	Bahia centre	31	161m	2008	Algeria
4	NITEL building	32	160m	1979	Nigeria
5	Marble towers	32	152m	1973	South Africa
6	Pearl Dawn	31	152m	2010	South Africa
7	SA Reserve Bank Building	38	150m	1988	South Africa
8	Villagio Vista	35	150m	2011	Ghana
9	Metlife Centre	28	150m	1993	South Africa
10	88 on field	26	147m	1985	South Africa

Source: Anthony, 2014

Nigeria with high increasing population is blessed to be one of the most economically developed nations on the African continent occupies a land area of about 923,768 sq. km and Lagos state happened to be former capital with major economic activities in the country also houses majority of the tall, iconic and masterpiece building which are largely attributed to the fact that most of the major financial and governmental activities are conducted in the city (Anthony, 2014). Ogundeji and Fadairo (2018); and Ogundeji, Fadairo, Ogundeji and Ekundayo (2022) explained further the urbanization as the movement of people from rural areas to urban areas to experience or acquire different benefits that are rare in the rural milieu. Thus, experiences massive influx of citizens from the rural areas in search of greener pasture which also contribute to Lagos growth hence, reason Lagos is selected as the study area. Table 3 shows list of some tall and masterpiece buildings in Nigeria with majority located in Lagos, Nigeria.

Table 3: List of Tall and masterpiece Buildings in Nigeria

S/N	Name Of Building	Floors	Height	Year	Location
1.	NITEL/NECOM house	32	160m	1979	Lagos
2.	Union Bank Headquarters	28	124m	N/A	Lagos
3.	Cocoa house	26	105m	1965	Ibadan
4.	Independence house	23	103m	1960	Lagos
5.	CBN Building	19	100m	U/C	Lagos
6.	Great Nigeria house	22	95m	N/A	Lagos
7.	Heritage Place	14	N/A	2016	Lagos

NOTE: N/A means Not Available; U/C means Under Construction;
Source: authors' archive, 2019

A Selected Masterpiece Building in Lagos, Nigeria

Susty Buildings (2016) opined that Heritage Place is one of the iconic buildings in Nigeria. The selected masterpiece development which is Heritage Place is Located at Alfred Rewane Road, Ikoyi,it provides quality office space in the commercial capital of Nigeria. Plate 2 and Plate 3 are pictures describing the building. Heritage Place is a massive rectilinear Modernist building with its office tower spreading on fourteen (14) floors providing over 15,736 square meters (sqm) of offices space ranging from 450sqm to 2,000sqm, 350 parking bays, double volume reception, suspended ceilings, and a cafe/coffee shop. It was completed in the first quarter of 2016 (Susty Buildings, 2016). Laurus Development Partners was nominated to oversees consortium of consultants including Capita Symonds UK, ECAD Architects, CA Consultants, Morgan Omonitan Abe and Tillyard Limited. The main contractor was ITB Limited which is also one of the leading construction companies in Nigeria while the nominated developer, Actis and Primerose Development Company which is a private equity firm were also the team behind the completed Ikeja City Mall, Abuja's Jabi Lake Mall Development and 9-floors office property with sustainable features located within the bustling Airport City of Accra which is in close proximity with Kingsway Tower, Alliance Place, B.A.T Rising Sun, Chelsea Group Hotel and Temple Tower (Susty Buildings, 2016). According to Susty Buildings (2016), Actis ensure that the project meets international green and sustainable building standards by attaining a Leadership in Energy & Environmental Design (LEED) certificate, a sustainable building rating system set out by the United States Green Building Council (USGBC). These features were expected to lead to 30-40 percent reduction in energy consumption, a valuable asset considering high power and energy costs in Nigeria. (Susty Buildings, 2016)

Plate 2: Aerial View of the Heritage Place Building at Night Time
Source: Susty Buildings, 2016

Porosity as Conceptual Framework

Pore from Greek means "a minute opening". Porosity or "the state of being porous" in the context of organic chemistry and the study of plants and animals indicates the existence of small openings. In biology and in medicine porosity is defined as:
"*the attribute of an organic body to have a large number of small openings and passages that allow matter to pass through*" (Sotirios, 2007).

Holl's contextual definition of *porosity by* Sotirios, (2007) was defined as part of "permeability hypothesis" that a porous morphology would produce considerable effects and positive impact on urban and building scale. That is, better air and light circulation, better accessibility and visibility, better communication between interior and exterior spaces. The assembly of the building container was practice by the production of pores, openings, internal channels and cavities. Sotirios, (2007) explained further that porosity can be accomplished in four ways:

i. First, by creating large-scale recesses of building envelop;
ii. Second by creating protrusions of building mass/envelop as shown in Plate 3;
iii. Third, by distributing a large and wide windows of various shape and size on the elevations as shown in Plate 3;
iv. Fourth, by distributing a number of free-form cavities penetrating the building from top to bottom, or and a case of typical court yard.

Plate 3: Aerial View of the Heritage Place Building at Daytime
Source: Susty Buildings, 2016

Steven Holl team of Architects, NY as noted by Sotirios (2016) explained typical word and synonyms of porosity as the case may be to be porous, permeable, honeycomb, screen, net, riddle, sponge, pore, opening, hole, aperture, passageway, cribriform, sieve-like, sieve, pervious, and unrestricted.

Findings and Discussions

Table 4 shows that 60% of the professional respondents are males while 40% are females. 80% of the non- professional respondents are males while 20% are females. Also, 43.33% of the respondents are within the age group of 21-30 for the professionals while 50% of the non-professionals respondents are within the age group 41-50. In addition, 50% of the non-professionals are Bachelor's degree holders while 60% of the professionals hold same level of education. Table 4 indicates that majority of the respondents are learned with probability of understanding the research area, questions with a reliable response.

Table 4: Respondents' Characteristics

	Professionals		**Non-Professionals**	
Gender	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Male	18	60	24	80
Female	12	40	6	20
Total	30	100	30	100
Age				
21-30	13	43.33	8	26.67
31-40	10	33.33	7	23.3
41-50	5	16.67	15	50.0
51-60	2	6.67	-	0

Total	30	100	30	100
Education				
HND	3	10	12	40
BSC/B.TECH	18	60	15	50
MASTERS	9	30	3	10
Others	--	-	-	-
Total	30	100	30	100

Source: Authors' archive, 2019

Table 5: Shows findings towards environmental friendly need on Heritage Place building

Factors and findings	**Representation in graph**	**%**
Design zoning	A	100
Natural air and light circulation	B	98
Functionality and communication	C	95
Open and wide windows	D	93
Double glazing to reduce emission of heat	E	92.3
LEED Certificate in design and construction	F	90
Façade and cladding	G	88
Water efficiency and storm water control	H	85
Technology advancement; cctv, sensors, alarm etc	I	80
Vertical parking	J	78
Mechanical facilities zoning	K	75
Landscaping degree	L	50
Fossil fuel consumption	M	30
Noise pollution	N	15
Smoke pollution	O	10
Floods	P	2

Source: Authors' archive, 2019

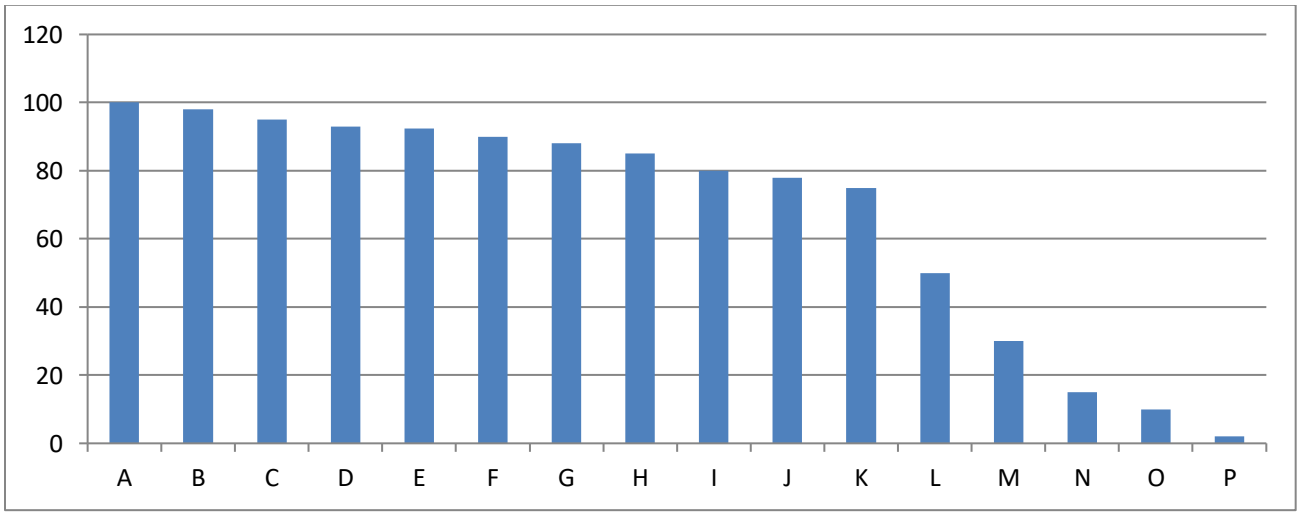

Fig. 3: Findings towards environmental friendly advantages on Heritage Place building
Source: Authors' archive, 2019

The philosophy of Heritage building takes after the porosity structure's school of thought earlier implemented by Holl's Architect purposely to achieve environmental friendly building with air, light circulation, better accessibility, visibility, and better communication between interior and exterior spaces which made it a functional building scale (Sotirios, 2007).

Heritage place is the first commercial building to achieve LEED certification in both design and construction; it applies cutting edge technology to fulfill environmental expectations at all time. The façade of the edifice comprises of alternating composite cladding and high quality Low- E double glazing on the upper floors reduce need for artificial lighting during the day and hollow fins substituting the floor to ceiling windows on the first five floors which forms the parking space compare to common horizontal we are used to which consume much space (Susty Buildings, 2016). UKGBC (2019) maintained that LEED basically includes a method of rating system for building types around the world with the aim of helping owners, occupants and operators be environmentally responsible and use resources efficiently. Thus, table 4 and Fig. 3 indicate attributes among other features that were utilized and that categorized the case in stydy to be energy efficient with LEED Certification.

Plate 4 shows drop-off point for visitors from which the 5 level multi storey parking could be accessed. Plate 5 also shows the reception area, the use of wood has been creatively employed to the ceilings as one advances from reception to the elevator lobby to give a sustainably pleasing experience.

Plate 4: Drop-off Zone
Source: Susty Buildings, 2016

Plate 5: Reception Area with wooden finishes on the ceiling
Source: Susty Buildings, 2016

Plate 6: Meeting Room with Folding Door Partition
Source: Susty Buildings, 2016

Open space meeting room with partitions by folding door to allow for expansion of meeting space for variety usage whenever desired is shown in Plate 6 indicate functionality of the building, the rentable meeting rooms are also located on the ground floor beside the reception. The cafeteria is serviced by a dry kitchen and can be found on the opposite side of meeting area. Plate 6 also observes floor to ceiling glazing which provides vista of the outdoor with provisions of an outdoor eating area to improve that experience. Mechanical services such as the Generator House is also on the ground floor but zoned away from the public areas. Plate 7 shows other mechanical facilities such as heating, ventilating, and air conditioning (HVAC) plants, exit deck and hydraulic-powered devices are located on the roof level.

Plate 7: Showing floors, long window façade, deck housing mechanical facilities and green areas
Source: Susty Buildings, 2016

Plate 7 also describe the general planning of the facility, service core is placed at the center and comprises 6 lifts for passengers and one lift for goods movement, an escape stair, storage and office spaces for the Facility Mangers. The centrally placed core actually provides an advantage of arranging all office space with the inevitable wide-view of the outdoor.

The Characteristic of Heritage Place after careful review has less environmental impact. Hence, the primary features are itemized;

The building's orientation maximizes natural lighting, ventilation and minimizes solar exposure which variably reduces energy requirements for cooling, heating and air quality systems

High efficiency glazing and external thermal envelope also reduce demand on cooling requirements (Susty Buildings, 2016).

It is the first LEED Certified Commercial Building in Nigeria both at design and construction.

Heritage building also achieved between 30–40% reductions in energy consumption compared to common practice building in Lagos (Susty Buildings, 2016). The use of natural light and natural ventilation to minimize energy demand is also observed.

The automatic presence detectors, sensors and high efficiency lighting from technological advancement are milestone achievement as energy efficiency is concern.

Occupants' thermal, visual and working comfort is increased by level of indoor air quality through adequate ventilation and quality of materials (Susty Buildings, 2016).

Water demand is minimized through rain water harvesting and condensate recovery from cooling units. Also, there is provision of water tank to collect or retain discharge of foul and storm water to the local sewers in Lugard Road (Susty Buildings, 2016).

Recommendations

Measures put in to consideration by the building professionals in the course of Heritage Building construction and it effect on the environment which consequently made the building an environmental friendly are specifically not limited to the followings;

Architect philosophy of porosity encourages environmental friendly building with air and light circulation, better accessibility, visibility and better communication between interior and exterior spaces of building.

The urgent need to reduce dependence on fossil fuels and massive exploitation of building materials will go a long way to reduces carbon emission impact on our environment. Thus, integrating renewable energy such as energy obtainable from the Sun, wind, waves, etc. other than energy generated from fossil fuels, thermal for heating water are economical, reliable, with viable technologies and simple application.

Conventionally, designed buildings priority must be to minimize energy demands in the first place. Hence, building should be designed to be naturally ventilated and lighting in architecture. Natural ventilation is one of most familiar aspects of energy efficient building design.

Use façade innovation system that will moderate solar gains and maximize potential for daylight.

The use of local knowledge to suit climate through insulation to standards

Uses of double and or triple glazed windows to prevent drafts which is current of air flow to minimizes heat loss through windows

Building materials of high thermal mass were used to prevent fluctuation of indoor temperature, to minimize heat loss and the impact on the environment is the energy required to produce materials of high thermal mass.

All pipes that were used were insulated purposely to minimize heat loss and gain for hot and cold pipes and the effect on the environment is understanding aspect that the colored insulation could be perceived or interpreted by the individual.

Position and orientation of windows and light shafts encourage maximum utilization of natural day lighting which is enough to reduce need for artificial lighting thus, with the effect of creating in-door and out-door connection.

Open-able windows, chimney for stack effect, underground culvert and availability of air inlet are existing features on Heritage building which also amount to energy conservation to the milieu.

Thermostat were used to ensure that heat is efficient, stays at a set temperature as 'heat control' and can be regulated as conditions change throughout the year.
The use of motion sensors for water taps reduces water consumption as taps turn off automatically and simultaneously reduces impact of sewage in to the milieu. Also, use of spray taps reduces water and energy used consumption by 80% compared to normal taps. This also yielded water conservation.
Waterless urinals do not require water supplies, cheap to install with no possibility of damage by frost. In addition, a dual flush or low flush toilet too reduces water consumption from 6l to 4.5l or less per flushing. Recently, dual flushing has raised awareness on water consumption
Rainwater harvesting achievement through provisions of storage tanks and treatment is to collect rainwater to be used for flushing toilets and that has reduces demand for local water supply. Collection of water from washbasins and other grey water with necessary minimal treatment if water is not stored for long is used for flushing toilets.
There are Low wattage light bulbs purposely efficient to reduce energy usage and they variably contribute to less heating of room and less energy consumption.
Motion sensors on lights reduce energy usage on unnecessary lighting when the occupants are not in the building.
Door sensors were avoided because no energy would be required for normal doors but sensor door consumes energy. Peradventure, doors for disability can be opened by switches for comfort, with little or no support to the disabled.
External blinds were used on windows to prevent overheating in summer as reviewed. Planting deciduous trees with a good landscape provide shading in the summer and would allow for heat gain in the winter.
The location of structure within buildings but other than virgin environment would provide protection from wind, thereby reducing heat loss and the draughts and the effect on the environment is its attraction for other buildings to spring-up.

Conclusion

Design process help in setting reasonable objectives at the designing process stage for the purpose of solving a problem (Gero, 1998). Conceptual frameworks may be composites involving notions from various domains of inquiry (Knight, 2005). The concept of porosity was transferred from medicine; biology and organic chemistry in to new urban context hence, aid air and light circulation, better accessibility, visibility and better communication between interior and exterior spaces of building. In order to create new buildings and adapt existing ones to be fit for the 21C, need to be environmental friendly. Performance analysis and energy prediction, the architectural design, available resources and with the empirical construction knowledge will help master builders not to construct inefficient buildings whose energy performance falls far below that which we need to achieve (RAEng, 2007). Government set out in Building a *Greener Future* (DCLG, 2007) that all new homes must be zero carbon from 2016 (UK Green Building Council, 2019). As steps to achieving this target, energy efficiency standards for new homes are to be improved, through Building Regulations, by 25% in 2010 and 44% in 2013 relative to current 2006 standards. *The Proposals for amending Part L and Part F of the Building Regulations* (DCLG, 2009) make it clear that a similar trajectory in Figure 2 for carbon reduction will apply to non-domestic buildings. In the UK, the 2006 revision to Part L of the Building Regulations (DCLG, 2006) in itself required a 25% reduction in carbon emissions over the previous standard.
In a bid to mitigate climate change and secure future energy supplies for the purpose of urban development which are masterpiece or massive building with the minimum environmental, social and economic impacts, we must fundamentally popularize green architecture that is, protection of nature, ecology and environment; and to be able to sustain it (Fadamiro, 1998; DCLG, 2007; RAEng, 2010). RAEng (2010) opined that the association of energy with heating, cooling, lighting and ventilating commercial buildings accounts for two thirds of the carbon emissions. Building must possess such features to optimize physical characteristics of buildings and their systems to balance these energy demands, exploit natural energy and minimize the reliance on artificial energy for environmental friendly in 21C. The Heritage Place building, Ikoyi has positive and less impact on the environment with the low energy consumption and emission, from the design stage to construction stage with less exploration of materials (sand, stone, granite and water) for concrete work of the frame structure (less massive concrete), natural ventilation and lighting to reduce burning of fuel to power plant and appliances, storm water collection to reduce effect of flooding (Akintola, 1978), green planting reduces effect of sunlight and global warming (Fadamiro, 1998; DCLG, 2007), among others. Heritage place Ikoyi shows that sustainability, environmental friendly design and construction in urban center is feasible in Nigeria.
Energy efficient design can be achieved with collaboration, inter-disciplinary knowledge between the architects, engineers and other related professionals from the onset of the project. By the time the building design has been sketched, the major opportunities for energy conservation which previous studies have shown to have negative impact on the environment would have been captured and mitigated. Hence, the man build-up environment would be guaranteed to be friendly.

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