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Concept of Building Adaptability: A Sustainable Approach towards Resources and Energy Conservation in Nigeria

Sogo Abiola Oyesode

Lecturer, Department of Architecture, Caleb University, Nigeria

Abstract:

The existing building stock represents the largest financial, physical and cultural asset in the industrialised world and most developing countries. A sustainable society is not possible until this key resource can be effectively managed.

With the prevalent increase in resource scarcity and ecological crises, the need to consider adaptability of building spaces as a tool to sustainably manage building stock is imminent.

This paper takes a look at the concept of adaptability of building spaces for multifarious use as a sustainable and veritable tool towards effective resources and energy conservation. The strategies of adaptability and various adaptive systems are discussed. The paper concludes by explaining how the concept of adaptability relates to conservation of resources and energy consumption in buildings and proffering possible recommendations towards achieving this.

Keywords: Building adaptability, sustainability, building stock

1. Introduction

Traditionally, buildings have been created to meet certain needs which include function, comfort, and shelter but minimally focused on how well they fit with the natural environment. They also have been designed and constructed for uses and conditions of the moment; they therefore usually require remodeling or total replacement when needs or circumstances change, a costly approach both financially and environmentally. Buildings tend to be thought of as static edifices that remain the same over decades, interacting little with their environment or occupants.

New building concepts are however now challenging the traditional building paradigm due to changing needs of man as time and events unfold. This gave rise to other concepts of living, regenerative, restorative, and adaptive buildings which tend to conceive building as a more dynamic and interactive structures. All of these new concepts constitute part of the essence of sustainable buildings which is to create buildings that will respond to changing needs of its immediate environment.

For a structure to be able to adapt means that it can be adjusted easily for use in different conditions while satisfying the functions of each activity in the space. This type of architecture can be referred to as Flexible architecture which adapts to new uses, responds to change rather than stagnating, and is mobile rather than static. One of the four factors that characterize flexible architecture is adaptation. The aim of which is to better respond to various functions, uses and requirements of the building – (The Sustainable Initiative Guidelines and Performance Benchmarks 2009).

Adaptable spaces promote variety through flexibility in functional, spatial and atmospherical terms at one place for either short or long-term use, relating to seasonal and biographical cycles or rhythms of life.

The need for building adaptability is becoming more relevant from both the commercial and architectural perspectives. A clear example of this need can be seen in “Policy Planning Guidance notes of the Government of the United Kingdom (UK) in the year 2006” which encouraged the conversion of work and retail spaces into leisure, service or residential uses.

2. Problem Statement

Despite the increasing awareness of the need for more sustainable development in the industrialized and developing countries, issues of sustainability and implementation of various sustainable measures in Nigeria is still found at its infancy. Whilst some are fully aware of the need to ensure more sustainable environment is achieved for posterity sake, the will power to apply these measures in our day to day endeavors is very low. The need for greater awareness on the application of sustainable development measures in building stock is increasingly becoming more imminent in Nigeria. Most of the trends in building stock as opined by Kohler N (1998) also speaks of the increased relevance of adaptable stocks are gradually becoming more evident in Nigeria. The number of old buildings (warehouses, industrial, commercial and residential etc.) sitting empty are on the increase daily. There is daily increase in the number of new, empty, highly-equipped office buildings for lease. Cost

consumption is on the increase due to excessive use of land space with little or no land space for parking, garden and other recreational activities. It is therefore necessary for increased awareness on the need for buildings to be designed for long term adaptable uses. It is intended to examine the issues of Building Adaptability as it helps to promote sustainable development.

3. Objective of Study

- To emphasize the fact that although land may be a commodity that Nigeria seem to have in abundance now, just like the case of Oil, it may soon become a scarce commodity or ridiculously expensive to acquire if it's not put to sustainable use.
- To revisit the idea of the concept of Building Adaptability for Professionals in Nigeria.
- To promote and encourage professionals to think "sustainability" of building development right from the design stage.
- To recommend measures towards achieving adaptable buildings for cost effectiveness and energy conservation in Nigerian Built Environment.

4. History and Evolution of Adaptable Spaces

Change and improvements in the design of buildings are as inevitable as the ever-changing needs of man. The need for multi-functional spaces has been demonstrated in the adaptability of man to use a single space for sleeping, eating, entertaining and sometimes work. The traditional Japanese house is an example that demonstrates formal simplicity coupled with ultimate flexibility in the use of space and integration with the external environment.

Multipurpose spaces became popular in the 1950's and were used prevalently in schools where it could accommodate a wide variety of activities, such as dining, plays, films, assemblies, community meetings, physical education and have become more emphasized with the design of multisport facilities, entertainment centres and mixed-use buildings. - (Russell and S. Moffatt November 2001).

The multipurpose space according to Butin (2000) should be able to satisfy the needs of its assigned functions at reasonably high levels of performance.

Adaptable spaces became noted through small units of residential houses in the late nineteenth century and spread into larger community spaces and became a primary requirement for learning centres. Vancouver City Planning Commission (2010) defines adaptable spaces as:

- The ability to accommodate changes with only minor modifications, even if the needs are substantially different than anticipated.
- The capacity of buildings to accommodate substantial change.
- Buildings that are functionally agile and intended to respond readily to different patterns of use and specific user's requirement throughout their lifetime.

More modern adaptable spaces have evolved from multipurpose space to maximizing a single space for multiple activities with different uses. – (Vancouver City Planning Commission (2010)).

5. The Concept of Sustainability and Building Adaptability

Whilst sustainability implies a responsible, proactive and innovative decision-making to help conserve existing resources for the present and future use for generations unborn, the concept of building adaptability is a key proactive strategy towards maintaining a sustainable building stock development that can effectively meet the changing needs of its user.

The concept of building adaptability can be broken down into a number of simple strategies that are familiar to most designers.

- Flexibility, or enabling minor shift in space planning,
- Convertibility or allowing for changes in use within the building.
- Expandability or facilitating additions to the quantity of space in a building.
- Durability, selecting materials, assemblies and systems that require less maintenance, repair and replacement. Since durability extends the useful lifetime of materials and technology in a building, it is complimentary to adaptability.
- Design for Disassembly, making it easier to take products and assemblies apart so that their constituent elements can more easily be reused or recycled. – (B. Reed & J.B. Hoboken 2009)
- As seen with many temporary exhibition halls, designing for disassembly can reduce the costs and environmental impact associated with adapting buildings to new uses. It is also possible to reduce the overall environmental costs by purposely designing a building for shorter life, and for easier disassembly and reuse of components and materials.

6. Adaptability and Environmental Performance

Unless a building is capable of responding to changing circumstances, it is vulnerable to becoming poorly utilized, prematurely obsolete and unable to accommodate new, more efficient technologies. The combined impact of such failures may be to increase resource use within the building sector by 20 to 30%. Depending upon the additional investment required to

achieve adaptable designs and materials, it is generally possible to significantly improve the environmental performance of buildings in at least two ways, as outlined below.

6.1. *More Efficient Use of Space*

Adaptable buildings are most likely to use the same amount of space and materials more efficiently, on average, over their entire life. For example, increased flexibility of spaces might mean that it is easy for occupants to use floor area more effectively as their needs change, or as their business (or family) expands.

Convertibility may allow basements, attics, hallways, storage areas, roofs and entrances to be used for other purposes, as new needs arise. Expandability may allow the building to accommodate much higher densities with the same footprint and infrastructure. If such adaptations create even small improvements in space utilization over the lifecycle of buildings, the impact on resource use can still be significant. For example, J.J. Canas 2003 stated if the average life time space utilization is 10% improved, and all buildings are similarly designed for adaptability, then the world needs 10% fewer buildings. From J.J. Canas assertion, I proceed to add that if fewer buildings can be achieved through the creation of similar adaptable structures, the following can in turn be effectively conserved.

- Land natural resources can be preserved for posterity. This is one of the major essences of sustainability as a concept. There will also be more bare land to use for parking instead of the horrible situation of road side parking which has become a norm in major cities in Nigeria.
- The ecological existence and plant life on such land is also preserved to help reduce the calamity of Climate Change. The harmful Carbon content in CO₂ and also obtainable from gaseous emissions is inhaled in by plants for existence.
- Additional financial resources that would have been expended in the development of such new buildings are in turn conserved and can be better utilized on other pressing needs.
- The energy requirements and corresponding implications cost of such new buildings would also have been conserved for use on other pressing needs.

6.2. *Increased Longevity*

Adaptability is also a strategy for extending the total lifetime of buildings. Most buildings are destroyed due to technological obsolescence, not necessarily structural deterioration. Adaptability can therefore extend lifetimes without imposing any of the significant environmental impacts associated with all the one-time investments in the building structure and infrastructure. Consider, for example, the embodied energy in reinforced concrete – probably the single greatest pollutant source in a typical commercial building. Or consider the other long-lasting elements of a building like wood, metal, glass and landscaping materials. Or consider the energy used in construction, demolition, and haulage and disposal of earth, materials and waste. If adaptable designs can extend the average life time of buildings by 20% and possibly much more, then we can similarly reduce the total world investment in replacing these long-lasting elements of the building stock. The most environmentally built building is the one that does not have to be built again and again.

7. **Adaptive Architecture and Buildings**

There are diverse notions in the practice of architecture and erection of buildings today which negates the recently acclaimed clamor for more sustainable building developments. Two of the most obvious notions are delusions of permanence and perfection. If a design is proper, then the function of space need would never have kept changing with time and structure will never go obsolete. In reality, we live in a world of change steadily increasing in pace and degree. Only God is widely known to be perfect. No such other thing is known to be perfect, building structures inclusive. The building might appear to be the perfect solution to our present urgent need, but as things changes with time, more present needs begin to unfold and such buildings increasingly becomes inadequate and imperfect. The practise of architecture need to be seen in this light by designers as something that should be able to produce a dynamic result rather than a static one which might eventually be seen as a sculpture.

To achieve a more dynamic building stock, three schools of adaptive architecture have further explained different adaptable design approaches. They are, -Adaptive Reuse, Functionally generic architecture and Adaptive systems.

7.1 *Adaptive Re-use*

Adaptive reuse is based on the re-purposing of a 'found' structure -often a pre-existing piece of architecture that has become obsolete in its original purpose. This is most common in the context of commercial, municipal, and industrial structures with large span interiors that allow for easy retrofit or sometimes the erection of whole light independent structures within the shelter of the larger structure. Adaptive reuse also can apply to entirely new prefabricated structures and building systems which are simply employed to a purpose they were not originally designed for. This is common with light industrial and farm structures and their sometimes highly modular building systems.

A major limitation of adaptive reuse as a strategy for adaptive architecture is that one is limited to the very providential adaptive potential of a found structure one has no control over the form.

7.2. Functionally Generic Architecture

Functionally generic architecture is based on structures intentionally designed for perpetual adaptive re-use. This is a level of design foresight that is rare today and typically limited to large scale commercial and industrial buildings. These are structures with no pre-determined purpose for any of their interior space -except, perhaps, in a very generalized sense relative to the environmental character of large zones of the structure. Instead, they are designed to accommodate as many uses as possible anywhere within them as necessary over time and with the aid of non-permanent retrofit that conforms to the dimensional limits of the larger structure.

7.3. Adaptive Systems

These are building systems where the whole structure can be freely adaptable with the use of easily demountable and manipulated modular components. This is the ideal form of adaptive architecture, where both the micro-scale structure of the discrete dwelling and the macro-scale structure of a whole community are freely and spontaneously evolvable at potentially the same very high rate of change if necessary. These systems are also potentially useful in the context of retrofit or in-fill structure in both the adaptive reuse and functional generic architecture contexts, providing the basis of light structures that can flesh-out the interior of other larger structures.

8. Recommendations for Achieving Adaptable Buildings towards Sustainable Built Environment

At the design stage of any building development, proactive thinking by designers into what is likely to become of the building in years to come should be employed. Clients should also be made to reason along this line beyond their present need for the building into unforeseen needs that may arise in the near future. A functionally Generic Design Approach should be employed for fresh developments by Designers.

Encouraging the use of more built up partitions. This will help for easy rearrangement of internal spaces to suit changing needs of the client. The use of columns and beams as proper load bearing elements should be applied. Often times, clients in habit to save money on the cost of concrete and reinforcements do employ the use of weak concrete embedded inside block walls as load bearing elements. This is not a safe and sustainable approach in the event of the need for a modification in case the need for additional requirements arises in the near future.

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