

Architectural design response to population issue in sub-Saharan cities

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Abstract. Overpopulation is a serious global problem, and it is predicted to get worse in future if unchecked; accompanied with threat of dwindling resources. The increase in population and its effect on the housing sector is surfacing as clog in the wheel of efforts at reducing Africa's housing deficits. How then can urban life continue to thrive in the existing housing issues in colonial, sub-Saharan city of Enugu, exploiting architectural design strategies is what the study investigates. It utilized a qualitative research approach of survey and participant observation in which data were collected and analysed based on thematic content analysis. Gross housing deficit, increased housing rent, emergence and expansion of squatter settlement, Land use conversion and slum conditions are some observable effects of population growth due to urbanization and rural-urban drift in the city; Statistics of public housing provision between 1999-2020, showed an over focus on high-income earners, neglecting the majority low-income population. Therefore, architect's intervention in the housing sector should be strategic, holistic and proactive and encourage use of local materials, vertical development, dry construction and stakeholder's participation in delivery process. The study concludes that futuristic architecture holds the key to humanity's continued stewardship on earth and a sustainable housing delivery.

1. Introduction

Concerns about overpopulation issue have continued to rise and have assumed global dimension. To better appreciate the crisis our planet is subjected to, it is crucial to understand the term overpopulation. It is a condition where the total number of humans in a particular geographical area (often a city, country or continent) is too high for the environment and its available resources to sustain them. Globally, overpopulation is a situation in which the earth's resources used by the world's population is unable to be regenerated by the earth each year. Since the 1970s, this trend has persisted with each successive year causing more harm with increasing damaging effect. The current global populace stands at approximately 7.6 billion individuals, and projections suggest that it will reach 9.8 billion by 2050 and further increase to 11.2 billion by 2100. Also, it is estimated that over 50% of the people will reside in urban areas [1]. This fast-escalating human population is mounting pressure on the earth's natural resources and consequently changing its climate at a frightening rate. Fears and doubts as to how access to adequate food, housing, water etc., for all these people will be made available. In the history of human species, there have always been a balance between birth and death rates, and it has maintained a sustainable population growth [2]. Evidence in literature suggests that since the Bubonic Plague in the 1400s, there have been constant population increase. The period between the plague and the 21st century, have witnessed several wars, natural disasters, and man-made hazards. However, none of these made a dent on human population [2]. The tipping point was generally accepted to be the fourth Industrial Revolution, although numerous smaller revolutions have contributed to population take-off and have resulted to the current

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dangerous overpopulation of the planet [3]. Although the overpopulation problem is currently felt more strongly in third world economies than in developed nations, it is nevertheless a problem with widespread across the globe at present. Available statistics shows that Nigeria (Africa), China (Asia) and India (Asia) are three countries whose total population over the next decade will amount to 40% of global demographic growth [4,5]. This reveals an imminent global population surge unless effective measures are implemented to manage it. However, it indicates that in these rapidly developing settings there are vast opportunities, and also unsettling risks related with the development.

No aspect of society has continuously sparked the intense need for restructurings more frequently since the 1970 after the Nigerian civil war than the phenomenal population growth, the state of housing, and the quality of life of the urban poor [6]. These significant transformations are resulting to widespread emergence of the present favelas. As stated by the UNDP [7], Africa harbours the highest number of slum dwellers globally, comprising 61% of its urban population, which translates to approximately 195.5 million individuals. Nigeria, specifically, possesses the 9th largest urban population worldwide and is home to some of the largest slums on the African continent [5]. The substantial rise in population, primarily driven by rapid urbanization and large-scale migration from rural to urban areas, attracts thousands of rural dwellers who seek education and employment opportunities in urban areas, perceiving them as promising destinations for a better life. However, very little thought has been paid to its effects and no strategic architectural mitigating measures have been instigated to accommodate the expanding human population within cities in a developing country like Nigeria. The colonial city of Enugu has undergone significant expansion and development since its early day as a coal miners camp (the current camp residential neighbourhood) within an area of 151 miles (243 km) and a population of about 3,170 people by 1921 to a projected population of over 1,125,467 in 2020. This has grievous implications for urban housing delivery for the metropolis. Anecdotal evidence suggests that public housing provision of the city, both currently and in the past has not made any significant contribution to ameliorate the housing deficit experienced by the teeming city population. The research therefore aims to investigate existing housing issues in the colonial city of Enugu as a result of population explosion and formulated a theoretical framework that is architectural based to mitigate the effects of emerging overpopulation problem been experienced in the study area. The specific objectives pursued in this study include; (i) to gain insights into the earth's environment, (ii) to analyse the population progression of the study area and relate to housing condition (iii) to examine the provision of Urban Public Housing of the city between 1999 and 2020. It is pertinent to note that discourse on overpopulation issues especially in a typical African setting like Nigeria can easily become provocative because of many unravelling questions; whose fault, what is the origin and who do we evict from the environment to maintain the balance. It therefore draws to attention that the research focuses on accommodating the already exacerbating issue that has come to stay. Findings of this study are instructive in noting that in order to achieve a balance between environment and human population architects and other building design professionals should endeavour to give adequate attention to the sociological aspect of environmental design.

According to Koslow [8] overpopulation has the capability to influence the way we think about architecture more than any other problem we face. Hence, architecture must adapt and address the evolving changes in cities, which are further compounded by additional challenges such as global warming, GHG emissions, climate change, biodiversity loss etc. This necessitates a comprehensive and sustainable transformation of existing city models, placing increased pressure on city governments to meet the growing demand for housing and workspaces. This research holds significant value in the ongoing discussions surrounding the management of growing urban populations in third world cities and the enhancement of housing conditions of the Global South by shedding light on and predicting the pace at which the population is growing as a result of urbanization, as well as proposing potential strategies to address the future housing challenges in urban area. Thus, these research findings are expected to build on existing knowledge base and inform building designer, town planners and policymakers on how to tackle the growing condition of housing shortage due to demographic surge in urban residential neighbourhoods through futuristic architecture and adoption of measures to efficiently mitigate its effects in Nigeria and beyond.

1.1. Context of the Study

Enugu, a city that emerged as a result of the discovery of coal deposit by 1915 is situated between latitude 06°21'N and 06°30'N and longitude 07°26' E and 07°37'E (see figure 1) within an estimated land area covering a total of 215mi² equivalent to 556 km² [9] and fondly called the coal city was named after “Enugwu Ngwo”; the Ngwo Hill community of the Nigerian Igbo race. The city experienced growth and expansion, encroaching upon the territories of indigenous communities such as Ngwo, Nike, Amaechi, and other neighbouring areas. Since 1929 as Capital of the Southern Provinces, Enugu has remained an administrative headquarter in various capacities and presently the capital of Enugu State from 1991 till date. Although coal mining activities no longer thrives in the city, Enugu is still regarded as the “Coal City”.

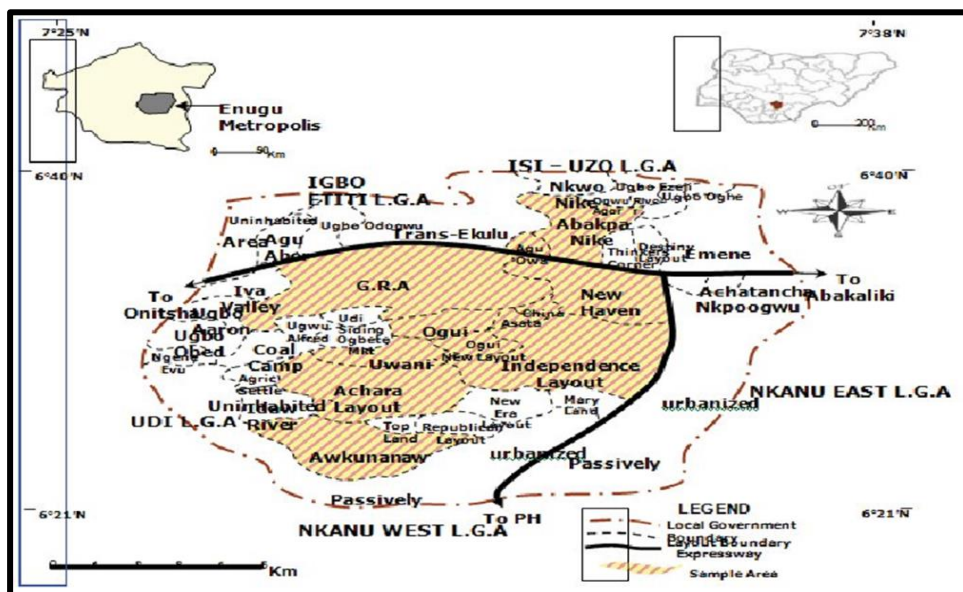


Fig. 1. Map of Enugu Metropolis

Enugu has emerged as a gathering place for diverse populations and cultures from the surrounding regions and has naturally assumed as administrative center of eastern Nigeria since the early 1960s and continues to hold that position to this day. As an administrative capital, government’s presence is dominant and is internationally ranked as the 553rd city of the world [10]. The city is dotted by numerous industries, educational and financial institutions, commercial and healthcare facilities, as well as infrastructure and essential amenities among other notable features, hence the research choice of the studied neighbourhood. All these attractions pull people to the city from far and near especially from surrounding rural communities. Most government institutions lack housing schemes for their employees, the majority of whom fall into the low- and medium-income brackets. The housing crisis is made worse by the limited availability and high cost of decent housing units in Enugu, making them unaffordable for a significant number of employees [11]. Numerous housing programmes in Enugu have been unsuccessful due to the misconception that the housing problem is solely a matter of insufficient housing supply [12]. As a result, most proposed solutions have been temporary and hastily implemented, focusing on rapidly increasing the number of housing units without considering long-term sustainability. This has led to poor targeting, haphazard development, lack of planning and implementation.

2. Literature review

In the mid-18th Century, the global population was under 800 million. However, in just over two centuries, the population has skyrocketed to over 7.7 billion, and it is projected to continue growing by at least 2 billion until 2050 [1]. Scholarship in literature shows that debate about overpopulation issue is controversial because of diverse view, opinion and perception from different researchers. Many questions bordering round overpopulation have remain unanswered. For instance, who is the problem source? How did we get to this sorry state? What should be done about it? Who do we evict from earth? Who have the right to live?

Considering the fact that human beings appeared on earth more than four million years ago, the cause of the exponential growth in number of people in recent history has been astonishing and unanticipated. Industrial revolution was widely regarded as the defining moment however, there have been numerous minor revolutions that have aided current global alarming population: There have been transformative revolutions in various domains, including medicine, technology, agriculture, finance, transportation, demographics, and more. To help temper this wildly unsustainable condition, we need to understand what is exacerbating overpopulation and overconsumption and how these trends affect everything from climate change to socio-political unrest. The rapid exponential growth of Human global population is overwhelming therefore the need to understand the root cause of it. Some factors contributing to overpopulation include: Increased birth rate, declined death rate, Agricultural advancements, Urbanization, better medical facilities and technological advancement in fertility treatment, Rural-urban migration, Lack of Family Planning and Poor Contraceptives Use, Child Labour, Religious ideologies etc.

2.1. Structure of the earth environment

Earth is a planet in the solar system that supports life with about 70% of its surface covered with water and only 30% of dry land. Its envelopes (or spheres) the atmosphere, hydrosphere, lithosphere, and biosphere and are closely linked by flow of matter and energy which integrate them into specific systems. According to Glazovsky [13], two large integrated systems are the geographical envelope and the biosphere. The basic components of the environment are;

- The atmosphere: the mass of air surrounding the Earth like a transparent wrapping. It spreads up to 300 km. above the earth's surface.
- The lithosphere: the solid outer crust of rocks about 80km thick, which is the outer solid shell of the planet body. This also includes the pedosphere, where the soils are present, and the soil-forming processes occur.
- The hydrosphere: the water portion of Earth. This part of the environment also includes the cryosphere, which is that part of the Earth's body that is predominantly frozen and mainly consists of different forms of ice.
- The biosphere: the life zone of the planet which permeates all the above as life is widely spread around the planet.

Since architecture is a discipline focused on the strategic planning and organization of the built environment and prioritizes the aspects of design that promotes functionality and safety [14]; it beholds on architects to plan the atmosphere, hydrosphere and lithosphere to provide housing for continual existence of biosphere.

2.2. Urbanization and housing issues in Enugu urban

Enugu is one of Nigeria's prominent cities facing a significant deficiency in housing infrastructure and has had its own fair share of urban population upsurge; a significant feature of cities of third world economies. Aka [15] assert that it is due to the incorporation of land use planning regulations that address the changing functions and responsibilities of urban areas, as supported by multiple research studies conducted in Nigeria. Although, according to Ononugbo et al., [16] from the 1960s through 1989, rapid urbanization and industrialization in Enugu, Nigeria, resulted in two housing-related issues. The first was a scarcity of low-income housing, and the second was the rising cost of decent living accommodation. According to [17], the combination of limited affordable housing options and the escalating prices of existing units has created a challenging situation for low-income households in Enugu. As a result, these households are facing significant difficulties in maintaining an acceptable standard of urban living. Consequently, many are forced to reside in slum areas, causing detrimental impacts on the surrounding ecosystem. Environmental problems escalate when and where there is a significant increase in urban population with little or no regard for the environmental repercussions. Anecdotal evidence and previous authors [16, 18-21] suggests a high level of landuse conversions in the city. Residential districts have been converted to commercial uses, and industrial areas turned into residential areas. Development of residential accommodation has moved to recreation parks and open spaces among other visible abuses. Several incompatible land uses have emerged resulting to health hazards, environmental deterioration, and chaotic traffic situation in the city.

3. Research methodology

This research originated from the noticeable challenges faced by residents in securing decent accommodation experienced within the metropolis. A literature review research design was employed, utilizing a qualitative research strategy, and incorporating both secondary and primary data sources. The study population involved the 19 neighbourhoods within the city. The primary data were collected through anecdotal evidence and techniques such as participant observation and surveys. Also, previous researcher studies on sustainable urban environment were incorporated to ensure an in-depth perspective depicting the current situation of study area. The secondary data for the study was obtained through a thorough literature review of relevant research publications. These sources were identified via journals, workshops, and conference papers. The papers reviewed were sourced from electronic archives such as Google Scholar, United Nations record, Science Direct, and other similar resources. Population and Housing Survey conducted by the National Population Commission and gazette of the Enugu State Housing Development Authority provided valuable data and insights into population dynamics and housing trends in the study area. Statistics of human population for Enugu metropolis was projected from 1991 to 2040 applying Thomas Malthus' Exponential Model. Thematic content analysis was applied to analyse the data gathered. The findings are presented through tables, figures, and descriptive text, allowing for a comprehensive understanding of the topic. Drawing upon these findings, conclusions were made regarding the increasing urban population and the impact on public housing provision in the Enugu metropolis with role of architects to accommodate the challenges.

4. Results and discussions

Table 1. Population of Enugu metropolis with future projections

	Neighbourhood	Density	Area (ha)	1991	2006	2020	2040
				Population	Population	Population	Population
1	Abakpa	High	50.2	90,619	137,124	201,846	350656
2	Asata	High	45.0	21,828	33,030	48,619	84465
3	Iva valley	High	50.3	8,891	13,453	19,804	34404
4	Akwuke	High	16.6	3,326	5,033	7,408	12522
5	Coal camp	High	34.0	25,994	39,334	57,900	100586
6	Ogui new Layout	High	44.3	41,237	62,400	91,852	159569
7	Emene	High	53.5	79,033	119,593	176,039	305823
8	Gariki	High	98.7	19,662	29,753	43,795	76083
9	Obiagu	High	43.0	5,487	8,303	12,222	21232
10	Amechi/Awk.	High	67.47	13,441	20,339	29,939	52011
11	Nike	High	138.2	34,501	52,207	76,848	133504
12	Achara Layout	Medium	955.0	50,427	76,306	112,321	195131
13	Maryland	Medium	40.4	4,666	7,061	10,393	18055
14	Uwani	Medium	61	31,875	48,233	70,999	123342
15	New Haven	Medium	48	18,753	28,377	41,770	72566
16	Idaw river	Medium	750	3,138	4,748	6,990	12143
17	GRA	Low	233.3	19,600	29,659	43,657	75843
18	Independence. L	Low	30.5	24,466	37,022	54,496	94673
19	Trans Ekulu	Low	103.9	11,474	17,358	25,557	44,399
	TOTAL		251346	505,280	722,664	1,125,467	1,955,216

The decision of human to migrate represents some form of collective wisdom because migration trend is mostly prompted by financial motives and improve standard of living and such ample opportunities are presumed to be available in cities. However, the mismatch between housing availability and the city's demographic demands emerges as a prominent urban issue, leading to overpopulation and subsequent overcrowding of the built environment. Therefore, the rapid and significant population movement, as documented in literature [22-26] and observed in Enugu city, has surpassed the government's capacity to address the growing housing needs of the population and several serious and hydra-headed problems of housing have emerged in the city. The proliferation of tertiary institutions and the establishment of industries such as automobile, food processing, breweries, pharmaceuticals, beverages, and a host of others around Enugu metropolis are part of the contributory factors to rural-urban drift. Enugu had 505,280 people according to the 1991 national census, growing at an annual rate of 2.5%, while the 2006 head count [27] found 722,664 people there, with 2.85% annual growth rate. Currently, it is anticipated that there will be more than 1,125,467 residents living in the city (see table 1 projections). It can be observed that within the interval of 15years (1991-2006) Enugu population figure rose by 217,384 inhabitants. Consequently, within the span of another 14years (2006-2020) it had an incremental change with 402,803 new people; approximately 90% growth. This suggests that the city is going through the proverbial roof, set to surpass 2 million by 2040 just like many third world cities. This finding tends to provide support to the study of Wei and Yuzhe [28], who posit that in the city of Chongqing, China the housing condition keeps declining amidst geometrically progressing population figures resulting to urban slum and blighted condition. The projected population growth change highlights the need for increased efforts from the government and stakeholders to address the growing demand.

Furthermore, the neighbourhood population distribution of Enugu city, as presented in Table 1 based on the National Population and Housing survey conducted by the National Population Commission, does not account for the presence of squatter settlements. The population trend illustrated in Table 1 for Enugu indicates that the city has experienced significant growth, leading to an imbalance between population increase and the availability of housing, placing strain on the city's natural resources to meet the escalating demands. It has also occasioned the growth and extension of low-income unplanned settlements on the city outskirts and workers from those areas are putting further stress on the already inefficient public transportation system and urban infrastructure. This is in consonance with the study result of [29] who attributed urban decay and declining public health in both developed and developing cities on the effects of galloping urbanization. In other to better understand the housing and population imbalance in the study area, inventory of the Public Housing initiatives in Enugu spanning from 1999 to 2020 was perused.

Table 2: Enugu city Public Housing provision according to density (1999-2020)

Sn	Housing Provision	Density	Housing Type
1	Coal city view	High density	3-bedroom semidetached bungalow
2	Valley	High density	4 housing unit per plot
3	Valley 2	High density	4 housing unit per plot
4	Harmony	Medium density	2-bedroom flat
5	Maryland estate	Medium density	2-bedroom flat
6	Trans ekulu housing	Medium density	5-bedroom duplex & 4-bedroom bungalow with BQ
7	New abakiliki road	Medium density	5-bedroom bungalow with BQ
8	WTC	Medium density	Block of 2-bedroom flat (4 housing unit)
9	Rangers 2	Medium density	3-bedroom semidetached bungalow
10	Sand view	Medium density	1&2-bedroom flat/ 3 floor semi detached
11	Ebe-Ano	Low density	5-bedroom duplex with BQ
12	Golf course	Low density	5-bedroom duplex with BQ
13	Zoo estate	Low density	5-bedroom duplex with BQ
14	Liberty estate	Low density	5-bedroom duplex with BQ
15	Coal city estate	Low density	5-bedroom duplex with BQ
16	Transparency	Low density	Block of 4-bedroom flat
17	Rangers 1	Low density	3-bedroom bungalow
18	Citadel estate phase 1	Low density	Block of 4 flat terrace
19	Citadel estate phase 2	Low density	Block of 4 flat terrace
20	Victory housing	Low density	Block of 4 flat terrace
21	Trinity	Low density	Block of 4 flat terrace
22	Fidelity estate	Low density	4-bedroom duplex
23	Liberty phase 1	Low density	5-bedroom duplex with BQ
24	Liberty phase 2	Low density	5-bedroom duplex with BQ

The recent allocation of public housing in the city between 1999 and 2020 has shown a clear bias towards individuals with higher incomes, neglecting the significant portion of the urban population consisting of low and medium-income earners. Table 2 show the data indicating that the state government has prioritized the development of housing projects targeting the elites. Furthermore, there is evidence suggesting the existence of several housing schemes initially planned for low- and middle-income groups; however, their implementation is virtually inexistent in the present housing provision within the city. Specifically, the Golf Course and Ebeano Housing Estates have been exclusively designed to cater for the housing needs of high-income earners. Harmony Estate which was designed to take care of the low, medium and high-income earners, was observed to have been hijacked by the high-income groups, thereby leaving the urban poor housing problems unaddressed. Out of 24 Urban Public Housing project embarked by the government in the metropolis from 1999-2020, only about three targeted the low-income earners and existing evidence revealed that it was futile as those facilities are presently been enjoyed by medium and high-income earners. Consequently, the cost of building materials in Enugu was also observed to be very high and keeps on increasing. This inhibits low-income housing provision in Enugu and thus, the call for the pursuit of more sustainable options of locally available building materials. Another trend of development within the city is ‘gentrification’ whereby low-income earner are displaced from their settlement in the city centers by the affluent individuals. This has left many local resident itinerants. Although by gentrification wealthier individuals move into a previously low-income urban area, improving housing conditions and attracting new businesses, its ill effects of displacing the current inhabitant usually the urban poor in the process have not been properly addressed. Rather the efforts of real estate developers are prioritized on immediate profits and maximising short-term returns on investments, resulting in inflated letting fees for newly built accommodation in those areas and adding to shortage of housing supply for the urban poor. Furthermore, as population figures keeps rising with influx of migrants to the city, the residential property stock is decreasing to accommodate commercial use mostly along the major roads and streets (Agbani road, Zik Avenue, Nike road, Okpara Avenue, Ogui road, Chime Avenue, Market road, Abakaliki road etc) in the metropolis spicing the hike in rent on the available housing in other locations, non-compliance with planning ordinances resulting from illegal land development, worsening of traffic gridlock, urban sprawl, and the extreme demand on the already-stretched infrastructure along main roadways contributing to the transformation of districts into commercial zones. These findings support the previous works of [18, 30] who noted that shrinkage of residential stock of housing, Land use conversion and traffic issues as one of the significant imprints of rural-urban drift and population growth in the city of Enugu.

4.1. Architectural response to accommodate the expanding population.

The global trend towards urbanization is undeniable, with projections indicating that by 2050, two-thirds of the world's population will reside in urban areas [31]. As urban centers increasingly accommodate the majority of the world's population, the architecture, structure, and ecology of cities are poised to have a profound influence on their residents. As a result, while designing new spaces and cities, architects must reflect previous experience and offer solutions in accordance with modern requirements.

Shelter, comprising of architectural building is one of the three requirements of life after food and clothing; thus, its absence or deficiency is viewed with serious concern [6]. Buildings provide the infrastructure for a functioning city and allow for many opportunities to demonstrate a commitment to sustainability. As stated by Chendo [32], architects by virtue of their acquired expertise and training, possess the ability to provide solutions for many environmental-related challenges, thus he has a role to play towards addressing overpopulation issue in the environment. It has been established in literature that environment consist of atmosphere, hydrosphere, biosphere and lithosphere and from time immemorial man has continual utilized the land and it is getting over populated. Therefore, the model below illustrates new areas architecture needs to harness. These interventions though theoretical will aid ameliorate the mammoth burdens felt by conurbations.

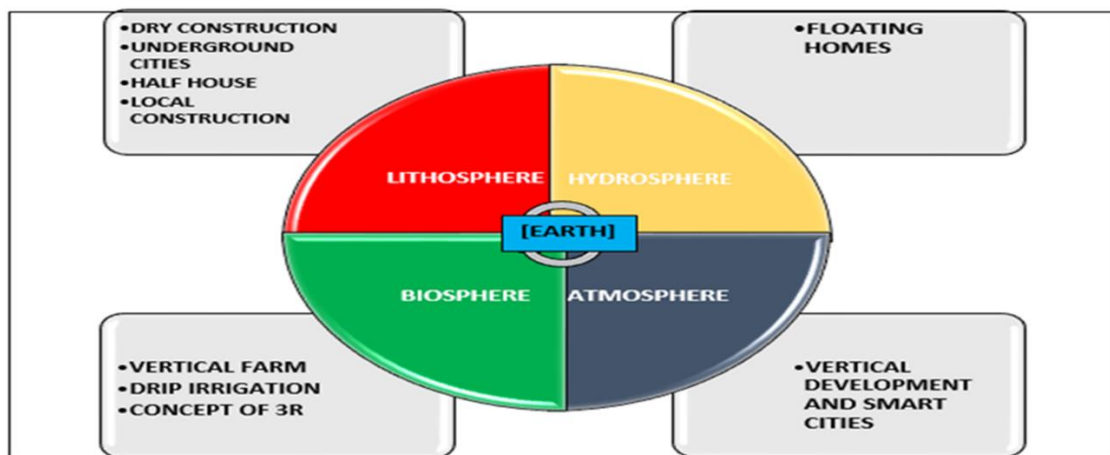


Fig. 2. Architectural model to mitigate the effects of overpopulation

4.2. Atmosphere

Vertical development. To tackle overpopulation, architects should look to the sky in search of an escape route. The development of high-rise constructions will act as a significant catalyst for the expansion of mega-high-rise clusters, offering long-term accommodation options that eliminate the need for frequent relocations. The concept of development of vertical cities is to build upwards as a substitute of outward (horizontal) development as the city housing development in Enugu. This can afford an insignificant area of space for a large population. Furthermore, vertical towers help conserve the environment rather than clearing forest to build cities resulting to loss of biodiversity and deforestation.

4.3. Lithosphere

Dry construction. It is an offsite fabrication of core building components and their subsequent assembly on the construction site in a dry condition without the use of mortar [33]. Such systems comprise of two basic construction elements – load bearing construction and lining, which when put together form a static, functional, and aesthetic unit. Plywood and gypsum board are used in dry constructions instead of concrete and bricks. According to Adegbeniga and Kamaldeen [34], this offers moisture resistance, reduction in construction time, fire safety, thermal and sound insulation and ease of the installation. Quality performance, quick and dry assembly, which does not require any additional time for drying of the construction, are important factors in this day and time, characterized by an increased pace of living and working. Example is a single storey office building at Chevron Lekki, Lagos. Built entirely by Kalsi dry construction (a division of Nigerite), the structure has a 60 sqm footprint and is completely framed with light gauge steel sitting on a concrete raft foundation.



Fig. 3. DCT office building at Chevron Lekki, Lagos

Underground cities. If the early man could live and survive in caves, why don't we think cities could be built underground because the earth surface is getting to its limit gradually. Just like we have vertical development upwards; architects can design and build habitable structures that grow downwards in cities with large population that cannot grow horizontally because of their location. Example of underground project include (i) Rascasuelos in Mexico now in design stage, is expected to extend beneath Mexico City with about 65 levels for housing accommodation, offices complex and commercial shops. Though currently in the study phase, the studio responsible for its design are BNKR architecture and the concept of an inverted pyramid form is used, to ensure natural daylight all through its 300m length underground (see figure 4). An estimated thousands of city population will reside and work in rascasuelos, below the 57000sqm (240m x 240m) of the Zócalo, in the city of Mexico.

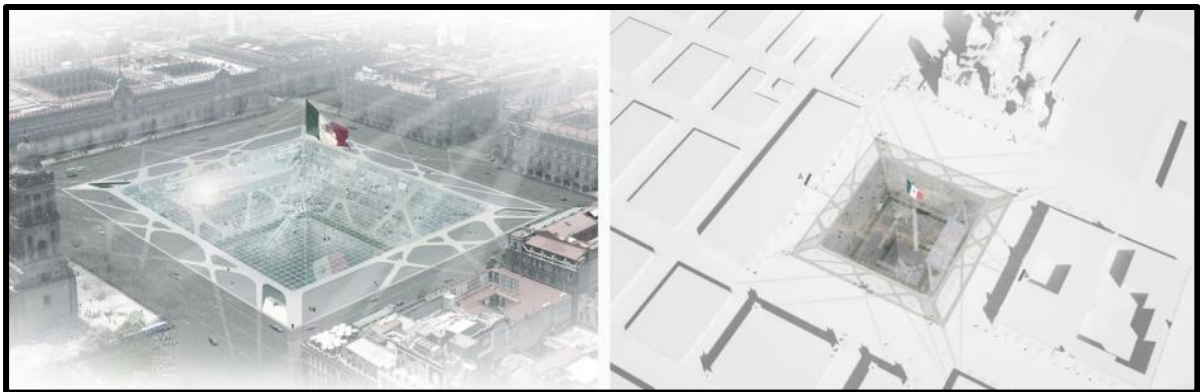


Fig. 4. Rascasuelos in Mexico (underground city)

(ii) Helsinki; another world lies below the metropolis of Helsinki. Approximately 10,000,000m³ of space was constructed underground comprising: running tracks, shopping malls and swimming pools enabled by the strata of granite subsoil the city has. In the capital of Finland during the winter, when temperatures drop to -20 degrees Celsius, it is preferable to be below the earth rather than on the surface. (iii) Underground city of Beijing; people in Beijing are already residing underground. In the capital city of China with large population, a network of anti-aircraft accommodations converted to housing is hidden due to high market demand price and approximately a million citizen live underneath the ground.

4.3.1. Half house construction. This is an adaptable architectural design that accommodates change in need. Building of half a good house is a futurist housing plan for new suburbs that utilizing elementary skills as the need arises, occupants can readjust and construct the remaining half over time depending on their financial capacity. An example is the Quinta Monroy housing in Chile.



Fig. 5. Image of the Half –Building

4.3.2. Use of local building material. Architects should actively advocate for the utilization of locally sourced building materials, collaborating with the private and public housing sectors to promote sustainable practices. The recurrent scarcity and rising retail prices for building and construction materials such as Rebars, roof coverings, cement, electrical and mechanical fittings are highlighted as obstacles to Nigeria's sustainable housing programme in published literature. Therefore, it is important to adopt the use of locally available, affordable, and environmentally friendly building materials. The general misconception of Nigerian indigenous architecture as being "backwards and primitive" should be dispelled by organizing special sensitization campaigns for stakeholders.

4.4. Hydrosphere

4.4.1. Floating building. The need to address the consequences of climate change-induced rising sea levels, leading to flooding and the loss of both properties and lives in Nigerian waterfront and coastal communities [35], has become imperative, calling for the exploration of sustainable solutions. Floating building concepts are becoming a strong and intriguing alternative around the globe. It represents a new architectural paradigm when compared to the traditional notion of building only on ground and will help accommodate people close to water bodies instead of moving to dry land. An example is the Makoko Floating school building project Lagos.



Fig. 6. Image of the Floating Building

4.5. Biosphere

4.5.1. Vertical farms. As global population continues to rise, both urban and rural areas will require more food to survive in the coming decades, therefore architects are to key into Vertical Farming design concept. It is a hydroponic farming system within high rise dwellings. This farming concept discharge a small proportion of pollution compared to traditional farming methods and requires a reduced amount of energy. Its farming technique is indoor with a technology regulated agricultural environment integrating renewable energy sources like solar and biomass. Also, within limited space in the city, corporations can stack used shipping containers furnished with innate climate controls, LED lights with vertical hydroponics for food crop production.



Fig. 7. Vertical Farming system

4.5.2. Dripping irrigation. This is an irrigation method that allows water to drop gradually to plant's root thereby minimizing evaporation. It has water saving advantage as nutrients are placed directly by slow dripping to the root region. Operating farms for agriculture to feed a large rising population comes with huge running cost and exercise, therefore drip irrigation is the most practical technique to irrigate food crops because research has shown that it has 30 – 50% water saving potential and food production is twice the amount of conventional methods.

4.5.3. Concept of 3r. Municipalities have adopted numerous 3-R strategies to create a sustainable environment, especially in the context of production and consumption. The principle of reducing waste, reusing, and recycling resources and products should be the target of architects in the built environment.

5. Conclusion and Recommendation

The human overpopulation is one vital issue the society must resolve to ensure a good quality of urban life for the future. Cities having greater populaces are at advantage and better equipped to deliver urban services, educational facilities, mobility infrastructure, energy provision and healthcare, however the side-effect and tipping point is when rising demographic overgrowth creates an imbalances situation that tends to put cities to a halt. The study discovered the significant influx of people relocating from rural to urban regions has contributed to the escalating population growth in Enugu city. This influx has further compounded the existing housing challenge faced not only by Enugu city but also by the entire nation of Nigeria. The government urban housing provision in Enugu has not matched the demographic increase and its effects in the city include; widespread housing scarcity, rising rents and skyrocketing property prices in the city. This have prompted the emergence and proliferation of squatter neighbourhoods on the city's outskirts, as well as changes in land use, infrastructure dilapidation, and blighted living environment. Urban planning and Architecture which throughout civilization have addressed the prevailing condition in its environment has a significant role to play to mitigate the effects of overpopulation. It is recommended that sustainable housing solutions like vertical development, underground cities, dry construction, half house construction, vertical farms, floating buildings and 3r concepts will be viable alternatives and response to contain the growing population figures especially within the city rapidly congesting spaces.

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