Design adaptability as a tool for achieving affordable housing in developing economies

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Abstract
Provision of affordable Housing is a basic human need, and in a developing economy such as Nigeria, the government is continuously seeking innovative means of tackling the challenge of housing deficit. The growing population coupled with the lack of adequate housing has necessitated the need for a strategy by architects and designers to proffer solutions that will complement government housing policies. This study aims to propose adaptable design strategies in the provision of affordable mass housing in a developing economy like Nigeria. To achieve that, the following objectives were pursued: to propose strategies for land-use efficiency, to recommend guidelines for flexibility in design and to incorporate end users’ opinion in the design of mass housing schemes. The study adopted the qualitative research method through the review of existing case studies. Among the recommendations made was proposing guidelines on adaptable design that will aid architects and designers in the design of affordable mass housing schemes.

Keywords: Adaptability; Affordable Housing; Flexibility; Design Strategies; Terrace Housing;

1. Introduction
Nigeria with a population of over 198 million people [1] is bedeviled with lots of challenges peculiar to developing nations. One of such is the lack of affordable housing for a larger chunk of its population that can’t afford or compete in the Nigeria urban housing dominated by the high income earners.

According to the Managing director of Federal Mortgage Bank of Nigeria (FMBN), in 2012, Nigeria has a housing deficit of about seventy to twenty million housing unit, and this figure increases by nine hundred thousand housing unit per annum [2]. Both the government and private sector has over time made effort to improve the lack of affordable housing for most of its poor and middle class citizen but the problem seems to escalate the more. A majority of the government interventions in the housing sector have failed woefully, typical example is the Shagari Housing programme of the 1980’s [3].

Some of the challenges militating against affordable housing in Nigeria include; access to land, high cost of building material, high rent percentage, the absence of any viable social housing scheme, lack of flexibility in the design of social housing and non-affordability of supposed affordable housing initiatives by government. According to the UN habitat document [4], 30% of the world population lives in slums, with deplorable conditions and lack of access to basic infrastructure.

2. Literature review
This section reviews the literature on affordable housing and adaptability in housing design and terms related to both concept; its justification and adaptable design strategies.
2.1. Affordable Housing

To understand what affordable housing is, we have to first understand what is housing. Housing is one of the basic needs of man that is very important to the development of a city. Cities are rated on their ability to provide and house their citizens. According to World Health Organization, housing is an enclosed environment in which man finds protection against the elements [5]. This definition from WHO is considered “partial and narrow and may have sufficiently served the pre-historic man whose main objectives were to achieve bare existence with the circumstances dictated by his natural environment” [5]. A more acceptable definition of housing is from Abrams, [6] who opined that “housing is not only shelter but part of the fabric of neighborhood life and of the whole social milieu, it touches on many facets of industrialization, economic activity and development”.

Affordable housing is housing which deemed affordable to those with a median household income or below as rated by the government of recognized housing index. In Australia, according to the National Housing summit Group [7], affordable housing is housing that is reasonable adequate in standard and location for lower or middle income households and does not cost so much that a household is unlikely to be able to meet other basic needs on a sustainable basis. In the United States, the term affordable housing is used to describe housing, rental or owner-occupied, that is affordable no matter what ones income is. Thus, the term ‘affordable housing’ describes housing that assists lower income households in obtaining and paying for appropriate housing without experiencing undue financial hardship [8]. Although, different countries have contrasting definitions for affordable housing, but it is mostly the same, that is, affordable housing should address the housing needs of the lower or middle income households. Affordable housing becomes a key issue especially in developing nations where a majority of the population isn't able to buy houses at the market price.

In Nigeria, Affordable housing is often referred to as low income housing or social housing [9]. Government at the different levels introduce schemes geared towards providing affordable housing for its population. Most of this housing scheme still end up not being affordable for those it is designed for. The Nigeria National Housing Policy defines ‘Housing’ as the process of providing functional shelter in a proper setting in a neighborhood, supported by sustainable maintenance of the built environment for the day-to-day living and activities of individual and families within the communities. [10].

Affordable housing is important to families and household around the world. Certainly, it fulfills a basic human need for shelter, but it also contributes to the well-being of both parents and children. Decent, affordable housing reduces stress, toxins, and infectious disease, which leads to improvement in both physical and mental health.

Affordable housing should be able to meet the following criteria to be considered sustainable;

- Need for low maintenance
- Efficient use of energy
- Regard for healthy indoor environments
- Responsibility use of the earth’s resources

2.2. What is adaptability?

Adaptability is the quality of being able to adjust to new conditions. We have some varied scholarly definition of Adaptability in design which is also similar to flexibility, though flexibility deals more on physical change while adaptability is of non-physical change. According to Friedman [11], adaptability is providing occupants with forms and means that facilitate a fit between the space needs and the constraints of their home either before or after occupancy. Freidman’s definition on adaptable does not support adaptability for future needs and that is very contestable. According to Schmidt, [12], anything adaptable should have the following characteristics:

- Capacity to change
- Ability to remain fit for purpose
- Maximizing value and
- Time (speed of change and through life charges)
Based on these characteristics, adaptability is the capacity of a building or design to accommodate effectively the evolving demands of its context, thus maximizing value throughout the building life [12]. The changing demand here include but not limited to increase in number of household, increase in income, technology and environmental changes. The ability to achieve this is a conscious effort to create houses that meets the present needs of the occupants and also their future need (sustainable) at an affordable rate. It is a way to achieve both sustainability and low income housing. With adaptability, building should be able to support change and reuse. Adaptability also allows for changes to be made with minimum of disruption and expanse to the occupants [13]. Adaptability is one of the most critical strategies for affordable housing.

2.3. Adaptable design Strategies

This are the various concept and strategies when effectively employed in building design will give the building the capacity to accommodate effectively the evolving demands of its context, thus maximizing its value throughout the building life cycle

- **Land use efficiency**

  Land still represents the most important development resource for municipal and national governments [14]. Land is a key factor in housing design and cost. The availability, size and location of land to a large extent determines its use and cost implications. More often than not, this cost is transferred to the end users/inhabitants/tenants. With the rate of price appreciation of land, the cost of housing also skyrockets at an alarming rate, with the low and middle income earners bearing the brunt of the costs in the form of rents and lease costs, being the ones who can hardly afford to build houses of their own. It is the quest of affordable urban housing that has given rise to urban sprawls and slums, unplanned urban areas and illegal occupation of existing accommodations.

  There have been different suggestions as to how to go about reducing this cost implication on the housing inhabitants. These are generally referred to as Smart Growth. Smart growth in a nutshell, refers to a set of goals and policies set in place in order to curb sprawls. Some proponents of smart growth are of the opinion that housing needs of low income earners can be addressed by planning neighborhoods of higher densities, a greater variety of housing types and mixed land use than by low-density, single-family homes [15]. However, in the study carried out by Aurand [15], it was discovered that the provision of a variety of housing types does not meet the entire housing demands of all the categories of low-income earners due to factors like family size and housing preferences.

  Land use efficiency takes into cognizance not only the designated use of the land, but also the location of the land and the size of the land. Sustainable land use for the low-income earners would imply residential zones sited close to commercial and institutional zones in order to reduce cost of transportation. For planners, land use efficiency involves maximizing the spatial provision of the structure erected on the site.

- **Flexibility in design**

  The term “flexibility” as distinct from “adaptability” connotes the capability of different physical arrangements, whereas, adaptability is concerned with capability of fitting different social uses [16]. This implies that “flexibility” is used for physical changes and “adaptability” used to depict non-physical changes, although, both usually occur at the same time thereby removing any rigid boundary between them. [17].

  Groak, [16] asserted that flexibility can be achieved by modifying the physical form of the building by linking, splitting, extending and integrating spaces. Thus, flexibility in design would allow for new modifications based new lifestyle, family size or economic growth. The drive for flexibility in designs is greatly influenced by economic constraints as well as functional use [13], although, the major factors influencing flexibility in the architectural circumstance are the users of buildings, their needs, and their requirements which change rapidly over time thereby necessitating the cause for buildings towards a flexible physical, spatial, and cultural structure to respond to the changes. [17].

  Tracing the history of flexibility in design, a major contributor Le Corbusier, proposed the Domino system which has formed a pillar in discussions on flexibility in design [18]. The domino
system entailed the industrialized designs for housing using concrete framed structures (columns and slabs). This informed the design of the free floor plan where the interior is different from the building frame which bore the building structural loads [18]. Thus, encouraging flexibility in arrangement of non-load bearing partition walls to meet user needs and requirements even as they change. Although, Le Corbusier’s Domino system achieves flexibility, it can be argued that this flexibility is confined to the delineation of the framed structure.

Research by Estaji, [17] gives indicators of flexibility which are listed in Table 1.

| Type of Flexibility/ Adaptability | Definition |
|----------------------------------|------------|
| Convertibility                   | allowing for changes in use within the building |
| Expandability                    | facilitating additions to the quantity space in a building |
|                                  | “Allowing for increases in volume or capacity (the latter can be achieved by inserting an additional floor in a building, which does not increase its volume)” |
| Durability                       | “Selecting materials, assemblies and systems that require less maintenance, repair and replacement” |
| Design for Disassembly           | “Making it easier to take products and assemblies apart so that their constituent elements can more easily be reused or recycled.” |
| Upgradability                    | “Choose systems and components that anticipate and can accommodate potential increased performance requirements” |
| Lifetime Compatibility           | Do not encapsulate, or strongly interconnect short lifetime components with those having longer life times |

Source: [17]

3. Research Methodology

Research was developed using the case studies approach. Case studies method was chosen because of its suitability over experimental and survey research design. This is because it does not rely on sample and it is not statistically-based, but analytically-based. The research tactics was developed in two stages:

- Definition and design on research
- Data collection and analysis

3.1. Definition and Design on Research

The first step was to define the aim of the research by developing research questions and propositions to guide the research, thus:

What design strategies can be employed by architects to increase affordability and adaptability in housing projects? The proposition for the research is that there are design strategies that can be employed by architects to increase affordability and adaptability in housing projects.
The unit of analysis for the research was the Quinta Manroy housing project in Iquique, Chile by ELEMENTAL [19]. The case was chosen due to its critical relationship to the topic being analysed. The variables to be analysed are:

- The aim of the project
- The design process
- The affordability based on design
- The end result of the development

The data were analysed using analytic generalization. This is done by linking data to propositions as a means to determine the “what” and “why” of the research.

3.2. Data Collection and Analysis

The aim of the Quinta Monroy housing project was to accommodate 100 families of Quinta Monroy in a plot of land (0.5 ha²) they had been occupying illegally.

The design process used was the “Participatory Design Process” in which the families that were to be accommodated were asked to contribute to the design solution based on their specific needs.

4. Findings

The following were the findings from the study of the Quinta Monroy housing project:

The participatory design process proved innovative for affordable housing. The building was designed as a “half-building” in the first phase, where the government funds were used, and another “half-building” in the second phase, where the families take over and adapt the building to their specific needs.

![Image of the “Half –Building”](www.archdaily.com)

The design process channeled the occupants’ building capacity into the development process, thereby keeping it within affordable means of the home owners.

Affordability: The design strategy was geared towards a social housing scheme that keeps increasing in value, opposed to one that keeps depreciating. For maximum land efficiency, the buildings were designed in clusters of 20, with a common public space and restricted entrance, to encourage social life. The design strategy allowed the most important sections of the site and building to be provided and also provide growth within a frame provided.

Low income families that started off living in 1 or 2 bedroom units in a very short time were able to complete the building into a middle income household of 3-4 bedrooms unit.
Adaptability: At the centre of the design philosophy, is the notion that the building should expand as the economic fortune of its occupant increase. The design of the “half-building” gave opportunity to the occupants to make additions within an already provided frame. The buildings designed as low income social housing, in a couple of years, grew into middle income homes.

The effect/end result of the development: The design adaptability and affordability proved to be effective only through participatory design process. The home owners themselves were able to maintain their social life and also live in the area that they want to live.
4.1. Discussion

The analytic strategies based on analytical generalization relies on the study proposition formed at the initial stages confirms that design strategies can be employed by architects to increase affordability in the design of residential buildings.

The Shagari Housing Programme of the 80’s/90’s has become one of the most ambitious programme on public housing in the country. The absence of clearly defined design strategies for affordability and adaptability can be said to be one of the challenges that plagued the Shagari Housing Programme of the 80’s and 90’s.

From the case studies, the following design strategies were proven to be essential;

Participatory Design:

This is the most important strategy for mass housing. Architects providing mass housing must be careful not to provide solutions to the wrong problems. Involving the end-users (occupants) early in the design process is at the base of the success of any affordable mass housing scheme.

Contextual Innovations:

An in-depth understanding of the life and environment of the occupants will always therefore, lead to contextual innovations. From the case studies, the site planning I unique clusters to maximize space and promote social life of the residents is a clear example of contextual innovations.

Affordability and Adaptability requirements differ from place to place, Architects and designers must take due diligence and seek for local solutions in designing, programming and construction. Contextual innovations is key to efficient management of resources. Design To Expand:

Due to the scarce availability of resources and the never-ending need for more residential developments. Architects must design to effectively allow the occupants space to improve the value of the buildings.

Figure 4: The effect/end result of the development.
Source: Retrieved from www.archdaily.com
Architects must strike a balance between various variables of scarce resources instead of providing very small spaces due to the low funds, designers should encourage home owners to ‘grow’ their buildings.

5. **Recommendation and Conclusion**

The provision of affordable housing is seen as a solution to the slums but Research has shown that most mass housing projects quickly degenerate back into the slums, they were meant to alleviate. This challenge is mostly due to the poor implementation or lack thereof an effective design solutions and strategies to guide architects in the development mass housing.

The aim of the paper has been to propose design strategies for affordable and adaptable housing projects. These strategies as discussed earlier is at its core, bringing the community to be accommodated into the design process through participatory design, contextual innovation and designing for expansion.

More research is encouraged to better understand how this strategies can be developed and implemented in other areas of architectural design.

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