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# Vertical Architecture Construction: Prospects and Barriers in solving Lagos' Housing Deficit

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## Abstract .

The population of Lagos State is projected to double by 2050 to 32.6 million people. This is estimated to be the 6th largest city in the world. However, the land mass area of the state remains relatively constant at 3,577 Km<sup>2</sup>. There is need to identify sustainable housing solutions to reduce the level of homelessness within the megacity. Therefore, this study was aimed at examining the prospects and barriers in the use of vertical architecture construction in solving Lagos city's housing deficit. The study utilized content analysis of literature on the subject matter which were obtained from major online databases. The study identified the prospects in the use of vertical architecture construction such as reducing housing deficit, adequate land management, engender sustainable practices, improved innovation and proper planning within the state. Nevertheless, some barriers are encountered in the actualization of a comprehensive vertical architecture in Lagos megacity. The barriers include cultural bias to high rise, lack of technology, epileptic power supply, poor maintenance culture, poor fire service delivery, inadequate policies and investment funding. In conclusion, preparedness towards a sustainable housing solution of vertical architecture construction requires a public-private partnership approach in public housing delivery.

**Keywords:** *Construction Industry, Housing Deficit, Lagos State, Sustainable Development, Vertical Architecture*

## 1. Introduction

Addressing housing needs through public housing provision is seen as an avenue to meet the socio-economic needs of the people. Nevertheless, [1] stated that urban housing in Nigeria is in crisis despite the numerous number of policies and strategic solution to address the menace. The crisis of the Nigerian public housing provision is worsened by high urbanization [2], high population growth [3], inadequate housing policies [1], inadequate land mass and high land cost [4], misappropriation and politics [5], high internal displacement and natural disasters such flooding [6]. The Nigerian housing supply deficit has been put at over 17 to 20 million while the housing production capacity is at 100, 000 units annually [7]. With this 100,000 unit housing production rate, in order to supply a 20 million housing unit, it would require 200 years. It is worthy to note that the population growth rate is not subsiding either. Nigeria's population growth is put at 3.2 percent per annum with an actual population of over 193 million as at the 2016 census [8]. If the Nigerian government and the private sector cannot meet the housing demand of the present population, it would become harder to meet the projected population by 2050. The United Nation's World Population Prospects of 2017 projected that Nigeria's population would have reached 410 million by 2050. [1] noted that no National Development plan on housing provision have been able to achieve above 23.6 percent of its planned housing production units since 1962 till date. It is worthy to note that Nigeria's low-income earners are mostly affected by the housing provision deficit [9]. This can be attributed to affordability of the available housing units while [10] argued that it should be the obligation of the Nigerian government to provide affordable housing units for its citizenry.

The rate of urbanization is also a crucial factor which affects Lagos megacity in Nigeria. The studies by [10] and [11] reported that the percentage of people in Nigeria who live in urban centres had increased from 10% in 1950 to over 40% by 2010. With emphasis on Lagos State, the state suffers from high urbanization while the population of Lagos State is projected to double by 2050 to 32.6 million



people. The study by [6] asserted that the high population is worsened by the high rural-urban migration. Lagos State is the economic hub of Nigeria and therefore, everyone wants to come and enjoy a bit of the prosperity. In [12], it was reported that at least 87 people per hour commute to Lagos on a daily basis. By 2050, Lagos State is estimated to be the 6th largest city in the world. However, the land mass area of the state remains relatively constant at 3,577 Km<sup>2</sup>. Lagos State is one of the urban cities in Nigeria with several slum settlements within the state. [13] asserted that there are over 100 slum locations within the state. In addition, [3] noted that an estimated 45 million Nigerians living in urban centres live in slums. This is putting undue pressure on the available housing and urban infrastructure within the state. Myriads of the environmental challenges face by Lagos state in the face of high and uncontrolled urbanization is overcrowding, poor sanitation, unplanned human settlement, blocked drains leading to floods, high pollution and so on [10]. There is need to identify sustainable housing solutions to reduce the level of homelessness within the megacity. Therefore, this study was aimed at examining the prospects and barriers in the use of vertical architecture construction in solving Lagos city's housing deficit.

## 2. Methodology

In this study, an in-depth literature review was used to sift through the prospects and barriers to vertical architecture construction in Lagos State. Materials included published articles from major databases on the subject matter of public housing and vertical architecture. A total of forty (40) articles were downloaded from online journal outlets and libraries while only twenty-one (21) were deemed adequate for this study. A discussion format was utilized to explain the objectives of prospects and barriers. Presently, there are over 47 megacities with Lagos State been one of them [14]. The study area of Lagos State was chosen for this study due to the peculiar challenges with housing, high population and urbanization and limited land area. Furthermore in [15], mismanagement of our land, recurring periods of building collapse, building fires, sick buildings, and urban defacement are problems faced in Lagos megacity environment. Figure 1 showed the map of Lagos State and local government areas within the State.



Figure 1. Map of Lagos State

## 3. Barriers to Vertical Architecture Construction

Nevertheless, some barriers are encountered in the actualization of a comprehensive vertical architecture in Lagos megacity. The barriers include cultural bias to high rise, lack of technology, epileptic power supply, poor maintenance culture, poor fire service delivery, inadequate policies and

investment funding. Public housing provision starts with actual policy formations to meet housing needs. [1] suggested that challenges with public housing provision can be linked to inadequate policy formulations in the allocation of land, funding and provision of the housing units. [16] noted that these housing policies should be able to address the performance of the sector in terms of quantity, quality and price index of each unit including the services within such buildings. However, the Nigerian housing policies from successive governments have not been able to meet the housing demand leading to the high rate of homelessness [3, 16]. The study by [17] opined that developing high rise and sky scrapers require consistent and huge investment. Vertical architecture construction would require investment in steel materials, heavy crane systems, efficient lift systems, HVAC and other technologies to make it work. Nigeria suffers from some environmental challenges such as epileptic power supply, poor fire services and other dilapidated ancillary infrastructure that would ensure the success of vertical buildings. In the case of power supply, most vertical buildings would require lift systems to commute occupants from one level to the other. Every high rise or skyscraper is heavily dependent on an efficient and reliable elevator system. In a country that still grapples to supply between 3000 – 5000 Megawatts, there is need for sustainable solution in the power sector. Without adequate power supply, investment in vertical buildings may become impracticable. A brief power failure in vertical buildings can result in operational and economic chaos.

In addition, the present vertical buildings in Nigeria are yet to attain the 50-storey structures which means that the fire service are ill-equipped to tackle fire accident. For an efficient and safe vertical construction, fire service departments should be well-equipped and trained to address fire situations that may arise in vertical buildings. The “failure” of a vertical building can be felt nationwide or even worldwide in the worst case as witnessed in the Grenfell Tower block in West London, United Kingdom which left many homeless and over 80 deaths. This scenario not only applies to such total failure as a major fire or collapse of the building. Vertical buildings such as high rise and skyscrapers are incredibly sensitive and vulnerable systems that should be carefully managed. There is the issue of cultural belief which can be a hindrance to vertical residential buildings in Lagos State. Most residents are not used to the system rather they prefer to own their own buildings with high fence and surroundings. The singular ownership of such buildings bring prestige and landlord-ship title to the owners which most Lagosian may not want to give up easily.

Another crucial factor in vertical buildings is consideration of maintenance. Vertical buildings require extensive investment, it is therefore essential that these investments must be maintained by proper conduct and application of maintenance management procedure and systems to prevent deterioration of the property itself and the loss in value of the property. Vertical architecture buildings are unique properties that differ from other landed properties such as bungalows, blocks of flats or terrace houses. In that, [18] noted that high rise buildings account for the high maintenance cases compared to other types of buildings due to the complex systems such as fire detection and protection systems, HVAC systems, elevators and other high rise accessories. In terms of elevators, maintenance control plans that consider issues regarding elevator door operations, hydraulic oil levels and evacuation procedures in case of emergencies need to be put in place. Several studies have pointed out that Nigerians lacked adequate maintenance culture for its infrastructure. This is evident in many public utilities that have been dilapidated. For vertical buildings to become sustainable, maintenance culture should be implemented by occupants and facility managers responsible for such buildings in order to change the mind-set and attitudes of Nigerians. The demands of the maintenance team in the vertical buildings would be to create maintenance awareness among all parties in maintenance management and building occupants through an effective and continuous maintenance culture.

#### **4. Prospects of Vertical Architecture Construction**

According to [19], the 21st century city is increasingly vertical. This is because many cities in developed and developing countries are readily embracing vertical architecture buildings and its technologies. Many of them have even tried to make it functionally sustainable by contributing

efficiently to the environment. This study opined that building vertically; rather than building horizontally as the present case is, vertical buildings would help reduce the housing deficit in Lagos State. A similar example is the 1004 housing estate built in the heart of Victoria Island, Lagos, Nigeria as shown in Figure 2. The building was commissioned in 1979 aimed at providing accommodation and provision of a serene environment for living, working and recreation. The development manages the scarce plots of land in the heart of Victoria Island, Lagos. This study asserted that in order to meet the housing delivery target for the Lagos citizenry, the template of 1004 flats and studio apartment can be replicated in several local governments, even in a larger scale. The study identified the prospects in the use of vertical architecture construction such as reducing housing deficit, adequate land management, engender sustainable practices, improved innovation and proper planning within the state.

The report by [20] opined that there is space crunch in many major cities around the world. This is as result of the world's population which continues to increase and the influence of environmental changes due to climate change, land is becoming a scarce commodity [17]. In order to create more space, many construction professionals have started to think vertically. Cities such as Singapore, Dubai, Hong Kong, New York and so on have successfully embraced vertical construction in form of sky scrapers and high rise buildings. Lagos State presently has a land mass area of 3,577 Km<sup>2</sup> and is constantly looking for areas to reclaim land through sand-filling such as in Eko Atlantic development and Ilubirin Turnkey project. In certain areas where the land is expensive, the reasonable solution would be to think vertical in order to optimize the land space. Using vertical construction architecture can change the future of urban environment in Lagos State. In that, there is increased density and its ability to 'shrink' a city [21]. The report by [17] advised that vertical construction would lead to vertical cities which would help save energy, support the increasing population and help food production in terms of land preservation. In the latter, [19] referred to the process as providing sky gardens or vertical courtyards which aid ventilation and improved air quality.

Living in sustainable cities should be paramount to emerging megacities around the world such as Lagos State. The environmental challenges within Lagos State if not handled appropriately can lead to outbreak of diseases as witnessed in the bubonic plague of 1924 to 1930. Buildings in Lagos megacity should resonate with the definition of sustainability by ensuring that the erection of buildings should not adversely affect future generations to meet their own needs. Vertical architecture construction is a sustainable practice that ensures that over 100 houses that could have been built on large expanse of land is conserved on a limited land space in one tall building. The study by [19] emphasized that when resources are finite, the long-term implication of human activities should be adequately scrutinized. Around the world, several tall buildings are been designed and constructed to be sustainable in terms of energy saving, smart and green. Vertical landscaping is also encouraged which can affect indoor and outdoor air quality within cities. [17] noted that vertical buildings would be energy self-sufficient due to the exposure provided to solar panels due to the heights of the buildings. In terms of proper planning, instead of building several bungalow which would stretch on several acres of land, the use of vertical architecture construction would ensure that the buildings are compressed into one vertical structure. Despite several efforts, Lagos State presently suffers from lack of building control which is resulting in fire outbreaks and building collapse [15]. In the report by [12], with vertical buildings situated in prescribed locations, the necessary infrastructure needed can be easily planned unlike for horizontal buildings. In that the needed services would be less compared to trying to supply several buildings.





**Figure 2.** Elevation view of 1004 housing estate, Victoria Island, Lagos, Nigeria

## 5. Conclusion

Due to the high urbanization and population increase in Lagos state, this study aimed at examining the prospects and barriers in the use of vertical architecture construction in solving Lagos city's housing deficit. The study identified the prospects in the use of vertical architecture construction such as reducing housing deficit, adequate land management, engender sustainable practices, improved innovation and proper planning within the state. The paramount driver to vertical architecture construction in Lagos State should be to reduce the over 3 million housing deficit within the State. Nevertheless, some barriers are encountered in the actualization of a comprehensive vertical architecture in Lagos megacity. The barriers include cultural bias to high rise, lack of technology, epileptic power supply, poor maintenance culture, poor fire service delivery, inadequate policies and investment funding. In conclusion, preparedness towards a sustainable housing solution of vertical architecture construction requires a public-private partnership approach in public housing delivery. Vertical buildings require adequate project planning and extensive funding of which the private sector has excelled in. With proper policies in place in terms of funding, land allocation, services and concessions with the private sector, vertical buildings can become a reality in meeting housing targets for the entire Lagos populace.

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## References

- [1] Ibem E O Anosike M N and Azuh D E 2011 Challenges in public housing provision in the post-independence era in Nigeria *International Journal of Human Sciences* **8** 2 pp 421 - 443.
- [2] Akinmoladun O I and Oluwoye J 2007 An Assessment of Why the Problems of Housing Shortages Persist in Developing Countries: A case of Study of Lagos Metropolis, Nigeria *Pakistan Journal of Social Science* **4** 4 pp 589-598.
- [3] Olotuah A O 2010 Housing Development and Environmental Degeneration in Nigeria *The Built & Human Environment Review* **3** pp 42 - 48.
- [4] UN-HABITAT 2006 *National Trends in Housing –Production Practices Volume 4: Nigeria*, United Nations Centre for Human Settlements: Nairobi.

- [5] Mustapha I 2002 Overview of Housing and Urban Development Programme since Independence *Housing Today-Journal of the Association of Housing Corporations of Nigeria* **1** 6 pp 28-30.
- [6] Afolabi A Oluwatayo A Oyeyipo O Ojelabi R and Fagbenle O 2018 Assessment of designers' perception of post conflict housing schemes for internally displaced persons *Construction Economics and Building* **18** 1 pp 27 – 47.
- [7] Centre for Affordable Housing Finance Africa 2018 Housing Finance in Nigeria Accessed on 25th January 2019 from <http://housingfinanceafrica.org/countries/nigeria/>
- [8] National Population Commission 2016 National Population Estimates Accessed on 25th January 2019 from <https://nigerianstat.gov.ng/download/474>.
- [9] Olotuah A O and Aiyetan A O 2006 Sustainable Low-Cost Housing Provision in Nigeria: a bottom-up, participatory approach. In: Boyd, D (Ed.) *Proceedings of 22nd Annual ARCOM Conference*, 4 - 6 September, Birmingham, UK, Association of Researchers in Construction Management, **2** pp 633 – 639.
- [10] Enisan O and Ogundiran A 2013 Challenges of Housing Delivery in Metropolitan Lagos *Research on Humanities and Social Sciences* **3** 20 pp 1 - 9.
- [11] Okupe O 2002 Problem of Real Estate Developers in Nigeria *A paper presented at a workshop organized by the Nigerian Institute of Quantity Surveyors*, Abuja.
- [12] Nwannekanma B and Gbonegun V 2018 Divergent views trail calls for adoption of vertical city development Accessed on 25th January 2019 from <https://guardian.ng/politics/divergent-views-trail-calls-for-adoption-of-vertical-city-development/>
- [13] Ilesanmi V O 2010 Urban sustainability in the context of Lagos mega-city *Journal of Geography and Regional Planning* **3** 10 pp 240-252.
- [14] Afolabi A O Ojelabi R A Bukola A Akinola A and Afolabi A 2018 Statistical exploration of dataset examining key indicators influencing housing and urban infrastructure investments in megacities *Data in Brief* **18** pp 1725-1733.
- [15] Ojelabi R A Oyeyipo O O and Afolabi A O 2017 Built Environment Professionals' Perceptions of the Effectiveness of Building Control Measures in Lagos State *Journal of Construction in Developing Countries* **22** 1 pp 41-54.
- [16] Sengupta U and Tipple A G 2007 The Performance of Public-sector Housing in Kolkata India, in the Post –reform Milieu. *Urban Studies* **44** 10 pp 2009 – 2037.
- [17] Robinson M 2016 Vertical cities could be the future of architecture Accessed on 25th January 2019 from <https://www.businessinsider.com/vertical-cities-future-of-architecture-2016-4>
- [18] Halim T Muthusamy K Chia S Y and Lam S W 2011 A Systems Approach in the Evaluation and Comparison of Engineering Services Applied in Facilities Management *Facilities* **29** 3/4 pp 114-132.
- [19] Al-Kodmany K 2018 Sustainability and the 21st Century Vertical City: A Review of Design Approaches of Tall Buildings *Buildings* **8** 102 pp 1 – 40.
- [20] Avsaththi B 2016 Vertical Architecture Designs set to Redefine Construction Industry Accessed on 25th January 2019 from <https://archinect.com/HCADDS/release/vertical-architecture-designs-set-to-redefine-construction-industry>.
- [21] Jo P 2016 Architects need to embrace vertical living. *Architects' Journal* Accessed on 25th January 2019 from <https://www.architectsjournal.co.uk/opinion/architects-need-to-embrace-vertical-living/10006379.article>.