The Current State of Green Building Development in Nigerian Construction Industry: Policy and Implications

Abiodun Olatunji Abisuga and Tope Femi Okuntade

Abstract The negative impact of the construction activities on the economy and the environment has necessitated the need for a green policy formulation and framework in developing country like Nigeria. To ensure the development of green policy, it is necessary to evaluate the existing green building policy, barriers, and benefits of green practice, and the drivers of green building policy implementation. The chapter identifies Green Building Council of Nigeria (GBCN), National Building Efficiency Code, Nigeria Building Code (NBC), and National Adaptation and Plan (NASPA) as the existing green building policy in Nigeria. The findings of the chapter indicated that the existing green policy is not fully implemented due to the lack of government and leadership political will, policy compliance and enforcement, and lack of public awareness of green practice benefits among others. A green policy formation framework that can be adapted in Nigeria was also developed. It was concluded that for the policy framework to be effective, government, politician, and construction stakeholders should be involved in the formation of the green building public policy. Particularly, the government should champion the campaign for its enforcement within the Nigerian construction industry and the citizenry. If an enforceable green building standard is in place, the country-built environment will be set up for sustainable building.

Keywords Construction stakeholders · Green building · Green building standard · Green policy formulation · Nigeria

1 Introduction

The friendliest way to protect the environment is not to build. However, without any building activities, life can be hopeless and undermining. What is required is an energy balance without risks particularly to the environment. It is broadly acknowl-

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edged that the construction industry has destructive impacts on the environment and society [4, 37]. According to the reports [9, 24, 28], the construction industry consumes up to 40% of energy and 19% yearly greenhouse gas emissions. Additionally, the construction industry uses approximately 70% of cement and 25% of steel in numerous nations [24]. These have raised a series of concerns about the impact of these materials on the environment. The combination of these challenges gave birth to an unused concept in the design, construction, and operation of buildings incongruity with "sustainable buildings" known as green buildings (GBs). Bell and Cheung (2018) explained that green building is now seen as a sustainable development because it takes the obligation for balancing long-term financial and social health. It also offers an opportunity to form ecologically efficient buildings by utilizing a coordinated approach to reduce the negative effect of building on the environment and its inhabitants [5].

The adoption of green buildings concept recently is gaining tripartite academic, professional, and government concerns. The drive for green buildings concept has diverse perspectives due to its understanding, complexity, and usage. There is no single definition of what constitutes a green building. Green building can be freely characterized as one in which all the materials and frameworks are outlined with an accentuation on their integration, for the reason of minimizing their impacts on the inhabitants and their environment [16]. This incorporates such issues as building, materials choice, energy productivity, water preservation, indoor quality, and others. The word "green" alludes to a strategic plan and development that minimizes the burden on our infrastructure and the environment. Green building design does make a positive impact on public health and the environment; it decreases working costs, enhances the building and organizational attractiveness, and increases occupant efficiency [21]. Green buildings are energy proficient, water conserving, tough, and non-toxic, with high-quality spaces and high-recycled substance materials, which presents an arrangement for a large part of assets issues [6]. In addition, the green building combines energy and water productivity frameworks, daylighting techniques, indoor natural quality frameworks, and productive building envelope system to supply consolation and positive effect on the inhabitants and the environment [23]. It also developed a framework that can be utilized as a means of setting up feasible design priorities and objectives, creating fitting sustainable design strategies, and deciding environmental performance measures to direct the sustainable plan and decision-making forms [1, 40]. Furthermore, green building is now becoming a methodology that is moving forward the maintainability of the construction industry [36]. These paramount characteristics drive the popularity of green building concept in becoming recognized by researchers, policymakers, industry practitioners, governments, and other stakeholders around the world.

Despite all these benefits accrued to green building, there is a big question mark about whether developing countries are tapping into these new areas of sustainable building termed "green building"? In developing nations such as Nigeria, the concept of green has been slowly embraced and in its infant stage, even though some developing countries in Africa, like South Africa, Kenya, and Ghana, are prioritizing green building. Several studies have focused on the barriers [12], technology [13],

and the promotion [12], of green building practice, but there is a lack of literature from the policy perspective [19]. Hence, it is an essence to explore the state of green building practice in Nigeria in relation to the barriers and policy that can encourage its adoption by construction stakeholders.

2 Developing a Green Agenda for Nigerian Construction Industry

Nigeria has an aggregate land territory of 923,773 comprising of abundant and differing renewable and non-renewable natural resources. These comprise energy, mineral, and organic natural resources. Tellingly, this natural endowment should transform into an industrialized developed country, with viable socio-economic development. Unfortunately, the reverse is the case: The nation is experiencing slow growth in technological advancement and increased in environmental degradation. The primary reason for this is lack of planning, execution, coordination, and monitoring in order to achieve the expected development drives. Recently, this challenge is being tackled by the government with the formation of different initiatives and environmental protection programs. But the attainment of the desired progress is far from success. Most of these initiatives to protect the environment in Nigeria are more focused on sanitation, oil pollution, and waste management. The initiative to go green also is attached to environmental protection with the view to manage waste production, disposal, and recycling. Green construction is not part of the large picture of the green initiative in Nigeria.

Green practice ideology is a strange phenomenon to a national system that even lacks maintenance culture. The challenges of the Nigerian construction industry go beyond the internal influencing factors to external factors. Suggestively, we listed some of the factors that inhibit green practices in the Nigerian construction industry as

i. Lack of government and leadership political will
ii. Lack of demand for green production
iii. Lack of sustainable practices and norms
iv. Lack of organization leadership commitment
v. Poor information sharing among stakeholders
vi. Lack of knowledge about environmental impact
vii. Lack of public awareness of green practice benefits
viii. Lack of green awareness
ix. Low green building policy and standard regulation
x. Inadequate green knowledge among professionals
xi. Poverty level in the country
xii. Lack of green building product production know-how
xiii. Cost implication of green product
xiv. Low development in design and innovation

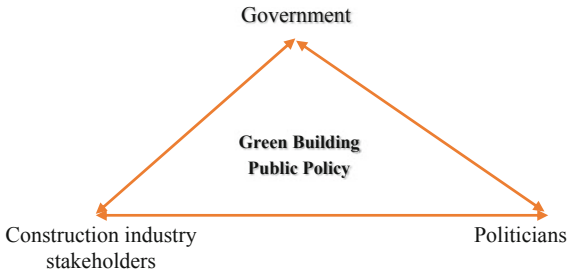

Fig. 1 Green building public policy formation circle

xv. Lack of interest of client and users
xvi. Lack of policy compliance and enforcement
xvii. Lack of green technologies.

Several researchers have investigated factors that affect the practices of green innovations in developing nations (see [12, 30]) and factors that can promote its implementation [12, 13]. Government regulation and policy has been indicated as the major driver of green building implementation. "Policy is a deliberate system of principles to guide decisions and achieve rational outcomes" [7, p. 120]. Government policy is an intended plan or course of action to influence and determine decisions relating to a purpose. Furthermore, policies are not legally binding but just plans and cause of direction. Hence, policies can only be enforceable legally when transformed into a law. Formation of green building policy is essential to be incorporated in the social, economic, and technological context of construction processes in Nigeria. This could only be done by the policymakers, after been influenced by the interested stakeholders. Passing policy to law involves lobbying of the politician by various interest groups. Therefore, construction practitioners need political influence to push some of their common goals, to get government public policy achieved. Green building public policy could be in fruition only if the construction stakeholders, politicians, and government share the same common interest to harness the benefits of greening. Green building public policy formation and implementation are within the circle of the government, politician and construction professionals and other stakeholders (see Fig. 1).

2.1 Green Building Policy Framework in Nigeria

One of few developing nations that have started the development and implementation of green building is Malaysia. Malaysia's green development started as early as 1976–1980 ([38]; Jomo and Syn, n.d; [25]). However, in 2009, Malaysia commenced the full development of green building policy by the introduction of the National Green Innovation Program (NGTP) and the Green Building Index (GBI) [35]. Nigeria, on the other hand, is still at an early stage of embracing and formulating a framework for green buildings [33]. Nigeria is slowly embracing the concept due to

a few reasons such as design, innovation, and public awareness. Despite the progressively extraordinary climatic conditions, decreasing environmental resources, and all manners of contamination, African nations must go past the thought (or plausible excuse) that financial improvement and poverty annihilation is more of a need than sustainable advancement. Although during the last few years, the Nigerian government and experts within the built environment have started the development of policies for green buildings [33, p. 49]. As a matter of fact, in 2014, Nigeria was enlisted in the World Green Building Board (WGBC) on a probationary enrollment level after establishing the Green Building Council of Nigeria (GBCN) [41]. Studies have uncovered that nations and states that embrace green building have more prominent prospects of delivering a high-performance green building that reduces poor environmental condition, energy use, operational cost, and advance collaboration and innovation in the workplace [14, 33]. Such nations encounter circumstances where contractors and clients now pursue certification for their project development [14]. The weight behind the consistent call for green building policy in Nigeria is anchored on the rising proof that the building sector is a major customer of natural resources and energy use around the globe. For example, the building industry accounts for around 44% of total material usage with an expansive proportion of more than 50% of natural resources [29]. In Canada, UK and USA, for examples, energy consumption by buildings alone is about 30–50% of the country's total energy demand [29]. In Nigeria, about 50% of energy is utilized in buildings for occupant's comfort [15, 20]. A satisfactory and effective policy is required to control and cut energy utilization by buildings in Nigeria. Although in time past, Nigeria has created policies and programs that particularly target green building, these policies have not yielded a critical result. For example, based on LEED achievement of nations in a green economy, some developing nations have a total number of 5,785, 244 net square meters of certified and registered green building projects, whereas Nigeria has 317, 039 net square meters. The green building policy framework or organizations adopted or formed by the Nigerian government are discussed below:

2.1.1 Green Building Council of Nigeria (GBCN)

GBCN was enlisted in 2014 with the World Green Building Board (WGBC) on a prospective enrollment level [41]. GBCN has the duty of creating a rating framework for the economic evaluation of buildings in Nigeria. GBCN is directly in the process of creating a development framework for green buildings. However, the Green Building Chamber of South Africa (GBCSA) rating device (the Green Star) is being utilized to certify green buildings in Nigeria. The certification is called "Green Star SA-Nigeria." It is not clear whether Nigeria intends to adopt any further arrangements to advance green building due to some perceptible insufficiencies in Green Star SA such as the range of weighting standards specifically on energy proficiency, management, and advancements. The Green Star SA rating tool (Green Star SA-Nigeria) is based on nine major categories which are, management, indoor environmental quality, energy, transport, water, materials, environment, outflows, and innovations.

Despite that Nigeria has not made a significant improvement on environmental rating scheme, it has, in any case, enlisted almost 317,039 gross sq. of green buildings [39]. To improve the rating schemes, different motivating forces were established in form of policies and control such as National Policy on the Environment (NPE), Environmental Protection Organization Act 1988, and the National Environmental Guidelines and Regulations Enforcement Office (NESREA) to encourage the GBCN policies.

2.1.2 National Building Efficiency Code

Nigeria's launch its first Building Energy Efficiency Code formally on the August 29, 2017, by the Minister for Power, Works, and Housing, Babatunde Raji Fashola (SAN). The occasion was facilitated by German Development Agency (GIZ), Nigerian Energy Support Program (NESP), and the Federal Ministry of Power, Works and Housing. The Building Energy Efficiency Code (BEEC) involves the pertinence of energy productivity in buildings and on climate change. The Building Energy Efficiency Code (BEEC) will create opportunities for energy efficiency with respects to retrofitting, existing, and non-compliant buildings to sustainable improvement. Geissler et al. [17] explained that the BEEC is only applicable to new buildings and is prepared based on climatic conditions of different zones in Nigeria. According to [17], adoption of the BEEC is voluntary (at the starting stage) but will become permanent after 2 years which will include enforcement of all the BEEC requirement by a competent authority. The enforcement authority according to the BEEC must understand the following [10, p. 25]:

i. Building physic
ii. Usage of calculation sheet for minimum energy efficiency requirements
iii. Minimum energy requirements on drawings
iv. Types of equipment used
v. Tracking of progress and database, and
vi. Route and performance.

2.1.3 Nigeria Building Code (NBC)

The first edition of the National Building Code (NBC) was developed in 2006 by a team of professionals in the built environment to ensure a standard for professionals, materials usage, fire prevention, and competency among construction professionals. Despite the concerted efforts of the construction professionals towards the codes, the National Building Code (NBC) is yet to be approved by the National Assembly which makes the code inactive since 2006. The code was, however, revised in 2015 but still inactive due to the aforementioned challenges. The aim of the NBC is to set a "minimum standards on building pre-design, designs, construction and post-construction stages with a view to ensuring quality, safety and proficiency in the

building industry" [26, p. 6]. Dahiru et al. [11] pointed out that the introduction of the building code to the building industry will help secure the built environment and ensure sanity among construction stakeholders. The NBC ([26], 2015) focuses on safety with respect to a sustainable building, but provisions were not made to key areas such as renewable building materials [11], sustainable design and construction, carbon emission, and energy preservation. The increasing emissions from building because of cement usage are not captured in the building code [32]. These gaps in the content of the NBC make it not enough to tackle green practice in the Nigerian construction sector.

2.1.4 National Adaptation and Plan (NASPA)

Most of the energy efficiency policy on green building and climate change are yet to be enforced by the National Assembly nor consented to by the executive. In 2012, the government adopted a scheme tag "vision 2020" which includes varieties of policy for climate change and sustainable development through the National Adaptation Scheme and Plan (NASPA). The overarching objective of NASPA is to advance low-carbon emission, high-growth financial improvement, and a climate-resilient society. According to Oribuyaku [32], the aim of NASPA is to promote renewable energy use and to create an adaptive measure of the greenhouse effect. In term of the greenhouse effect on the environment, the NASPA document traced the problem to poor infrastructural development that poses enormous challenges to the environment [27]. The report suggested that the government and relevant agencies should ensure a building is a design to adapt to green building models such as roofing requirement and alternative building materials that can ensure sustainability [27, p. 46]. Nevertheless, if the policy is not transformed into a law, it cannot be enforced to drive public decision making.

3 Major Drivers Essential for Green Building Practices in Nigeria

3.1 Research and Practice

Ordinarily, the thought of a green building would have been an unusual convention in developing nations. But with the climate change and high energy usage, nothing may be more alluring presently. A green building may be a structure that has been developed to join aesthetics, innovations, and materials that are ecologically friendly. Some school of thought believes that implementing green building in Nigeria would be confronted with challenges within the built environment primarily because most clients, investors, and engineers are not really concern of the practice. In addition, there is a tremendous disconnect between research and practice in Nigeria. For instance, the

Nigerian Building and Road Research (NBRRI) has done an extraordinary work in terms of research and systems improvement within the adoption of green building to produce sustainable buildings and infrastructure. The NBRRI has done a lot of investigation on the most excellent ways to utilize conventional building materials such as bricks, bamboo sticks, and alternative replacement of the concrete materials with local resources for the development of sustainable advanced architecture and buildings to drive the green building policy in Nigeria. Hence, the government should partner with other stakeholders such as the manufacturers, architects, clients/owners, construction units, developers, and so on, and thrust for more advocacies and the standardization of conventional building materials to guarantee quality, supportability, health, and cost-effective building.

3.2 Availability of Green Materials

Sustainability in development is approximately about an appropriate decision on the choices of materials, their sources, development techniques, as well as a planning logic in order to enable an improved performance, minimize waste and become ecologically friendly [1]. Green building materials utilize the use of low-carbon emanation with reusable and recyclable capacities. The challenges in many developing countries are that many of these green materials are not yet readily available locally, as the available ones are not strictly in use due to lack of enforcement, and awareness of their effectiveness. It has remained a major concern for the government in Nigeria due to the over-dependence on the imported sustainable building materials. Amal et al. [2] stated that building design and construction should endeavor to utilize locally made materials with renewable features. However, the major challenges of locally produced materials for green building in Nigeria are the lack of standardization.

3.3 Education and Training

Green building concept should be incorporated in the higher education curriculum, especially for built environment students. The National Adaptation Scheme and Plan [27] also suggested that information-based awareness on a sustainable building should be encouraged which will involve developing a skilled-based curriculum for every institution in Nigeria. In addition, a professional association within the industry should also organize seminars on the benefit of green building and how they can educate their clients on the benefits of consolidating green activities on infrastructural development. This will altogether reduce the operating cost over the lifetime of a building, whereas contributing emphatically to the environment and the individuals who utilize the building. There is enough proof that “green” feasible building is cost-effective and safe to live in. Experts advice could drive the green campaign if properly channeled.

3.4 Government Regulations and Enforcement

Every government should thrive to take the issue of sustainable building serious and should also be a priority. The government should lead in the green building implementation crusade. Government regulation and laws are the major drivers of green practice [3]. Green construction law and regulation need to be promulgated and enforced. Nigerian construction industry has been operating under less operational regulations. Even the proposed building code which reflects little or no items on green rating has not been signed into the federal law over the years. Few states like Lagos State have witnessed the promulgation of the building code at state level but confronted with enforcement challenges. The government must consolidate sustainable infrastructure into their environmental protection agenda. Approaches on greening buildings should be the government major agenda for a sustainable development. Such approaches should incorporate energy proficiency, sustainable building materials, indoor environmental quality, and advancement in design that consider the green building as a criterion. The government should introduce a certification for energy design and innovation to ensure compliance. The government needs to encourage regular audits on a green environmental standard of all construction industry activities. According to Arif et al. [3] green practice reflects the responsibility of the government because it is solely influenced by regulations.

The major challenge of enforcing, implementing, or promoting sustainable development faced by the Nigerian courts and policymakers is whether it is a moral or legal concept [31]. According to Okon [31], the legal status of green practices in Nigerian environmental law is still controversial. Nevertheless, the legality of green practices (i.e., sustainable development) in Nigerian environmental law depends on the judgment of the court [31]. Even the few policies on green building that have been formulated by the government are still inactive as the agencies to ensure compliance with green building measures are complicit. To achieve an effective implementation and enforcement of green practices in the Nigerian, there is a need for it to be directly integrated into the Constitution of the Federal Republic of Nigeria 1999. The major stakeholders for enforcement of the regulation need to energize the political will and capacity to encourage and foster the practice.

4 Green Building Policy Formation Process Framework for Nigerian Construction Industry

The Nigerian construction industry is regarded as a huge, energetic, and complex division that plays a crucial role in the economy. The industry accounts for more than 10% of most country's capital growth. Hence, if this growth is not controlled, it can pose a serious environmental challenge. For example, the building industry in Nigeria extensively utilizes resources such as water, timbers, and energy for its construction activities. But if all these resources are not put under control most especially materials

that are energy intensive, they can erode the environment. It was reported that the construction industry consumes up to 40% of energy and 19% yearly greenhouse gas emissions majorly from air conditioning, water heater, and lighting. Likewise, the operation of the building also generates large chunks of waste materials into the environment about 48% waste generation and 50% air and water pollution [34].

Therefore, for the Nigerian construction industry to prevent energy emission of building and reduce the gap between energy supply and energy loss, "an effective green building policy framework" (EGBP) should be constituted on how to achieve environmentally friendly building in Nigeria. The building policy formation process would involve six interconnected activities/factors such as construction stakeholders, green rule standards, green building drafting policy, green policy presentation, public green building policy, implementations, and enforcement (see Fig. 2). The green building policy framework would aim at:

i. Constructing building to be self-sufficient and consume less energy and water during the whole building life cycle without altering the building standard;
ii. Reducing the impact of exploitation of our natural resources because of traditional method of building;
iii. Provide guideline for various construction stakeholders and organization with the aim of adopting the green building policy for new development;
iv. Encourage the use of energy efficient building materials;
v. Implementation of the existing energy efficiency code such as BEECC, NASPA, National building code (NBC), and National Building Efficiency Code (NBEC).

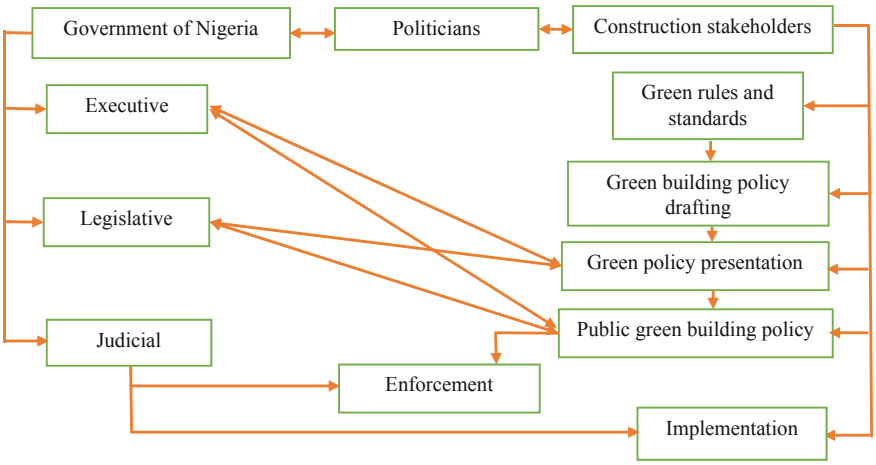

Fig. 2 Green building public policy formation process framework

4.1 Construction Stakeholders

The construction stakeholders involve the major players in the built environment. For a policy to become effective, all major stakeholders in the built environment must be involved in the policy formulation. The policy formulation is not only limited to construction stakeholders but also to politicians (lobbyists) that will act as the major drivers to the policy; the government which consists of the executive arm, legislative, and the judiciary is also key stakeholders in the policy formulation. The federal ministry of work and housing through the National Council of Housing can help organize a workshop on green building policy formulation before passing it to the Federal Executive Council for ratification. The construction stakeholders should also involve private organizations. Likewise, the interest of those who will be affected by the new policy on green building such as

i. Owner's representatives—Such as the owner's representatives that will be responsible for interpreting the green building policy.
ii. Supporting organizations—Those who may be responsible for funding the implementation of the green policy.
iii. End users—Users that will benefit from the implementation of the green building policy.

4.2 Green Rules and Standards

The construction stakeholders and other government representatives will make their input on the green rules and standards. The green rules and standards will consist of a set of ratings and certification that will act as a guide for delivering a sustainable building. The rules and regulations will be based on the input of all the construction stakeholders based on their areas of expertise and the international rating standards for building. Other stakeholders that will be involved in the drafting of the rules and standard are federal government agencies. The federal government agencies should create a consensus standard since other major stakeholders are involved to prevent a situation where a proprietary standard will be created for green building. The green rule and standard should also be subjected to public comments. More so, since there are international standards for a green building called the green star rating, all rules and standards should be subjected to the international green building standards in order to be in conformity with the known standard worldwide. Since international rating standard is based on nine major categories which are management, indoor environmental quality, energy, transport, water, materials, environment, outflows, and innovations, the green rules should be an improvement of these indices.

4.3 Green Building Policy Drafting

The green building policy drafting is the starting point for sustainable green building practice. The government can take the lead by drafting a unique policy based on the already prepared set of green rules and standard by the construction stakeholders. The purpose of the draft is to set a green building ordinance that will promote green building in Nigeria.

4.4 Green Policy Presentation

The green building policy is presented to the upper and lower assemblies in form of a proposal for first reading. After the first reading, a second reading date will be announced for the submitted policy document. At the second reading, the purpose of the "green building policy" is explained and debated by the house. A committee is set up to examine the details of the "green building document" for amendments and corrections which are made in accordance with the draft prepared by the construction stakeholders and suggestions. The "green policy document" is then presented by the committee set up by the house for third readings. At this time, the green policy document is subject to a vote by the house. If the bill passes through, a printed copy of the bill is signed by the clerk of work of both houses for consideration. If both chambers approve the green policy document (GPD), it is sent to the president for approval. Once the president signs the policy document, it then becomes a law, or otherwise an act in Nigeria for all construction industry.

4.5 Public Green Building Policy

Once the president signs the policy document, it then becomes a law, or otherwise an act in Nigeria for all construction industry. Should in case the bill is sent back to the house for amendment, the original copy is sent to the clerk for amendment and production of a new copy based on the amendment; it is then sent back to the president for assent and a seal of approval. Sometimes, if the public green building is not assented to by the president after 30 days due to some political reasons, the National Assembly can veto or overrule the president, and the public policy bill can be recalled and repassed by both chambers. At this stage, the public policy bill may require two-thirds in order to automatically become a law without the consent of the president.

4.6 Enforcement

The enforcement of green building will involve establishing and setting up an agency of the government involving a representative from the construction profession to ensure compliance during the construction of new building or retrofitting. The judiciary will also help in interpreting some part of the document to defaulters in the form of penalties or fine to prevent precedence. The police will also ensure a strict compliance by working with the established government agencies that oversee the adoption of green building in every construction development.

4.7 Implementation

The implementation will also involve the roles of the judiciary in ensuring compliance with the green building document. The implementation may involve monitoring the compliance of the green building policy through government-approved agencies and all the Nigerian built environment professional associations involved in the formulation of the policy. They would ensure that the manufacturers, contractors, suppliers, and other stakeholders operate with the directive of the green building policy. The implementation will involve ensuring control and proactive actions to ensure compliance.

5 Benefits and Reasons to Build Green in Nigeria

Green buildings join sustainable materials in their development (e.g., reused, recycled-content, or made from renewable assets); make sound indoor situations with negligible (e.g., decreased item emanations); and decrease water utilization (e.g., by utilizing local plants that survive without additional watering). The built environment includes an endless effect on the common environment, human well-being, and the economy. Green buildings are outlined to reduce the general effect of the built environment on human well-being and the characteristic environment through:

- Proficient use of energy, water, and other valuable resources
- Securing the inhabitant health and ensuring efficiency, and productivity
- Reducing waste, contamination, and natural debasement
- Green building is less expensive except in cases where retrofitting of existing buildings is carried out
- Less operating risk
- Low maintenance and replacement cost
- Consistent temperature and humidity
- High indoor air quality

- Low environmental impact
- Efficient waste management.

6 Implications of Green Building for Nigeria

Green innovations in Nigeria have the objective of moderating climate change and have impacts on different issues that incorporate social economic, political, and innovative advancements in Nigeria. It is basically for improving the developments of local practices and values, to improve the economy. There is no better time other than the present for Africa to seek green innovations to combat future challenges.

6.1 Economic Implication

Building materials generally constitute an expansive addition to capital project and add up to 80% of infrastructural development. Green technology utilizes locally made materials and building strategies to cut costs to its barest minimum. The effect of this is that house rent and cost of building that have been a major problem in the third world nation will reduce drastically. It will also optimize national domestic economic exhibitions. It will enhance multiple business and employment as well as occupational and regulatory efficiency, whereas poverty alleviation is upgraded. There will moreover be an expansion of market opportunities for green items, e.g., sales of locally produced energy efficient materials and higher exportation. Considering all factors, green technology would help in the areas of economic viability.

6.2 Political Implication

Green building technology ignites the legitimate issues pertaining to indigenous innovation by the government agencies. Government at different levels could formulate policies and monitor the performance at different jurisdiction to ensure open intrigued. These will also ensure that local materials and costs are controlled. By so doing, the objectives of green building technology can be realized. Government's activities will go a long way in implementing policies that are competent of advancing green technology. It will define a premise for controls and the application of policies that would lead to advancement.

6.3 Sociocultural Implication

Extemporizing green innovation in the Nigerian construction industry would lead to an advancement within the general quality of life of the populace. It would characterize the production of an occupant's wellness and the comfort of living in an eco-friendly building. Availability of green buildings, which take care of fundamental infrastructural needs, like clean water, solar powered (energy) electricity, and secure environment, is what society requires for sustainability. Green technology can change the social value system in Nigeria within the sense that the indigenous potentials will be sustained, approved, and compensated appropriately. Greener culture would have induced the consciousness of environmental protection and lean concept in the construction activities. Client organization awareness of green building practice would transform the construction procurement system. Formation and enforcement of building code for green innovation implementation in construction processes would imbibe green culture within the system, whereas awareness is improved as the Nigerian construction industry progresses in a profitable adventure bringing approximately efficiency through green indigenous innovation.

6.4 Technological Implication

Innovations in science have brought major advancements globally. Modern revelations in innovation would make tremendous commitments towards sustainability while making local assets necessarily in the improvement processes to encourage inventive thoughts in a developing country like Nigeria. Green innovation will advance discoveries and instructive values when given adequate supports; it would help improve innovative discoveries and revitalized industrialization in Nigeria and Africa at large.

7 Conclusions and Recommendations

This chapter viewed green building practice as related to developing economies such as Nigeria. It gives a brief insight into the issues of green policy adoption and formation in the country. Barriers and benefits of green practice in a developing nation like Nigeria were also highlighted. It was indicated that the government, politician, and construction stakeholders should be involved in the formation of the green building public policy. Particularly, the government should champion the campaign for its enforcement within the Nigerian construction industry. Education and training are also paramount to the success of its adoption. Availability of sustainable materials is essential for the attainment of the practice in the country. Nevertheless, it all should begin from somewhere either from the construction experts, private sector,

or the government. What is paramount is that developing countries should endeavor to introduce a green building standard for all its future domestic and commercial buildings development. If an enforceable green building standard is in place, the country-built environment will be set up for sustainable building. Green building is frequently unreasonably blamed as being a hassle according to many academia in developing countries. What developing nations must know is that green building technology is not that cumbersome. At its most essential, green building is all almost making buildings more economical and eco-friendlier.

The unexpected thing is that most of the nations who will face the greatest impact of climate change are the third world countries that in fact are not contributing much to the greenhouse effect. We have seen how nature unleashes its wrath through tropical storms, typhoons, surges, and dry spell, making it a major catastrophe for third world nations. But building green requires a degree of moderation on the impacts of catastrophes on the building. Green building rewards individuals with energy efficient, secure and toxic-free residences and commercial space, and sustainability. Hence, it is of importance that developing nation should envision and thrust for the attainment of greening culture, develop a policy, make it a public policy, and enforce its implementation. Based on this vision, commitment to sustaining the green practice in Nigeria is a possibility.

References

1. Abisuga AO, Oyekanmi OO (2014) Organizational factors affecting the usage of sustainable building materials in the Nigerian construction industry. J Emerg. Trends Econ Manag Sci 5(2):113–119
2. Amal MG, Halil Z., Alibaba HZ (2017) The use of traditional building materials in modern methods of construction: a case study of Northern Nigeria. Int J Eng Sci Technol Res (IJESTR), 30–40
3. Arif M, Egbu C, Haleem A, Kulonda D, Khalfan M (2009) State of green construction in India: drivers and challenges. J Eng Design Technol 7(2):223–234. https://doi.org/10.1108/17260530910975005
4. Asmawi MB (2010) The relationship between construction and the environment: the perspectives of town planning system. B.sc Project, Islamic University Malaysia, Department of Urban and Regional planning, Malaysia
5. Anselm AJ (2006) Building with nature (Ecological principles in building design). J Appl Sci 6:958–963. https://doi.org/10.3923/jas.2006.958.963
6. Akadiri PO, Chinyio EA, Olomolaiye PO (2012) Design of a sustainable building: a conceptual framework for implementing sustainability in the building sector. Buildings, 126–152. https://doi.org/10.3390/buildings2020126
7. Beqiri B, Musliu A, Rexhepi G (2017) Policy in relation with health of citizens. Eur J Interdisc Stud 3(4):120–124
8. Bell D, Cheung YK (n.d.) Introduction to sustainable development. Encycl Life Support Syst. Retrieved 30 Oct 2018, from http://lsf-lst.ca/media/resources/en/cri/documents/David_Bell_and_Annie_Cheung_Introduction_to_Sustainable_Development_EOLSS.pdf
9. Buys F, Hurbissoon R (2011) Green buildings: a Mauritian built environment stakeholders' perspective. Acta Structilia, 81–101

10. Building Energy Efficiency Code (BEEC) (2017) Scoping study report developed under the framework of the Nigerian energy support program (NESP). Available online: http://www.energyplatformnigeria.com/index.php/library/energy-efficiency (Accessed on 9 Jan 2019)
11. Dahiru D, Abdulazeez AD, Abubakar M (2012) An evaluation of the adequacy of the national building code for achieving a sustainable built environment in Nigeria. Res J Environ Earth Sci, 857–865
12. Darko A, Chan AP, Yang Y, Shan M, He BJ, Gou Z (2018) Influences of barriers, drivers, and promotion strategies on green building technologies adoption in developing countries: the Ghanaian case. J Cleaner Prod, 1–46. https://doi.org/10.1016/j.jclepro.2018.07.318
13. Darko A, Chan A, Manu D-GO, Ameyaw E (2017) Drivers for implementing green building technologies: an international survey of experts. J Cleaner Prod, 1–9. https://doi.org/10.1016/j.jclepro.2017.01.043
14. Darren AP, Tetsuo K (2014) Green building geography across the United States: does governmental incentives or economic growth stimulate construction? Real Estate Law J, 43(1)
15. Energy Commission of Nigeria (2014) National energy masterplan. Retrieve from http://www.energy.gov.ng/index.php?
16. Fletcher LK (2009) Green construction cost and benefits: is national regulation warranted? Nat Resour Environ 16(1):18–24
17. Geissler S, Österreicher D, Macharm E (2018) Transition towards energy efficiency: developing the Nigerian building energy efficiency code. Sustainabilty, 2–21. https://doi.org/10.3390/su10082620
18. Global Environmental Facility (n.d.) Retrieved from https://www.thegef.org/about/funding
19. Gunatilake S, Liyanage C (2010) Harmonizing sustainable construction policy with practice at project level: a research proposition. In: Egbu C (ed) Procs 26th annual association of researchers in construction management (ARCOM) conference, 6–8 September 2010, Leeds, UK, pp 1457–1466
20. Hassan JS, Mohamad Zin R, Majid AMZ, Hainin RM (2014) Building energy consumption in Malaysia: an overview. J Teknologi 707(7):180–3722
21. Heerwagen JH (2000) Green buildings, organizational success, and occupant productivity. Building Res Inf 28(5–6):353–367. https://doi.org/10.1080/096132100418500
22. Jomo SK, Syn TW (n.d.) Privatization and renationalization in malaysia: a survey. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/un/unpan021546.pdf
23. Laurent CJ, Williams A, MacNaughton P, Cao X, Eitland E, Spengler J, Allen J (2018) Building evidence for health: green buildings, current science, and future challenges. Annu Rev Public Health 38:291–308
24. Lucon O, Ürge-Vorsatz D, Zain Ahmed A, Akbari H, Bertoldi P, Cabeza LF, Eyre N, Gadgil A, Harvey LDD, Jiang Y, Liphoto E, Mirasgedis S, Murakami S, Parikh J, Pyke C, Vilariño MV (2014) Buildings. In: Edenhofer O, Pichs-Madruga R, Sokona Y, Farahani E, Kadner S, Seyboth K, Adler A, Baum I, Brunner S, Eickemeier P, Kriemann B, Savolainen J, Schlömer S, von Stechow C, Zwickel T, Minx JC (eds.) Climate change 2014: mitigation of climate change. Contribution of working group III to the fifth assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p 736
25. Mokthsim N, Osman Salleh K (2014) Malaysia's efforts toward achieving a sustainable development: issues, challenges and prospects. Procedia–Soc Behav Sci, 299–307. https://doi.org/10.1016/j.sbspro.2014.02.107
26. National Buiding Code (2006) Federal republic of Nigeria. LexisNexis Butterworths. Retrieved from https://epp.lagosstate.gov.ng/regulations/National_Building_Code_of_Nigeria_2006.pdf
27. National Adaptation Strategy And Plan Of Action On Climate Change For Nigeria (2011) (Naspa-Ccn). Retrieved From http://Csdevnet.Org/Wp-Content/Uploads/National-Adaptation-Strategy-And-Plan-Of-Action.Pdf
28. Nelson AJ, Rakau O, Dorrenberg P (2010) Green buildings: a niche becomes mainstream. Deut Bank Res, 1–24

29. Nelms C, Russell DA, Lence JB (2005) Assessing the performance of sustainability technologies for building projects. Can J Civ Eng 32(1):114–128
30. Ojo E, Mbowa C, Akinlabi ET (2014) Barriers in implementing green supply chain management in construction industry. In: Proceedings of the 2014 international conference on industrial engineering and operations management, pp 1974–1981
31. Okon E (2016) The legal status of sustainable development in the Nigerian environmental law. J Sustain Dev Law Policy 7(2):105–134. https://doi.org/10.4314/jsdlp.v7i2.6
32. Oribuyaku D (2015) Code for a sustainable built environment in Nigeria: a proposed high-level vision of a policy framework. University of Greenwich. Munich Personal RePEc Archive, London
33. Onuoha IJ, Kamarudin N, Aliagha GU, Okeahialam S, Atilola MI, Atamamen FO (2017) Developing policies and programmes for green buildings: what can Nigeria learn from Malaysia's experience? Int J Real Estate Stud 11(2):50–58
34. Osmani M (2011) Construction waste. In: Osmani M Construction Waste. ScienceDirect, United Kingdom, pp. 207–216. https://doi.org/10.1016/b978-0-12-381475-3.10015-4
35. Suhaida MS, Tan, KL, Leong YP (2013) Green buildings in Malaysia towards greener environment: challenges for policy makers. Paper presented at the international conference on energy and environment, Malaysia
36. Shen L, Zhang Z, ZhangXia X (2016) Key factors affecting green procurement in real estate development: a China study. J Cleaner Prod, 1–12
37. Tyler (2017) The environmental impacts of construction projects and the next steps forward for the industry. Retrieved from eSUB construction software: https://esub.com/environmental-impacts-of-construction-projects/
38. Tan TH (2011) Sustainability and housing provision in Malaysia. J Strateg Innovation Sustain 7(1):62–71
39. United States Green Building Council U.S-GBC (2015) Country market brief. http://www.usgbc.org/advocacy/country-marketbrief
40. WSP (2014) Green star SA for use in Nigeria: local context report version 1. 2nd, Feb. Retrieve from http://www.gbcsa.org.za
41. YÕlmaz M, BakÕú A (2015) Sustainability in construction sector. Procedia–Soc Behav Sci, 2253–2262

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