

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,200

Open access books available

169,000

International authors and editors

185M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Chapter

Imperative of Nigerian Demographics for Green Housing

Olubunmi Comfort Ade-Ojo and Ayotunde Anthony Babalola

Abstract

Housing is a basic necessity of life. Provision of adequate housing is a perennial problem confronting the nations of the world. The problem is more challenging in the developing countries like Nigeria. Nigeria with a population estimated at over 200million people is plagued with the shortage of quality and adequate housing. The demographics from the National Bureau of Statistics shows the median age of 22.7 years. More than 60% of the population are less than 65 years. The implication is that more houses will be required to meet the need of the younger population with attendant environmental, social and economic problems. Increased consumption of physical and environmental resources is required for the development of more houses. Implementing green housing requirements in housing development ensures that resources are used sustainably in the provision of housing for the populace now and in the future.

Keywords: demographics, green, housing, Nigeria, sustainability

1. Introduction

Nigeria is a country with rapidly growing population with an estimated yearly increase of 3.5% per annum. The country is projected to be the 4th most populous by year 2050 with a population of 410 million. Interestingly, over 60% of her population are below 45 years of age [1]. Unfortunately, Nigeria is one of the countries with great housing challenge. The current housing shortage is estimated at 28million units. The country needs to provide 1.2 units per annum to bridge the housing gap [2]. Another problem with housing provision in Nigeria is the poor quality of the available ones with attendant social, environmental and economic implications. Efforts to ameliorate the housing problem by subsequent governments in the country have minimally achieve the expected result while various resources were consumed in the process. Apart from the high cost of such housing schemes, there were no consideration for sustainability—social, economic and environmental. The changing global climatic condition and increasing high cost of living have further compounded the challenges confronting quality housing provision. Hence Nigeria needs to evolve ways to adequately provide quality and affordable housing for her citizens now and especially the growing population of the younger ones. One of such intervention is the green housing [3, 4].

Green housing is the provision of housing without unnecessary consumption of physical environmental and natural resources thereby leaving a lighter footprint on the environment. Green housing development ensures economical and optimal utilization of resource by minimizing wastes, reduce carbon emission, making use of renewable and natural energy sources, green housing provision conserves water through the use gray water, water harvesting, reducing the use of clean water through technologies. Green housing improves the indoor environmental quality thereby improving user comfortability and health. With the dwindling national economic resources and consistently growing youthful population, the adoption of green housing becomes imperative for future housing [4].

2. Nigeria demographics

Demography is the study of the quantitative and qualitative aspects of human population. It shows the distribution of people across the continent, countries, and regions. The quantitative aspect of demography includes the population composition, density, distribution, growth and size while the qualitative aspect includes sociological in nature. These are factors such as education quality, diet and nutrition, race, social class, crime, wealth and wellbeing. Nigeria is the most populous country in Africa and also the most populous among the black nations of the world. Globally, Nigeria is among the 10 top countries with the largest population [5]. Most of this are people in the working ages, between age 15 and 64. The median age of the population is 22.7. **Table 1** shows Nigerian population growth from independence till date and the population projection till 2050. The growth in population have resultant impact on the population density. The table shows that the urban population also continues to increase in proportion to the population growth. This in no doubt compounds the problem of housing provision and shortage in the urban centers.

According to the national bureau of statistics [6]. Nigeria's population has consistently been on the rise. The NBS record shows Nigeria population as consisting more of younger population. By implication, there will be need for quality housing for this growing population in the future. This does not discountenance the acute shortage of quality and affordable housing currently bedeviling the country. The housing shortage in the country has also grown geometrically with the population while efforts to reduce the housing gap have not yielded commensurate results. Available data indicates that housing deficits has continued to grow in direct proportion to the population growth (**Table 2**).

2.1 Nigerian demographic implication for green housing

The national population policy recognizes population factors, social and economic development, and environmental issues as irrevocably entwined and are all critical to the achievement of sustainable development in Nigeria. Consequently, this section discusses the implications of Nigeria's demography for future housing.

Human beings depend on the environment to survive. The population of a people occupying a geographical location represents the population density. The consistent increase in population increases the population density of the country. There is increase in the demand for housing with increased consumption of both physical and natural environmental resources to meet this growing demand. Subsequent housing development policies did not consider the degrading impact of housing development

Year	Estimated population	Density (ppl/km ²)	Urban population	% of urban population
1960	45,137,812	50	6,955,737	15.4
1965	50,127,214	55	8,296,555	16.60
1970	55,981,400	61	9,942,297	17.80
1975	63,373,572	70	12,535,293	19.8
1980	73,460,724	81	16,139,321	22.0
1985	83,613,300	92	21,434,269	25.6
1990	95,269,988	105	28,276,132	29.7
1995	108,011,465	119	34,785,092	32.2
2000	122,352,009	134	42,627,440	34.8
2005	138,939,478	153	54,289,212	39.1
2010	158,578,261	174	68,949,828	43.5
2015	181,181,744	199	86,561,390	47.8
2020	206,153,000	226	106,639,000	51.7
2025	233,692,000	257	129,131,000	55.3
2030	264,068,000	290	153,962,000	58.3
2035	297,323,000	327	180,826,000	60.8
2040	333,172,000	366	209,775,000	63.0
2045	371,119,000	408	241,450,000	65.1
2050	410,638,000	451	275,538,000	67.1

Source: [1].

Table 1.
 Population growth from 1960 to 2050.

Year	Population	Housing deficit (millions)
1991	104,000,000	7
2007	145,000,000	12
2010	158,578,261	14
2015	181,181,744	17
2019	184,000,000	18
2021	211,447,000	20
2022	216,844,000	28

Source: [7–9].

Table 2.
 Growth in housing deficit trend.

on the environment. Increased population density has created unequal distribution of the population. The urban centers are overpopulated with attendant slums, environmental degradation and poor-quality housing. The cities and villages on the other hand are left unattended and under developed. Deforestation and desertification are major environmental problems plague the country. Housing provision is

reported to be the largest contributor to land degradation and greenhouse gas emission. Construction waste generation and management are poor and indiscriminate. Secondly, the age distribution of Nigerian demography leaves much for concern. Large percentage of the population are below 65 years of age. The median age is 22.7. This age group are growing and requiring housing. Majority of this young population are millennial. Given the global economic development and the impact of climate change, the need for a sustainable building development is more critical to the survival of this generation. Thus, the need for quality housing increases.

Efforts to provide quality housing dates back to the pre-colonial era [3, 7]. Since then, various housing development policies were promulgated with various setbacks. It is on record that these housing schemes fell short of achieving the expected result at different times. The successive housing development policies did not consider the environmental impact and the need to reduce the foot print of such housing developments. Lighting and ventilation are not priorities of such policies while consideration for regional priorities are lacking. The policies did not consider sustainability issues such as the life cycle cost implication of the buildings, user satisfaction and comfortability, indoor environmental quality. Many of the housing policies use prototype building structures. A prototype used for housing units in the northern part of the country is also used for the southern part with high rainfall and relative humidity. The north of Nigeria is in the Sahara region while the south is tropical in nature. Housing development programs contains provisions for infrastructure facilities but they lack consideration for minimizing energy and water consumption. The excessive population growth creates great demand for energy and water resources. With a large population of growing young people and general reduction in the globally available resources, Nigeria need to begin the implementation of green principles for future housing.

The various housing schemes failed to achieve desired goals due to high cost of construction and high economic impact of such developments. The buildings were beyond the reach of an average Nigerian [8]. Despite the abysmal performance, the various housing schemes; public and private, by organizations or individuals have continued to do untold damage to the environment. Little or no consideration is given to occupational cost to the user and comfortability. The housing sector is said to be the major generator of green-house gases, the major cause of deforestation giving the expanse of land required for construction. Housing provision destroys the natural eco system resulting in various environmental challenges such as flooding, erosion and heat highland. The sector consumes about 48% of the world's resources and energy for construction and maintenance [9–12]. There is no specific figure on housing contribution to carbon emission in Nigeria. However, as signatory to various international conventions such as the Inter-Governmental Panel on climate Change (IPCC), the government plans to reduce its greenhouse gas emissions by 20% by 2030, when compared to “business-as-usual” levels [13]. The various housing schemes did not also consider the economic implication of such houses. A future house must be environmentally, socially and economically sustainable through the adoption of green housing schemes.

The demand for more housing in the urban centers lead to environmental degradation, increased cost of land due to scarcity and consequent increase in building cost. The social implication is that there is more demand for labor force in the building sector in the urban areas. Most of these labors force that cannot afford reasonable housing live in slums and the shanties.in contrast, is the massive reduction of economic activities in the rural areas as there are no meaningful demand for building

labor force. The skilled and unskilled construction workers are rendered unemployed. The implication on the economy of the rural areas are less desirable and better imagined.

A green-housing refers to the building practices and process that are in tandem with green building principles. A green building is that which is a building which its construction and subsequent operation has minimum negative impact on the environment [14]. The construction and lifetime operation assure healthiest possible environment, it represents the most efficient and least disruptive use of land, water, energy and resources. Since the enactment of the Brundtland's commission in 1984, the world has been very concerned about achieving sustainable development. Sustainable development according to the commission is the one that meets the need of the present generation without compromising the ability of the future generation to meet their own needs. The green building Process helps in Reducing Energy consumption without sacrificing comfort levels, reduces Waste generation due to recycling/reuse, reduces Pollution and minimizes loads Carbon Footprint. With the reported 50% Energy saving and up to 40% Water savings, green building for Nigeria will help in providing adequate low-income housing units much desired. To ensure compliance and a frame work for sustainable housing development, the world green building council sets out some basic green parameters for a green building. These are referred to as green building requirements. In compliance with these principles, various countries set up their green building assessment or rating tools. These are used as benchmarks to ensure adequate implementation of green building principles. Leadership in Energy and Environmental Design (LEED) is one of such rating tools. The LEED is most widely accepted and used due to its ease of adaptation. The LEED certification system have seven impact factors [12]. Nigeria is yet to have her own certification tools. However, efforts have been made by the government to ensure housing development in the country are sustainable.

2.2 Efforts towards green building development in Nigeria

Efforts towards green building development kick started in 2014 with the registration of the green Building Council of Nigeria (GBCN) with the World Green Building Council (WGBC) as a probationer member [15]. This is in contrast with some African countries like Malaysia. The establishment of the 3rd Malaysian Development plan of 1976–1980 was followed by establishing the National Green Technology Policy (NGTP) and the introduction of the green Building Index (GBI) [16].

Although, Nigeria is prospecting the adoption of the South African Green Star rating tool, [15] believes it would have no significant impact on investment in green building development in Nigeria. According to him, the Green Star does not imply a serious commitment to green building development. Therefore, the use of the Green Star may not sufficiently improve green building development in Nigeria. It should therefore be a temporary measure for Nigeria to develop her own rating tool. Conclusively, efforts towards green building development are at infancy in Nigeria unlike the duo of South Africa and Malaysia [17, 18].

However, the federal government through the Federal Ministry of Power, Steel and Housing in 2016 developed the building Energy Efficiency Guideline (BEEG). The BEEG is in cognizance of the energy situation in Nigeria and the life cycle cost implication on buildings. Efficient energy performance is a key criterion for green building development. The electricity burden on Nigeria is huge and this has been a major albatross to the housing development program. With a large percentage of

the population lacking access to constant electricity supply, any step taken towards energy efficient building is of great importance. The establishment of the BEEG is noteworthy since most green building rating tools kick started from the energy efficient point such as the GBI, LEEDv1 and many others [19–21]. The Nigerian BEEG provides regulations and information on the development of efficient residential and office energy costs [22].

Office ventilation accounted for 40–68% of electrical consumption, lighting (13–37%), and office equipment (12–25%) [23]. Energy required for Heating, Ventilation and Air conditioning (HVAC) for residential buildings in Nigeria is 50% compared to only 15% required for lighting. These have great implication for life cycle costs of the building projects while contributing significantly to greenhouse gas effect. Thus, a meaningful housing provision for the teeming populace must meet the energy requirement for a green housing development. The BEEG in conjunction with other green rating systems will enhance the quality of the future housing provision in Nigeria.

Developing the BEEG included a general review of various building assessment tools. The LEED and Green Star-SA were recommended for use and probable adaptation in Nigeria. The LEED has about 317,039 gross square meters of certified and registered building projects in Nigeria [15]. There are over 135 countries using LEED. Some of the LEED certified buildings in Nigeria include the Heritage Place in Ikoyi Lagos, The NOX building in Abuja (Gold rated), P&G Nigeria MDO warehouse, AfDB Nigeria Field Office in Abuja and some others [24]. Reiterating the need for green housing development in Nigeria, [25] identified lack of awareness, lack of enabling policies and legislation to encourage prospective clients and unfavorable economic situation as challenges to green building development in Nigeria. Undoubtedly, the sorry state of the Nigerian housing sector and the demographics requires the implementation of green building practices to achieve appropriate future housing.

2.3 Future housing

The Nigerian population continued to grow geometrically while housing provision is in its trail. Recently, the minister for Power, Steel and Housing, Babatunde Raji Fasola, declared that there was no housing shortage in Nigeria. This he premised on the fact that many urban dwellers have houses in rural areas especially their native towns and villages not adequately in use. Many of the rural dwellers do not have quality housing while most of the urban settlers live in slums and substandard housing. This claim presents some facts about available housing in Nigeria but does not at any rate diminish the fact that Nigerian housing provision at the current pace cannot meet the future housing needs of the Nigerian demographics [7, 26]. Nigeria needs to construct 1.2 million housing units per year to offset the current housing deficit [27]. The goal of the revised national housing policy of year 2006 was to ensure that Nigerians have access to decent, safe and healthy housing accommodation at affordable price. Hence, to achieve qualitative housing provision, Nigeria future housing must consider implementing the green building requirements. These requirements are established as 5 impact factors. The imperative of this requirement to the Nigerian future housing are as follows:

2.3.1 Site design

The design stage forms the foundation for every building project with great impact on cost and project performance. This requirement under LEED is addressed in two

ways. First is the requirement for location and transportation. This requirement ensures ease of movement and unhindered access to public infrastructures to reduce carbon emission through vehicular movement. The buildings are close proximity to public infrastructures and facilities [12]. Poor transportation system, infrastructural deficit is a major driver of rural-urban migration. The rural areas are neglected with poor infrastructure and no enforcement of building regulations. The rural dwellers are unsatisfied. Housing intervention program are targeted at the urban centers leaving the less developed towns, cities and villages poorer and less desirable for dwelling. It is very expensive and disturbing for those in the rural areas, towns and cities to access facilities outside their immediate environment. This include good hospitals, schools, market and other social infrastructures. Developers want good return on their investments; hence there is need for government policy drafted to developing quality housing that meets the need of the younger population. Improve the development of the rural areas, redistribute construction economic resources and minimize the pressure for housing development in the urban centers. If the younger population are assured of adequate affordable housing, with the advent of internet services, rural urban migration will be minimized.

The second aspect is sustainable site. This requirement aims to minimize urban sprawl and needless destruction of valuable land, habitat and green space. It discourages inefficient low-density development, encourages higher density urban development, urban re-development and urban renewal, and brownfield development as a means to preserve valuable green space. The future housing provision should preserve key environmental assets through careful examination of each site. It should engage a design and construction process that minimizes site disturbance, values, preserves and actually restores or regenerates valuable habitat, green space and associated eco-systems that are vital to sustaining life [10]. Minimal effort is required for to achieve this requirement in the southern part of the country being a rain forest zone. Contrastingly, the northern part of the country is ravaged by deforestation. Unfortunately, as well, the eastern part suffers lots of land degradation form gully erosion. The land use Act currently in force in Nigeria also poses a challenge to the attainment of this requirement as it hampers access to land. The difficulty in the processing of land titles, certificate of occupancies and related documents are contributory factors to the development of urban sprawls [28–30].

Urban centers like Lagos, Nigeria are over developed. The need for more sites for housing development created the Eko-Atlantic City. Many highbrow housing areas in Lagos were sand filled and reclaimed from the Atlantic Ocean to provide more land for housing development. The incidence of slums, indiscriminate waste disposal with attendant pollution is on the rise as more people desire to live in the urban centers. Urban centers are better regulated with better layouts and improved access to social and economic facilities. However, re-development and urban renewal activities including brownfield development are at its lowest ebb. The geometric growth of the urban centers generates slums and shanties as building development spills unconsciously to adjoining rural communities without adequate provision or government presence.

New buildings are hardly developed in the rural areas due to the lack of interest of the younger generation to stay back while existing ones are left to dilapidate. The principle of sustainable site if incorporated into housing development policy in Nigeria will ensure that future housing is developed to cater for not only the urban dwellers but the rural dwellers also. The provision of modern and affordable housing units in the rural areas will minimize the incidence of urban sprawl and shanties due to lack of reasonable development in the rural areas.

2.3.2 Water quality and conservation (water efficiency)

Reducing water consumption and protecting water quality are key objectives in sustainable buildings. The construction industry is said to be responsible for more than half of carbon emission, water consumption and land fill wastes in the UK with 13% of the raw materials used [10]. According to the report, about 35% of human water use is unsustainable. The percentage will likely increase if climate change worsens, populations increase, aquifers become progressively depleted and supplies become polluted and unsanitary. Humans currently use 40–50% of the globally available freshwater in the approximate proportion of 70% for agriculture, 20% for industry, and 10% for domestic purposes with the total volume increasing progressively. The low-cost houses are poorly serviced and existing water systems are in a deplorable state [31]. Contrastingly, the report on water usage in Nigeria has 69% for agriculture, 10% for industry, and 21% for domestic purposes [32]. Comparatively, Nigeria uses twice the volume of water for domestic purposes, water conservation should be of great concern for future housing.

Provision of portable water is a major challenge to both the rural and urban dwellers in Nigeria. Consequently, the Federal government declared a State of emergency in the water sector. The Nigerian President, Mohamed Buhari noted that access to piped water services which was 32% in 1990 has declined to 7% in 2015 [33, 34]. With global warming, the volume of available water continues to dwindle. Most urban dwellers in Nigeria buy water from vendors while those in highbrow areas live on boreholes. The rural dwellers make use of whatever is available from streams, to hand dug wells and sometimes borehole water from well-meaning neighbors. Motorized wells and boreholes are more prevalent in towns and cities. Every household have a borehole with grave implication for soil stability. Aside the increased cost implication to the home owner in the cities and towns, the rural dwellers do not have access to portable water. Quality water from public facilities are zero to non-existence. The declared state of emergency has no meaningful impact on its availability. Therefore, the requirement for water efficiency needs serious consideration for Nigerian housing provision.

2.3.3 Energy and environment

Energy efficiency leads to important social benefits, such as reducing the energy bills for poor households [35]. Power generation is generally the most expensive feature to add to a building. It is a major challenge for green building development in Nigeria according to literature, 40 million liters of petrol is consumed daily for private generation of electricity [36]. Surprisingly, green building development produces a high-performance building which uses less energy. Hence, its adverse impacts on the environment (air, water, land, natural resources) is minimized through optimized building siting, optimized building design, material selection, and aggressive use of energy conservation measures. The resulting building performance exceeds minimum International Energy Code (IEC) compliance level by 30–40% or more. It maximizes the use of renewable energy and other low impact energy sources. Embodied energy makes up to 30% of the overall life cycle energy consumption of buildings. Effective window placement for day-lighting is also employed to provide more of natural light against the use of artificial lighting during the day [37].

Residential customers sue up 64% of energy generated in Nigeria, 27% commercial with 9% used by industries. In the same vein, 50% of household power consumption is used for Heating, Ventilation and Air Conditioning (HVAC) compared

to only 15% required for lighting in Nigeria [38]. Apart from its contribution to high operational cost, this also increases the greenhouse gas emission especially in urban centers. Since there is no record decrease in the rate of global warming across the world, the demand for HVAC will continue to increase. To meet the housing need of growing Nigerian population, the use of green and renewable energy is pertinent for future housing. Any housing development that does not provide for HVAC is not appropriate. It goes to say that 50% of whatever is spent on electricity is used for HVAC. Buildings in the northern part of the country need electricity for heating more at some point in the year while those in the southern part needs more for ventilation. Energy cost constitute more of the occupational cost. The provision of green energy using renewable energy sources, energy metering and use of high impact opening for ventilation and lighting, both the initial and future running cost of such buildings will be minimized. This will improve the positive impact of the building.

The rural areas are left in darkness for months up to years, the cities towns and urban centers are subject to noise and pollution from generating sets. There are reports of families losing their lives to fumes from generating sets left running while they went to sleep. Others would have suffered life threatening illnesses not so obvious to the naked eyes as a result of pollution from generating sets. Despite the economic challenges in the country, an average home uses 50% of its income on fueling generating set alone. This is an economic loss which is reversible through the use of renewable energy sources such as solar inverter systems. Improved energy demand can be achieved also by the use of energy saving materials [21].

The Nigerian power sector persistently is unable to provide adequate supply of electricity to domestic households and for industrial uses in contrast to its rapidly growing economy and population. Only 45% of Nigerian's population are connected to the power grid. There is power failure 85% of the time with an average supply of 4 hours/day. The obviously poor supply of electricity in the country is attributed to Nigeria's overdependence on oil revenue, lack of legal framework articulating comprehensive strategy promoting green energy and political will to enforce and implement existing laws. The country's huge potential for renewable energy is not fully utilized unlike countries like china, brazil and Germany. The installation of prepaid meters after the privatization exercise gave a boost to energy metering in contrast, to use of renewable energy sources [39].

Poor power supply cripples developmental and economic activities, negatively affecting the economic power and livelihood of the younger population. The resultant effect is the use of electrical power generating set to meet up their electricity needs. This comes at a high cost to the individual, and environmental pollution from burning of fossil fuel used for the generating sets. Nearly every household in the cities and towns own a particular type of generating set or the other. People in the villages now use smaller generating sets to substitute for electricity which may not be available for 3–4 months and to years in some instances. In 2018, the federal government through the Nigeria Energy Policy (NEP) [24] embarked on rural electrification process to provide solar energy systems to 5million houses by 2030 if successful. The NEP is to guarantee adequate, reliable and sustainable supply of energy at an optimum cost. However, NEP was intent on providing access to power and not on environmental sustainability. Therefore, there is not much consideration for renewable energy sources such as biomass, geothermal, hydropower, solar and wind energy. While the country seeks to promote access to qualitative power supply, there should be balance with environmental sustainability.

Apart from poor power supply, another major problem is that 80% of carbon emission in Nigeria is from fossil fuel [40]. Nigeria currently sources very little of its energy from wind and solar. In 2018, around 18% of its electricity came from hydro-power which is the largest source of low-carbon energy in Nigeria's power. In 2006, Nigeria produced a "Renewable Energy Master Plan" (REMP). Updated in 2011, the plan seeks to increase the supply of renewable electricity to 23% of the total electricity generation in 2025 and 36% by 2030 [13].

From the foregoing, the need for energy efficient building in the provision of future housing cannot be over emphasized. The gap in the energy need and supply will not provide the quality housing if this requirement for green housing is not incorporated into housing policies in Nigeria.

2.3.4 Indoor Environmental Quality

The Indoor Environmental Quality (IEQ) category such as in LEED standards was created to provide comfort, well-being, and productivity of occupants. The IEQ requirement provides comfort, well-being, and improve the productivity of occupants [41]. The objective of this principle is to provide a healthy, comfortable and productive indoor environment for building occupants and visitors. The building design affords the users the best possible conditions in terms of indoor air quality, ventilation, and thermal comfort, access to natural ventilation and day-lighting and effective control of the acoustical environment. Human beings spend more than 90% of their time indoors while 87% is spent at home [37].

A careful integration of daylight and electrical light sources improves the lighting quality and energy performance of a structure giving a performance luminous environment. A green building provides opportunity for Personal temperature and airflow control over the HVAC system backed. A properly designed green building envelope increases the building's thermal quality [42]. A well-insulated and tightly sealed building envelope reduces moisture problems. Adequate ventilation is thus necessary to eliminate moisture from sources indoors and prevent incidences of sick building syndrome. A poor quality indoor environment impairs cognitive performance, negatively impacts occupant's health, and reduces performance [43, 44]. However, [45] reported low quality of houses and its services in the government estates.

The impact of global climate change in Nigeria include reduced rainfall, shorter period of the raining season, long term increase in temperature in most part of the country; the extreme northeast, extreme northwest and extreme southwest. The average temperatures increased by 1.4–1.9°C. Heat waves from this phenomenon is expected to be on the rise resulting in hot nights. Hot night is where night time temperatures are in the top 10% experienced by a region. Advances in extreme heat particularly is a threat to millions of Nigerians without access to electricity or air conditioning. 92 in every 1000 people in the urban areas and just 14 in every 1000 in rural areas have access to air conditioning. Future housing must provide for quality indoor environment.

2.3.5 Materials and resources

The requirement seeks to minimize the use of non-renewable construction materials and other resources such as energy and water. Maximizes the use of recycled

content materials, modern resource efficient engineered materials, and resource efficient composite type structural systems. Maximizes the use of re-usable, renewable, sustainably managed, bio-based materials [46]. One major factor identified for high cost of building construction in Nigeria is massive importation of building materials used. Apart from the fact that some of these materials might not be suitable for the local climatic conditions, many of these contain CO₂ and are very costly. Green building development seeks to reduce embodied energy and CO₂. Nigerian future housing should be developed with consideration for more environmental friendly building materials, less CO₂ and environmentally resilient.

Nigerian construction sector contributes greatly to waste generation and indiscriminate waste disposal. The building process is subject to rework with high volume of waste generated and Nigeria is yet to embrace deconstruction as a practice. Construction waste management is at infancy. There exist various preventive measures to reduce waste thereby conserving resources and minimizing cost. Building construction process go through conventional systems and the various elements are done in segments. There are incidences of the plumber getting to site to tamper with the tiller's work. The building processes are not well integrated to minimize waste of materials and resources. There are no guides for green material specification. Material choices are made based on visual or ego satisfaction. There is no market outlet for supply and demand for recycled materials. Construction wastes are generally dumped and most times, indiscriminately. Domestic wastes are also treated the same way. Indiscriminate waste disposal in urban centers block drains and causes pollution.

Excessive building materials' cost is one major factor identifies for inadequate housing provision quantitatively and qualitatively [8, 47]. Implementing the green building principle will 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 (Intergovernmental Panel on Climate Change [46]. Up to 35% of the investment in conventional building process goes as waste [12]. Huge amount of financial resources goes down the drain thereby hampering the provision of much needed housing.

The problem of housing shortage, poor quality building and its facilities and environmental degradation due to the increased use and consumption of environmental and natural resources in the provision of affordable housing will be minimized if the principles of Green building development is embraced. The choice of green materials and equipment influences the implementation of sustainable construction practices. However, the lack of knowledge of green technologies is a challenge to the implementation of green strategies and standards [48, 49].

Construction and Demolition Wastes (C&DW) are generated during construction of new building and civil engineering structures, and during renovation of existing buildings and civil engineering structures or demolished. C&DW consist of debris that is generated during construction, renovation and demolition of buildings, roads, and bridges. Construction and demolition waste (C&DW) accounts for half of the solid waste generated in our environment Sustainable waste management processes implemented on housing provision will minimize cost and prevent large volume of waste on landfills [50].

2.3.6 Innovation and regional priority

These are additional requirements in the LEED rating system. Innovative design and construction practices is meant to improve the quality of the building and increase user satisfaction. Implementing green building practices requires innovation there are few LEED accredited professionals in Nigeria since Nigeria is yet to develop its policy for green building development. Design professionals are reluctant to adopt green technology, materials, and resources necessary to reduce the cost of green building development. The requirement for regional priority is to encourage every country to prioritize the immediate environmental, social and economic conditions. Nigeria has a tropical climate. The southernmost part of the country is affected by monsoon rainfall and is characterized by rainforests and mangroves, the country's middle belt has a tropical savannah climate and the most northern part of the country is arid and hot. Most parts of the country have seen a reduction in rainfall. The government estimates a decrease in average temperature across the country [13]. The south, is affected by changes in timing and duration of the raining season while the northern region is experiencing a steep rise in the frequency and duration of drought. This regional variation in climatic condition holds significant for green housing development in Nigeria. The use of prototype buildings across the various climatic zones in the country have not achieved the desired result. Green housing provides that climatic and environmental conditions of each country, region or state is prioritized in design and construction of housing.

3. Conclusions

Nigeria has a large and growing population. A large percentage of this population are young people with the median age at 22.7 years. Historical population growth and the estimated growth till 2050 in addition with the current housing deficit poses a great challenge to housing provision in Nigeria. Subsequent efforts by previous administration have failed to meet expected target of various housing polices. Despite, these polices and subsequent housing development did not consider sustainability issues. The resultant economic, social and environment impacts of the housing development policies were not considered. To meet the housing needs of this teeming population, more physical and natural environmental resources will be consumed. This will further compound the current negative environmental foot prints of housing provision. There will be increased environmental degradation, massive depletion of physical and natural resources, increased construction waste generation with indiscriminate disposal of such, more deforestation and generation of heat highlands and much more. The economic implication of this is enormous. With the huge amount of both public and individual resources committed to housing provision, the life cycle cost implication and social impact of the future housing will be daunting. Hence, efforts towards housing provision should implement green building requirements.

Green housing will minimize the development of urban sprawl, minimize resource consumption and reduce greenhouse gas generation among others. Green housing provides Nigeria the opportunity to minimize the challenges of qualitative housing provision.

IntechOpen

Author details


Olubunmi Comfort Ade-Ojo^{1*} and Ayotunde Anthony Babalola²

1 Federal University of Technology, Akure, Nigeria

2 Federal Polytechnic, Ado-Ekiti, Nigeria

*Address all correspondence to: ade-ajoco@futa.edu.ng

IntechOpen

© 2022 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Populationof.net. 2022. [Accessed: September 12, 2022]
- [2] Statista. 2022. Available from: <https://www.statista.com/statistics/1122838/population-of-nigeria>
- [3] Olotuah AO. Housing development and environmental degeneration in Nigeria. *The Built & Human Environment Review*. 2010;**3**:42
- [4] Ade-Ojo OC. Awareness of the LEED requirements for green housing development among built-environment professionals in Nigeria. *Built Environment Project and Asset Management*. 2022;**12**(4):521-536. DOI: 10.1108/BEPAM-02-2020-0032
- [5] Etebong PC. Demography in Nigeria: Problems and prospects. *Biostatistics Biometrics Open Access Journal*. 2018;**5**(1):555654. DOI: 10.19080/BBOAJ.2018.05.555654
- [6] Nigeria Bureau of Statistics. 2022
- [7] Emiedafe W. *Housing in Nigeria: Why We Desperately Need 17 Million More Homes*. Nigeria: Sapient Vendors LTD; 2015
- [8] Moore EA. Addressing housing deficit in Nigeria: Issues, challenges and prospects. *Central Bank of Nigeria Economic and Financial Review*. 2019;**57**(4):201-222
- [9] Shen L, Hao JL, Tam VW, Yao H. A checklist for assessing sustainability performance of construction projects. *Journal of Civil Engineering and Management*. 2007;**13**(4):273-281. DOI: 10.1080/13923730.2007.9636447
- [10] Bashir A, Suresh S, Proverbs DG, Gameson R. Barriers towards the sustainable implementation of lean construction in the United Kingdom construction organisations. In: *Arcom Doctoral Workshop*. 2010. pp. 1-8
- [11] Hussin JM, Rahman IA, Memon AH. The way forward in sustainable construction: Issues and challenges. *International Journal of Advances in Applied Sciences*. 2013;**2**(1):15-24. DOI: 10.11591/ijaas.v2i1.1321
- [12] Ade-Ojo CO, Ogunsemi DR. Cost prediction for green affordable housing in Nigeria. In: Abdullateef O, Zalina S, Zhonghua G, editors. *Greening Affordable Housing: An Interactive Approach*. 1st ed. Florida: CRC Press, Taylor & Francis Group; 2019. pp. 265-281
- [13] Dunne D. The carbon brief profile: Nigeria. *Country Profiles*. 2020
- [14] Gupta JK. *Buildings Economics*. Bhaddal; 2013
- [15] Onuoha IJ, Kamarudin N, Aliagha GU, Okeahialam SA, Atilola MI, Atamamen FO. Developing policies and programmes for green buildings: What can Nigeria learn from Malaysia's experience. *International Journal of Real Estate Studies*. 2017;**11**(2):49-58
- [16] Pandey S. MIT-UTM Impact of green building rating systems on the sustainability and efficacy of green buildings: Case analysis of green building index, Malaysia. Malaysia: 2016. [Accessed: August 24, 2019]
- [17] Waniko SN. Implication of agricultural and industrial sector linkages on sustainable development in Nigeria. *Journal of Sustainable Development in Africa*. 2016;**18**(4):67-80

- [18] Ejohwomu OA, Oshodi OS. A review of construction management and economics research outputs in Nigeria: Towards a sustainable future. *Journal of Construction Project Management and Innovation*. 2014;4(sup-1):900-905
- [19] Howe M. Housing design Award project winner 2011-New Islington. Man
- [20] Ghiran A, Mayer A. The Move Toward Net Zero Energy Buildings, Experiences and Lessons from Early Adopters. Institute for Building Efficiency. Available from: <http://www.Buildingefficiencyinitiative.org/sites/default/files/legacy/InstituteBE/media/Library/Resources/Existing-Building-Retrofits/Issue-Brief-Moving-to-Net-Zero-Energy-Buildings.pdf>. 2012
- [21] Bedon C. Recent trends and challenges of energy efficient and sustainable buildings. *American Journal of Engineering and Applied Sciences*. 2014;7(3):292
- [22] Arup. Building Energy Efficiency Guideline for Nigeria. Abuja; 2016
- [23] Nigerian Energy Support Programme, (NESP). Promoting Clean Energy Investments in Nigeria. 2013
- [24] Amasuomo TT, Atanda J, Baird G. Development of a building performance assessment and design tool for residential buildings in Nigeria. *Procedia Engineering*. 2017;180:221-230
- [25] Dahiru D, Dania AA, Adejoh A. An investigation into the prospects of green building practice in Nigeria. *Journal of Sustainable Development*. 2014;7(6):158
- [26] Olofinji L. An overview of the national housing policy. *Real Estate*. 2015;12. Available from: <https://nigeriarealestatehub.com/an-overview-of-the-national-housing-policy> [Online]
- [27] Ajayi O, Ukanwa E. Nigeria's housing deficit jumps to 28 million, International rights group. Vanguard Newspaper. 2022
- [28] Pushkar S, Becker R. Katz, AA methodology for design of environmentally optimal buildings by variable grouping. *Building and Environment*. 2005. DOI: 10.1016/j.buildenv.2004.09.004
- [29] Adedeji YMD, Olotuah AO. An Evaluation of Accessibility of Low-Income Earners to Housing Finance in Nigeria. 2012;7(1):23-31. DOI: 10.5829/idosi.ajejsr.2012.7.1.1101
- [30] Ibimilua AF, Oyewole IA. Housing policy in Nigeria: An overview. *American International Journal of Contemporary Research*. 2015;5(2):53, 2162-59, 142X
- [31] Adetokunbo OI. Housing, neighbourhood quality and quality of life in public housing in Lagos, Nigeria. *International Journal for Housing Science*. 2012;36(4):231-240
- [32] Dounngmanee P. The nexus of agricultural water use and economic development level. *Kasetsart Journal of Social Sciences*. 2016;37(1):38-45. DOI: 10.1016/j.kjss.2016.01.008
- [33] Falaju J. Government Declares State of Emergency in Water, Sanitation and Health Sector. *The Guardian*; 2018
- [34] Afolayan FO. Funding higher education in Nigeria. *Journal of Research & Method in Education*. 2015;5(1):63-68. DOI: 10.9790/7388-05116368
- [35] Oyedepo SO. Energy and sustainable development in Nigeria: The way forward Energy. *Sustainability and Society*. 2012;2:15
- [36] Africa M. How we made it in Africa. *Africa Business Insight*. 2017

- [37] Simpson JR, McPherson EG, Lichter JM, Rowntree RA. Potential of tree shade for reducing building energy use in the Sacramento valley. *Journal of Arboriculture*. 1993;22(1):10-18
- [38] Ijigah EA, Jimoh RA, Aruleba BO, Ade AB. An assessment of environmental impacts of building construction projects. *Civil and Environmental Research*. 2013
- [39] Ezema IC, Olotuah AO, Fagbenle OI. Evaluation of energy use in public housing in Lagos, Nigeria: Prospects for renewable energy sources. *International Journal of Renewable Energy Development(IJRED)*. 2016;5(1):15-24. DOI: 10.14710/ijred.5
- [40] Ogundipe AA, Okwara C, Ogundipe MO. CO₂ emissions and environmental implications in Nigeria. *International Journal of Energy Economics and Policy*. 2020;10(3):317-324
- [41] Lee YS, Guerin DA. Indoor environmental quality related to occupant satisfaction and performance in LEED-certified buildings. *Indoor and Built Environment*. 2009;18(4):293-300. DOI: 10.1177/1420326X09105455
- [42] Alhorr Y, Arif M, Katafygiotou M, Mazroei A, Kaushik A, Elsarrag E. Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature. *International Journal of Sustainable Built Environment*. 2016;5(1):1-11. DOI: 10.1016/j.ijsbe.2016.03.006
- [43] U.S. Green Building Council. LEED v4 User Guide. 2013
- [44] Mihai T, Iordache V. Determining the indoor environment quality for an educational building. *Energy Procedia*. 2016;85(2015):566-574. DOI: 10.1016/j.egypro.2015.12.246
- [45] Mohit MA, Iyanda SA. Liveability and low-income housing in Nigeria. *Procedia—Social and Behavioral Sciences*. 2016;222:863-871. DOI: 10.1016/j.sbspro.2016.05.198
- [46] IPCC. Summary for Policymakers. In: Solomon, Qin SD, Manning M, Chen Z, Marquis M, Aver KB, editors. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. United Kingdom and New York, NY, USA; 2007. DOI: 10.1038/446727a
- [47] Obi ANI, Ubani O. Dynamics of housing affordability in Nigeria. *Civil and Environmental Research*. 2014;6(3):79-84
- [48] Saleh MS, Alalouch C. Towards sustainable construction in Oman: Challenges & Opportunities. 2015;118(2015):177-184. DOI: 10.1016/j.proeng.2015.08.416
- [49] Dalibi SG, Feng JC, Shuangqin L, Sadiq A, Bello BS, Danja II. Hindrances to green building developments in Nigeria 's built environment: "The project professionals ' perspectives". In: *IOP Conference Series: Earth and Environmental Science*. Vol. 63(012033). IOP Publishing; 2017. pp. 1-9. DOI: 10.1088/1755-1315/63/1/012033
- [50] Omoniyi TE, Akinyemi BA, Nwosu SC. A management approach to construction and demolition wastes in Ibadan Metropolis. *International Journal of Scientific & Engineering Research*. 2014;5(5)