

# Policies for Adaptability in Retrofitting Office Building

Yakubu Aminu Dodo<sup>1\*</sup>, Abdulaziz Umar Raji<sup>2</sup>, Aisha Haladu Bornoma<sup>3</sup>, Ahmed Yahaya<sup>4</sup>, Sabeen Qureshi<sup>5</sup> and Parviz Gohjogh Najad<sup>6</sup>

<sup>1</sup>Department of Architecture, Universiti Teknologi Malaysia 81310 Skudai, Johor, Malaysia

<sup>2</sup>Department of Real-Estate and Facility Management, Universiti Tun Hussein Onn, Malaysia, 86400, Johor, Malaysia

<sup>3</sup>Department of Architecture, Modibbo Adama University of Technology, Yola, Nigeria.

<sup>4</sup>Department of Estate Management and Valuation, Federal Polytechnic, Nasarawa Nigeria.

<sup>5</sup>Department of Urban and Regional Planning, Universiti Teknologi Malaysia 81310 Skudai, Johor, Malaysia

<sup>6</sup>Institute for science and Technology Geospatial (INSTEG), Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

\*dyaaminu@yahoo.com +60166486703,

**Abstract-** As sustainability becomes a central point in the conceptual stage and design process in most architectural practice, research on office buildings' impact on the environment is greatly increasing and gaining high attention around the globe. Although many designers claim their buildings to be sustainable, unless a comprehensive Life Cycle Assessment (LCA) study is carried-out to ascertain the real situation, it is difficult to ascertain the total environmental burden a particular building has on its surrounding and global environment. This paper demonstrates how design policies for adaptability is applied to choose more sustainable materials alternatives during the maintenance (retrofit) phase of the building with an estimated projected life cycle of 50 years. However, most designers believed that, their designs will never undergo any change, as it is designed to suit the demand of the client's requirements, without given much emphasis on future retrofitting of the building to cater for most especially the technology (smart) yet to be developed. The paper focus on the need to create an awareness of the new paradigm shift in building industry in Nigeria on sustainable development where green technology is the new idea that needs to be applied to design. A Review of; the World Green Building (WGB) movement with a focus on the progress of the Malaysian GBIM (Green Building Index Malaysia) and other progressive countries were compared with the present situation of Energy utilization and conservation in Nigeria. Emphasis on how to strategize the adaptation of developmental policies into the mainstreamed of Vision 2020:20 as propose by Nigerian Government.

**Index Terms:** Adaptability, Office-buildings, Retrofitting, Sustainability.

## I. INTRODUCTION

There has been evidence of climate change in Nigeria and the consequences well elaborated (Okali, 2008), with Nigeria contributing 0.79 per cent (0.79%) of CO<sub>2</sub> into the atmosphere an estimation of 2.1 Metric tons/person this exclude the land use change according to world research institute (WRI 2005). We find ourselves to be among the most vulnerable to the effect of climate change, this call for local action to be taken. Massive public awareness and in increase in knowledge base are two key factors needed to be addressed. To reduce greenhouse gas (GHG) emission at least by 5% by 2012, in order to tackle global warming and climate change, new and old buildings construction require low-energy criteria (Chlela et al., 2009). As climate change negotiations advance, it is becoming increasingly clear that there is a greater need to shift the focus on developing countries, since the international negotiations have not adequately addressed other priorities for sustainable development, support for adaptation activities and technology transfer. This will be because affordable and accessible modern energy services along with poverty reduction are essential to achieve sustainable development "(Reddy and Assenza, 2009).

## II. BACKGROUND

### A. Source of energy in Nigeria.

The three main sources of energy in Nigeria are; Traditional, Conventional and Alternative (Thomas, 1980). The high energy demand by the world's population has made it mandatory for us to preserve and conserve energy as well as to source for alternative.

The advent of international- style and our quest for development and lifestyle, saw an era where buildings were constructed neglecting original standards and requirements. Much energy was required to cool, light, ventilate and this required the use of fossil fuel which is non-renewable and contributes an amount of CO<sub>2</sub> to our atmosphere.

#### *B. Energy utilization and conservation in Nigeria.*

The method in which buildings are designed and built in Nigeria compliments conservation especially in the rural area; this is as a result of the limited resources. In the rural area the shapes, forms and functions are still very traditional and materials used are predominantly clay and mud. At the late end of colonization, traditional buildings were not preserved and subtly destroyed, especially in the metropolis. The discovery of oil and prosperity that comes with it saw a large influx of ideas and styles in building from international style to the postmodern style as well as high-tech. Most of these buildings did not consider the standard and requirement for building them in the various localities and a great deal of energy was required in buildings to provide; cooling, lighting and other gadget requirements. The energy sources, after all is exhaustible and coupled with the limitation in technological base, policy are needed to enhance the conservation of the energy source (Thomas 1980).

#### *C. Effect of climate change in Nigeria.*

Late onset of the rains around (1970 - 2000) was observed in Northern and Southern part of Nigeria, which is a sign of precipitation change. Extreme weather events: Droughts and floods were experienced in some part of the country. NEST (Nigeria Environmental study Team) has identified a framework at the local and National level that will be implemented, in order to address the issue of climate change.

One of the actions is massive public awareness (Okali, 2008). Climate change is a complex phenomenon and requires mutual action among; climate environment, economy, politics, institutional, social and technological processes. The hostile effect of climate has made Nigeria one of the vulnerable nations to desertification and soil erosion. It has an adverse impact on our; agriculture, energy, biodiversity and water resources.

#### *D. Vision 2020:20 a mile stone for Nigeria energy sector*

In 2005, Goldman Sachs looked at the economy of the world and made a prediction on the world economy potentials, he predicted that most economy will outplay the big economy if they continue on the path of growth rate, Nigeria will be the 12<sup>th</sup> largest economy by 2050, this made the Nigeria government plan for 2020 in lieu of 2050 prediction (Nwachukwu, 2009). For developmental growth the issue of energy efficiency was not established, except the issue of generation and deregulation of the downstream oil sector (Soludo, 2007)

### III. METHOD

#### *A. World green building movement and the green building index*

The World Green Building (WGB) movement started in early 1990 due to world global warming and climate change. It is a union of councils from around the world that aims to accelerate global sustainable building practices. The world Green Building Council (GBC) has the sole authority to appoint and direct the formation of green building councils throughout the world, launched 1988 by David Gottfried, founder of US Green building council. Various affiliated bodies are; Green building council of Australia (GBICA), United State green building council (USGBC), New-Zealand, and South-Africa have adopted the Green Star rating tools with modification to suite the unique conditions of their countries as well as the implementation stage for the completion of Malaysian green building council MGBC. Most of the countries mentioned above are developed nations except for Malaysia which is at the height of the fully implementation of the Green Building Index Malaysia (GBIM), what about other developing countries? (Jamaludin, et. al., 2010).

#### *B. Malaysia quest for sustainable energy development and Green Building Index Malaysia (GBIM)*

Malaysia has well-established set of plans that are laid out for implementation every five (5) years. The 2006 to 2010 plan addresses the issue of energy vividly, which all started in the 70's with the strategy of implementing energy policies which had a target of renewable energy providing 5% of electricity generation by the year 2005 (Jamaludin, et al., 2010).

Sustainable building program started with energy efficiency (EE) and renewable energy (RE) program beginning in the year 2000 with Low Energy Office (LEO) building demonstration project commissioned in 2003 and followed by national Malaysia Building Integrated photovoltaic (MBIPV) program started in 2005. The newly launched Green Building Index Malaysia (GBIM) in 2009 is another milestone for Malaysia towards green development after a long effort primarily initiated by the Malaysia energy policies and promotion on RE & EE.

LEO is focuses only on low energy which directly contributes to the reduction of CO<sub>2</sub> emissions. ZEO of PTM (commissioned in 2006) has further proved in achieving low energy demand by tremendous Building Energy Index (BEI) reduction as low as 30kWh/sq.m/year. ZEO demonstrates both RE & EE features successfully.

#### *C. Office building Adaptability*

Office buildings design has been very much influenced lately by the concept of open building system historically (Raji et al., 2012). From the very initial period of modern office building, purpose built buildings have often incorporated the future spatial requirements, when building needs to cater initially for current spatial needs of users. These initial designs were done without any serious emphasis on future adaptability. Hence, more creative and innovative perspective on designing office buildings which will accommodate adaptability is needed to enhance building performance, through design concept for adaptable office buildings. Adaptable building appears to be a vital response to rapid change, especially in terms of user demand for more space, as a result of organizational growth. As Graham (2006) stated, "A sustainable building is not a building that must last forever, but a building that can easily adapt to change" (Eguchi et al, 2009). Thus the creation of a more sustainable environment can be augmented by adaptable design strategies that produce a level of building flexibility, and which allow for a variety of changes to be accommodated. However, developing a better understanding of how buildings change over time is another issue argued by architects concerned with extending the life of buildings. The lengthening of the life of a building is believed to be useful to reduce the consumption of natural resources and the economic burden of building expenses for organization (Kendall et al, 2011). Therefore, adaptability is inevitable to the future office building of Nigeria.

According to Schmidt et al (2005), time as a design contingency relies on placing architecture in context, making it responsive to its temporal reality and biggest fear - change. Designers tend to ignore these temporal aspects focusing on an aesthetic fixation and functional performance, freezing out time in pursuit of a static idealized object of perfection. A reaction to this way of operating is the encouragement of a more dynamic and long-term understanding of the built environment. How then, does one design for time? (Eguchi et al, 2005).

Adaptability as a design characteristic embodies spatial, structural, and service strategies which allow the physical artifact a level of malleability in response to changing operational parameters over time. (Schmidt et al, 2009) This strategic shift reflects buildings, not as finished work removed from time, but as imperfect objects whose forms are in constant flux continuously evolving to fit functional, technological, and aesthetic metamorphosis in society. According Baldwin (2000), states that the capacity for buildings to respond to these changes are highly determined through design decisions early on resulting in the building's design structure – what it is, how it is constituted ( Schmidt et al., 2009). Achieving adaptability then demands a shift away from the current emphasis on form and function in response to immediate priorities, towards a 'context' and 'time-based' view of design.

Adaptability as a design principle which brings to the forefront of this critical path- time, as Croxton (2003) points out, "If a building doesn't support change and reuse, you have only an illusion of sustainability."

#### *D. Retrofit adaptability in office building*

A basic interpretation of building adaptability is the *refitting* of a physical environment as the result of a new circumstance. According to (Friedman, 2002), states that the process can be brought about by conditions that are internal or external to the building. The fitting of a building can occur in some cases prior to occupancy, as a choice to the occupants or user. Retrofitting usually take place during the occupancy period, the user exercise the previously conceived and constructed options for adaptability in a particular unit so as to satisfy inevitable dynamic needs of time (Friedman, 2002).

#### *E. Fitting new technology*

Architects, designers and builders incorporate into building the technology of their time as they designed and built. In the ensuing years new advances are introduced and old technologies become obsolete (Friedman, 2002). Friedman further states that systems and utilities in office buildings are designed to be upgraded and adapt to the needs of the original and subsequent users. Subcomponents are the elements that are usually fitted into building once the structure has been erected. Recent advances in information technology have introduced additional and different kinds of subcomponents into buildings. They can be electrical or computer wiring, heating and ventilation ducts. The useful life of many such subcomponents is often shorter that the life of the building structure, which requires replacement when the part is obsolete (Friedman, 2002). Hence, designing for adaptability "retrofitting" would permit easy access and replacement when the subcomponents need repair or upgrade, and will contribute immensely in reducing the amount of waste being induced by conventional renovation in retrofitting or "reworking" and existing plan of the building to meet the challenges and demands of modern technology.

## IV. RESULT & DISCUSSION

### *A. Adapting the green technology and initiative for future development in Nigeria*

The emergence of two most serious threats that confront the world today are: the threat to the atmosphere and the biosphere, which are fundamentally urban and the solution is known and clearly understood (Low, et al. 2007). This require the emergence of a

green building movement in Nigeria, and the world as a whole especially those countries who have not started the movement (Achyuthan and Balagopal, 2007).

### B. Policies for developing countries a beneficial movement for Nigeria

Developing countries need to integrate both development and change climatic policies that have to be embedded in its development policy and the use of SDPAM (sustainable development policies and measures). This is of the global action on climate change.

### C. Technology advancement

Artisan would have to be Information Technology (IT) literate, low carbon buildings, carbon - foot printing, health and safety would be of priority as well as a mobile computing and ICT. Architecture has to do with preservation of culture and heritage but principally sustainability. To achieve and deliver this, players involved in construction project must fully utilize all available resources and IT is one such resource and the functional role of IT can be best described in the role it plays in the various stages in construction Pre-tender, post-tender and post completion stages (Sommerville & Craig 2006, UNEP, 2009).

## V. CONCLUSION

Sustainability development has clearly taken on a global dimension, even in recent years it has recently been acknowledged that there is a close mutual interaction between local and global process which requires; networks, knowledge and local milieu. To achieve this in a conventional building, it requires a lot of energy and most of the energy used in Nigeria are non-renewable. For the energy from the renewable source is not enough to serve the nation and therefore have adverse effect on our climate as a whole and much concern and effort is required to formulate the policies, strategies to implement programs to develop green building and its related technology.

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