

A Review of Essential Sustainable Development Principles in Housing: The Case of Nigeria

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Abstract: - The paper examined why the idea of sustainability had been brought into housing discourses and how sustainable development principles benefits housing. This was carried out by examining how has sustainability been interpreted in the context of housing. The research adopted exploration of secondary data by a concise review of literature. The paper highlights how the sustainability principles has become imperative as a basis in housing and the built environment and shows housing, as a key component of the built environment, which plays an important role in all aspects of sustainable development. The study concludes that a sustainable housing development should not only have environment friendly and energy efficient buildings, it should be affordable, accessible to facilities and public transportation and be manageable. It must facilitate social inclusion and not a mechanism of social exclusion. Such development must enhance resident quality of life from generation to generation.

Keywords: Sustainability, Housing, Built Environment, Nigeria

I. INTRODUCTION

The interaction between sustainability and urban housing has often been discussed in the last decade. There has been and still is being presented considerable literature on what might constitute sustainable urbanisation such as the provision of basic needs, appropriate technology, urban management and job creation, but seldom has these components been pulled together into an overall framework for sustainable urban housing (Ebsen & Ramboll, 2000). The general concept of sustainable urban housing is to integrate energy and environmental issues in urban housing programmes and projects. It is important to underline that this integration take place in all aspects of the housing process. By addressing sustainable housing we state that the following issues have to be taken into account: these are light, air, space; health, building functionality, architectural design, accessibility, quality of materials and constructive features, all these contribute decisively to the sensitive comfort of people, influencing the population's quality of life, and the socio-cultural value of the interventions (Maes, et al., 2011).

The master plan of a specific housing project has to be adjusted to the surroundings. The damage to sensitive landscapes, including scenic, cultural, historical, and architectural must be minimised. The use of sustainable sound building materials has to be incorporated. Local traditional materials often have a minor impact on environment than modern materials such as bricks, concrete and corrugated iron sheets. A life-cycle-analysis must be utilised to determine the

sustainability of the building materials. Water supply and sanitation must be designed and maintained appropriately to minimise the impact on the local environment. To minimise the environmental impact from the inhabitants, renewable energy such as solar and wind energy must be integrated to the highest extent. In general environmental and housing sustainability is a matter of minimising the pollution from the consumption of energy, water, materials and land, and maximising the use of recycled materials and renewable resources (Ebsen & Ramboll, 2000).

In its application to cities, sustainability adopts the metaphor of metabolism; according to (Newman, 2001). A city is defined as becoming more sustainable if it is reducing its resource inputs (land, energy, water, and materials) and waste outputs (air, liquid, and solid waste) while simultaneously improving its liveability (health, employment, income, housing, leisure activities, public spaces, and community). Beyond the issue of sustainability and cities, the relationships of sustainability to architecture, construction, housing, landscape, and site design have also been examined. Carpenter, 2001 contributed to sustainable architecture and construction. Edwards, et al. 2000 offer insights into sustainable housing. He investigated the links between landscape, site planning and sustainability. The concern with urban sustainability in the developing world lies not simply in the level of urbanisation, but in its sheer scale and rate of growth. Studies have shown the futility of urban sustainability that does not address automobile dependence; when an urban area assumes automobile use as the dominant imperative in its decisions on transportation, infrastructure, and land use (Newman, 2001).

Also in term of Sustainable architecture which is often referred to as green architecture, which ensures that the buildings we make today, work with the earth's ecological systems rather than in opposition to them. According to (Mockbee, 2011) sustainable housing and architecture involves a combination of values: aesthetic, environmental, social, political, and moral. It's about using one's imagination and technical knowledge to engage in a central aspect of the practice designing and building in harmony with our environment. An architect thinks rationally about a combination of issues pertaining to sustainability that including durability, longevity, appropriate materials, and sense of place among others. The challenge is finding the balance between social and environmental considerations and economic constraints. Consideration must be given to the

needs of our communities and the ecosystem that supports them (Mockbee, 2011). Hence, this study therefore looks at the essentials of sustainable development principles in housing and the built environment toward enhanced urban and housing development in Nigeria.

II. LITERATURE REVIEW

The word sustainability is derived from the Latin *sustinere* (tenere, to hold; sus, up). (Onions & Charles, 1964) provide more than ten meanings for sustain, the main ones being to maintain, support, or endure. However, since the 1980s sustainability has been used more in the sense of human sustainability on planet Earth and this has resulted in the most widely quoted definition of sustainability and sustainable development (Onions & Charles, 1964). (Veiderman, 2001) define sustainability as a vision of the future that provides us with a road map and helps us focus our attention on a set of values and ethical and moral principles by which to guide our actions. In line with (Veiderman, 2001) the concept first emerged in the early 1970s but it exploded onto the global arena in 1987 with the Brundtland Report, in which sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability is equity and harmony extended into the future, a careful journey without an endpoint, a continuous striving for the harmonious co-evolution of environmental, economic and socio-cultural goals. Sustainability is not about threat analysis; sustainability is about systems analysis. Specifically, it is about how environmental, economic, and social systems interact to their mutual advantage or disadvantage at various space-based scales of operation. According to (CSUD, 2004) sustainability is the capacity for continuance into the long term future. Anything that can go on being done on an indefinite basis is sustainable. Anything that cannot go on being done indefinitely is unsustainable.

Consequently, it was noted that this requires the reconciliation of environmental, social and economic demands, the three pillars of sustainability (UN, 2006). The triple bottom line as defined by the (UN, 2006) is not universally accepted and has undergone various interpretations (I. I. S. D, 2009). What sustainability is, what its goals should be (see Table 1) and how these goals are to be achieved are all open to interpretation (Holling, 2000). For many environmentalists the idea of sustainable development is an oxymoron as development seems to entail environmental degradation (Ratcliffe, 2000). The word sustainability is a very diverse subject. It is not limited to the environment. It equally has its relevance in all spheres of life including socio-cultural, economic and all development policies. The path to a truly sustainable society begins with the objective of improving and sustaining efficiency and safety in all forms of development. It is however a long-term process. The focus is on enhancing and sustaining an existing system or development over a period of time or life-span; thus the term sustainable development (Odebiyi, 2010).

(Ott, 2003) described it as a development that reaches or maintains a sustainable state. It is the guiding principle for international environmental policy and decision-making in the twenty-first century. The core or emphasis of sustainability or any sustainable development is observed in its ability to enhance efficiency in its entirety. (Adams, 2006) describes sustainable development in terms of economic growth, environmental protection and social progress known as the core of mainstream sustainability thinking, drawn in a variety of ways as pillars, concentric or interlocking circles of sustainable development. The resilience of a development in harmony with the environment makes it sustainable. In architectural terms, a sustainable building is such that enhances environmental protection, economic growth and social progress. According to (HREA, 2003) Sustainable development ensures the well-being of the human person by integrating social development, economic development, and environmental conservation and protection as demonstrated in Figure 1, Figure 2 and Figure 3. It is impossible to separate the well-being of the human person from the well-being of the earth. As the goal of sustainable development is to permanently improve the living conditions of human beings, social and economic developments must be carried out in a way that is environmentally and ecologically sound; ensuring the continual rejuvenation and availability of natural resources for future generations. In order to deal with the on-going environmental degradation the United Nation in the 1980's began to cope more explicit with development and environment. It stated that we must meet the need and the aspirations of the present without compromising the ability to meet those of the future. Sustainable development is therefore much more complex than what is the general perception (HREA, 2003).

Table 1: Sustainability Goals

Economic	Social	Environmental
Economic productivity	Equity / Fairness	Climate change prevention and mitigation
Local economic development	Human safety, security and health	Air, noise and water pollution prevention
Resource efficiency	Community development	Non-Renewable Resource Conservation
Affordability	Cultural heritage preservation	Open space preservation
Operational efficiency		Biodiversity protection
Good Governance and Planning		
Integrated, comprehensive and inclusive planning Efficient pricing		

Source: Litman, 2006

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN, 1987).

The report given by the World Conference on Environment and Development (WCED) known as Brundtland

Commission has resulted to the usage of the concept sustainable development internationally (Alao, 1995). The commission thus defined it as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in having and enhance both current and future potential to meet human needs and aspirations. Sustainable development in general term as the provision of adequate and affordable basic needs of life for the present generation without jeopardizing the prospects of subsequent generations. Sustainable development therefore is a notion, a movement and an approach which has developed into a global wave of concerns, study, political mobilization and organization around the turn issues of environmental protection and economic development. The approach embodies the notion and ideal of a development process that is equitable and socially responsive, recognizing the extensive nature of poverty, deprivation and inequality between and within nations, classes and communities (Akinbode, 1995).

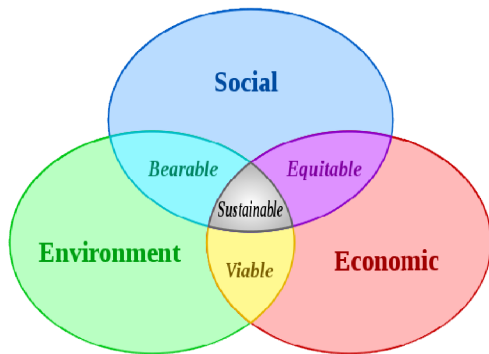


Figure 1: Scheme of sustainable development: at the confluence of three constituent parts
Source: Sunray, 2009

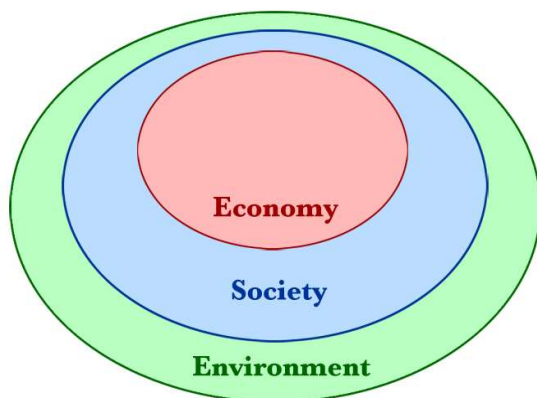


Figure 2: A diagram indicating the relationship between the three pillars of sustainability suggesting that both economy and society are constrained by environmental limits.
Source: Sunray, 2009

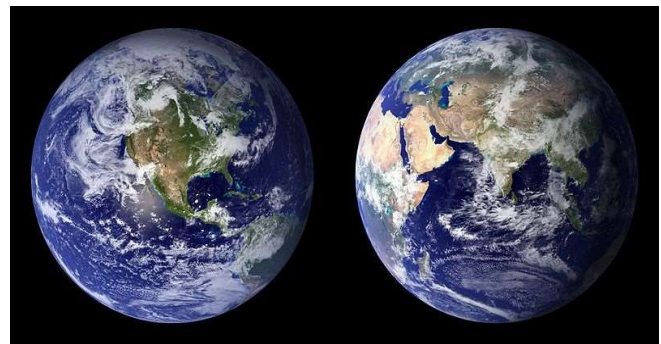


Figure 3: Achieving sustainability will enable the Earth to continue supporting human life as we know it.
Source: NASA, 2009

Sustainable development as a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspiration. The concept according to (Fri, 1992) the field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and socio political sustainability (Olotuah, 2010). Sustainability as a concept attempts to achieve, simultaneously, the goals of an improved environment, a better economy, and a more just and participative society, rather than trading off any one of these against the others (Newman, 2001). While its primary context is global, sustainability is seen to be meaningful when it is practiced through local initiatives with global significance.

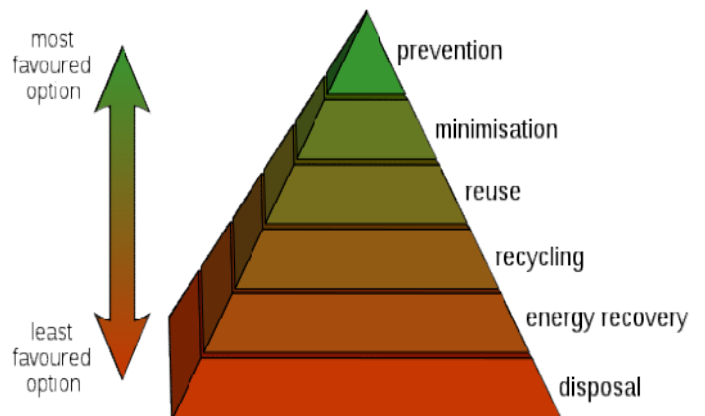


Figure 4: The waste hierarchy
Source: Waste-hierarchy.png, 2008

III. THE IDEA OF SUSTAINABILITY IN HOUSING DISCOURSES

The concept of housing is inevitable in sustainability discourse particularly in the perspective of the three pillars of sustainable development: environmental, economic and socio-cultural development. A sustainable building is measured in terms of resource use and management e.g. water, energy,

waste/recycling as demonstrated in Figure 4 (the waste hierarchy) as well as building designs or construction practices. It could be evaluated by its environmental, social and economic values measurable by the impact and trade-offs. A sustainable building is a value-added product. From this perspective, Nigerian indigenous Architecture is sustainable as it focuses on the potentials of available local resources for enhancement of the building industry for the provision of sustainable mass housing development in developing countries. The degree of adherence to sustainable principles will determine the effectiveness and implementationability of policies needed to enhance any anticipated development in Nigeria (Odebiyi, 2010).

The characteristics of our built environment are vital to the achievement of sustainability objectives. These include cutting greenhouse gas emissions, reductions in pollution and the conservation of resources, cohesive and inclusive communities, and a prosperous and secure economy (Stevenson and Williams, 2005). Housing in particular can make a significant contribution to sustainability because: it consumes large amounts of resource in its construction, maintenance and use. It is a fixed asset with a long life and it is central to quality of life and has implications beyond housing affecting transport, health, employment and community (Aldous, 1992). The relationship between sustainability and housing is two-way. Incorporating principles of sustainability into housing development, maintenance and refurbishment will not only make a significant contribution to the achievement of general sustainability objectives, but will also provide important advances in the quality, durability and cost effectiveness of our housing. Accordingly there is a need for a change of culture with regard to housing development which places sustainability at a center stage. This should include the developers, builders and land use planners and also the tenants and owners. Sustainability objectives will be achieved only if they are taken into account at all stages from design through construction to long term use and eventual disposal and recycling (Stevenson and Williams, 2005).

The most widespread and potentially damaging environmental problem at present is global climate change as a result of the emission of greenhouse gases, notably CO₂ (DETR, 1998). The housing sector also has an important role to play, both in terms of dwelling characteristics and the structure and location of residential developments. Housing consumes large quantities of energy in its production and use: between 40 and 50% of CO₂ emissions are attributable to buildings, two thirds of this to the domestic sector 10 per cent of CO₂ emissions are due to embodied energy used in the construction process. Figure 5 demonstrated the Flow of CO₂ in an ecosystem (RCEP, 1994).

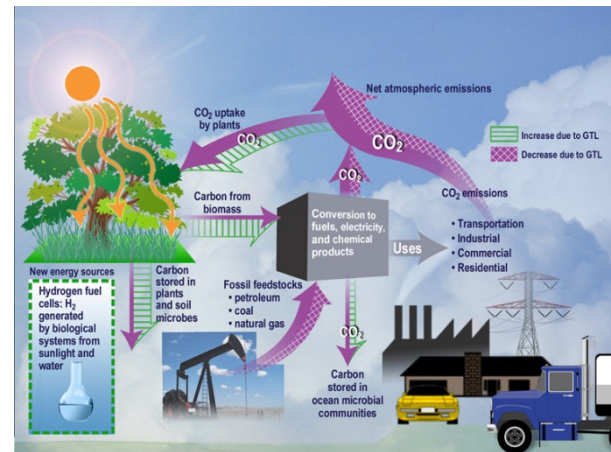


Figure 5: Flow of CO₂ in an ecosystem

Source: U.S. Department of Energy Genome, 2007.

IV. SUSTAINABILITY IN THE CONTEXT OF HOUSING

In the context of housing, according to (Maes, et al., 2011), sustainable housing refers to the homes and communities developed with the objective of reducing environmental impact through the use of ecological materials, equipment and practices; improving the quality of life for society by creating a social fabric that fosters prosperous societies, as opposed to simply building commuter cities with little to no interaction among inhabitants, and increasing access to financing for those in need while promoting savings through the efficient use of water and energy, through public-private-sector partnerships and attractive incentives. A sustainable housing is one that is accessible, safe, environmentally-friendly and affordable. Along with Maes, et al., 2011, the sustainable housing initiative innovatively addresses several of housing problems, namely, the massive housing deficit, the marginalization of low-income families, a lack of social integration, and growing environmental concerns. To this end, sustainable housing-development ensures the economic, social and environmental viability. It ensure holistically sustainable projects that address infrastructure, transportation, public-space utility and the green nature of the homes; high-quality homes designed to be environmentally, socially and economically sustainable. These developments will have an environmental impact, with reductions in carbon emissions, water contamination and other pollutants. Greener communities are expected to serve as models for housing development, subsequently encouraging other communities to adopt best practices for water, energy and waste efficiency (Stevenson and Williams, 2005).

Housing is a crucial parameter in any sustainable development watch as construction is the biggest resource consumer and carbon dioxide emitter in 21st century development after vehicular modes of transport. Moreover, it has long-term impact and a large ecological footprint. Housing touches crucial points of quality of life and has implications beyond it, affecting transport, health and employment (Anik, et al 1996). While housing is an essential

today, especially in developing countries, most nations are turning their back to sustainable and inclusive housing modules as had been practiced through generations in their countries. The earlier practices had shown enormous adaptive reuse capabilities and were in tune with socio-cultural, climatic and environmental requirements of a particular country. A major effort needs to be undertaken to effect a total mind-set change, one which places sustainability at the centre stage. Sustainability objectives will be achieved only if they are taken into account at all stages; from design through construction to long-term use and eventual disposal and recycling. Raising awareness is important for all involved. Environmentally sustainable housing is the one that does not endanger public health or ecosystems and meets needs for access consistent with: use of renewable resources at below their rates of regeneration, and use of non-renewable resources at below the rates of development of renewable substitutes. Modern housing can be categorised into three types: the fully automated technological house, the ecological house made from a range of features including preassembled components, and a lifestyle house that changes to suit the owner’s present well-being. Improvement of housing efficiency is an imperative preoccupation on the process of house building. The process of housing development should be based on sustainability principles, which could be applied in the conception, construction and use of the buildings. The goals of the process are to decrease the environmental costs incurred by inadequate constructive systems and solutions, minimizing the impacts on natural resources and improving users’ comfort (Maes, et al., 2011).

Sustainable housing is a form of affordable housing that incorporates environmentally friendly and community based practices. It attempts to reduce the negative impact that homes can have on the environment through choosing better building materials and environmental designs. Concern for the environment is imperative in sustainable housing. This is particularly important in the face of changes in climatic conditions occasioned by human activities, which are likely to have significant impact on man. The phenomenon of climate change and global warming has arisen from the continued emission of carbon dioxide and other greenhouse gases into the atmosphere. The reduction of carbon dioxide emissions in house construction and domestic housing is thus a critical issue in environmental management. Consideration should also be given to the durability, permeability and build ability of defined material resources; the structures fixity, structural stability and acoustic attributes. Broad social elements of sustainable house construction will be met through innovative design solutions leading to social and environmental improvements. According to (Olotuah, 2010), these features of environmental comfort and energy saving procedures constitute the indicators that can be applied in the conception, construction and use of buildings, according to the perspective of sustainable development. This way light, air, space, health and efficiency constitute structuring elements in the concept of sustainable construction. Building functionality,

architectural design, accessibility and space elements ergonomics, along with the quality of materials and constructive features, contribute decisively to the sensitive comfort of people, influencing the population’s quality of life, and the socio-cultural value of the interventions (Maes, et al., 2011). Table 2 clearly show case the social sustainability of housing, while Table 3 illustrated the cultural sustainability of housing.

Table 2: Social Sustainability of Housing

Social preconditions for ecological sustainability	Equitable housing distribution and consumption	Harmonious social relations	Quality of housing and living environment
Values Habits Rules Life-style Environmental consciousness Regulations	Housing equity Housing standards Affordability Role of the government Housing subsidy Policies	Landlord and tenant relationship Have and not have relationships Influence of stake holders	Internal housing conditions Immediate environment

Source: Chiu, 2004

Table 3: Cultural Sustainability of Housing

Cultural preconditions conducive to environmentally sustainable housing	Acceptable quality of housing Conditions	Preservation of housing heritage
Values Habits Rules Life-style Environmental consciousness Regulations	Internal housing conditions Immediate environment	Internal housing design External housing design Housing structure Reflect the way of life of a people from past to present Cultural identity Collective memory of people Locate a contemporary society In its traditional context.

Source: Chiu, 2004

V. CONSTRUCTION AND THE ENVIRONMENTAL SUSTAINABILITY

Site design and response of construction to the natural environment remains a common problem in Nigeria. By not allowing a proper investigation of the site, the natural environment ceases to be an integral part of design and construction implementation and is thereby compromised. The architects, developers, builders and owners often overlook the site as one of the significant elements of sustainable development and construction. In many urban areas of Nigeria

and especially in the cities, construction of buildings generally, but especially residential buildings has been carried out to occupy the entire site. The natural green system has been destroyed and compaction has taken place to a level that prevents air movement even after construction is completed. The existing natural environment has in many cases been destroyed beyond repair. In addressing the complex problem of construction and the environment, efforts towards sustainable design are fundamentally an attempt to put into place practice that restores the balance between the natural and built environment. It is a search for an ecological model that views both realms as fundamentally interconnected. It should be recognised that mankind is locked into a highly dynamic relationship with the natural world and that the two are acutely interdependent. If this relationship is forgotten, certainly mankind and his integration into the environment has failed to effectively utilize it to build and shape the land in a manner that is harmonious, symbiotic and sustainable (Adebayo, 2000).

Site planning as an approach is well understood by the professional as a way in which to achieve balance between the built and natural environment. The work of Lynch, 1975 gives a comprehensive approach to site planning, to identify the critical and important aspects of the site to be integrated in the project. The point of departure of design on site and construction should understand the existing characteristics of the site which also include climatic conditions, orientation, hydrology, geology and ecology among others. It is not uncommon in today's construction to see sinking, cracking of walls and unbearable indoor temperatures coupled with faulty foundations, construction material choice yielding unhealthy environments and high maintenance costs and compromising the notion of sustainable construction (Norberg and Schultz, 1984).

Waste on construction sites is equally important in most Nigerian cities, with dumping taking place in landfills and sometimes with other hazardous material, and in other instances left on the site, often in the case of smaller construction sites. Dams or unseen river courses and hollows also usually attract dumping. Dumping sites, if left unchecked, become a breeding ground for mosquitoes and vermin. The building materials manufacturing industries in some urban areas are also not exempt from problems of waste disposal, with disposal taking place in water or rivers, pits and landfills among others. These are all contributory factors to environmental degradation. The recycling of construction and waste management in the construction industry are areas that require strengthening. Perhaps the failure in this area lies in the synthesis of theory and practice (Adebayo, 2000).

The other environmental malady of Nigerian cities is to be found in residential areas. Land is a costly commodity and a basis of many economic activity on which survival rests. The use of land, especially where there is lack of stringent application of environmental standards and regulations, tends to disregard the quality of the built and natural environment in

pursuit of maximum economic gain (Adebayo, 2000). Sustainability in such instances is questionable. Further, massive deforestation in Nigeria can be attributed to the building material industry. Timber for construction and related industries is often harvested, sometimes from indigenous forests and not necessarily replaced. While forestry and timber harvesting is an important economic activity, it can only continue to be so if deliberate steps to replace the harvested trees are taken. The other dimension related to the timber industry is the tendency of sawmills to be located in towns as part of urban industry, with noise and air pollution from dust and smell, and the unsightly appearance of industrial waste contributing to environmental problems. Griffith, 1994 also draws attention to the environmental effects of construction activities resulting in a number of comfort disturbances to individuals living and working in the areas surrounding construction projects. This is manifested through noise of construction operations and equipment, dust from construction process and traffic, hazardous contamination, for example toxic waste and other visual disturbances from signs and advertising boards, as environmental problems associated with construction sites.

VI. MEASURING SUSTAINABILITY IN HOUSING

In line with (Odebisi, 2010) a sustainable housing is measured in terms of resource use and management for example, water, energy, waste/recycling as well as building designs or construction practices. It could be evaluated by its environmental, social and economic values measurable by the impact and trade-offs. As said by Sunray, 2009 sustainability measurement is a term that denotes the measurements used as the quantitative basis for the informed management of sustainability. The metrics used for the measurement of housing sustainability involving the sustainability of environmental, social and economic domains, both individually and in various combinations are evolving: they include indicators, benchmarks, audits, sustainability standards and certification systems like Fairtrade and Organic, indexes and accounting, as well as assessment, appraisal (Dalal et al, 2009) and other reporting systems. They are applied over a wide range of spatial and temporal scales (Hak, et al. 2007).

World Sustainability Society estimates the quality of sustainability housing for individual countries using the Environmental Sustainability Index and Environmental Performance Index. A set of well-defined and harmonized indicators is the only way to make sustainability tangible. Those indicators are expected to be identified and adjusted through empirical observations (trial and error). The most common critiques are related to issues like data quality, comparability, objective function and the necessary resources (Pezzey, 1997). In keeping with Brandli, et al 2006, sustainability is presented and evaluated by dividing it in relation to the costs of a building's life cycle, including the location characteristics, convertibility and flexibility, internal living conditions, environmental capacities in operation and

environmental capacities during construction, safety characteristics, comfort and the impact of the building in the neighbourhood, In order to characterize the existing sustainability performance. However, capturing the dynamics of sustainable development and presenting them in terms of measurement indicators that could be unambiguously interpreted and easily communicated to policymakers for public policies remain a challenging task (United Nations, 2009). Measuring housing sustainability we needs to review every aspect of economic, environment and social linkages but it also requires simple measures and an adequate framework that informs policymakers about major trends and issues as well as support in-depth analysis and identify concrete policy options (Hecht, 2006).

Along with Hecht, 2006 sometimes a single measure, within one of the three arenas of sustainability, can by itself tell us something about whether our system is sustainable. Among housing indicators, air quality is one such measure. If we know the ambient concentration of air pollutant that is safe to breathe, any observation above that level must be unsustainable, because it will lead to illness. This single indicator only addresses environmental health, however, so it is a very partial measure of sustainability. Moreover, if we exceed the standard, we know we are not sustainable, but if we fall within it, we don't know that we are sustainable. This is a common quality of sustainability indicators. In keeping with Chiu, 2004 the assessment tools used to measure sustainability of any construction work only measure environmental and economic impacts. It is justifiable to argue that most of these tools are not comprehensive enough to assess sustainability of any building construction without being able to measure the social impacts of the construction (Mohammad and Amato, 2006).

We cannot discuss measurement of sustainable housing without understanding what indicator are. Therefore, indicators are things we measure to evaluate progress toward goals and objectives. Such indicators have many uses, which include: help identify trends, predict problems, assess options, set performance targets and evaluate a particular jurisdiction or organization. Indicators are equivalent to senses (sight, hearing, touch, smell, taste) they can help determine how problems are defined and which impacts receive attention (Hecht, 2006). An activity or option may seem good and desirable when evaluated using one set of indicators, but harmful when evaluated using another. It is therefore important to carefully select indicators that reflect overall goals. It is also important to be realistic when selecting indicators, taking into account data availability, understand ability and usefulness in decision-making (Mohammad and Amato, 2006). While the selection of indicators is often based on an assessment of observation and measurement constraints, it does nevertheless always include theoretical elements (Boulanger, 2008). In the second case, measuring the phenomenon will require to set a reference level (distribution mean or median), a spread compared to it (40%, 50%, 60 %?)

and the appropriate scale (household or individual?). On the word of Boulanger, 2008, once indicators are defined, they must be measured. Then must be decided the level of precision, accuracy, spatial and temporal scale as well as which units are to be used. More often than not, indicators do not have the same degree of precision and are not measured with similar units, which of course complicate the process of aggregation of measurements into a synthetic indicator (Mohammad and Amato, 2006). According to Litman, 2006 sustainable housing is generally evaluated using indicators, which are specific variables suitable for quantification measurement. Such indicators are useful for identifying trends, predicting problems, setting targets, evaluating solutions and measuring progress.

VII. HOW SUSTAINABLE DEVELOPMENT BENEFITS HOUSING

The most cost-effective way to develop and maintain a high quality housing stock in the long term is to incorporate principles of sustainability into all parts of the housing development process (Aldous, 1992). Since new build comprises only a small fraction of the existing stock it is also important that refurbishment incorporates sustainability principles (Stevenson and Williams, 2005). The poor performance of the housing stock in terms of energy efficiency is not only wasteful of resources and the cause of harmful pollution, but also a contributory cause of poverty and poor health and is particularly damaging because of the severe climate (Anik, et al 1996). Higher energy efficiency can make a significant difference to quality of life, health and material standard of living, especially to poor households (Hecht, 2006)

A sustainable housing development would not only have environment friendly and energy efficient buildings, it would also have access to employment, schools, shops, places of entertainment, primary health care and it would be accessible by public transport (Stevenson and Williams, 2005). It would also be mixed in terms of tenures, incomes and age groups. For a house to be a home it must be geographically located such that its inhabitants can use it as a base from which to enter society at large; it must facilitate social inclusion and not be a mechanism of social exclusion as much housing has been in the past (Stevenson and Williams, 2005). As stated by (Anik, et al 1996) scale is an important dimension of sustainability. Housing developments should not be so large that they alienate the people who live in them. Residents should be given the opportunity to take responsibility for their environment whether they are tenants or owner occupiers, and this is only possible when they live in developments or management units which are small enough for this to be practicable. As reported by Anik, et al (1996) residential development which is designed to contribute to sustainability will provide not only warm, dry and healthy homes and reduce the need to travel, but also a setting which enhances quality of life from generation to generation and which integrates people into society at large. It will maximize

the effectiveness of housing investment and be crucial to the building of cohesive communities.

The essence of sustainability is a consideration of long term costs and benefits (Stevenson and Williams, 2005). Residential development according to sustainability principles may cost more in the short term, but will have a significant downward effect on overall, long term costs. Extra expenditure on energy efficiency, for example, may increase capital costs but there is evidence that in the long term the savings in running costs will exceed the initial extra capital costs. There is also evidence that building to a high environmental specification leads to lower maintenance and management costs. Whole life costing can be used to estimate long term costs and allocate them to different people and agencies (landlord, tenant, developer). These techniques are essential to the effective application of sustainability to residential development. Planning for the long term planning for sustainability can increase the flexibility and effectiveness of the housing stock and lower long term costs. Guidance has already been issued on how to provide for housing of varying needs in a flexible manner (The Stationery Office, 1999).

VIII. ARCHITECTURAL PRACTICES FOR POVERTY ALLEVIATION THE OPTIONS FOR HOUSING SUSTAINABILITY

The issue of sourcing and utilization of local building materials for housing development in Nigeria is a great concern for all professionals and researchers in the housing field. Building materials in the country are scarce and extremely costly with the result that the poor cannot afford to purchase materials either as owner-occupiers or renters of housing units in our cities (Sangosanya, 1987). What are needed are traditional technology in producing and applying materials in buildings and also intermediate one that is appropriate to local conditions. It is expected that if we decide to “look inwards” for our materials, then we will be able to produce building material that are available, can be easily applied, cheap and be sustainable, therefore can be afforded by the poorest of the poor. The country cannot afford to continue mass importation of building materials because the resources are just not there and are not sustainable. There are a lot of raw materials and possibilities waiting to be tapped. There is therefore no need to run a development race with the developed nations. We must move at our pace but at a faster rate than they did when they were at this stage of development because we can draw on their experiences. This will be possible if political decisions are realistic and stable (IMF, 2005).

Poverty has been a long lasting issue in Nigeria and is concerns with relationship between the minimum needs of people and their ability to satisfy those needs (Sida, 2005). A thorough understanding of poverty in Nigeria required an analysis of its evaluation over the past two or three decades and an assessment of how economics polices have impacted on it (UNCHS, 1996). It is generally believed that the pride

of an average Nigeria citizen is to own a shelter of his own as a reward for hard work and self-sacrifice. Shelter is one of the basic requirements of human life and living. It is the starting point of a decent life, dignity, good health, safety, happiness and hope. Home is where all human activities radiate from. There is no doubt that shelter is one of the major problems facing many Nigerian cities today. It is becoming increasingly difficult for average Nigerian to own a house or to procure decent accommodation at reasonable rent in the market. In the 1990s 30% of workers monthly income was spent on rent, then it was consider ridiculous; today the same workers spend 70% of his basic salary on rent. Owning a house, purchased or self-built has become a dream due to cumbersome process of housing delivery system in the country (World Bank, 2000).

The excessive shortage in housing stock must be recognized as a serious problem and urgent steps taken to alleviate the situation. However, the reality of this dream has eluded many people no matter how long and how much they have been saving. This is mainly due to the poverty in the Nigeria present escalating cost of building materials. Such materials that include: cement, iron rods and roofing sheets. From the analysis of the prevailing circumstances in the property market, it is evident that the only way out of this predicament is to device a means of providing sustainable, suitable and improved materials that are more accessible and cheaper to the prospective building owners, to replace some of these highly priced materials, which aim at alleviating the suffering of Nigerians by finding architectural solution and researching toward finding alternative local building materials substitutes and design that could be avoidable, easy to construct, fire resistant, lasting and at the same time accessible and sustainable (Muhammad, 2007).

8.1 Sources and Possible Sustainable Available Building Materials

Since cement, iron rods, and gravel are the major building materials in the country that pose special problems to the users in recent times because of their galloping prices, a marked reduction in their use in building construction will definitely reduce the cost of construction both in rural and urban areas. Hence, it is advisable for Nigeria to look into the prospects of substituting suitable alternatives that are cheaper, easily available, sustainable and durable; to meet its housing demands. In the case of cement blocks, either established or burnt bricks can be used because they are 30 – 60% cheaper and more readily available (Rafchiffe, and Stubbs, 1997). The only major material used for producing these bricks is clay, the sourcing of which is no problem because Nigeria is endowed with vast resources of clay and shale commonly called ‘argilles’. Such deposits are found in the Imo State (which extends from the border with the Republic of Benin, near Abeokuta, to IkotEkpene in the South East). Clay is also found in Kerri formation near Bauchi state, and in Share and Ilesha areas of Kwara and Oyo States respectively. Fired clay bricks are known to have compressive strength one-third that of concrete. Nevertheless, for single storey structures, the low

compressive factor would not affect the structure. Also the strength of 4% stabilized bricks is 1.6N/M², which is acceptable for building bungalows (Agboola, 2004).

A reduction in cost of building can also be achieved by using fibrous core bamboo for ceiling instead of celotex ceiling boards or asbestos sheets. The bamboo can be painted with fire-retardant paint and creosote to improve their fire rating and resistant to insect attack. There is abundant supply of bamboo in the swampy areas of the country. Timber frames can be substituted for steel and aluminium in doors and windows, because of its structural properties, which compare favourably with those of other materials especially for very short spans. The availability level of timber in the country is relatively high because it is wholly locally available and produced in Nigeria. However, there is a need to plant more trees on a 'Daily Basis' in order to ensure that the stock is replenished and be sustainable. For floor decking, we should explore the use of timber floor boarding and hollow clay pots locally manufactured, to reduce costs. Considerable savings up to 70% of the cost of finishes can also be made by substituting clay tiles polished with lacquer instead of marble or terrazzo flooring. However, glazed clay tiles are better used in the wet areas such as toilets, bathrooms and kitchen. To achieve greater efficiency in cost reduction, the structural requirements of the building can be lowered by using lightweight materials for the walls (Olunubi, 2004).

In pursuance of this objective, the use of sawdust mixed with cement, to make building blocks is recommended. Sawdust are dust or small particles of wood detached in sawing a log or board of wood, and is comparatively lighter than sand which is the usual material mixed with cement and water to mould blocks. The cement-sawdust aggregate ratio used in the test was 1:10. The results indicate a 7-day compressive strength of 0.19N/MM² and an average weight of 8kg per unit of 150 x 225 x 450mm block. This represents a reduction in weight of about 60% relative to that of normal sandcrete blocks. From further studies, the sawdustcrete block produced from this mix can be readily used for internal partition walls and as infilling panels above window and door openings. The sawdustcrete blocks also serve a dual purpose of utilizing a waste product from our saw mill, which usually constitutes a disposal problem. The aesthetic qualities of the interior walls thus produced and are comparable to those of conventional sandcrete blocks after rendering (Healey, 1991).

8.2 Recommended Strategies for Effective Social Change

The introduction of a new alternative building material, even of identical properties with a conventional and well accepted one, often meets with a lot of speculations and resistance from the public. This is because; people will always build a defence against any change that affects their status quo. In introducing these materials therefore, the following strategies should be adopted. The design of the dwelling units that is very functional, with a high level of cost consciousness, aesthetic values, and maintainability (that is, low recurrent

maintenance costs). All the consultancy work involved from inception to completion should be arranged under one umbrella, to reduce consultancy and project management fees and for more effective co-ordination. A target costs should be developed, for each of the different housing types based on the suggested materials, to avoid undue fluctuation in prices. The base quotations to be used should be for the conventional building materials, to present a building that the client would readily identify with and relate to. As the client is made aware of the cost implications of using the conventional materials, he would normally want a reduction in the prices of the relevant items and of the building as a whole. To achieve the reduction in cost, he should be made to understand that the reduction can only come by a process of elimination by substitution; that the usual materials can be substituted for without jeopardizing the functional and or structural integrity of the original building component. This, the client would readily agree with. The government agencies and project developers should also encourage the popularisation of these materials by putting them to use. Further awareness should be created by the Universities, Polytechnics and Colleges of Education. Houses should be built on a "Cash and Carry" basis so that the prospective buyer sees the building as a package and gets convinced of the properties of the building before he makes payment, either in full or instalments. Adequate provisions are to be made for services such as water supply, electricity among others on a communal basis (Agboola, 2004).

According to IMF, (2005) Nigeria desires houses that ordinary citizen can afford. To address the problem, there is the need to make it at ease for developers to purchase land on which to construct affordable housing for an average Nigeria. Also, there is the need to reduce the cost of erecting houses by promoting and encouraging the usage of local building materials. The school of architecture in Nigeria should educate a new generation of architects in the act of planning and designing low-cost housing for Nigerians. Furthermore policy should be developed to enable public and private construction companies, state and local governments to shoulder the responsibility for supplying and providing low-cost housing at affordable price. The housing policy should be aimed at developing and encouraging affordable houses for the common people. The Land Use Act should be reviewed with the intention of making the procurement of land inexpensive for developers with the purpose of making houses more affordable. There is the need to re-appraise of the Land Use Act with the aim at accelerating the acquisition of title by individual land allottees to facilitate access to mortgage finance. Efforts should be intensified to promote the usage of local raw materials, for example bamboo, burnt bricks and cement-stabilized laterite so as to lessen the cost of housing construction. Departments of building and architecture at tertiary institutions should be fortified to impart and lecture their students to build and design with low-cost and local materials. Public buildings (markets, post offices, hospitals, barracks and schools) should lead in the adoption and

acceptance of these local materials. As matter of policy, the production and fabrication of houses should be the obligation of the state, local governments and private sector. Apart from the federal capital territory, the federal government should support housing developers only through matching grants for providing services and developing sites (IMF, 2005).

IX. CONCLUSION

The concept of sustainable development has come a long way as the concept has developed over the years, it has incorporated economic sustainability and social sustainability issues within its broader framework. It is quite natural that these key areas of sustainability should not be separated from one another; rather they should be understood within the holistic framework of sustainable development. Housing which is a key component of the built environment plays an important role in all aspects of sustainable development need to be perceived in line with sustainability principle. The assessment tools used to measure sustainability of any construction work only measure environmental and economic impacts. It is justifiable to argue that most of these tools are not comprehensive enough to assess sustainability of any building construction without being able to measure the social impacts of the construction. All the key sustainability aspects of housing should be well understood; integrated and embraced sustainable development in its fullest sense. There is need for all stakeholders to respect sustainable development principles, and engage in greater synergy on the future of housing and the built environment.

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