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URBAN TELECOMMUNICATION INFRASTRUCTURE: A SPATIAL ANALYSIS OF MOBILE MAST DEPLOYMENT IN PORT HARCOURT METROPOLIS, RIVERS STATE, NIGERIA

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URBAN TELECOMMUNICATION INFRASTRUCTURE: A SPATIAL ANALYSIS OF MOBILE MAST DEPLOYMENT IN PORT HARCOURT METROPOLIS, RIVERS STATE, NIGERIA

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Abstract

The demand for effective telecommunication services, particularly mobile phone usage, has grown significantly due to the increasing need for communication and social connection. The socioeconomic development of a nation heavily relies on communication infrastructure aligned with its developmental goals. However, while telecommunication masts play a vital role in enhancing connectivity, their proliferation has raised environmental concerns. The clustering of masts near residential areas has posed challenges related to land use and urban planning. Additionally, the absence of geospatial data on telecom masts necessitated this study, which focused on determining their geospatial distribution in Port Harcourt Metropolis, Rivers State, Nigeria. Garmin 78csx GPS receiver was employed to geolocate existing telecom masts within the study area, and a comprehensive database of these masts was developed. The acquired coordinates were visualized using QGIS software with OpenStreetMap (OSM) to confirm that the positions aligned within the study area boundaries. Technical guidelines stipulate a minimum spacing of 1 km between telecommunication masts. However, the study revealed that many masts in the area do not adhere to this standard. The spatial distribution patterns of the masts were analyzed using Microsoft Excel, employing various charts to illustrate their spread across selected communities. Furthermore, proximity and spatial distribution maps of the telecom masts were generated using QGIS software. The findings indicated a total of 290 telecom masts in the study area, with 103 located within Port Harcourt Metropolis and 187 in Port Harcourt Local Government Areas. Among the service providers, MTN accounted for the highest number of masts (125), followed by GLO (80), AIRTEL (71), and 9MOBILE (14). The study also detailed the proportional percentages of masts for each service provider. Based on these insights, the study recommended strict adherence to regulatory standards and the implementation of measures to mitigate the adverse effects of telecommunication masts on the environment and urban areas.

Keywords: Geospatial, Geospatial Analysis, Mobile, Telecommunication Masts, Map, QGIS, GPS

Introduction

Communication plays an indispensable role in human existence, emphasizing its profound significance in connecting individuals across vast distances with immediate responses, a major advantage facilitated by telecommunication [10]. The ability to bridge gaps in distance through seamless interaction has been made possible by technological advancements, particularly the introduction of telecommunication infrastructure. These facilities have revolutionized the dissemination of information over long distances via electronic means [10]. In recent years, the demand for efficient communication and social connectivity among individuals, driven by the widespread adoption of mobile phones, has grown exponentially. This surge in communication needs underscores a global shift towards systems that are increasingly reliant on the constant availability and rapid dissemination of information. This trend has been further fueled by the ever-expanding population, particularly in urban and semi-urban areas, where the need for efficient information exchange is paramount [11].

The creation of mobile phones prompted the creation of mobile phone base stations also known as telecommunication masts in order to enhance the effectiveness of communication with the use of mobile phones [10]. Telecommunication mast is a freestanding structure which supports antennas at a height where they can transmit and receive radio waves [11]. The mast is literally the metal structure that holds the antennas. Mobile telecommunication masts may be of several types, and range in height from 30 to 300 meters or more. When a call is made, the GSM phone transmits signal to the nearest base station, the signals are received by the antenna of a base station and passed from one cell to another through an underground fibre optic cable or through a point-to-point fixed microwave beam, which require a direct line of sight [11].

Samuel, Alfred and Baba (2020) emphasized that telecommunications are a technology for remote communication and telecommunication masts tower consist of a body framework made of steel beams and materials with a concrete foundation, protected with dwarf metal fence approximately 25 to 55 meters in height. The antennae, transmitter and receiver are installed on the body of the structure. These antennas obtain high-frequency radio waves from cell phones. The range of these antennas ranges from radius as short as 1.5 to 2.4 km to distances as long as 48 to 56 km.

The telecommunication industry is an emerging one with a massive investment in the development of structures to support effective communication, such as the mobile telecommunication masts and their service providers. A telecommunication service provider refers to a company that operates within the telecommunication sector to ensure the effective transmission of information [11].

[13] stated that there are currently four service providers; MTN, AIRTEL, ETISALAT, and GLOBACOM that controls the telecommunication industry in Nigeria and hence, requires telecommunication masts which forms part of the basic infrastructure required for an effective telecommunication system, in order to have optimal network coverage, telecom masts are often located in close proximity to the target users. This is the reason why telecom operators (service providers) oftentimes site their masts in residential neighborhoods [1].

However, the concentration of telecommunication infrastructure poses significant challenges to effective land use planning and management, particularly in urban environments. These challenges are particularly relevant to the study area of this research, where the rapid expansion of telecommunications infrastructure intersects with urban development concerns [6]. In the study area, it is evident that telecommunication mast facilities are permanent structures, often located in residential and commercial areas. These masts have created significant challenges occupying land that could be used for other economic purposes such as subsistence farming. Therefore, it is crucial to develop a comprehensive strategy to minimize the encroachment of urban land by telecommunication facilities and address the related societal and economic impacts on the community [6].

The rapid proliferation of mobile telecommunication masts, while enhancing connectivity, poses land use challenges such as space consumption, land acquisition and ownership particularly within Port Harcourt metropolis. These masts are frequently clustered in residential and commercial zones, often without proper consideration of limited nature of land resources and urban planning principles. As permanent structures, some location of these masts occupy lands that can be used for other economic activities such as subsistence farming and small-scale food businesses but has rendered these spaces unusable. The absence of an up-to-date database of telecommunication facilities had created a gap in the optimization of these facilities in view of land resource sustainability [6]. This situation underscores the urgent need for an updated database to allow for a thorough analysis of the changes that have occurred over the years and provide a reliable basis for monitoring and controlling the geographic spread of telecommunication masts in relation to land use planning and urban development within the Port Harcourt metropolis. Therefore, The study centers on analyzing the geospatial locations of Mobile telecommunication masts in Port Harcourt metropolis, Rivers State, Nigeria by analyzing the spatial distribution pattern of mobile telecommunication masts within the political wards in Port Harcourt Metropolis, determining the distances between mobile telecommunication masts, developing an updated database of mobile telecommunication masts and producing a spatial distribution map of mobile telecommunication masts within the study area.

Geographic Information System (GIS) plays an important role in utility mapping which is the mapping of public services such as electricity, telecommunication lines and mapping of communication towers/masts which is the main focus of this research. A utility map is being produced by determining the spatial locations of relevant points or points of interest on the earth surface. The geospatial data obtained in the field by Global Positioning System (GPS) would be structured in the computer by appropriate software [4].

Study area

Port Harcourt is the capital of Rivers State and it is located in Southern Nigeria, occupying an area of approximately 369km2. It is the capital city of Rivers state. Port Harcourt metropolis comprises of Port Harcourt City Local Government Area (PHALGA) and Obio/Akpor Local Government Area (OBALGA) as seen in Figure 1.1. The both Local Government Areas (LGAs) are major centers for economic activities in Nigeria and pronounced in the Niger Delta region. Urbanization and Population: Port Harcourt metropolis is a maritime state in the southern geopolitical region of the country; with inhabitants of 464,789. The study area is influenced by industrialization or urban sprawl where small communities have merged and formed megacity due to high influx of people resulting to rapid growth of population overtime [14].

Location and Extent: The Metropolitan region of Port Harcourt (Obio/Akpor LGA and Port Harcourt City LGA), is the oil and gas hub of Nigeria is one of the major cities of the Niger Delta located in Rivers State [2]. It is situated approximately 25km from the Atlantic Ocean and it is between the Dockyard creek/bonny river and the Amadi creek. The land mass is about 311.71km2 and bordered by many LGAs and approachable through land, water and air and the area belongs to the south-south regions of Nigeria or otherwise known as Niger delta region [16]. Obio/Akpor local government area has it’s headquartered at Rumuodomaya.

Geography and Topography: The Local Government Area is a lowland area with an average elevation below 30m above sea level. Significant changes in the land Use/ land cover in the area include changes in water bodies, built-up areas, and depletion of the mangrove vegetation along rivers and creeks shorelines, vegetation, and wetlands [9]. The local government area is rich with land and natural resources, such as land, soil, vegetation, water, coal, petroleum, gas, animals, wildlife, air, wind and atmosphere, clay, sand, gravel [16]

Climate/Environmental Conditions: The study area enjoys tropical hot monsoon climate due to its latitudinal position. The tropical monsoon climate is characterized by heavy rainfall from April to October ranging from 2000 to 2500 mm with high temperature all the year round and relatively constant humidity. The relief is generally lowland which has an average of elevation between 20 and 30m above sea level. The geology of the area comprises basically of alluvia sedimentary basin

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and basement complex [16]. Rainfall is at its peak in July and September with a little dry season occurring in August, although the period of the break has been fluctuating in recent times. The study area also experiences a double maximum rainfall occurs between July and August. Although there might be rain during the months of December, there is no year the length of rainy season is about 272 days. Rainfall in the study area occurs over a long duration of usually between 2-4 hours and it is high intensity [15]. Temperature on the other hand is high and fairly constant throughout the year in Choba. February is the warmest of all the months of the year with an average temperature of 32°C at noon, the month of July is the oldest.

Tribes and Language: Port Harcourt metropolis which consists of Obio /Akpor Local Government Area with 17 political wards and Port Harcourt City Local Government Area with 20 political wards. It consists of the Ikwerre speaking people and partly the Okrika people. Due to proximity of Obio/Akpor to the state's capital, it is most times regarded as Port Harcourt. Specifically, there are four (4) Ikwerre Kingdoms that constitute the local Government Areas, which are: Akpor, Apara, Evo and Rumueme Kingdoms and 8 (eight) kingdoms which constitute Port Harcourt City Local Government Area, which are: Obumton-chiri, Abuloma, Okuru-Ama, Azuzbie.Kala Ogoloma, Fimie-Ama.Koko-Ama and Rebisi Kingdom.

Occupation: In the pre-colonial era, the study area has traditional occupation such as farming, lumbering, local markets, native ways of healing sicknesses, Arts, culture and hunting. However,

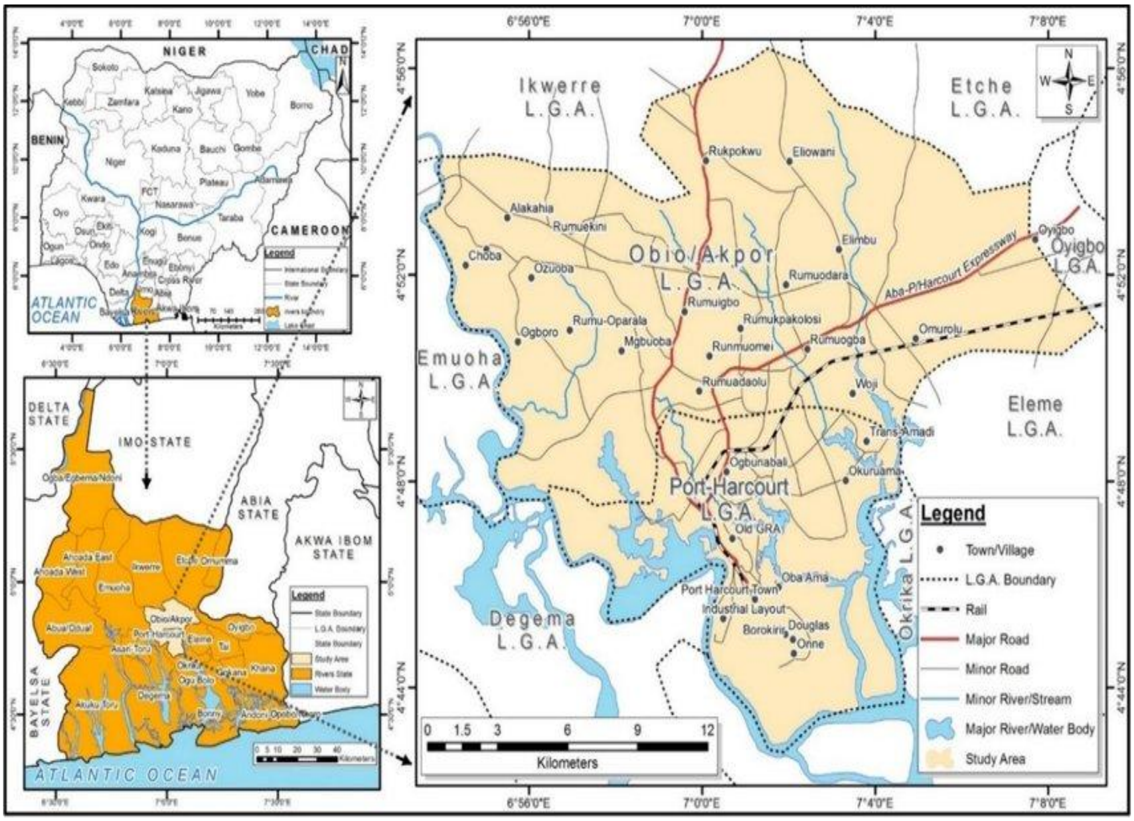

Figure 1.1: Map of Port Harcourt Metropolis
Source: Francis and Michael, 2020

the rapid increase in development in recent times has increased the level of population which has simultaneously transited the occupations to construction, engineering, civil service, administration, manufacturing, mining, sand dredging, printing and other public services [15].

Materials and Methods

Table 1: Instruments used for the research work

S/N	Software	Hardware	Instrumentation
1	QGIS 3.22	Core i3 Hp Laptop (8.00 GB)	Garmin GPS Map 78Sc
2	Microsoft Word	CPH2505 OPPO Reno8 T 5G Phone	50m Steel tape
3	Microsoft Excel	Camera	Field Book
4	Google earth	Printer	
5	UTM Geo Map		

Source: Author, 2024

Data Acquisition

Works done by another researcher or author was referenced and was vital to achieve this research work sourced through related literatures and textbooks.

Primary data was sources through the use of handheld GPS receiver (Garmin 78cx) was used to obtain the coordinates of various mobile telecommunication masts within the study area, camera was used to take photographs of some of the masts within the study area.

The Global Positioning System (GPS) is a U.S. owned utility that provides user with positioning, navigation and timing services. Precise distances from the satellites to the receivers are determined from timing and signal information, enabling receiver positions to be computed. In satellite surveying, the satellites become the reference or control stations, and the ranges (distances) to these satellites are used to compute the positions of the receiver as seen on the handheld GPS receiver. Conceptually, the GPS principle is equivalent to resection in traditional ground surveying work where distances and/or angles are observed from an unknown ground station to control points of known position. The global positioning system has three parts which are;

The Space Segment: this consists nominally of 24 satellites operating in space that transmits one-way signals that gives current GPS satellite position and time.

The Control Segment: consists of monitoring stations which monitor the signals and track the positions of the satellites over time for maintenance and sustainability. While;

The User Segment: consists of the GPS receiver equipment which receives the signal from the GPS satellites and use the transmitted information to calculate three-dimensional position and time (Ghilani and Wolf, 2012) as shown in figure 2.

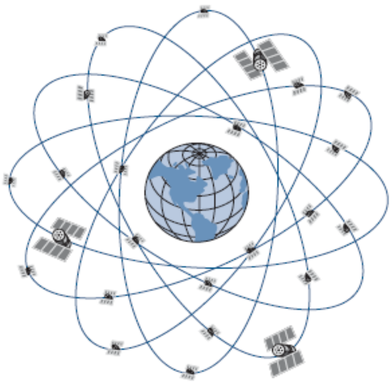

Figure 2: GPS satellites in Orbit around the Earth [7]

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Data Processing

Creation of Shapefile: A shapefile is an ESRI (Environmental System Research Institute) vector data storage format for storing the location, shape and attributes of geographic features. The shapefile format is a geospatial vector data format for geographic information system (GIS) software. It is developed by ESRI. The shapefile format can spatially describe vector features such as points, lines and polygons representing water wells, rivers, lakes etc. with an underlying attribute information that describes it [3]. The shapefile of telecommunication masts would be created by saving the coordinates of various telecom masts as CSV (Comma Separated Value, delimited text) file extension through Microsoft Excel.

Validation of Coordinate Points: The coordinate acquired would be overlaid on the shapefile of Port Harcourt metropolis to ascertain if the position of the various telecom masts is within the study area and this would be done by importing the shapefile of the telecom masts and Port Harcourt metropolis. This would be done to verify if the obtained coordinates are insitu or falls within the study area.

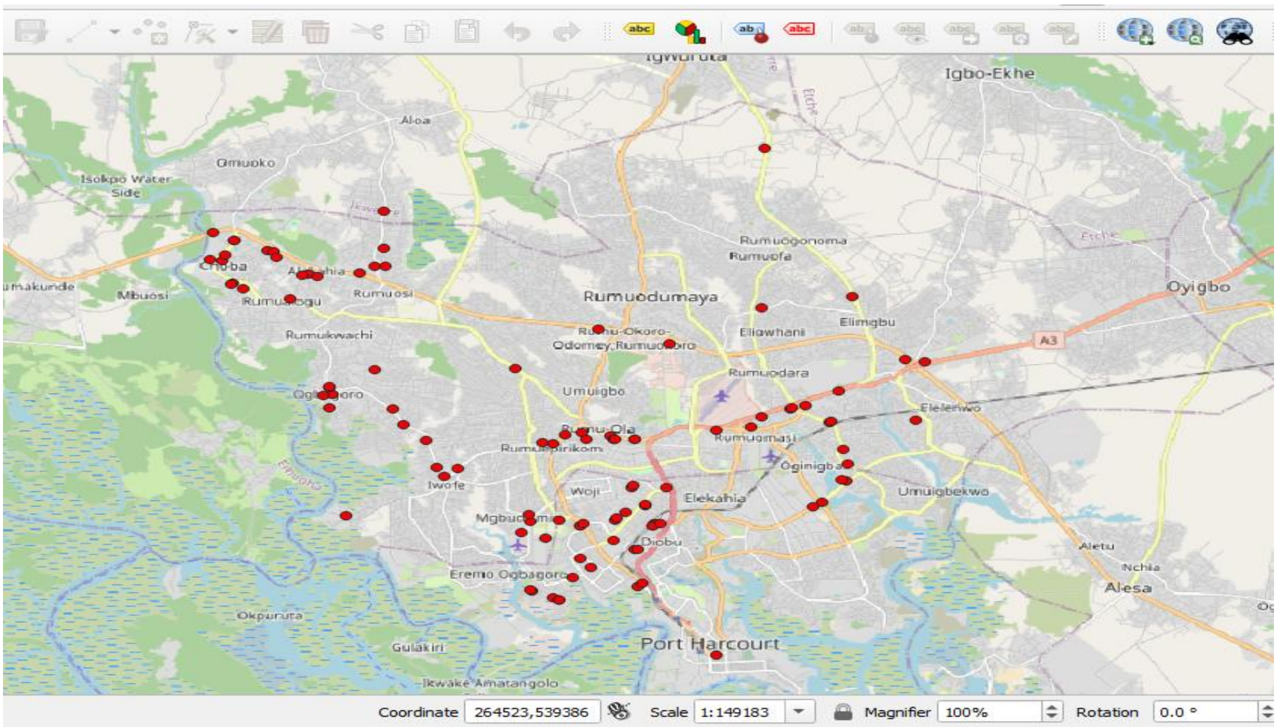

Figure 3: Specimen of Spatial Distribution of Mobile Telecommunication Masts obtained during Data Acquisition

Utilization of Open-Source Data: According to [3], open-source data refers to data that is freely accessible and can be used without any restrictions. This means that users have free access to this type of data. The open-source data was utilized for this study is the OpenStreetMap (OSM) which is a free, editable map of the world, created and maintained by volunteers. OSM is a free, open geographic database that is constantly updated and maintained through open collaboration by its community. It includes data on roads, buildings, addresses, shops, points of interest, railways, trails, transit, land use, and both natural and artificial features [3]. In this study, OSM was utilized for a detailed and up-to-date geographical information, including roads, buildings, land use, and other relevant features within the Port Harcourt metropolis. In QGIS, OSM serves as an additional plugin and layer for various features that would otherwise need to be digitized from a base map. OSM is already a georeferenced and digitized map layer in QGIS. However, field observations would be necessary to ensure the accuracy and relevance of the data. Familiarity with the terrain can validate the points of interest when imported into QGIS and superimposed on the OSM. The integration of OSM and field observations provides a comprehensive and reliable dataset, supporting the analysis and findings of the research.

Map production: QGIS software was used to produce the map. The coordinates and attributes of the different telecom masts would be saved in Microsoft Excel as a CSV (Comma Separated Value) file and imported into QGIS as a delimited text file. OSM would be also launched to validate these points. The imported layers would then be modified, with different point colors selected for each layer. To enhance data usability, the layers would then be exported to a shapefile format. Once the shapefile is created from the CSV data, it would be imported into QGIS under the print layout. The points and the OSM map would be added to the map canvas.

Data Analysis

Spatial Pattern Analysis: An analysis was done using graphic illustration showing the spatial distribution pattern of mobile telecommunication masts within the study area using Microsoft excel. This analysis includes the category and percentage of service providers and geographical spread of mobile telecommunication masts within wards in the study area.

Results

Table 2: Statistics of the Spatial Distribution of Telecommunication Masts within Port Harcourt Local Government Area (PHALGA) Political Wards in Port Harcourt Metropolis

Political Wards	Names of Political Wards	Service Providers				
		MTN	GLO	AIRTEL	9MOBILE	No. of Masts
1	Oromineke/Ezimgbu	6	4	9	0	**19**
2	Orogbum	1	2	5	0	**8**
3	Oroabali	0	0	0	0	**0**
4	Ogbumnabali	1	4	9	0	**14**
5,6 &7	Port Harcourt town	24	13	9	5	**51**
8	Ochiri/Rumukalagbor	1	0	0	0	**1**
9	Oroworukwo	0	0	0	0	**0**
10 & 18	Nkpolu-Oroworukwo I & II	21	14	7	0	**42**
11, 12 & 13	Rumuwoji	0	0	0	0	**0**
14 & 15	Mgbundukwu I & II	0	0	0	0	**0**
16	Rumubiekwe	0	0	0	0	**0**
17	Diobu	8	7	3	6	**24**
19	Elekahia	8	11	3	0	**22**
20	Abuloma/Amadi-Ama	4	2	0	0	**6**
Total		**74**	**57**	**45**	**11**	**187**

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Table 3: Statistics of the Spatial Distribution of Telecommunication Masts within Obio/Akpor Local Government Area (OBALGA) Political Wards in Port Harcourt Metropolis

Political Wards	Names of Political Wards	Service Provider				
		MTN	GLO	AIRTEL	9MOBILE	No. of Masts
1	Oroigwe	4	0	0	0	**4**
2	Rumuodara (Okporo and Iriebe)	2	1	0	0	**3**
3	Rumuokwurushi/ Atali	2	0	0	0	**2**
4	Rumuodomaya /Rumuobiakani	1	0	0	0	**1**
5	Elelenwo	4	0	1	1	**6**
6	Woji /Oginiba	4	2	2	0	**8**
7	Rumuokoro	1	1	0	1	**3**
8	Rumuomasi	4	0	2	0	**6**
9, 10 & 11	Rumueme 7A, 7B & 7C	8	4	5	0	**17**
12	Rumuigbo /Rumurosi	2	0	0	0	**2**
13	Rumuokwuta /Rumuola	4	6	4	1	**15**
14	Rukpokwu / Eneka	2	0	0	0	**2**
15	Choba	7	6	7	0	**20**
16	Ozuoba/ Ogbogoro/Rumuekini/Rumuosi	5	2	3	0	**10**
17	Rumuolumeni	1	1	2	0	**4**
Total		**51**	**23**	**26**	**3**	**103**

Table 4: Category of Telecommunication Masts based on Service Providers in Port Harcourt Metropolis

S/N	Service Providers	No. of Masts
1	MTN	125
2	GLO	80
3	AIRTEL (formerly Zain)	71
4	9MOBILE	14
5	**Total**	**290**

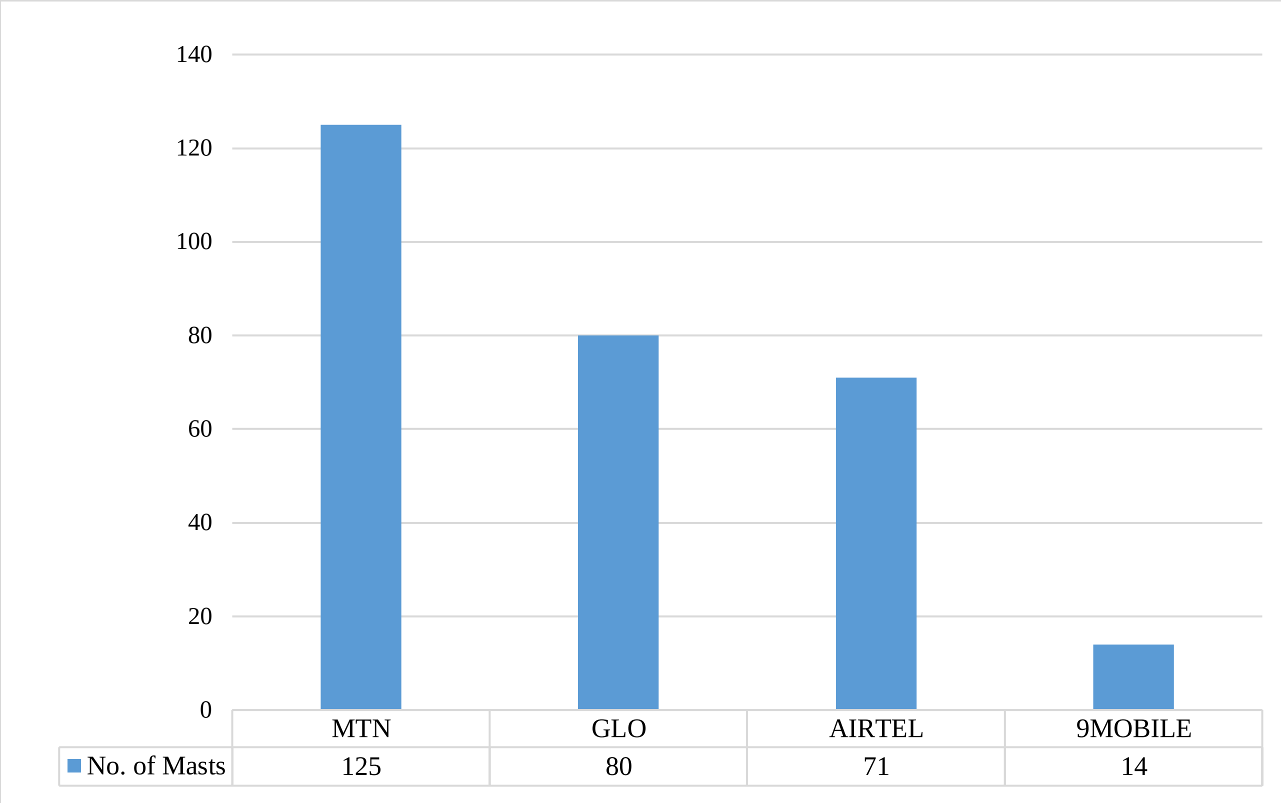

Figure 4: Chart Illustrating the Spatial Distribution Category of Telecommunication Masts based on Service Providers

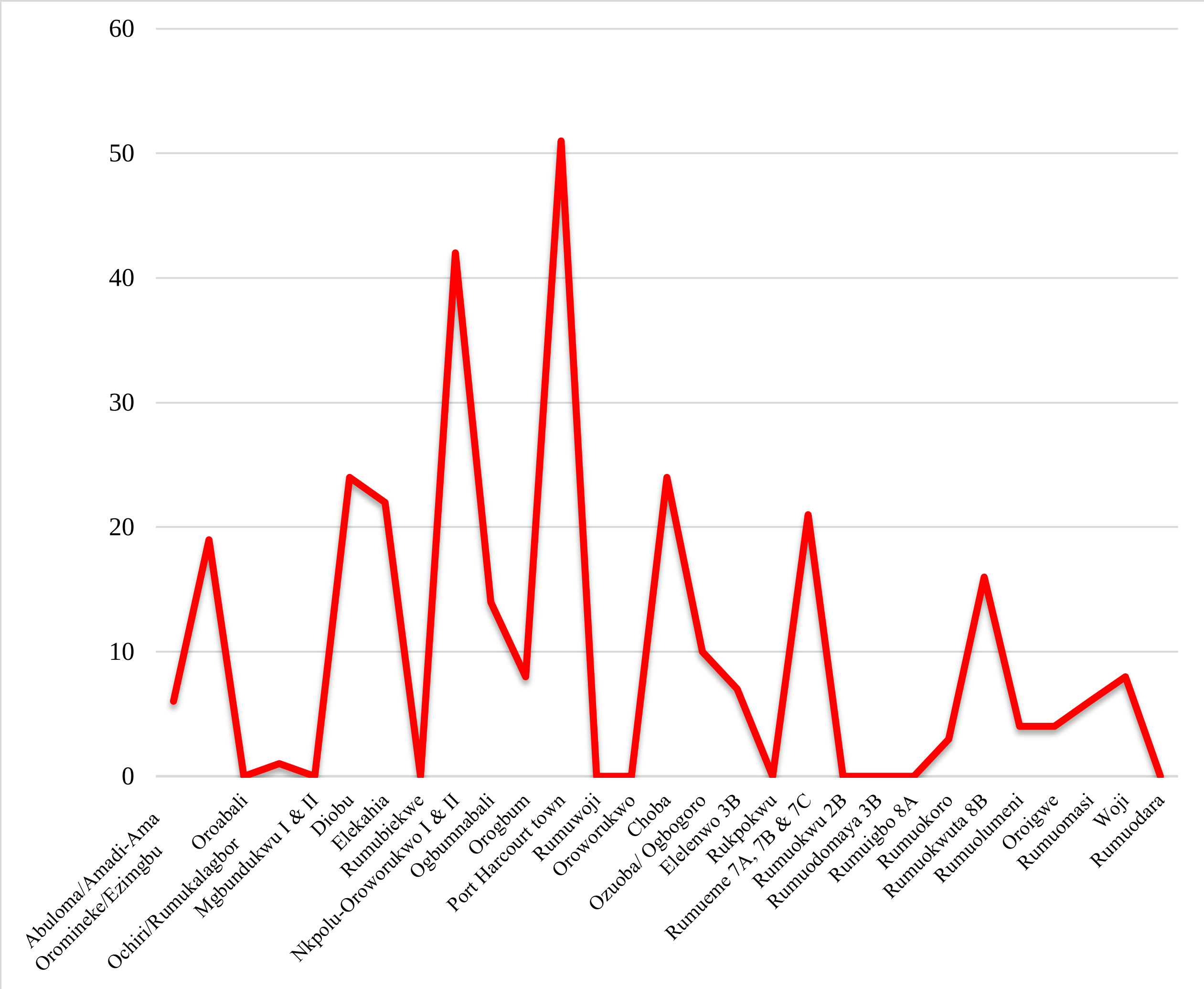

Figure 5: Chart Illustrating the Spatial distribution of Telecommunication Masts within Political Wards in Port Harcourt Metropolis

Table 5: Number of Telecommunication Masts within the Local Governments in Port Harcourt Metropolis

S/N	Local Government Area	No. of Masts
1	Obio/Akpor LGA	103
2	Port Harcourt LGA	187
3	**Total**	**290**

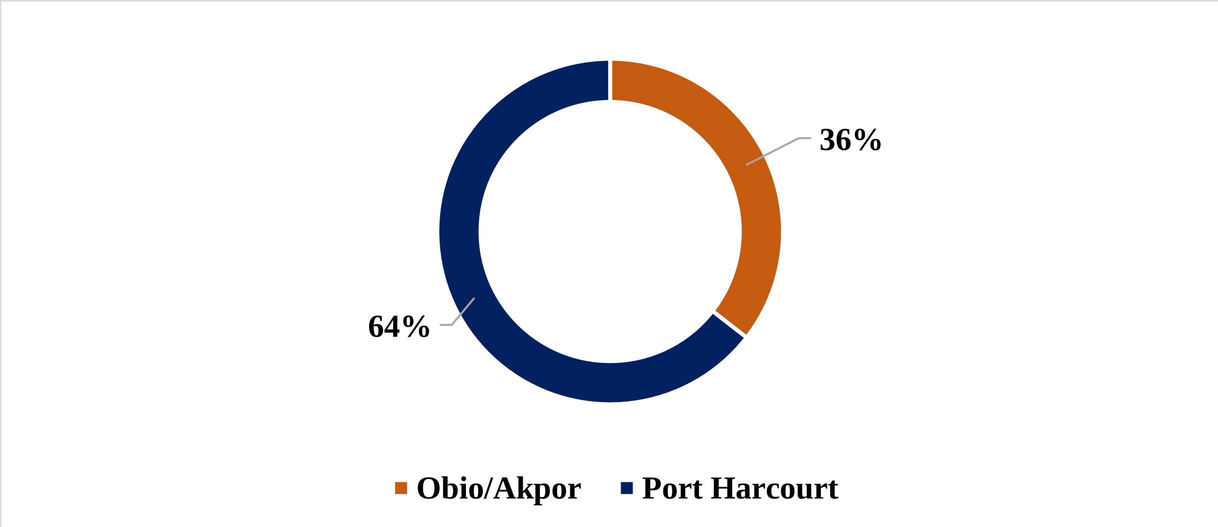

Figure 6: Chart Illustrating the Percentage of Telecommunication Masts within the Local Governments in Port Harcourt Metropolis

Telecommunication Masts Spacing

The Guidelines on Technical Specifications for the installation of Telecommunication Masts and Towers that was issued on 09/04/09 by Nigerian Communications Commission (NCC) captures towers to towers spacing and specified that the minimum distance between two or more telecommunication masts should be (1000m)1km.

Table 6 presents the analysis that reveals the distances between telecommunication masts in Abuloma community in relation to a fixed MTN mast. Some of the mast show that the spacing between two towers are below the minimum limit of 1km. However, the distance between two (2) mast MTN to MTN and MTN to GLO are above the minimum limit.

Table 6: A Specimen of the Distances between Telecommunication Masts in Abuloma Community

S/N	Service	Coordinates		Partial Coordinates		Distance (m)	Minimum Distance (m)	Diff.	Remark
	Providers	Eastings (m)	Northings (m)	E	N				
1	MTN	281788.03	529415.83						
2	MTN	282146.78	529414.81	358.752	-1.028	358.754	1000	-641.246	below limit
3	AIRTEL	284854.06	528105.7	2707.286	-1309.112	3007.187	1000	2007.187	Above limit
4	MTN	284853.97	528072.52	-0.094	-33.18	33.18	1000	-966.82	below limit
5	MTN	285008.33	528381.76	154.36	309.249	345.633	1000	-654.367	below limit

6	GLO	284433.13	528352.05	-575.201	-29.714	575.968	1000	-424.032	below limit
7	GLO	282066.03	529632.56	-2367.095	1280.507	2691.252	1000	1691.252	Above limit
8	MTN	281789.67	529989.12	-276.364	356.566	451.128	1000	-548.872	below limit
9	MTN	281585.04	530209.08	-204.634	219.951	300.422	1000	-699.578	below limit
10	MTN	281611.8	530513.16	26.763	304.083	305.258	1000	-694.742	below limit

Table 7: A Sample of the Database of Telecommunication Masts within the Port Harcourt Metropolis

S/N	Community	LGA	Address	Service Provider	Eastings	Northings
1	Abuloma	Port-Harcourt	Abuloma	MTN	281788.026	529415.834
2	Abuloma	Port-Harcourt	Abuloma	MTN	282146.778	529414.806
3	Abuloma	Port-Harcourt	Abuloma	AIRTEL	284854.064	528105.695
4	Abuloma	Port-Harcourt	Abuloma	MTN	284853.971	528072.515
5	Abuloma	Port-Harcourt	Abuloma	MTN	285008.330	528381.764
6	Abuloma	Port-Harcourt	Abuloma	GLO	284433.130	528352.050
7	Abuloma	Port-Harcourt	Abuloma	GLO	282066.034	529632.557
8	Abuloma	Port-Harcourt	Amadi Town	MTN	281789.670	529989.124
9	Abuloma	Port-Harcourt	Amadi Town	MTN	281585.036	530209.075
10	Abuloma	Port-Harcourt	Amadi Town	MTN	281611.799	530513.158
11	Alakahia	Obio/Akpor	ALAKAHIA	AIRTEL	269757.000	540285.000
12	Alakahia	Obio/Akpor	ALAKAHIA	MTN	269630.000	540252.000
13	Alakahia	Obio/Akpor	ALAKAHIA	AIRTEL	270008.000	540215.000
14	Alumini	Obio/Akpor	Opp. Alo Alumini, East west road	AIRTEL	283613.387	536171.886
15	Borikiri	Port-Harcourt	Borikiri	GLO	282223.318	524472.473
16	Borikiri	Port-Harcourt	Borikiri	MTN	282423.654	524685.738
17	Borikiri	Port-Harcourt	Borikiri	MTN	283147.289	524875.403

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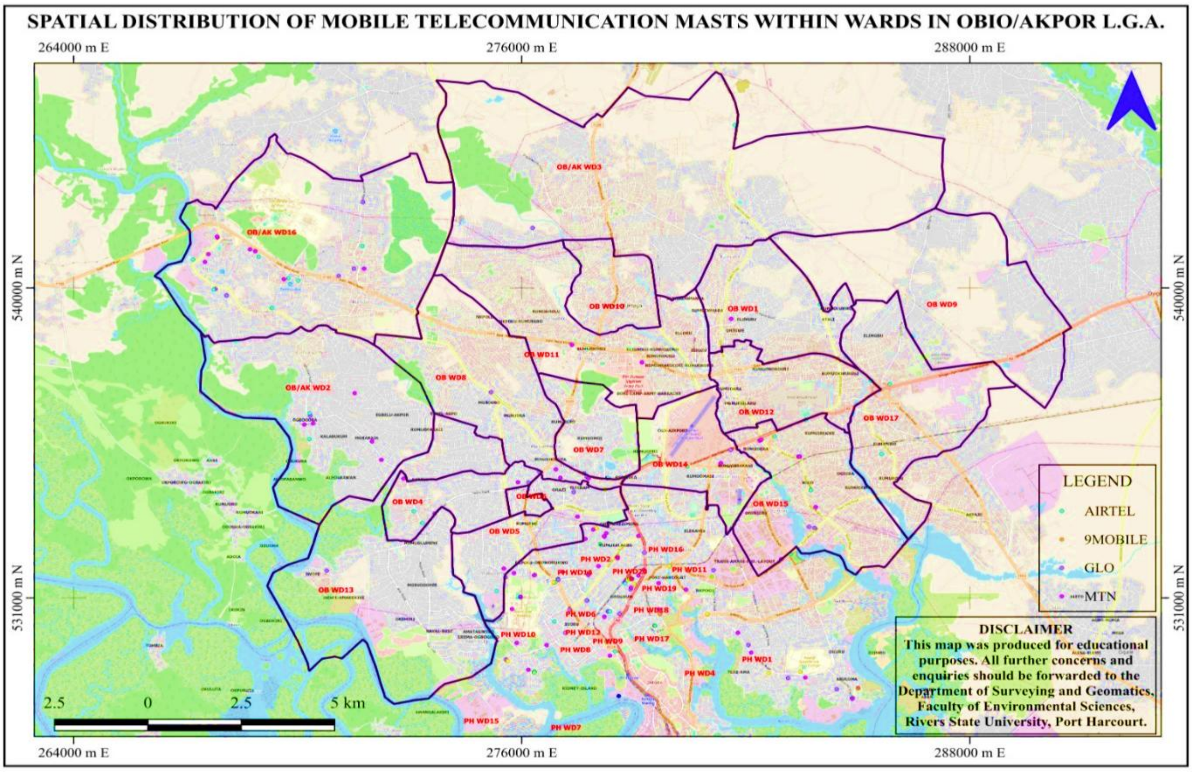

Figure 7: Spatial Distribution Map of Mobile Telecommunication Masts within Political Wards in Obio/Akpor Local Government Area

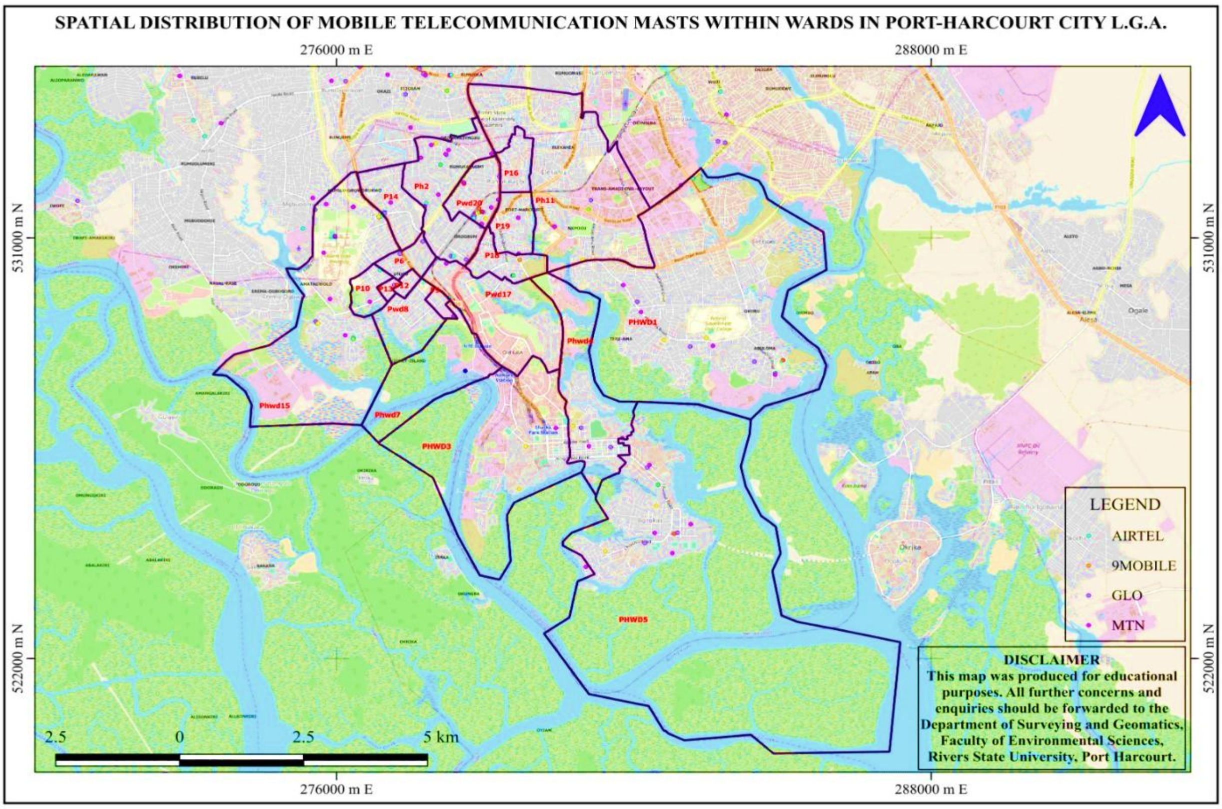

Figure 8: Spatial Distribution Map of Mobile Telecommunication Masts within Political Wards in Port Harcourt Local Government Area

Findings and Discussion

In addressing the statement of the problem regarding the rapid proliferation of telecommunication masts in Port Harcourt metropolis, the findings provide critical insights into the spatial patterns, and challenges posed by these structures. The research revealed the significant presence of 290 mobile telecommunication masts distributed across the study area, with a marked concentration in commercial and residential zones, substantiating concerns captured in the statement of the problem about land consumption and spatial clustering of these facilities. To solve these issues, the service providers must follow the laid down guideline in tower to tower spacing of 1000m and avoid placing mast in residential areas.

The findings show that MTN has the highest number of masts (125), followed by GLO (80), AIRTEL (71), 9MOBILE (14). Communities such as Borokiri have the highest concentration of telecommunication masts (38), demonstrating a lack of regulatory oversight that could contribute to more evenly distributed mast installations, thereby mitigating the negative impacts on available land resources.

Moreover, the findings indicate that Port Harcourt Local Government Area (LGA) has the majority of masts, with 187 masts (about 64% of the total), while Obio/Akpor LGA has 103 masts (36%). This concentration aligns with urban development patterns where telecommunication services are in higher demand. However, the clustering of masts within limited zones without adequate adherence to spatial planning affects available space.

The problem concerned about the environmental and land resource impact is further supported in Table 6, which demonstrates that many masts in certain areas, such as Abuloma Community, do not meet the recommended 1km separation guideline. This clustering does not only reduce the usability of valuable land for other purposes, such as small-scale food businesses and urban agriculture, but also creates safety and environmental concerns due to the potential overloading of specific areas.

Finally, the absence of a unified database for mobile telecommunication facilities, as pointed out in the statement of the problem, has likely contributed to the unplanned placement of these masts, reducing opportunities for coordinated infrastructure development and resource optimization. This lack of coordination means that land designated for other economic uses is instead occupied by masts, which have become permanent fixtures due to the inadequate management and regulation highlighted by the research findings.

In summary, these findings underscore the need for improved regulation and planning in telecommunication infrastructure development within Port Harcourt metropolis. Establishing a comprehensive, up-to-date database for telecommunication facilities could enable better planning, ensuring that land resources are used sustainably and equitably across both residential and commercial zones, and thereby addressing the core issues raised in the study’s problem statement.

Conclusion

While the benefits of mobile telecommunication infrastructure, particularly GSM base stations, are evident, their proliferation has raised significant environmental concerns due to the clustering of these masts near residential areas which has led to environmental concerns in terms of land use and urban planning, also, studies have highlighted potential risks associated with prolonged exposure to microwave radiation emitted by these masts, including skin burns, neurological disorders, and increased cancer risks. Moreover, noise, vibration, and emissions from standby power generators further contribute to environmental pollution and health risks for nearby residents. The rapid installation of mobile telecommunication masts in Port Harcourt metropolis without adherence to regulatory standards set by the Nigerian Communication Commission (NCC) and the National Environmental Standard and Regulation Enforcement Agency (NESREA) exacerbated these concerns. Given these challenges, there was an urgent need for a comprehensive study of the situation. The findings of this research work offer valuable insights into the distribution, ownership, and spatial characteristics of telecom masts, laying the groundwork for informed decision-making in telecommunications management, urban planning, and infrastructure development.

Recommendation

Telecommunications companies should strictly adhere to regulatory standards set forth by bodies such as the Nigerian Communication Commission (NCC) and the National Environmental Standard and Regulation Enforcement Agency (NESREA). This includes ensuring compliance with guidelines regarding the installation, operation, and maintenance of mobile telecommunication masts to minimize environmental impact and health risks and establish robust monitoring mechanisms to track compliance with regulatory standards and environmental guidelines.

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