Assessment of Metropolitan Urban Forms and City Geo-spatial Configurations using Green Infrastructure Framework: The Case Study of Lagos Island, Lagos State, Nigeria

Adesina John A., Timothy Michael A., Akintaro Emmanuel A.

(Adesina John A., Department of Architecture, University of Lagos, Lagos, adesinajohnlloyd@gmail.com)
(Timothy Michael A., Department of Surveying &Geo-informatics, Bells University of Technology, Ota, Ogun State, posttim@gmail.com)
(Akintaro Emmanuel A., Department of Architecture, Federal University of Technology Akure, Ondo State, akintaroakinyemi@gmail.com)

1 ABSTRACT

For over three decades, the economic and commercial activities of both local and foreign organizations, firms, industries and institutions have been moving to the Lagos Island in search for a reputable business atmosphere and this has led to the emergence of vertical urbanizations of the area thereby turning it into a foremost Central Business District (CBD). The Lagos metropolis is the economic hub of West Africa and the Lagos Island has the bulk of the economic activities. Most of the ill-controlled infrastructural developments are along the major streets and the Island districts are supposed to have certain spatial configurations expected of a metropolitan city like Lagos. The basic urban form design policies and theories had been neglected long time ago thereby making the streets faced with chaotic smart growths, worrisome urban resilience and harsh biophilic architecture with little or no consideration to green landscapes. This study is situated upon the Urban Morphological Theory which investigates the relationships between urban design spatial configurations, landscape and ecological urbanism and some other green city conceptual frameworks. Scholars in the field of landscape urbanism had made divergent or opposed theoretical, conceptual and methodological choices, opportunities in the metamorphosis of a city forms and streetscapes. The normative, descriptive and the critical analysis of the theories were holistically investigated and assessed which informed the study objectives. How do we conceptualize the spatial order of contemporary Lagos Island? What models can best describe its emergent urban forms almost without any green innovations and infrastructures? Land use and detailed geodetic data were obtained from various analysis conducted by the use of Geographic Information Systems (GIS), interviews and personal deductions. This study identifies the different barriers, green innovative strategies for achieving sustainable urban morphology, exploring relationships between quality of life in cities, wellbeing of citizens and mobility, exploring relationships between spatial configurations and equity, exploring implications of emerging technologies for urban development and dynamics, exploring implications of emerging lifestyles and/or business practice for dwellers. This paper demonstrates and evaluates the present upheavals in the urban spatial configurations and geomorphology, social development framework and socioeconomic masterplans for Africa’s business districts.

Keywords: metropolitan; urban sprawl; spatial configurations; resilience; urban morphology.

2 INTRODUCTION

The rapid influx of commercial activities into the Lagos Island has led to the increase in the Lagos’s population in both absolute and relative terms which has also naturally been accompanied by the expansion of existing built-up areas and the upsurge of Central Business District (CBD) has some common identifiable metropolitan settlement patterns with little or no concern for urban green infrastructures. The dominant nucleated commercial centre has four major building types with little or inadequate cark parking spaces and there are no open space for greenery and recreational parks. Lagos has been identified as the seventh fastest growing economy and urban city centre in the world. The average annual growth rate between 2006 to 2020 is 4.44 % behind Bamako (Mali) that is 4.45% (UNDP, Urban Strategy, 2016). The Marina stretch in Lagos Island has some of the tallest buildings in Nigeria, some of which are owned by the Commercial Bank Headquatres and Multinational Corporate Buildings. Transportation hub at Lagos Island Central Business District (CBD) has witness tremendous improvement in the traffic situation always caused by the high commercial activities going on within the area and the government intervention through the implementation of a strategic plan to improve traffic situation on the Island by the Lagos State Government has led to a drastic reduction in traffic gridlock at Broad Street, Apongbon Street and Nnamdi Azikwe Street. The landuse zones are residential, commercial, administrative, recreational and few industrial zones. Overall, the physical development of the high rise buildings and the evasive built-up areas is expected to continue in the
coming years if not properly controlled especially along the Marina Street and there is considerable uncertainty about how much expansion will take place in the coming years.

The key issues are that the population growth, economic upsurge and demanding residential spaces are critical for an emerging Africa’s commercial hub and it has increased the population density. The growth of Lagos Island physical developments is accompanied by the expansion of existing built-up areas and the physical expansion of built-up areas is expected to continue in the coming decades, although there is considerable uncertainty about how much expansion will take place. The key issues are the spatial designs and unidentifiable urban configuration. This assessment acts as an outset for the Urban Change Processes theme of the Urbanisation Research Nigeria (URN) programme – and thus as a foundation for later, targeted and more detailed research in the years 2015 to 2017 (Robin Bloch et al, 2015). The study analyses urbanisation and urban expansion in Nigeria. In portraying the dynamics and drivers of urban population growth and the spatial expansion process, it presents an integrated analysis incorporating: An overview of the spatial-demographic dynamics of Nigeria’s urban transition. While the information available is at times problematic and ambiguous, by combining and summarising data from multiple sources, credible facts are identified on the dynamics of the urban transition. The analysis points to an expected persistence in rapid urbanisation, urban population growth and urban expansion. As the country’s cities have expanded in terms of land cover, their physical organisation has been transformed. Through a historical overview of the evolution of urban structures and the linkages with demographic changes, spatial patterns characteristic of contemporary Nigerian urbanism and landscape are identified (Robin Bloch et al, 2015). It is intended that the findings and conclusions established in this study could advance the development of strategic spatial planning in Nigeria. The following are some of the research questions: What are the general perception about the integration of nature within the urban form context? What makes us epitomises social and economic activities against the liveability of a city? How can the love for nature start at our doorstep especially in our urbanized cities? How is the landscape designed to be resilient in the face of increasing urbanization?

The aim of the study is to assess the extent to which we have achieved a climatic resilient Urban Forms, Metropolitan City Geo-Spatial Designs and Urban Configurations using the Lagos Island as a case study to ensure a Sustainable Lagos Metropolis. To achieve this the following objectives are to be pursued:

1. Determining the ill-controlled infrastructural developments are along Lagos Marina Street and the Island districts are supposed to have certain spatial configuration expected of a metropolitan city.

2. Have understanding of the perpetual changes of spatial expansion and the physical configuration and structural characteristics of the city.

3. Promoting integrated spatial planning by identifying multi-functional zones or by incorporating habitat restoration measures and other connectivity elements into various land-use plans and policies.

4. Contributing to developing a greener and more sustainable economy by investing in ecosystem services and not only technological solutions, and mitigating adverse effects of transport and energy infrastructure.

3 LITERATURE REVIEW

The theory and practice of ecological urbanism has a long history, a foundation of knowledge to support it, and built works that demonstrate its benefits (Spirn, 1985). The roots of this tradition in Western culture are deep: from Hippocrates’ treatise of Airs, Waters, and Places to contemporary authors (Spirn, 1985). The world is rapidly approaching a situation in which most people live in urban settlements sometimes megacities like Lagos. The pioneering environmental writer George Perkins Marsh stated this warning several years ago when he proposed that “human improvidence” was depleting the earth “to such a condition of impoverished productiveness, of shattered surface, of climatic excess” as to threaten the “extinction of the living species” (Marsh 1865). Marsh proposed that “in reclaiming and reoccupying lands laid waste by human improvidence or malice the task is to become a co-worker with nature in the reconstruction of the damaged urban fabrics and urban landscape mosaics.” It is surprising, therefore, that in the burgeoning literature on the theories of environmental sustainability and environmental politics, the urban environment is often neglected or forgotten as attention is now focused on “global” problems like; landscape degradations, climate change, deforestation, desertification, and the likes. Similarly, much of the urban studies literature is symptomatically silent about the physical-environmental foundations on which the urbanization process rests. By the beginning of the twentieth century, some scholars disagreed over whether
the task was to rebuild existing cities or to build a new “garden cities” in the countryside, such as those advocated by the author Ebenezer Howard, whose book, Garden Cities for To-Morrow, influenced the garden city and new town movements in England and the US (Howard 1902). Geographer and planner Patrick Geddes opposed Howard’s approach in His book “Here or nowhere is our Utopia,” he argued (Geddes, 1915). Geddes, who was educated as a biologist, viewed each city and its surrounding countryside as an evolving organic whole whose future plan should be based on an understanding of its natural and cultural history and its “life processes in the present” (Geddes, 1915). For Kelvin Lynch, the city is first and foremost a human habitat, and he judged “good city form” by how well it sustains human life and existence (Lynch, 1981).

Lynch stressed the importance of how people perceive the city, proceeding from human perception to understanding the sense of place. He explored the role that natural features play in enhancing the identity, legibility, coherence, and immediacy of urban forms and open spaces from the scale of the streets, cities to that of the regions. His last book, Wasting Away, takes an ecological approach to managing resources and waste (Lynch, 1990). McHarg’s professional practice was devoted predominantly to the planning of suburbs and metropolitan regions as opposed to downtown and inner-city districts. His approach is valuable for ecological urbanism, even though he viewed the city as a pathological environment (McHarg, 1969). The state of ecological urban design and planning in the present day in comparison to 1984 and about the foundations that make advance possible was deeply explored in her book; The Granite Garden: Urban Nature and Human Design. The award winning book is credited with launching a movement that provided the foundation for current strands of practice such as landscape urbanism and ecological urbanism (Spiro, 1985). The key achievement of professional practices stating categorically how and why they advanced the state of the art of ecological urban design and planning.

Various advances in landscape architecture education and urban design theories reflecting the promises that they hold for the practice of ecological urban design and planning. There are discovered and important new knowledge and areas of opportunity for urbanist yet to be recognised and are yet unexploited. Spiro stated in The Granite Garden in sections and details on “What Every City Should Do” at the scale of a street corner and the scale of the city as a whole. Assess how well that agenda has been met and identified areas of opportunity for landscape architects. New knowledge about urban nature and identify areas of opportunity for landscape architects, which are currently under recognized and under exploited. Climate and air quality in relation to urban form. Opportunities for designed experiments in collaboration with scientists and environmental justice. The city is part of nature, a fact that has profound implications for how cities are designed, built, and managed. City designers have exploited nature to promote human purposes. The roots of this tradition are as diverse as the many ways in which nature contributes to human health, safety, and welfare. An overview of that tradition is also well outlined, along with an assessment of existing knowledge and prospects for city designed in line with urban morphological configurations and Human Designs (Spiro, 1985). Emerging literature on political ecology (Walker, 2005), little attention has been paid so far to the urban as a process of socio-ecological change, while discussions about global environmental problems and the possibilities for a “sustainable” future customarily ignored the urban origin of many of these problems. Similarly, the growing literature on the technical aspects of urban environments, geared primarily to designers and environmental policy makers, fails to acknowledge the intimate relationship between the antinomies of capitalist urbanization processes and socio-environmental injustices (Whitehead, 2003). This book seeks to address this gap and to chart the contours of a critical academic and political project that foregrounds the urban condition as fundamentally a socio-environmental process. The technology to control urban changes in the form of geospatial datasets comprised of updated satellite imagery and population density through census count (Leonard et al, 2013). Stating that satellite imagery of built-up areas “is a more precise, consistent and comparable definition of an urban area than notions such as population thresholds or administrative boundaries” (Leonard et al, 2013). Sustainable development has been commonly defined as “Economic and Social Development that meets the needs of the current generation without undermining the ability of future generations to meet their own needs” (WCED, 1987).

This definition brought together what is now known as the three pillars of sustainable development; economic development, social development and ecological development under one societal goal of sustainability. Per continent, Copenhagen is the top green city in Europe, Vancouver in North America, Auckland in Oceania, Tokyo in Asia, Curitiba in South America and Cape Town in Africa. Moscow,
Shanghai and Sao Paulo, important BRICS Cities (Brazil, Russia, India, China and South Africa) have medium green performances. Per country, two Dutch and two Canadian cities are among the top 10 green city performances. All studied African and Indian cities such as Cape Town, Nairobi, Johannesburg, Accra, Lagos, Mumbai, Bengaluru and Delhi are in Cluster 3 with low green performances. Lagos is the city with the lowest green performance (17.27 points) in this ranking (UNDP, 2016). Environmentalists are typically well aware of the potential of urban green spaces to contribute to human health and wellbeing, to species protection or provision of wildlife habitats and for contributing to climate change adaptation. However, policy makers also need to be aware of other social and economic trends and emerging challenges, since these can be some of the important drivers and risks for investing in Urban Green Infrastructure (UGI). (Ulrich, 1974).

The findings have a number of implications for environmental planning and design. At the most general level, the results suggest that outdoor visual environments can influence individuals’ psychological well-being, and therefore should be given explicit attention in planning and design decisions. Most planners have some sensitivity for aesthetic aspects of environments, and in fact there exists some direct empirical evidence showing that aesthetic benefits can be of considerable importance (Shafer and Mietz, 1969). The findings here imply that the importance of strategic urban greening is by no means limited to aesthetics only but also includes a range of influences on emotional and psychological state of the users It also shows how it help the environment to reduce atmospheric heat. Urban parks and gardens play a critical role in cooling cities and provide safe route for walking and cycling as well as site for physical activities, social interactions and recreations. Recent estimates emerged showing that lack of access to green open spaces and physical in activities linked to poor walkability accounts for 3.3% of global death (WHO, HSD, 2012). Green spaces are very important to mental health. Having access to green spaces can reduce health inequalities, improve weel-being and aid the treatment of mental illness. Studies also suggests that physical activities in a natural environment can help remedy mild depression and reduce physiological stress indicators. (WHO, 2001). Urban morphological elements, degradation and loss of urban connectivity are caused mainly by the development of grey infrastructure such as roads, urban settlements, and hydropower plants, dams, car parks poses significant threats to ecosystem coherence. The Urban Green Infrastructure (UGI) decisions will determine Africa’s cities landscapes and urban forms for the next ten decades.

The conventional infrastructure planning arrangements put in place by the government of Lagos State through the Ministry of Environment (MoE) and Lagos State Parks and Garden Agency (LASPARK) given the mandate to build neighbourhood parks in all the available open spaces within the metropolis cannot cope with the new challenges and need to integrate other aspect of urban green like green wall, green roofs/gardens, urban agriculture which are some of the sustainable ecological urbanism. While grey infrastructure refers to the technical interconnected structures that support a society, such as roads, railways, water supply, sewers, power grids, telecommunications, green infrastructure is an interconnected network of green space that conserves ecosystem values and functions and provides associated benefits to society (Rees, 1991). It is clear that we need all the types of infrastructure for us to have balances ecosystem and have to find ways of making the three types of infrastructure complement each other. Sometimes, certain types of grey infrastructure measures are needed to support green infrastructure, for example hard structures to protect a valuable coastal habitat from erosion or a sluice to regulate the water regime in a wetland. The added value of green infrastructure arises from its multifunctional use (Rees, 1991). Blue infrastructures are elements that can be linked to water. They are pools, ponds, artificial basins, water course, blue roofs (Vlaanderen, 2016). Blue roofs helps to store and harvest annual precipitation, reduce storm water runoff, increase available water supply and improves air quality (Winkelman, 2017). Winkelman argued that while green, blue and gray infrastructure are all important, green seem unabatedly to be cheaper than grey. He went further to state that Green and Green-Grey blends increase Economic Benefits (Winkelman, 2017).

There is need for green, grey and blue infrastructures functions together within the same microclimate of the megacity. Nature can provide services for free, that in other cases grey infrastructure can provide only after large investments. Green infrastructure measures, such as habitat restoration and maintenance, also create jobs and fuel the economy, just as grey infrastructure activities do, but in a more sustainable manner. The concept, which helps to understand the various impact of city’s food requirement on the landscape termed as ecological footprint (Rees, 1991).
An ecological footprint is a measure of the impact that a given population exerts on nature. It represents the land area necessary to sustain current level of resource consumption and waste disposed of a specific population. Urban Greening Synergies (UGS) as discussed in this study will help decision makers in planning and designing, pushing the boundaries of greening for urban architecture, ecology, urban public spaces and the design of the streetscape for all users which is one of the determining factors in the success of a balanced ecosystem and providing comfortable and sheltered conditions (Rees, 1991). Developing a conceptual masterplan and framework for the green city and using it to develop a method to measure a city’s green performance is a difficult and time-draining task, as has been pointed out throughout this research work. Behind the basic parameters that define how cities perform in terms of green and other related issues there are, for example, different and sometimes complex patterns of city planning and development. These have diverse spatial, cultural, environmental, social and economic characteristics that are almost impossible to capture using a small set of thematic areas and indicators (Ogenis B. and Jannes K., 2018).

4 THE STUDY AREA

Lagos Island is the Principal and Central Local Government Area (LGA) of the Metropolitan Lagos in Nigeria. It is part of the Lagos Division. The LGA only covers the western half of Lagos Island; the eastern half is under the jurisdiction of the LGA of Eti-Osa. The Lagos Island is in Eti-Osa Local government in Lagos State, Nigeria. It is popularly regarded as “Eko” which trade activities is usually carried out. It has an estimated population of 212,700 as at 2006-03-21 (A Population Projection of 292,900 by 2016-03-21 2016:- National Population Commission of Nigeria; National Bureau of Statistics). The metropolis is located on the sandy barrier-lagoon complex of Western Nigeria coastline. It is framed by Longitudes 3°23’32.97” of the Greenwich Meridian and Latitudes 6°27’19.99” of the Equator (Wikipedia, 2018).


Plate 3&4: Lagos Island Map Showing the (a)Zoning (b)Wards Source: Possitive Reference Limited, 2018
Its ward jurisdiction encompasses an area of about 3.5km X 3km (10.5sq/km). Lagos Island is divided into two main parts which are: Lagos Island East and Lagos Island West, and also subdivided into various wards titled with alphabets ‘A’ to ‘J’. However the micro-climatic condition of the area is influenced by climatic seasons; dry season and wet season. The major water body in the local government is the Lagoon and the Atlantic Ocean where the area is environmentally friendly. Lying on Lagos Lagoon, a large protected harbour on the coast of Africa, the island was home to the Yoruba fishing village of Eko, which grew into the modern city of Lagos. The city has now spread out to cover the neighbouring islands as well as the adjoining Mainland. Lagos Island is connected to the mainland by three large bridges which cross Lagos Lagoon to the district of Ebute Metta.

It is also linked to the neighbouring island of Ikoyi and to the Victoria Island. The Lagos harbour district of Apapa faces the western side of the island. Forming the main commercial district of Lagos, Lagos Island plays host to the main government buildings, shops and offices. The Catholic and Anglican Cathedrals as well as the Central Mosque are located here. Historically, Lagos Island (Isale Eko) was home to the Brazilian Quarters of Lagos where the majority of the slave trade returnees from Brazil settled. Broad Street now has so many administrative, commercial and residential facilities within the area in the Marina district.

5 METHODOLOGY
The research adopted a deductive approach, building on the state of the art literature on green city and the authors’ knowledge and experience with the environment, infrastructure, sustainability and green city. Primary data formed the basic source of information used in this study. This was obtained through conduct of reconnaissance survey through direct survey techniques using Global Positioning System (GPS) and Geographic Information System for the both the mapping, database analysis and presentations. Physical observations and face to face interviews were also conducted.

Data needs in the questionnaire and interviews were targeted at households, commercial complexes, shopping malls, office complexes and financial institutions in each districts and geo-locations and it is centered on the dwellers and commuters socio cultural and economic backgrounds, shanty settlements, their waste disposal systems and the manner of their environmental awareness on greening, cleanliness and environmental sanitations. Major streets were identified, they include: Marina Street, Broad Street, Akpongbon Street, Church Street and TBS Street. The other streets were also taken as independent entities from physical planning perspective in this study. Some landmarks and iconic locations some of which are monumental buildings and parks were identified and there geo-spatial locations gotten during the survey.

The land use was classified into Administrative, Commercial, Educational, Health, Public, Recreational, Residential, Mixed-used, Religious and Transportation Zones. The second set of data were gotten from the Physical Planning Development Control Department of the State and Local Government Secretariat and through various interviews that were conducted with some environmental enthusiasts and stakeholders. Information of statutory setbacks and minimum requirements for greening before building development approvals. The available descriptive and inferential statistical techniques were used in the collation and analysis of the data. The main hypothesis in this study is that there is need for the incorporation of Urban Green Infrastructure (UGI) into the urban forms and the geo-spatial configurations of the urban open spaces.
Plate 5: Map Showing the Network Analysis of Road Networks to various Open Spaces and Landmarks

Plate 6: Map Showing the Spatial Analysis at the Open Spaces and Landmark Points (264 Points)

<table>
<thead>
<tr>
<th>S/N</th>
<th>CLASSIFICATION</th>
<th>USE</th>
<th>NAME</th>
<th>EASTINGS</th>
<th>NORTHERNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Savello Bank House</td>
<td>543276.934</td>
<td>713212.270</td>
</tr>
<tr>
<td>2</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NITEL Headquarter</td>
<td>544074.528</td>
<td>712456.270</td>
</tr>
<tr>
<td>3</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Group House</td>
<td>544670.643</td>
<td>712115.740</td>
</tr>
<tr>
<td>4</td>
<td>Administrative</td>
<td>Office Block</td>
<td>United State Information Services</td>
<td>544113.231</td>
<td>712561.377</td>
</tr>
<tr>
<td>5</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NCR House</td>
<td>544073.391</td>
<td>712688.484</td>
</tr>
<tr>
<td>6</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Western House</td>
<td>544035.322</td>
<td>712688.734</td>
</tr>
<tr>
<td>7</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Independence Building</td>
<td>544336.885</td>
<td>712361.608</td>
</tr>
<tr>
<td>8</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NITEL Headquarter</td>
<td>543843.836</td>
<td>712759.662</td>
</tr>
<tr>
<td>9</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Shell Petroleum House</td>
<td>543354.509</td>
<td>712579.667</td>
</tr>
<tr>
<td>10</td>
<td>Administrative</td>
<td>Office Block</td>
<td>General Post Office Marina</td>
<td>543075.713</td>
<td>713024.230</td>
</tr>
<tr>
<td>11</td>
<td>Administrative</td>
<td>Office Block</td>
<td>CSS Book Shop House</td>
<td>543330.461</td>
<td>713084.897</td>
</tr>
<tr>
<td>12</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Investment House</td>
<td>543246.272</td>
<td>713041.634</td>
</tr>
<tr>
<td>13</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NITEL Exchange</td>
<td>543415.316</td>
<td>713062.022</td>
</tr>
<tr>
<td>14</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Nigeria Insurance Plc</td>
<td>543506.403</td>
<td>713103.745</td>
</tr>
<tr>
<td>15</td>
<td>Administrative</td>
<td>Office Block</td>
<td>St Peter’s House</td>
<td>543489.902</td>
<td>712946.957</td>
</tr>
<tr>
<td>16</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Federal Fire Service</td>
<td>543926.139</td>
<td>712959.285</td>
</tr>
<tr>
<td>17</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Royal Exchange Assurance Plc</td>
<td>543513.999</td>
<td>712959.913</td>
</tr>
<tr>
<td>18</td>
<td>Administrative</td>
<td>Office Block</td>
<td>General Post Office Marina</td>
<td>544073.713</td>
<td>712688.484</td>
</tr>
<tr>
<td>19</td>
<td>Administrative</td>
<td>Office Block</td>
<td>CSS Book Shop House</td>
<td>543303.461</td>
<td>713084.897</td>
</tr>
<tr>
<td>20</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Investment House</td>
<td>543246.272</td>
<td>713041.634</td>
</tr>
<tr>
<td>21</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NITEL Exchange</td>
<td>543415.316</td>
<td>713062.022</td>
</tr>
<tr>
<td>22</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Nigeria Insurance Plc</td>
<td>543506.403</td>
<td>713103.745</td>
</tr>
<tr>
<td>23</td>
<td>Administrative</td>
<td>Office Block</td>
<td>St Peter’s House</td>
<td>543489.902</td>
<td>712946.957</td>
</tr>
<tr>
<td>24</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Federal Fire Service</td>
<td>543926.139</td>
<td>712959.285</td>
</tr>
<tr>
<td>25</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Royal Exchange Assurance Plc</td>
<td>543513.999</td>
<td>712959.913</td>
</tr>
<tr>
<td>26</td>
<td>Administrative</td>
<td>Office Block</td>
<td>General Post Office Marina</td>
<td>544073.713</td>
<td>712688.484</td>
</tr>
<tr>
<td>27</td>
<td>Administrative</td>
<td>Office Block</td>
<td>CSS Book Shop House</td>
<td>543303.461</td>
<td>713084.897</td>
</tr>
<tr>
<td>28</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Investment House</td>
<td>543246.272</td>
<td>713041.634</td>
</tr>
<tr>
<td>29</td>
<td>Administrative</td>
<td>Office Block</td>
<td>NITEL Exchange</td>
<td>543415.316</td>
<td>713062.022</td>
</tr>
<tr>
<td>30</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Nigeria Insurance Plc</td>
<td>543506.403</td>
<td>713103.745</td>
</tr>
<tr>
<td>31</td>
<td>Administrative</td>
<td>Office Block</td>
<td>St Peter’s House</td>
<td>543489.902</td>
<td>712946.957</td>
</tr>
<tr>
<td>32</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Federal Fire Service</td>
<td>543926.139</td>
<td>712959.285</td>
</tr>
<tr>
<td>33</td>
<td>Administrative</td>
<td>Office Block</td>
<td>Royal Exchange Assurance Plc</td>
<td>543513.999</td>
<td>712959.913</td>
</tr>
</tbody>
</table>

Adesina John A., Timothy Michael A., Akintaro Emmanuel A.
Assessment of Metropolitan Urban Forms and City Geo-spatial Configurations using Green Infrastructure Framework: The Case Study of Lagos Island, Lagos State, Nigeria

The table above shows that Administrative use is 61 (20%), Commercial use is 55 (18%), Educational use is 22 (7%), Residential/Mixed-used is 50 (17%), Transport use is 12 (4%), Health use is19 (6%), Public use is 28 (9%), Recreational use is 22 (7%). The total land use locations of the various points captured in this study is 264 (100%). This table shows that most of the land use are for administrative uses followed by commercial activities and residential/mixed-used facilities that the Lagos Island has limited open spaces that are specifically for greenery. The 17% of both the residential and mixed-use are now prevalent as most of the buildings that were originally residential are now been partly or fully converted into commercial shops, complexes, stores and ware houses while still maintaining the upper floors for residential purposes.

6 FINDINGS AND DISCUSSIONS

This study was conducted to assess the Urban Forms and Metropolitan City Spatial Designs and Configurations of the constantly Changing Urban Spaces to enhance the green rating, Wellbeing and the Depleting Urban Spaces, the social relation based on psycho-social climate, psychological wellbeing components of the Lagos Metropolitan city. Over two Hundred Landmarks where identified within the CBD and It was found out that there are various landscape features at all the zones assessed and there are no provisions for greenery. The 7% of the recreation area comprises of the open spaces at some school and few residential buildings. This suggest neglect and lack of appropriate planning in the allocation of recreation spaces. The Administrative buildings had about 20% of the total land use but the and the roof tops were used for the air conditioning chillers and outdoor units which also suggest that there are limited technology for the installation of roof gardens and green walls that can make the facilities biophilic and conducive for human habituation. Plate 1 revealed that as at 1962 the Carter Bridge was the only Bridge connecting the Island. But in the early 1980’s the Eko Bridge and Third Mainland Bridge were constructed to meet the demand for more road networks due to the increasing population of Lagos Island.

6.1 Basic Features of the Open Spaces and Landmarks Locations

The factor influencing CBD was originally earmarked for administrative and residential estate development not until about three decades ago when commercial activities bewildered the area and most of the originally built residential apartment are now converted to commercial store outrightly while some of the building still maintain a dual status of a mixed-used building meaning that it still serve both commercial and residential
purposes. The original layout as designed in 1967 made provisions for Recreation, sport complex, golf course, horse race course cemetery and many other open spaces which has either been relocated or redeveloped for other purposed thereby creating a vacuum in the ecosystem and altering the natural biodiversties. The urban planning barriers majorly is over population and traffic congestions which has affected the green innovative strategies for achieving sustainable urban morphology, relationships between quality of life in cities, wellbeing of citizens and mobility, relationships between spatial configurations and equity, implications of emerging technologies for urban development and dynamics, exploring implicatons of emerging lifestyles and/or business practice for dwellers. Further findings revealed and evaluates the present upheavals in the urban spatial configurations and geomorphology, social development frameworks and socio-economic masterplans.

6.2 Geo-Spatial Characteristics of the Non-Motorized Transportation Networks

Urban design configurations of Lagos Island were originally designed with cycling route in some areas but further development in the three decades has not given priority to walking, cycling, jogging, and eco-friendly motorized rapid transit vehicles like the electric cars with low or zero amount of carbon emission and other forms of renewable energy technologies. A further studies shows that this area has been no proper reference to energy efficient practice in the public service and solid waste discharge and collections. The quality of air, water and soil has been overly saturated and they need quick improvement so as to attain the global standard.

6.3 Challenges to Achieving a High Green Rating

The building industry is one of the most energy consuming industry of the city. The Lagos Island as the area of study focused on the extensive use of energy and resources efficiency in combination with the increment of the production and use of renewable energy in the industry. Key elements of this study area which are just emerging includes the use of low development impact practices in the construction of new buildings and in the remodeling of the existing facilities, the use of building energy green ratings and performance rating as to energy improvement and efficiency. The construction technology adopted for construction of road, parks, and building are still obsolete since there are quicker and better approaches which should be as a matter of policy be adopted in both local, state and national level.

7 CONCLUSION

For Lagos to attain the vision of becoming a smart city, sustainable city and also main her position as the economic and financial hub of Africa that is safe, secure, functional and productive, the Lagos State government embarked on the implementation of various urban planning and development regulatory and policy frameworks as well as urban development projects. This paper, however, demonstrated that urban neglect of green infrastructures like green transportation networks, urban agriculture and urban greening solutions like green roofs, vertical farming, green walls, green ICT and technologies, green public services. Lagos metropolis is in dire need of green urban space to sustain the growing population and to reduce the increase atmospheric temperature. Open spaces are now very scarce. An interest in urban green infrastructure (UGI) must look in the direction of already built up spaces and central business districts and commercial hubs. Above all Lagos State Parks and Gardens (LASPARK) must come up with sustainable greening guidelines and effective policies that will encourage the placement of value on the urban and residential landscapes for a better, healthier, serene and greener city. The people now know the importance of greening, social cohesion and the need to restore our habitat so it can keep thriving and withstand the pertinent commercialization of the city. The use of both government setbacks and private residence land areas requires a detail understanding of the long-term urban greening goals and objectives of the primary urban space. Applying a comprehensive urban green infrastructure is an important approach to mitigate urban heat island happened during the urbanization, construction, and development process. Development of a conceptual framework of research on urban greening masterplan. This study summarizes and integrates the main findings which are presented in the urban greening. This includes debates around which benefits are provided by UGI and how these benefits can be articulated in ecological, social and economic terms. Furthermore, we scrutinize the relationship between green spaces and social cohesion and discuss links between biological and cultural diversity. Hence, UGI is perceived as a comprehensive landscape approach acknowledging services and benefits from a coherent green, grey and blue network at different urban spatial configuration and levels, linking up neighbourhoods, districts and cities.
Assessment of Metropolitan Urban Forms and City Geo-spatial Configurations using Green Infrastructure Framework: The Case Study of Lagos Island, Lagos State, Nigeria

8 REFERENCES


Howard E. (1902) Garden Cities of To-morrow, Published by Swan Sonnenschein & Co., Ltd. Collection Americana.


Ulrich O. (1974) From City Parks to Regional Green Infrastructure, scholarworks.umass.edu/cgi/viewcontent.cgi?filename=3&article.


