

MORPHOLOGICAL IMPLICATIONS OF URBAN GROWTH ON THE INSULARITY OF URBANIZED ISLANDS; THE ISLAND OF LAGOS AS CASE STUDY

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ABSTRACT

Coastal areas and Islands are always the worst hit by the prevailing global urbanization and urban growth phenomena. Understanding the Spatio-temporal pattern of expansion of urbanized islands has become very pertinent to salvage the insularity and diversity of resources therein. The goal of this study is to evaluate the spatial change in the morphology of the island of Lagos over 165 years (1850 to 2015) period and its implication on island development. Descriptive analyses of demographic census data, documented and oral historical materials and remotely-sensed spatial data were undertaken. The results indicate that the rate of population growth is proportional to land expansion despite limited spatiality. There has been a steady increase in population over the century and a complementary expansion in space both laterally and vertically. While the land area increased from 13.64km² in 1962 (just after independence) by 49.85% to 20.44km² in 2015 through reclamation of adjoining wetlands, the population inhabiting the island shot up astronomically from 235,052 in 1962 to 1,423,961 in 2015 representing a 505% rise. The urban expansion pattern on the island between 1984 and 2015 revealed an increase in built-up area from 5.63km² to 12.95km² and a reduction in vegetal cover from 7.33km² to 0.83km² respectively, with associated impacts. This seeming unabated unsustainable growth and expansion portend grave environmental implications especially for island stability as well as climate change, thereby justifying the need for a holistic coastal zone and island management framework, to provide a guide for development on the urbanized island sustainably.

Keywords: *Insularity, Lagos Island, Morphology, Urban Growth, Urbanization*

1. INTRODUCTION

Urbanization as a global phenomenon has a great influence on the form and structure of cities, both at the global and local scales. Despite being a benchmark for measuring economic development and growth (in developed societies), urbanization in developing economies like Africa is characterized by a plethora of physical, environmental, social and economic problems. These negative externalities directly or indirectly impact the form and structure of communities and consequently their functionality, resilience and sustainability. The resultant impacts are visibly manifest in the pattern and process of urban growth. Rapid urbanization and urban growth have therefore emerged as issues of global concern affecting the morphology of cities in the 21st century.

According to United Nations; in 2011, 3.6 billion of the world's population (52%) were urban dwellers. Universally, while the level of urbanization is expected to rise to 67% in 2050, by 2025, 75% of the world's population is estimated to live within 60 kilometres of the sea, which can be considered "the global coastal zone" where more than 70% of the world's metropolises and megacities are located (UN, 2002). A high proportion of this occupancy will be on islands of developing countries. The natural land cover of island systems has changed drastically under the pressure of growing human populations and consequent

exploitation of the landmass. On some islands, the impact has exceeded critical thresholds, particularly along the coastal fringe. With rising numbers of people moving to coastal areas and islands, conflicts over coastal resources and human values and expectations will increase in the years to come.

For megacities located in low-lying coastal areas, the threat of climate change is an added stressor to rapid population growth. While the mainland has a higher adaptive and resilient capability, the littoral zone and the islands contend with the diverse challenges posed by urbanization and urban growth. As the largest and one of the most rapidly growing cities in sub-Saharan Africa, Lagos has experienced the phenomenon of urbanization as much as any leading global city, but its experience has been unique in scale, in pervasiveness, and historical antecedents having evolved from a farm settlement in the precolonial era to a 21st-century megacity. Considering the insularity of the Island of Lagos and its historical antecedents, the peculiarity of the growth dynamics of this delimited space as the point of evolution of present-day Lagos Megacity and the commercial nerve of the state and the nation's commercial capital, it becomes expedient to investigate the influence of urban growth on the morphology and insularity of the island. Efforts to actualize goals 11 (Sustainable cities and communities), 13 (Climate action), 14 (Life below water) and 15 (Life on land) of the global agenda Sustainable Development Goals (SDGs) as an antidote to rapidly urbanizing coastal zones are becoming increasingly daunting. This study, therefore, evaluates the spatial change in the morphology of the island of Lagos over a 165-year period (1850 to 2015) and its implication on island development.

2. LITERATURE REVIEW

2.1 Conceptual Issues

Urbanization and Urban expansion in studying urban change processes the generalized concept of 'urbanization' can be disaggregated into four distinct spatial-demographic phenomena of interest: urbanization, urban growth, urban expansion and urban system. The term 'urbanization' specifically refers to an increase in the proportion of a country or region's population residing in urban settlements, while 'urban growth' refers to an increase in the absolute size of a country or region's urban population. An urban system, however, could be described as a set of elements or subsystems interacting with each other through socio-economic and spatial mechanisms of the urban area; with corresponding variables that can be used to describe the structure of the system (Robinson, 1998). 'Urban expansion' indicates the spatial or physical enlargement of built-up areas. This generally accompanies urban growth, but the dynamics of urban expansion also depend upon the nature of physical developments and the population densities they promote. It is possible, for example, for a city to experience urban growth without expansion if this growth is absorbed within existing settlement boundaries. Conversely, expansion can occur without growth where new developments are created to facilitate lower population densities for an existing community, the morphological attributes however provide for the spatial changes that may arise from this phenomenon.

Since urban expansion impacts the form and structure of cities and consequently their functionality, resilience and sustainability, planning and management of urban spaces, therefore, require a comprehensive knowledge of the development process and physical dimension of cities (Klosterman, 1999). In developing countries, urbanization is a phenomenon that has become increasingly intense in the past decade. With Africa's urban population expected to triple from 414 million in 2011 to 1.2 billion by 2050, as reported in the 2011 Revision of the World Urbanization Prospects (produced by the UN Population Division of the Department of Economic and Social Affairs, DESA), Lagos as a coastal megacity being one of the top urbanizing cities in the world, requires efforts in qualitatively analyzing urban growth trends to further establish its significance as a guide in the administration, planning and development of urbanizing islands. As land scarcity associated with island spatiality encourages dense and incremental urban

expansion, facilitated by coastal land reclamation, causing spatiotemporal urban expansion with its attendant challenges of traffic congestion, environmental pollution, and lack of space for housing and other urban functions (Ni Sheng, U Wa Tang & Adam Grydehøj, 2017), it is significant to provide valuable information to help local and regional land-use planners to better understand the urban growth processes and patterns in sensitive and heterogeneous enclave spaces to enhance decision-making. If the current scenario is not properly managed, as opined by Dubovyk et al. (2011), it may jeopardize the sustainable development efforts of cities in the long run. Hence the focus on urbanization and urban growth as they affect nissology; being the study of Islands and their islandness. Spatially and historically, sensitive geographical understandings of island city development are indeed necessary to broadly understand the urbanization of Lagos megacity.

2.2 Urban Morphology

As the spatial expansion of cities through the process of diffusion continues along a trajectory of organic growth and outward expansion, the examination of the structure, form and physical expression of the city helps to understand how the building fabric of the city can create identifiable spaces overtime. The consensus is that the city can be read and analyzed via the medium of its physical characteristics, the form, resolution and history (time) form the basic principles of morphological analysis (Moudon, 1997). This urban morphology discipline, therefore, bridges the divide between planning, geography and architecture (Whitehand, 2007). With regard to monitoring urban change processes, there are essentially three fundamental sources of quantitative data on urban population and urban settlement characteristics: population censuses; household surveys; and satellite imagery (Bloch, Fox, Monroy and Ojo, 2015). Through a historical overview of the evolution of urban structures and the linkages with demographic changes, spatial patterns characteristic of contemporary urbanism can be identified.

Nissology; Islands and their Insularity Islands are usually defined as pieces of land surrounded by water, formally smaller than Greenland, which has 2.2 million square kilometres (Gorman, 1979). Conceptually, islands are defined as lands isolated by surrounding water and with a high proportion of coast to the hinterland.

The need to debunk the unfair prejudice attached to island studies in the 21st century has engendered a growing phenomenal school of thought in “the study of Islands on their own terms” termed Nissology. It sets out to establish strong and substantial theoretical underpinnings by giving Island studies more visibility and attention and turn the dominant continental paradigm such that Islands become the “*deus ex machina*”, that is the causal agent, of a holistic understanding of the world of the archipelago and its ongoing globalization (Depraetere, 2008). Islands differ in their geological and geomorphologic settings and geography, in their physical, biological, climatic, social, political, cultural, and ethnic characteristics, and in their stage of economic development. Yet they share several characteristics that not only unify them as a distinct category but underscore their overall vulnerability in the context of sustainable development (Maul, 1993; Leatherman, 1997).

The degree of isolation of an island from the mainland in terms of natural and social aspects is a function of its insularity that leads to the “*isola effect*”. While Insularity is a distinguishing feature of islands and is influenced by their size to some extent, the Isola Effect is the physical seclusion of islands as isolated pieces of land exposed to different kinds of marine and climatic disturbances and with more limited access to space, products, and services when compared with most continental landmasses. Although insularity is clearly increased by geographic, socioeconomic, and political isolation (Granger, 1993), sociocultural factors are probably more important in defining the insular characteristics of islands. The more powerful the links with the outside world, the less pronounced will be insularity, no matter the size of the island.

The significance of perceptions of small island spatiality has been a part of Island Studies in many ways. Grydehøj (2015) inquired how island spatiality affects urbanization processes and if island spatiality encourages the development of certain architectural and urban design solutions. The inquiry established that “land scarcity caused by island spatiality subsequently leads to urban densification and powerful agglomeration economies, resulting in the formation and growth of island cities.”

Urban Growth/Expansion on Islands with increasing human population pressures through high migration and reproductive rates, island systems will face several serious issues both in the immediate and the near future. Low-lying island systems are under threat from climate change and predicted sea-level rise, which would be severe or devastating to millions of people living on low-lying islands and atolls. The natural land cover of island systems changes drastically under the pressure of growing human populations and consequent exploitation of the landmass. The spatial characteristics of islands and island cities as associated with a linking of high urban density and slow spatial expansion (Grydehøj, 2015) renders impossible many expansion-oriented urban solutions thereby providing a peculiarity in the aspect of growth analysis. Since the coastal systems of islands are being altered through coastal urban sprawl, industrialization, and resort development, these alterations exacerbate the fragility of island systems, hence the growing concern on the qualitative methods of island development analysis which has engendered the need for empirical data and urban growth processes for this part of the urban space (McCall 1996; Baldacchino 2006; Grydehøj 2015). As further submitted by Gang (2017), the absence of a holistic and dynamic understanding of the spatiotemporal, socio-geographic coproduction of an island city can result in vulnerable islands, therefore the need to develop appropriate coastal assessments and management framework to adapt to these changes in a sustainable manner. The island systems management approach, as a multidisciplinary, integrated mechanism, offers an adaptive management strategy that both addresses the issue of resource-use conflict and provides the necessary policy orientation to control the impacts of human intervention on the physical environment of islands.

2.3 Context; Lagos Island

Lagos Island is geographically placed along the lagoon of Lagos located on the southwestern coast abutting the Atlantic Ocean. Situated between latitudes 6° and 7° North of the Equator, and between longitudes 3° and 4° East of Greenwich, the lagoon remains the only natural break along about 2500 kilometres of the West African coastline, extending from Cotonou, Republic of Benin in the West, to the Niger Delta in Nigeria (Agbola, 1997).

Lagos, by interpretation, implies "lakes", going by the description given about the settlement by the Portuguese explorer Rui de Sequeira in 1472 naming it “Lago de Curamo”, being an island located between the sea and the lagoon, while the indigenous inhabitants called the settlement “Eko” (meaning ‘war camp’)(Hubert de Vries, 2009). Historically, it was first inhabited in the 15th century A.D., as a small fishing and agricultural village around the Island and later became a very important seaport during the trading activities of the eighteenth and nineteenth centuries. At the beginning of the 19th century, Lagos became the main slavery port along the Slave Coast (Law, 1983).

The Lagos Island (Island of Lagos) for the purpose of this study shall imply the whole stretch of the island between the Lagos Lagoon and the Five Cowrie creek with a deliberate disregard of the one-time prominent natural drainage channel (Aromire canal) but now practically non-existent or almost extinct (now Macgregor Canal) due to the forces of urbanization. Thus the study area comprises of Isale Eko, Obalende and Ikoyi. The area that makes up Ikoyi was originally a continuous land mass with Lagos Island until it was separated by a narrow waterway that was dug by the British colonial government. This canal

has now been built over or filled so that the island is fused with Lagos Island once again. The main settlements in the study area as defined include; IsaleEko, Aroloya, Lafiaji, Tinubu, Okepopo, Epetedo, Olowogbowo, Offin, Oko-Faji, Ereko, Bamgbose, Idumota, Igbosere, Araromi-Odo, Popo Aguda, ItaBalogun, Ita-Faji, Obalende, Ikoyi.



Figure 1; Google. (n.d.-a). [Island of Lagos]. Retrieved November 29, 2017, from <https://www.google.com/maps/@6.4576826,3.4277008,5542m/data=!3m1!1e3>

3 Materials and Methods

Within the context of historical analogy, this study shall conceptualize the temporal aspect under two (2) regimes based on the independence of the Nigerian nation, thus the Pre-Independence (pre-1960) and Post-Independence (after 1960) regimes. Thematically, the study explores Urban Expansion Analysis, Nissiology, Historicity, Remote Sensing and Demographic Analysis as frameworks to adequately investigate the impacts of urban expansion on the morphology of the Island of Lagos.

The study spread over a temporal space of 165 years is based on remote sensing and GIS techniques in conjunction with historical and demographic data. The data relating to remote sensing are handled with the help of ENVI 5.0 and related to GIS with the help of ArcGIS Desktop 10.0 respectively.

The Oral tradition provided the base point of reference as it relates to establishing the pattern and nature of growth and expansion in the pre-colonial days through narratives. Such text materials as History of West Africa and the Sandbank City corroborated and provided documented evidence of historical antecedents of the study area. The ancient spatial topology, migration and growth trends, economic and socio-cultural thresholds as well as physical configurations were diligently deduced from historic materials. Different remote sensing and GIS data from different sources have been used in this research. Landsat TM images were used to detect urban land cover change patterns of the study area. These images were obtained from the United States Geological Survey (USGS) website (<https://earthexplorer.usgs.gov/>) as standard products. The Toposheet provided a reference pedestal for the subsequent satellite data from Landsat TM, IRS LISS III, IRS PAN, and acquired from Google earth. The toposheet and Google earth images have been classified by visual interpretation. To avoid the impact of seasonal variation, all images are selected from the same season in such a way that the cloud cover will not exceed 5%. These images are also of the same level of spatial resolution of 30m which makes it convenient for comparison of changes and patterns that occurred in the time under consideration.

4. FINDINGS

Demographics as the population of Lagos increased, expansion became inevitable. From an island of barely 4km² as a farming and fishing port, Lagos has been greatly influenced by substantial growth in its

population of migrants, workers and visitors. It has urbanized within the limits of its spatiality and also extended through reclamation. As a historical slave trading port, the island has enjoyed relative economic vibrancy in the pre-independence era hitherto the abolishment of the slave trade. However, commercial success blossomed after the independence as a result of the administrative, economic and socio-cultural statuses held by Lagos (Island). The administrative buildings, the economic apparatus and space and the socio-cultural enclaves have greatly influenced the morphology of the Island. As a result, between 1851 and 2015 the island's population increased from about 20,000 to about 1.4million, while the pre-independence era witnessed a 1075.26% rise, the post-independent era saw a 505.81% rise% rise as shown in table 1 below;

Table 1: *Spatial and Population Growth of Study area between 1850 and 2015*

Regime	Year	Population	Pop. Change%	Regime Change%	Area (km ²)	Area change%	Regime change	Period
Pre-Independence (110 years)	1850	20,000			4.00			1850
	1900	41,847	109	1075.26	5.07	26.75	241%	-
	1961/62	235,052	461.70		13.64	169	(9.6km ²)	1960
Post-Independence (55 years)	1961/62	235,052			13.64			
	1984	518,494	120.59		17.49	28.22	49.85%	1960
	2000	837,925	61.61	505.81	19.21	9.83	(6.80km ²)	-
	2015	1,423,961	69.94		20.44	6.40		2015

Source; Author 2019.

Pre-independence colonial Lagos experienced a sporadic demographic leap in the first half of 1900, as the population increased at the rate of 461% from 41,847 to 235,052 with a corresponding land expansion from 5.02km² to 13.64km², representing a 168% rate of spatial expansion over a period of 60 years.

For a hundred years of colonial rule between 1861 and 1960, Lagos (declared a Colony of Britain in 1886) served in the administrative capacity as the capital of Nigeria for almost five decades. The city, therefore, had its city typology/ morphology etched due to this political status. This rate, pattern and nature of growth and development laid the foundation upon which the present-day Lagos Island is built.

Table 2: *Landcover Morphological Analysis of the island of Lagos between 1984 and 2015*

	Built-up Area (km ²)	Bare land (km ²)	Vegetal cover (km ²)	Total (km ²)
1984	5.63	4.73	7.33	17.69
2000	12.21	4.26	2.48	18.95
2015	12.95	7.27	0.83	21.05

Source; Author 2019.

At the dawn of independence despite the consistent increase in population from 235,052 in 1961 to about 1.5 million in 2015, the rate of spatial expansion was rather on the decline. The reduction from about 28.22% between 1960 and 1984 to 9.83% between 1984 and 2000 and further to 6.4% rate between 2000 and 2015, has been occasioned by the reduced land reclamation and increase in vertical development.

A spatial analysis of the rate of morphological change of landcover on the Island in the post-independent era is established as shown in Tables 2 and 3. The island of Lagos continues to experience expansion

through lateral reclamation and longitudinal densification. The urban expansion pattern on the island between 1984 and 2015 revealed an increase in built-up area from 5,63km² to 12.95km² and a reduction in vegetal cover from 7.33km² to 0.83km² respectively.

Table 3: *Composite Population Growth, Landcover Change and Expansion of the Island of Lagos*

Regime	Year	Population	Pop. Change %	Regime Change %	Area (km ²)	Area change%	Regime change	Period	Built-up Area (km ²)	Bare land (km ²)	Vegetal cover (km ²)	Total (km ²)
Pre-Independence (110 years)	1850	20,000			4.00			1850				
	1900	41,847	109	1075.26	5.07	26.75	241%	-	Non-availability of remotely sensed data for landcover analysis			
	1961/62	235,052	461.70		13.64	169	(9.6km ²)	1960				
Post-Independence (55 years)	1961/62	235,052			13.64							
	1984	518,494	120.59	505.81	17.49	28.22	49.85%	1960	5.63	4.73	7.33	17.69
	2000	837,925	61.61		19.21	6.40		2015	12.21	4.26	2.48	18.95
	2015	1,423,961	69.94		20.44				12.95	7.27	0.83	21.05

Source; Author 2019

Despite the constraints of the water bodies surrounding the land area, the reclamation exercise goes a long way to impact on the nature of morphological change. The hitherto physical form of the island, as several creeks, swamps and lagoons were reclaimed thereby re-configuring the morphology of the landscape. Elegbata creek, Alakoro Island, Idumagbo lagoon, Isale Igangan lagoon and MacGregor canal, all on the western portion of the island gave way to more stable land for development. Internal connectivity within the island and external linkages to the mainland through roads, trams and bridges respectively at the turn of the 20th century, enhanced the spate of sporadic development and influx of people onto the island. Of notable importance are the carter bridge (1901) and the Lagos Steam Tram (1901 -1933). Subsequently, the Eko bridge (1975) and most recently, the 3rd mainland bridge (1990). A post-independence new wave of coastal reclamation on the island has been predominantly peripheral, majorly accounting for the expansion in the landmass of the island and occurring at the Northern and North-eastern portion of the study area such as Ilubirin, Osborne Foreshore, Banana Island etc. This can be attributed to the limited spatiality, high land value and increased linkages to the mainland. The administrative status of the island as the then seat of power, and the regional economic hub for the West Africa sub-region also form part of the factors.

5. CONCLUSION AND RECOMMENDATIONS

Due to the level of vulnerability and fragility of the coast, it is important to give scholarly attention to the interrelated peripherality and centralities of island spaces and related issues. The study into the morphological impact of space delimitation on the growth or expansion in rapidly urbanizing islands has established historical, economic, political and environmental influences on the growth of Lagos island. The prevalence of spatial expansion and urban densification, due to reclamation and hitherto sparsely built-up areas being replaced by dense developments, especially in a fragile zone such as an island, portends danger to lives, properties and the environment at large thereby necessitating the adoption of effective coastal development guide that conforms with global best practices of coastal zone management and infrastructural upgrade commensurate with the current pace of urban growth. A holistic smart city policy to reduce human and traffic flows, energy consumption and stressors to the environment will go a long way to help improve the resilience capacity of coastal areas.

As a coastal land with a history of age-long reclamation exercises in the past culminating in the present-day morphology having a detrimental impact on people, properties and the environment. Urban heat island, climate change-induced environmental degradation, island fragmentation and subsidence, loss of biodiversity amongst others form the resultant consequences of unsustainable coastal development such as continuous island reclamation and densification. The following recommendations have been put forward to address observed challenges. (a) **Institutionalization of a Coastal and Island Development Policy framework** within the context of a broad Coastal Zone Management tool as an effective mechanism to guide development to conform with global best practices of coastal development overseeing the activities on the island to help re-direct development efforts towards sustainability, bearing in mind the diverse uses to which the coasts can be subjected to. (b) **Sustainable Urban Development Strategy** through infilling and compact development to mitigate expansion and sprawling on and around the island. This will consciously encourage multiple and flexible designs of public land uses and buildings to accommodate multiple uses at different times. (c) **Smart Development and Infrastructural Upgrade** are essential for the optimal development and management of the island of Lagos, considering the magnitude of activities and intensity of pressure exerted on the space and the deficient and degraded infrastructure currently available on the island. In the current dispensation, the adoption of digital technology for smart development through the harmonization of data resources for efficient decision making will engender sustainable city growth. An infrastructure mix considering a combination of green, grey and blue infrastructure sustainably will ensure positive growth and development in and around the coasts.

6. REFERENCES

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