E-ISSN: 1115 – 8492 P-ISSN: 3027 - 0693
MPRI-JNSAR
INTERNATIONAL JOURNAL OF NATURE AND SCIENCE ADVANCE RES.
VOL. 08 NO. 9 APRIL, 2025

SPATIAL ANALYSIS OF TELECOMMUNICATION MAST DISTRIBUTION IN MUBI METROPOLIS, ADAMAWA STATE, NIGERIA: RESIDENTS' ADAPTATION STRATEGY PERSPECTIVE

ANJORIN, OLUFEMI JACOB (PhD)
Urban and Regional Planning Department, Federal Polytechnic Mubi, Adamawa State, Nigeria. ORCID https://orcid.org/0000-0003-3940-1728
Corresponding Author:
anjorinfemi2002@yahoo.com
DOI: https://doi.org/10.70382/mejnsar.v8i9.053

tetfund
TERTIARY EDUCATION TRUST FUND

Abstract

Telecommunication masts are essential for global communication systems. However, research reveals an uneven distribution of these infrastructures in urban areas and raises health and environmental concerns. This study aims to analyse the spatial distribution of telecommunication masts in Mubi metropolis and the adaptive strategies employed by residents in response to related challenges. The study utilized primary and secondary data, including distances from masts to nearby buildings and health concerns reported by residents. The evaluation included the specific locations of all active masts in the Mubi metropolis. All but one of the 102 distributed questionnaires were analyzed. A random sampling technique was employed to choose three households near each mast for questionnaire administration. Additional data collection

Keywords:
Telecommunication mast, national setback, governmental regulations, Adaptation Strategy

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

instruments for the study included a TECNO Spark 30C camera for photographic documentation, a 72H Garmin GPS device for location tracking, and measuring tape for distance measurements. ArcGIS version 10.5 and Microsoft Excel 2013 were utilized for data processing and analysis. The study found that MTN, Airtel, and Glo are the active telecommunication companies in Mubi metropolis. Notably, 29.4% of the masts are operated jointly by MTN and Airtel, following principles of sharing and co-location. However, telecommunication operators in Mubi metropolis often neglect the prescribed national minimum setback distance. The trend of non-compliance with established setback regulations necessitates the formulation of various coping strategies by residents. Consequently, the study recommended orienting residential structures away from the proximity of telecommunication masts.

Introduction

Telecommunication masts are integral infrastructures globally, particularly in developed nations, facilitating extensive communication networks amidst a burgeoning mobile user demographic. These structures enable the transmission of varied mobile communications, including voice, text, and essential data exchanges. Installation and regulation of telecommunication masts typically rest with mobile network operators and governmental authorities, who ensure compliance with safety standards. In Nigeria, since 2001, the telecommunications sector has expanded dramatically, with about 169.2 million subscriber base in 2001 and GSM operators establishing over 53,460 base stations by 2022 (Ekata and Kostanic, 2014 and Onolemhemhen et al., 2022). This is a reflection of significant growth and improved access to telecommunication services in the country. The substantial growth in the Nigerian telecommunications industry is a significant catalyst for the development of urban infrastructure, as GSM base stations, along with cellular communication masts, are fundamentally integral to the overall efficacy and reliability of communication networks. In their research, Turletti et al. (1999) posited that telecommunication base transceiver stations (BTSs) play a pivotal role in enhancing communication signals, which, in turn, serves to broaden the consumer base for digital telecommunications in both urban metropolitan areas and rural localities. As a

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

direct consequence of this expansion, access to telecommunication services has improved for numerous individuals who previously encountered barriers to obtaining such services. However, existing literature has indicated that, for various reasons, the concentration of telecommunication facilities is not uniform across all localities, towns, and cities. For instance, Dalil et al. (2016) stated that the districts of Wuse I and II in Abuja, Nigeria, host more telecommunication masts (44), in stark contrast to Garki I and II, Maitama, Asokoro, and the Central Business District that accommodates between 22 and 4 masts. Additionally, Mohammed and Abdurrahman (2014), Isiaka (2017), and Oruonye, Ahmed, and Jutum (2021) have documented the clustering of telecommunication masts within the regions of Kano, Adamawa, and Taraba States, Nigeria.

Typically, the positioning and installation of telecommunication masts within any given locality are believed to be intricately linked to a series of environmental and human health concerns that warrant careful consideration. Reports indicate that these masts emit electromagnetic radiation, which poses potential risks to both the environment and the health of individuals residing in proximity to these structures; and release pollutants that can adversely affect environmental quality (Emma, 2012). Furthermore, Adamu et al. (2016) demonstrated a correlation between prolonged exposure to telecommunication masts and a myriad of serious health complications, which encompass different forms of cancer, chronic headaches, and debilitating chronic fatigue, episodes of dizziness, a decrease in sperm count, and even a heightened risk of premature mortality. Iortile and Agba (2014) and Ekata and Kostanic (2014) further assert that the unregulated establishment of these masts presents significant threats to both human health and ecological stability. These risks are particularly exacerbated among individuals who reside in close proximity, specifically within a range of 5 to 10 meters from the telecommunication masts. (Isiaka, 2017). These concerns necessitate stringent regulatory oversight within the telecommunications sector, to mitigate these risks.

Therefore, the Nigerian government, through its relevant agencies, including the Nigeria Communication Commission (NCC), which has been specifically mandated to supervise the activities of telecommunications companies, and the National Environmental Standards and Regulations Enforcement Agency (NESREA), which bears the responsibility of ensuring environmental safety throughout the nation,

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

has taken certain measures to safeguard human life and protect the environment from the potentially deleterious effects associated with telecommunication masts. These agencies have instituted a regulation that stipulates a mandatory setback distance of 10 meters for telecommunication masts from the nearest residential structures, aiming to minimize exposure to harmful emissions. Regrettably, studies revealed a gross violation of these established regulations by telecommunication operators operating within the country. According to Babatunde and Adewuyi (2013) and Aderoju et al. (2014), telecommunication facilities in urban centers such as Ibadan and Abuja significantly contravene the NCC and NESREA's mandated 10-meter minimal setback stipulation. Alarmingly, only a mere 26.1% of the 92 masts that were surveyed in Abuja demonstrated compliance with the established NCC regulations (Dalil et al., 2016). In Osogbo (Osun State) and Zaria (Kaduna State), telecommunication infrastructures are found to be in violation of the national setback standards, exhibiting compliance levels of only 38% and 14% respectively (Akindele and Adeniji, 2014, Adamu et al., 2016).

But despite existing research on telecommunication masts' environmental and health implications, there is a notable gap in studies focused on the localized mitigation strategies employed by communities affected by these issues. For instance, Laura et al. (2024) examined the factors influencing RF-EMF exposure legislation, emphasizing the complexities surrounding decentralization and mobile competition in the context of 5G technology, yet neglected to explore local adaptive strategies. Similarly, other studies, Yekini et al. (2016), Pachuau and Pachuau (2019), and Elbasheir et al. (2024), concentrated on health impacts without addressing how vulnerable populations navigate the risks posed by telecommunication masts. In Nigeria, Omogunloye et al. (2013), Isiaka (2017), Oruonye (2021), and Lawrence and David-West (2025) analysed the spatial distribution of telecommunication masts across various towns and states. These investigations reveal diverse distribution patterns of telecommunication masts in Nigeria and emphasize the importance of following regulatory guidelines to enhance service delivery and mitigate environmental and health risks. Nonetheless, the studies fail to address the localized strategies employed by communities to manage the health impacts associated with these masts.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Therefore, this study aims to elucidate the spatial distribution of telecommunication masts and the domesticated adaptation measures implemented by residents of Mubi metropolis, Adamawa State, Nigeria. The aim of this study was achieved by conducting a comprehensive analysis of the spatial arrangement of telecommunication masts within the study area to better understand their geographical implications; evaluating the extent to which network service providers adhere to the established national setback requirements, which are crucial for ensuring public safety and environmental considerations, and assessing the various strategies and coping mechanisms employed by individuals to mitigate any adverse effects that may arise from the presence of telecommunication masts in their vicinity.

Material and Method

Study Area

Mubi, located in northeastern Nigeria's Adamawa State, is defined by its geographical coordinates: latitude 10°16'8"N and 10°20'00"N and longitude 13°16'14"E and 13°20'00"E (Joshua and Odihi, 2018). This city is bordered by the LGAs of Hong, Maiha, and Michika and is near Borno State and Cameroon. Mubi town is administratively divided into two distinct areas, with the southern part falling under the administration of Mubi South LGA and the northern part under Mubi North LGA, collectively, forming the Mubi metropolis (Peter et al., 2016). The metropolis has a population of 423,226, encompassing diverse ethnicities such as Fali, Gude, and Hausa, engaged in various economic activities and supported by public institutions and infrastructure (Anjorin, Balogun, Kadala, 2025). Mubi has experienced significant growth in commercial activities and services, establishing itself as Adamawa State's commercial capital and underscoring its economic importance in the region. The socioeconomic characteristics of Mubi drive the development of telecommunication infrastructure, highlighting the relationship between economic growth and technological progress. Figures 1a to 1d visually represent Mubi's unique locational features and administrative details.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

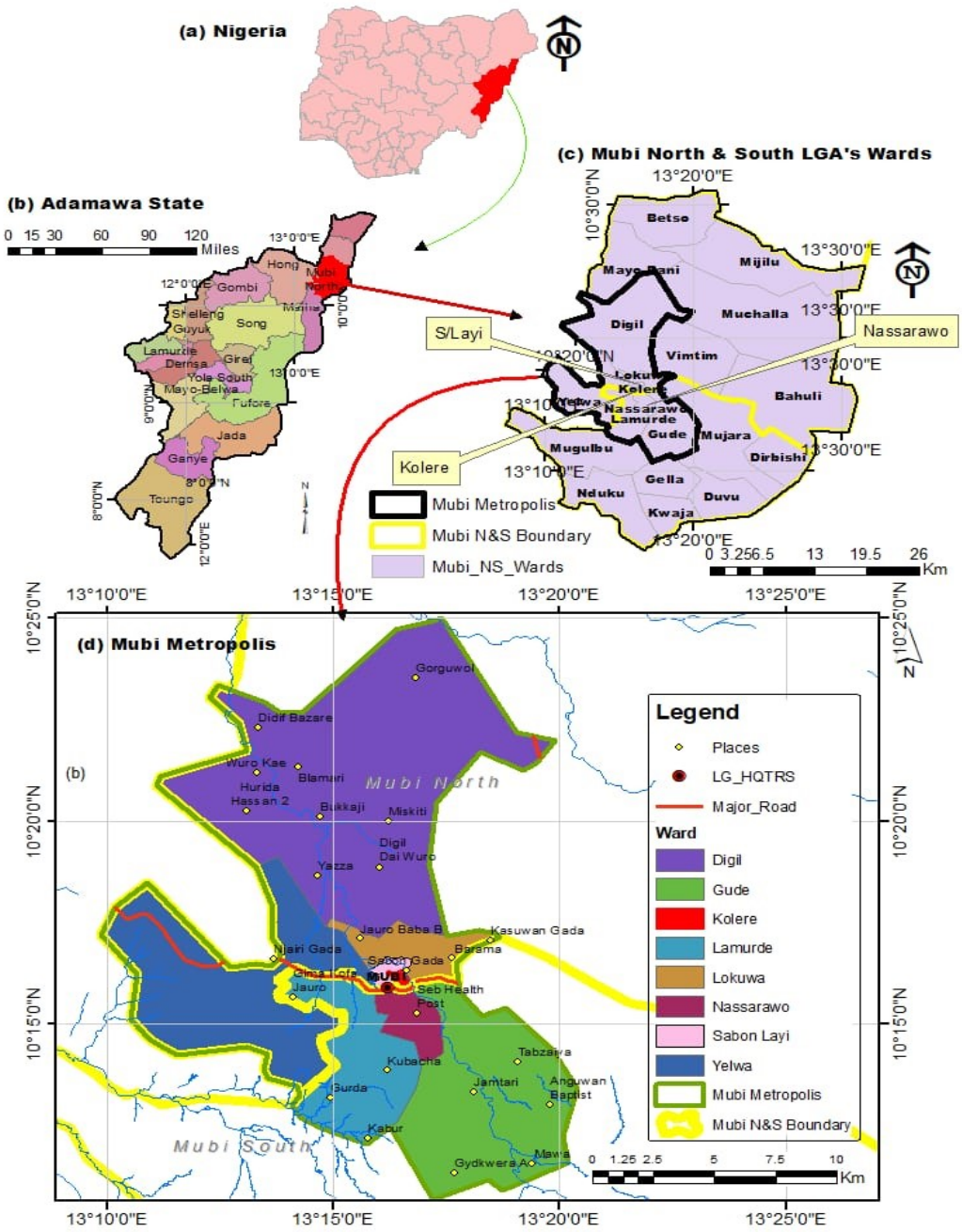

Figure 1. Maps of:

A. Nigeria Showing Adamawa State

B. Adamawa State Showing Mubi North and Mubi South L.G.A

C. Mubi North and Mubi South L.G.A showing Mubi Metropolis

D. Mubi Metropolis. Source: Anjorin, Balogun, Kadala (2025)

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Methods

This research systematically collects primary and secondary data relevant to the telecommunication masts in Mubi metropolis, Adamawa State, Nigeria. The primary data acquired includes information regarding the quantity and ownership of the telecommunication masts and their respective proximities, quantified in meters, to the surrounding buildings. Moreover, the investigation also secured data on the health-related concerns that emerge due to the existence of these masts for the populace residing nearby. In contrast, the secondary data compiled for this research comprises the names and geographic locations of the various administrative wards within the metropolis and the operational guidelines established by the Nigerian federal government regarding placement of telecommunication facilities. These primary data was sourced from the inhabitants of the Mubi metropolis. Conversely, the secondary data was acquired from an array of published documents or archival materials, along with the offices of MTN Nigeria located in Mubi, which enabled a precise and accurate determination of the ownership of the telecommunication masts present within the metropolis. It is vital to emphasize that specific areas within the Mubi North and Mubi South Local Government Areas (LGAs) collectively form the Mubi metropolis, which serves as the defined focal point for this research. Furthermore, additional secondary data were sought from the websites of the Nigerian Communications Commission (NCC) and the National Environmental Standards and Regulations Enforcement Agency (NESREA), from which the study procured operational guidelines for the telecommunication companies in Nigeria. Additionally, the office of the National Population Commission in Mubi furnished the demographic statistics for the study area.

In terms of the sample size and the methodologies employed in the selection of the samples, the study analysed all thirty-four telecommunication masts in Mubi metropolis. The study systematically sampled three households near each mast to gather relevant data. Questionnaires were administered to the heads of the families or their duly authorized representatives in each of the sampled households, ensuring that the perspectives of both male and female respondents were included in the data collection process. The underlying rationale for the exclusive selection of household heads as participants stems from the understanding that these individuals possess the requisite maturity and

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

knowledge to provide reliable and credible information pertinent to the objectives of the study. A simple random sampling method was used to ensure unbiased household selection for the questionnaires. The questionnaire consisted of two sections: biographical data and telecommunication service information. A total of one hundred and two questionnaires were administered, but only one hundred and one were suitable for analysis due to discrepancies in the information provided by one respondent. Additionally, a TECNO Spark 30C camera, GPS device of 72H Garmin series, and measuring tape were employed to capture photographic evidence of the telecommunication masts, obtain precise coordinates for each mast, and measure the distances of each mast from the neighboring buildings respectively. A database was created using ArcGIS 10.5 to organize the coordinates, allowing for effective visualization of mast locations on a base map.
The evaluation of mast setback distances necessitated meticulous measurements from each mast's base to nearby structures in all directions. Subsequently, the four setback values per mast were aggregated and averaged to determine the mean setback distance. Additionally, the compliance of each mast was determined by comparing the average setback distance to the 10-meter regulatory standards established by the NCC and NESREA. Consequently, masts with setback values below 10 meters were deemed non-compliant, whereas those meeting or exceeding this threshold were recognized as compliant. Furthermore, each mast was assigned a distinct identification number by its proprietors to facilitate identification. In addition, data gathered from questionnaires were extracted and coded utilizing Microsoft Excel 2013, allowing for organized data analysis. Following this coding, visual representations such as pie and bar charts were generated to illustrate the analytical findings. This research's report was subjected to SciSpace AI for refining.

Result and Discussion

Demographic Characteristics of Respondents

The demographic characteristics of the respondents, which encompass a range of variables including gender, age, educational qualifications, occupational status, and monthly income, among various other pertinent factors, are meticulously illustrated in Figure 2, thereby offering a comprehensive and detailed description of the subscribers who avail themselves of telecommunication services within the

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Mubi metropolis, as well as their perspectives regarding the positioning of telecommunication masts in their local communities.

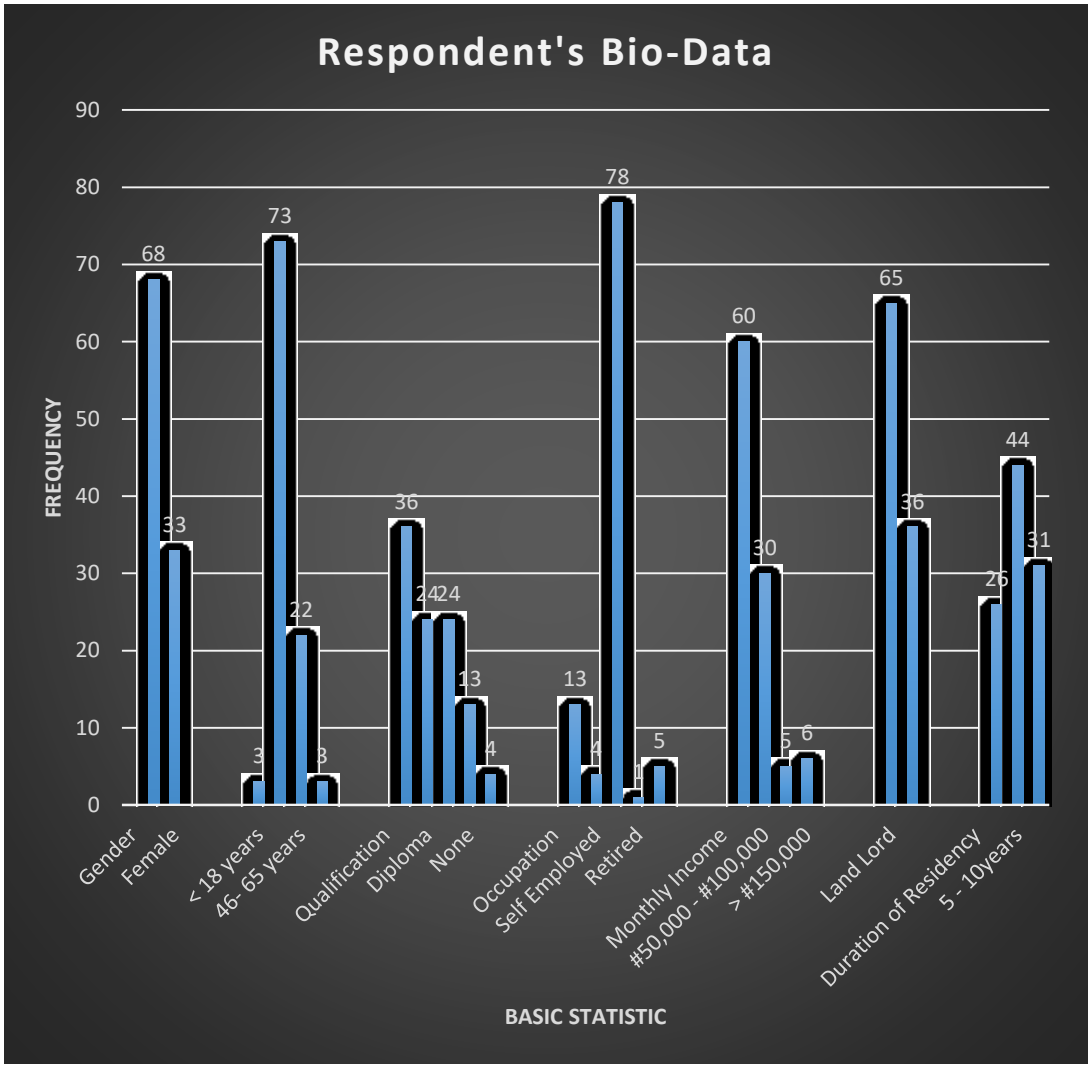

Figure 2: Demographic Information of Respondents

Figure 2 illustrates the diverse variations observed in the bio-data of respondents residing within the Mubi metropolis, showcasing a comprehensive overview of the demographic characteristics of this population. In terms of the gender and age distribution of the respondents, the findings reveal a significant predominance of male participants, accounting for 67.3% of the total respondents, in stark contrast to their female counterparts, who represent 32.7%. A substantial majority of the respondents, specifically 72.3%, fall within the age range of 18 to 45 years, while a

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

considerably smaller segment, comprising 21.8%, belongs to the older age category of 46 to 65 years, indicating a youthful demographic overall. Additionally, the data indicates a high level of educational attainment among the respondents, as only 12.8% reported lacking any form of formal education, thereby suggesting that the majority possess at least some degree of educational background. Furthermore, it is noteworthy that a significant portion of the respondents, equating to 77.2%, are engaged in self-employment across various occupations, with a particular emphasis on trading activities, thus reflecting the entrepreneurial spirit prevalent within the community. Moreover, the results elucidate that the income levels of the respondents exhibit considerable variation, closely aligned with the nature of their respective occupations. While it is observed that the majority of the respondents, approximately 59.4%, earn below #50,000.00 on a monthly basis, nearly 30% of the respondents are situated within the income bracket of #50,000.00 to #100,000.00 monthly, indicating a diverse income spectrum within the population. The findings further reveal that a substantial portion of the respondents, specifically 64.4%, are homeowners residing in their personal properties, while a smaller yet significant segment, comprising 35.6%, are tenants occupying rented accommodations. Forty-four of the respondents representing 43.5%, have stayed in the neighbourhood for between 5 to 10 years. These demographic details pertaining to the respondents of Mubi metropolis imply that the respondents are predominantly adults who are educated, employed, and resident in the neighbourhood of the telecommunication masts, and thus presumed to possess a fundamental understanding of the national standards, procedures, and ramifications associated with telecommunication facilities that are present within their neighborhoods.

The Spatial Pattern of Telecommunication Masts in Mubi Town Metropolis.

The data reflecting the spatial distribution of telecommunication masts throughout the Mubi metropolis is systematically organized and presented in Table 1. This particular dataset elucidates critical information regarding the specific locations of each mast, the Local Government Area (LGA) in which each segment of the metropolis is categorized, the total number of masts situated within each administrative ward, and the corresponding identification number assigned to individual mast.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Table 1: Spatial Pattern of Telecommunication Masts Mubi Town

Mast Location	LGA	No. of Mast Location	PerMast Ownership	Identification Number
Federal Polytechnic Mubi	Mubi North	2	MTN	AD 5080
			Airtel	AD 0524
Barama	”	2	Airtel/MTN	AD 0593/AD 0019
			MTN	AD 0057
State Low Cost	”	2	GLO	MUB 003
			MTN	T 5244
Shuare	”	2	MTN	T 5434
			Airtel	AD 0002
Sabon Gari	”	1	Airtel	AD 0526
Kolere	”	3	MTN	T 5622
			GLO	MUB 002
			MTN	AD 4903
Sabon Layi	”	3	Airtel	AD 0008
			MTN	AD 07021
			MTN	AD 4902
Lokuwa	”	2	MTN	AD 4909
			MTN/Airtel	AD 4908/AD 0470
Yelwa	”	3	MTN	AD 4907
			GLO	MUB 001
			MTN/Airtel	AD 0521/AD 4906
Dasala	”	1	MTN/Airtel	AD 5147/AD 0593
Lamorde Ward	Mubi South	8	MTN/Airtel	AD 0317/AD 5621
			MTN/Airtel	AD 2022/AD 0480
			Airtel	AD 0009
			MTN	T5130
			GLO	AD 4905
			MTN/Airtel	AD 2034/AD 0506
			MTN/Airtel	AD 0073/AD 0395
			GLO	MUB 005
Nassarawo	”	3	MTN/Airtel	AD 4997/AD 0504
			MTN/Airtel	AD 4985/AD 0527
			MTN	ADA 471
Tsamiya	”	1	MTN	ADA 721
Girpata	”	1	Airtel	ADA 525
Total		34		

Table 1 illustrates the intricate spatial arrangement of telecommunication masts located throughout Mubi metropolis, presenting a comprehensive overview of

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

their distribution. It is noteworthy that there exists a total of 34 distinct telecommunication masts, which are strategically positioned across 14 different neighborhoods within Mubi metropolis. A significant observation is that a substantial proportion of these masts, estimated to be around 62%, are predominantly situated within the confines of the Mubi North Local Government Area (LGA), while the remaining 38% are distributed within the Mubi South LGA section of the metropolis, thereby highlighting a pronounced geographical disparity in the distribution of these infrastructures. The operation of these masts is managed both independently and collaboratively by three major telecommunication companies that have established their presence within the metropolis. Specifically, the active telecommunication service providers within Mubi metropolis are identified as MTN, AIRTEL, and GLO, which collectively contribute to the operational landscape of the metropolis. Notably, MTN is responsible for the management of approximately 38.2% of the total masts, while AIRTEL and GLO oversee 17.6% and 14.7% of the masts, respectively. Furthermore, an estimated 29.4% of the masts are jointly operated by MTN and Airtel, which signifies a collaborative effort between these entities to optimize their operational capabilities. The collaborative management of these telecommunication masts, particularly between MTN and Airtel, can be interpreted as a strategic cost-cutting measure that ultimately facilitates the realization of economies of scale among the telecommunication companies involved. It is also important to note that a significant number of masts are concentrated in specific neighborhoods such as Lamorde, which accounts for 23.5% of the total, alongside Kolere, Sabon Layi, Yelwa, and Nassarawo neighborhoods, each contributing 8.8%, in stark contrast to other locations within the metropolis that host fewer than 3% of the masts.

Literatures have shown that the high density of population and the prevalence of commercial activities in certain regions of Kano, Yola, and Jalingo are responsible for the elevated concentration of telecommunication facilities in particular areas of those urban centers (Mohammed and Abdurrahman, 2014; Isiaka, 2017, and Oruonye, Ahmed, and Jutum, 2021). Nevertheless, these explanations may not sufficiently account for the notable concentration of 23.5% of the masts situated in Lamorde ward within Mubi metropolis, as this specific ward is characterized by the presence of only a neighborhood market and a moderate population density

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

in comparison to other neighborhoods within the metropolis. Instead, it is plausible that telecommunication companies have opted to concentrate their infrastructural assets in Lamorde ward primarily for the purposes of infrastructure sharing and co-location strategy. The concept of infrastructure sharing and co-location is recognized as a pivotal approach wherein multiple telecommunication operators collaborate by sharing the same mast infrastructure, thereby diminishing the necessity for redundant infrastructure and optimizing the geographical distribution of telecommunication masts (Amadasun and Agajo, 2022 and Amadasun et al., 2020). This phenomenon of mast clustering is often criticized a stark indicator of inadequate spatial planning practices and the absence of rigorous technical standards that should ideally govern the strategic placement of masts (Isiaka, 2017). The spatial distribution pattern of telecommunication masts in Mubi metropolis is shown in Figure 3.

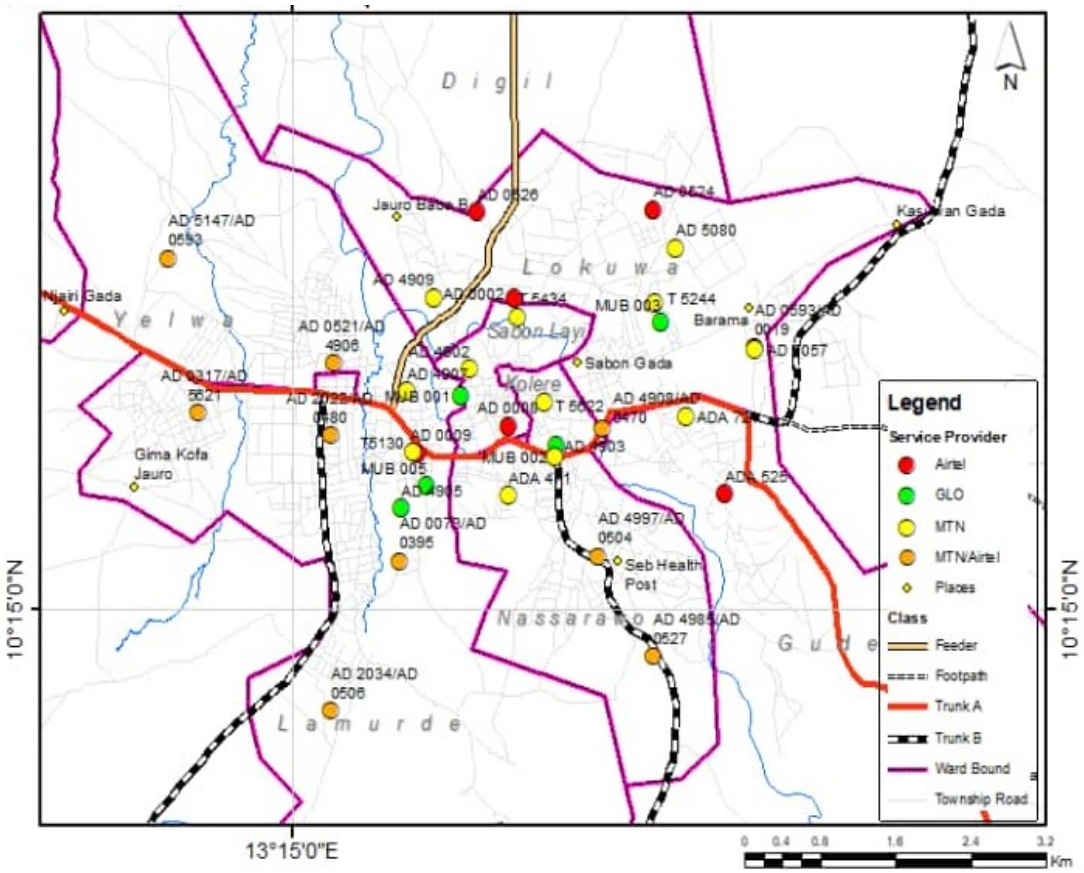

Figure 3: Distribution Pattern of Telecommunication Masts in Mubi Metropolis (Source: Author's GIS analysis, 2025).

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Compliance to the Setback Requirement in Mubi Town

An evaluation was conducted to ascertain the degree to which telecommunication companies adhere to the NCC and NESREA established minimal setback requirement for telecommunication masts in the Mubi metropolis, and the results are comprehensively displayed in Table 2.

Table 2: The Compliance Level to NCC and NESREA Setback Standard in Mubi Metropolis

Mast Location	Mast Ownership	Mast Identification Number	Set Back (Meters) North	South	East	West	Average	Compliance to 10 meters Setback
Federal Polytechnic Mubi	MTN	AD 5080	15	4.20	10.30	15	11.13	Complied
	Airtel	AD 0524	15	15	15	15	15	Complied
Barama	Airtel/MTN	AD 0593/AD 0019	4.27	15.65	19.43	6.13	11.37	Complied
	MTN	AD 0057	1	15	15	10.45	10.36	Complied
State Low Cost	GLO	MUB 003	1.6	15	15	5.65	9.31	Not Complied
	MTN	T 5244	3.40	15	2.1	3.40	5.97	Not Complied
Shuare	MTN	T 5434	7.2	1.6	1.47	8.34	4.65	Not Complied
	Airtel	AD 0002	15	3.40	15	15	12.1	Complied
Sabon Gari	Airtel	AD 0526	15.80	2.90	15.00	2.09	8.95	Not Complied
Kolere	MTN	T 5622	0.38	1.32	0.00	5.8	1.88	Not Complied
	GLO	MUB 002	4.30	0.00	0.00	3.70	2.00	Not Complied
	MTN	AD 4903	12.43	5.0	5.03	16.35	9.7	Not Complied
Sabon Layi	Airtel	AD 0008	1.76	3.80	5.20	1.04	2.95	Not Complied
	MTN	***AD*** 07021	2.6	2.0	0.48	5	2.52	Not Complied
	MTN	AD 4902	4.00	0.70	15.00	11.65	7.84	Not Complied
Lokuwa	MTN	AD 4909	0.00	11.37	5.66	5.02	5.51	Not Complied
	MTN/Airtel	AD 4908/AD 0470	8.50	18.26	14.30	21.60	15.67	Complied
Yelwa	MTN	AD 4907	5.84	4.63	5.3	4.88	5.16	Not Complied
	GLO	MUB 001	0.00	22	0.00	0.00	5.5	Not Complied
	MTN/Airtel	AD 0521/AD 4906	5.07	19	3.89	9.04	9.25	Not Complied
Dasala	MTN/Airtel	AD 5147/AD 0593	2.00	2.70	1.1	6.20	3.00	Not Complied
Lamorde Ward	MTN/Airtel	AD 0317/AD 5621	1.1	2.00	1.06	10.60	3.69	Not Complied
	MTN/Airtel	AD 2022/AD 0480	15	4.8	1.5	3.32	6.16	Not Complied
	Airtel	AD 0009	13	7.75	4.55	13.49	9.69	Not Complied
	MTN	T5130	3.87	0.00	0.00	0.00	0.97	Not Complied
	GLO	AD 4905	5.90	1.17	1.45	1.15	2.41	Not Complied

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Mast Location	Mast Ownership	Mast Identification Number	Set Back (Meters) North	South	East	West	Average	Compliance to 10 meters Setback
	MTN/Airtel	AD 2034/AD 0506	8.95	6.22	7.00	2.68	6.21	Not Complied
	MTN/Airtel	AD 0073/AD 0395	5.30	3.00	4.77	6.2	4.82	Not Complied
	GLO	MUB 005	1.00	0.15	0.46	2.50	1.02	Not Complied
Nassarawo	MTN/Airtel	AD 4997/AD 0504	7.73	2.53	9.00	0.96	5.05	Not Complied
	MTN/Airtel	AD 4985/AD 0527	15	15	23	15	17	Complied
	MTN	ADA 471	1.90	6.43	10.9	3.60	5.70	Not Complied
Tsamiya	MTN	ADA 721	0.42	0.76	0.3	4.0	1.37	Not Complied
Girpata	Airtel	ADA 525	6.59	10.56	4.50	5.10	6.68	Not Complied

Table 2 exemplifies the compliance of telecommunications companies in Mubi metropolis with setback standards established by the NCC and NESREA. The NCC aims to foster competition and service quality in telecommunications, while NESREA enforces a comprehensive set of environmental regulations, both of which advocate for a minimum setback of 10 meters from residential properties to telecommunications infrastructure (Nigerian Communications Commission [NCC], 2024; Ogboru, 2015, and Mantu, 2019). Consequently, the national standard mandates this 10-meter separation to ensure safety and regulatory conformity. Regrettably, approximately 79% of telecommunication masts in Mubi metropolis do not meet the mandated 10-meter setback requirement, with only 21% of the 34 masts compliant. Alarmingly, over 71% of the 21 masts in the metropolis that falls in Mubi North LGA fail to adhere to regulations, while a striking 95.2% non-compliance is noted in the section of the Mubi South LGA. These findings align with previous scholarly research indicating a pervasive lack of adherence to national setback standards among telecommunication operators throughout Nigeria. According to Akindele and Adeniji (2014), Adamu et al. (2016) and Dalil et al. (2016), the level of adherence to the national setback standards by telecommunication operators is alarmingly low in Osogho, Osun State, where only 38% of masts complied, Zaria in Kaduna State, where compliance was less than 14%, and the Federal Capital City (FCC), Abuja, where merely 26.1% of the masts were in accordance with the established regulations.

This study indicate that the stipulated minimum setback distance is frequently disregarded by the three telecommunications companies operating within Mubi

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

metropolis. The principal offenders in this context are MTN and GLO, exhibiting non-compliance rates of 78.6% and a full 100%, respectively. Conversely, Airtel has demonstrated a comparatively stronger dedication to adhering to the setback stipulation, as at least 33% of its masts in Mubi metropolis are situated at a minimum of 10 meters from the boundary walls of adjacent residential properties. It is noteworthy, however, that the prevalence of non-compliance with the minimal setback by network providers appears to be more pronounced on private land compared to corporate land within Mubi metropolis. For example, masts positioned within the premises of the Federal Polytechnic and Sa'adat College of Health Mubi, as well as one in proximity to the Mubi Emirate Council, among others, comply with the national minimal setback requirement, in contrast to those erected in private residential zones and on individual plots. This observation aligns with the findings of Adamu et al. (2016), who asserted that telecommunication base stations situated within educational environments in Zaria, Kaduna State, Nigeria, largely adhered to the 10-meter World Health Organization (WHO) setback requirement for installations within residential areas. Similar, telecommunication operators in FCC, Abuja also substantially contravene the same regulation with MTN identified as the principal offender, demonstrating a mere 8.3% compliance (Dalil et al., 2016).

The evident extensive non-compliance with the requisite minimal standards by telecommunications operators in Mubi metropolis can be characterized as exploitative, as these operators appear to have taken advantage of the local populace's lack of awareness regarding governmental regulations on the minimal setback requirements for the establishment of telecommunication facilities within residential neighborhoods. The low level of public awareness concerning these regulations renders the local community vulnerable to exploitation. This conclusion aligns with the assertions of Akindele and Adeniji (2014), who contend that individuals residing near masts exhibit a significant lack of awareness regarding their operational mechanisms and associated impacts. It, however, contrasts with the economic incentive factor purportedly responsible for the diminished compliance levels in FCC, Abuja (Dalil et al., 2016). In contrast, the increased awareness among corporate entities and institutions seemingly ensures full compliance with the NCC and NESREA minimal setback standards on those lands.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Telecommunication companies' significant non-adherence to the 10-meter setback regulation in Mubi metropolis poses detrimental health and environmental risks, particularly due to exposure to high-power electromagnetic radiation and noise pollution from generators. Figure 4 shows that over 55% of residents report adverse effects like headaches and hearing issues. Conversely, over 44% of the respondents perceive no significant adverse effects attributable to the non-compliance of telecommunication operators with the minimum setback regulations. This perception is likely due to the installation of solar power systems as the primary energy source in certain locations of the telecommunication masts, thereby mitigating the noise and vibration typically associated with generator usage for power generation. In light of this, previous studies in other parts of Nigeria affirms that individuals living within the 10-meter setback zone are not solely subjected to the effects of electromagnetic radiation from Base Stations but are also at risk of experiencing fatigue, headaches, dizziness, tumor development, reduced sperm motility, cancer, as well as premature mortality, among other ailments (Emma, 2012, and Adamu et al, 2016). These health concerns are often significantly heightened among individuals residing within 5 to 10 meters of telecommunication masts, with a marked decline observed beyond a distance of 15 meters (Isiaka, 2017). The proximity of telecommunications masts to residential areas in Mubi metropolis is illustrated in figures 5a to 1d.

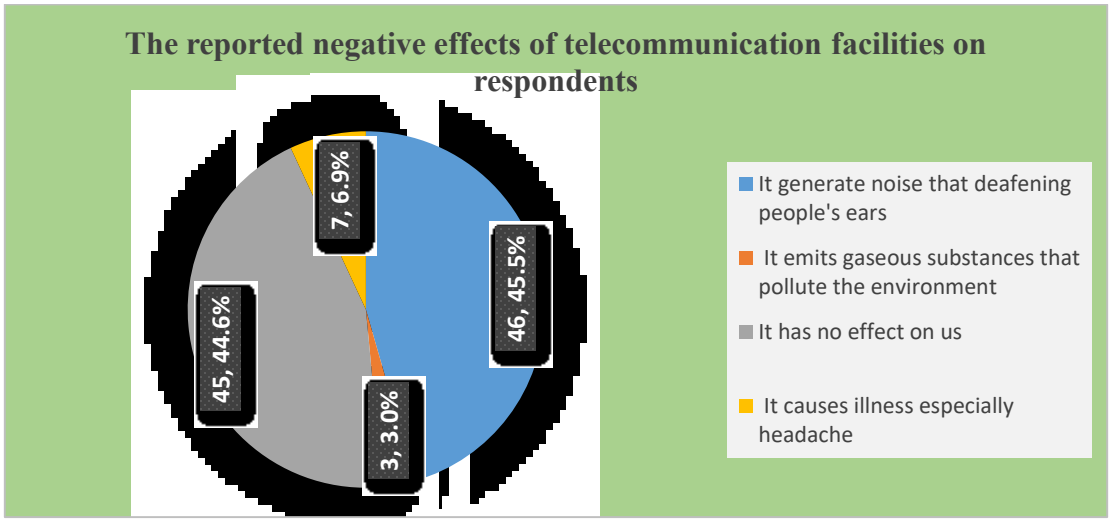

Figure 4: The reported adverse effects of telecommunication masts in Mubi metropolis.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

(a). 

(b) 

(c) 

(d) 

Figures 5a - d: Setbacks of telecommunication masts from buildings in Mubi metropolis.

The Adopted Adaptation Strategies among the Residents

An evaluation was conducted to ascertain the strategies being employed by the residents of Mubi metropolis, especially those that resides within the close proximity to the telecommunication masts, and the results are comprehensively displayed in figure 6.

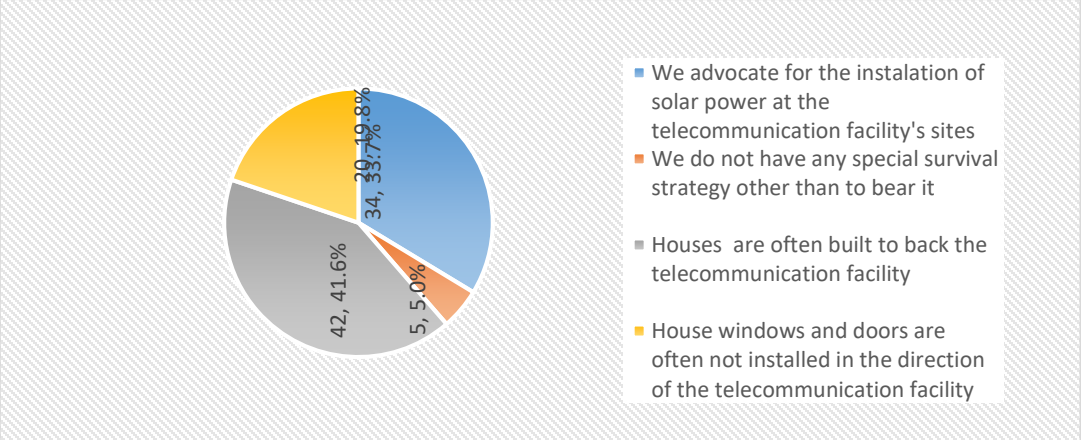

Figure 6: Residents' adaptation strategies to the effects of telecommunication masts in Mubi metropolis

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Figure 6 illustrates the four primary methods that individuals have adopted to manage the adverse effects of the masts that are installed in their neighborhoods. As depicted in Figure 6, a significant 41.6% of the respondents indicated that they have chosen to construct their residences in a manner that orients them away from the direction of the masts, thereby attempting to shield themselves from the potential negative impacts. This particular strategy is closely trailed by the 33.7% of respondents who have reportedly taken the initiative to engage in advocacy efforts aimed at promoting the installation of solar panels at the sites where these masts are located, thereby seeking a more sustainable and less disruptive alternative. Furthermore, 19.8% of the respondents have articulated that they cope with the adverse ramifications of the mast installations by deliberately avoiding the placement of windows and doors in the direction of the masts, thereby minimizing their exposure to whatever disturbances may emanate from these infrastructures. Additionally, a only 5% of the respondents conveyed that they have felt compelled to simply endure the situation as it currently exists, indicating a sense of resignation in the face of these disturbances. The collective results of this investigation reveal that individuals living near telecommunication masts are not only aware of the adverse effects these installations might have on their quality of life, but they are also proactively employing a range of strategies to confront and mitigate these issues. As a result, participants have either attempted to communicate with representatives from telecommunications firms, especially the engineers overseeing the site operations, regarding the urgent need to replace current generators with solar energy systems to reduce the noise, vibration, and smoke generated by these machines; oriented their residences away from the masts to lessen their exposure to these negative impacts; ensured that their architectural designs exclude windows and doors that face the masts; or have simply chosen to coexist with the situation as it exists. These coping mechanisms seem to possess a uniqueness that is specific to the geographical and sociocultural environment of the study area, distinguishing them from the adaptation strategies that might be found in other areas of Nigeria. There is a significant gap in the literature concerning the adaptation strategies employed by locals to address the challenges posed by telecommunication masts in Nigeria. Figures 7a – c shows the adaptation strategies that residents adopt in Mubi metropolis.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

(a)  (b)  (c) 

Figures 7: (a) Solar Panels Installed at Mast Site
(b) Residential House Back the Mast
(c) No windows and doors in the direction of masts

Conclusion/Recommendation

The comprehensive investigation scrutinized the spatial distribution of telecommunication masts, the extent to which telecommunications operators adhere to established setback regulations, and the potential adverse effects these installations pose to the well-being of the nearby residents of Mubi metropolis, Adamawa State, Nigeria. The findings of this analysis revealed the presence of a total of 34 telecommunication masts dispersed across 14 neighborhoods within the metropolis, with a staggering 62% of these structures located within the section of Mubi North LGA that is part of Mubi metropolis. This underscores a deeply concerning pattern of regulatory non-compliance, particularly among telecommunications providers such as MTN and GLO, wherein an alarming 79% of the masts are not in compliance with the mandated 10-meter safety setback requirement. In light of the challenges posed by these masts, residents have resorted to implementing a variety of adaptive strategies designed to mitigate the potentially negative impacts on their quality of life, including but not limited to the practice of orienting their homes away from the direct line of sight of the masts and actively advocating for the integration of solar energy installations as a sustainable alternative.

In light of the results obtained, a set of recommendations has been formulated, which encompass:

- Given the concentration of telecommunications masts in urban areas, it is essential for government oversight to mitigate their proliferation in residential zones, thereby protecting residents from potential adverse effects.
- In view of the telecommunications operators' significant rates of non-compliance with national setback regulations as stipulated by the NCC and

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

NESREA, it is vital to establish and implement regulatory discussions among telecommunication providers and the Nigerian government to guarantee conformity with national safety protocols, thereby fostering public health.

- Since it has been established that telecommunication masts adversely impact individuals, it is crucial to orient residences away from telecommunication masts, encourage solar panel installations at mast locations, and prevent the placement of windows and doors facing these masts to mitigate health risks and enhance community safety.

Acknowledgement

This research was financed by the Tertiary Education Trust Fund (TETFUND), Nigeria.

References

Adamu, G., Usman, A. K., Sawa, B. A. and Abdulkareem, B. (2016). Analysis of the spatial distribution of global system of communication base station in Zaria urban area, Kaduna State, Nigeria. *Zaria Geographer. 23(1): 1 – 17.*

Aderoju, M., Godstime, J., Olojo, O., Oyewumi, A., Eta, J., Onuoha, U., Salman, K. and Nwadike, K. (2014). Studied space-based assessment of the compliance of GSM operators in establishing base transceiver station (BTS) in Nigeria using Abuja municipal area council as case study. *Journal of Environmental Science, Toxicology and Food Technology*, 8(10): 46 - 57.

Akindele, O. A. and Adeniji, M. (2014). Location adequacy of telecommunication masts and residents livability in Osogbo, Nigeria. *International Journal of Research in Applied, Natural and Social Sciences*. 2(11): 7 - 16.

Amadasun, K. N. and Agajo, J. (2022). *Decision support for GSM co-location using machine learning*. 1 - 5. https://doi.org/10.1109/ICECCME55909.2022.9988542

Amadasun, K. N., Short, M. and Crosbie, T. (2020). Telecommunication infrastructure sharing a remedy for the reduction of network operator cost and environmental pollution. *International Conference on Environment and Electrical Engineering*, 1 - 6. https://doi.org/10.1109/EEEIC/ICPSEUROPE49358.2020.9160661

Anjorin; Balogun, G. F. and Kadala, B. S. (2025). Road accidents and socioeconomic development: The case study of Mubi, Adamawa State, Nigeria. Conference paper to be presented at the *International Conference on Urban Planning, University of NiS, Serbia*, from 10 – 11 April, 2025.

Babatunde, A. A. and Adewuyi, G. K. (2013). Analysis of telecommunication Mast using GIS and GPS techniques : A case study of Ibadan north east Local Government, Oyo State Nigeria. *Global Journal of Advanced Engineering Technologies and Sciences*, 4(6), 1–9.

Dalil, M., Yahaya, A. A., Yaya, B. F. and Adeleye, B. M. (2016). Assessment of spatial distribution of telecommunication base stations and compliance level of the operators to the regulations in federal capital city, Abuja, Nigeria. *Journal of Sustainable Development in Africa*, 18(3), 38 – 52.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Ekata, G. and Kostanic, I. (2014). A model for monitoring GSM base station radiation safety in Nigeria. *International Journal of Engineering Research and Applications*, 4(10), 97–104.

Elbasheir, M. S., Saeed, R. A. and Edam, S. (2024). *EMF exposure de-concertation model for multi-technology mobile base-station.* https://doi.org/10.1109/gpecom61896.2024.10582563

Emma, K. (2012). Sample records for real world communication. www.science.org

Iortile, J. T. and Agba, E. H. (2014). Assessment of radiofrequency radiation distribution around mobile base stations in Makurdi, Benue state, Nigeria. *International journal of natural sciences research*. 2(1), 1 – 4.

Isiaka, U. A. (2017). Spatial distribution of telecommunication masts and their hazards in Kano metropolis, Nigeria. M.Sc Thesis, Ahamadu Bello University, Zaria, Nigeria.

Joshua P. B. and Odihi, J. O. (2018). Spatial analysis of the implications of traffic and parking activities in the Mubi cattle market area, Adamawa State, Nigeria. *Journal of settlements and spatial planning.* 9(1), 67-76.

Mantu, J. I. (2019). NESREA and the challenge of enforcing the provisions of environmental impact assessment act in Nigeria. 10.2139/ssrn.3410104.

Mohammed, A. H. and Abdurrahman B. I. (2014): The incorporation of precautionary principle in the planning of global system for mobile communications mast location in built-up areas: proposal for Jimeta, Nigeria. *Journal of earth science and engineering*.4 (2). 284 - 294.

Nigerian Communications Commission ([NCC], 2024). Who We Are. https://ncc.gov.ng/who-we-are

Ogboru, T. (2015). *NESREA and NCC Regulations on Telecommunication Masts: Implementing the Precautionary Principle*. 5(1), 55–71. https://doi.org/10.4314/JSDLP.V5I1

Omogunloye O. G., Qaadri, J. A., Omogunloye, H. B. and Oladiboye, O. E. (2013). Analysis of mast management distribution and telecommunication service using geospatial technique. *Journal of environmental Science, Toxicology and Food Technology*, 3(3), 58-75.

Onolemhemhen, J., Osanaiye, O., Adetokun, B. B. and Oje, A. Q. (2022). Location-based distribution of network towers using spatial analysis. 1–5. https://doi.org/10.1109/NIGERCON54645.2022.9803014

Oruonye, E.D., Ahmed, Y. M. and Felix, J. (2021). Analysis of spatial distribution and pattern of GSM mast location in Jalingo town, Taraba State, Nigeria. Int. *Journal Social Science & Humanities Research*, 4(4), 1 – 11.

Pachuau, L. and Pachuau, Z. (2019). Analysis of mobile tower radiation and its health effects in Champhai district of Mizoram. *URSI Asia-Pacific Radio Science Conference*, 1. https://doi.org/10.23919/URSIAP-RASC.2019.8738408

Peter, Y., Sheriff, E. and Garba, B. A. (2016). Temporal change detection of vegetation cover in Mubi metropolis and environs, Adamawa State, Nigeria. *Sky Journal of Soil Science and Environmental Management*, 5(3), 59 – 65.

Laura, R. V., Marek, C and Froidevaux, J. S. P. (2024). The determinants of legislation for radiofrequency electromagnetic fields (RF-EMFs) with the onset of 5G: An empirical analysis with a worldwide cross-sectional dataset. *Risk Analysis.* 44(9), 2046-2088.

Lawrence, H. and David-West, K. M. (2025). Urban telecommunication infrastructure: A spatial analysis of mobile mast deployment in Port Harcourt metropolis, Rivers State, Nigeria. *Journal of Spatial Information Sciences*, 2(1), 159 – 175.

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]

Turletti, T., Bentzen, H. J. and Tennenhouse, D. (1999). Toward the software realization of a GSM base station. *IEEE Journal on Selected Areas in Communications*, 17(4), 603-612.

Yekini, N. A., Babalola, I. T., Aighokhan, E. E., Akinwole, A. K and Igwe, N. S. (2016). Survey of potential adverse health effects of mobile phones, and wireless base stations in Nigeria. *World Academy of Science, Engineering and Technology, International Journal of Electrical and Computer Engineering*, 3(12), 276 - 281.

Conflict of Interest

The author wish to declare no conflict of interest

EDITOR-IN-CHIEF
Prof. E. Mclenna [Australia]